

Placemaking & Augmented Reality

**A Theoretical
Exploration**

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Augmented Reality and Placemaking: A Theoretical Exploration

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Placemaking & Augmented Reality

Augmented Reality and Placemaking: A Theoretical Exploration

Augmented reality is a technology that has the potential to greatly impact current approaches placemaking. Place is an abstract term that refers to the ability of a physical space to have a deeper, more subjective level of meaning for an individual or group of people. Traditional placemaking strategies can impact physical space but their adaptability is often limited by cultural changes or local needs. Augmented reality is a reactive technology through which people are able to manipulate their environments to more closely reflect personal values and communicate ideas. This paper explores current trends and potential applications of augmented reality in the placemaking process.

Placemaking & Augmented Reality

Place

The following two statements introduce a multidimensional approach to an understanding of place:

1. Place consists of space, but a space is not necessarily a place.
(Creswell, 2015)
2. Places are composed of a spatial structure and meaning.
(Lynch, 1960)

A multidimensional approach to understanding place is useful because it reflects the relationship between the physical space, subjective meaning, and variable contexts that compose it. Both spaces and places have a level of physicality but not all spaces are endowed with an abstract sense of value by their users. Places require a designation of personal value that goes beyond basic understanding of their physical attributes.

Space and Place

Place requires a connection between people and their environment. For example, there are multiple bridges that cross the Alabama River, however, the Edmund Pettus Bridge in Selma is considered a place due to the historically significant events which occurred on the bridge during the Civil Rights Movement. This bridge is a place for those individuals with strong ties to the Civil Rights Movement, some of whom go to visit the bridge annually. The value of this bridge as an artifact of the Civil Rights Movement by American society extends the longevity of its existence as a place for those who were there as well as their predecessors, and anyone who is able to historically contextualize it. This is an example of an easily identifiable place. However, the abstract value of place does not need to be widely shared nor does it need to be multigenerational. The

other bridges along the river may also serve as a place for a single person or a small group of people. For example, if another bridge along the Alabama served as a spot for a marriage proposal then it will likely have value as a place for that couple. This value may pass within one generation or remain limited to the people who knew the couple.

Theoretically, this subjective meaning of place means that one space can be multiple places because it is perceived and valued differently among different groups. An example of this may be seen in the ways in which different groups experience historical spaces like the Spanish Missions of California. Spaces like these may be experienced by some as places that connect them to California and United States history, complimented by memories from childhood projects and fieldtrips. However, they may also be perceived as a place of suffering and cultural loss by the members Native American population. Existing places can also change or be lost, and new places can be created as time passes and spaces change. Geographer YiFu Tuan (1977) attempts to explain the distinction and dynamics between space, place, and people, in the following passage:

What begins as undifferentiated space becomes place as we get to know it better and endow it with value... The ideas “space” and “place” require each other for definition. From the security and stability of place we are aware of the openness, freedom, and threat of space, and vice versa. Furthermore, if we think of space as that which allows movement, then place is pause; each pause in movement makes it possible for location to be transformed into place. (p. 6)

Creswell's Place and Lynch's Environmental Image

Creswell's Place and Lynch's Environmental Image

Tim Creswell and Kevin Lynch have contributed to the study of place through their work. In particular, Tim Creswell's *Place: An Introduction* deconstructs what place is and explains place in the contexts of existing and emerging disciplines. Alternatively, Kevin Lynch's *The Image of the City* speaks to the creation of an "environmental image" as a method of connecting urban planners and architects to the perceptions and experiences of city dwellers. There is a symbiotic relationship between the terms place and environmental image in which the existence of one implies the existence of the other. Place is a physical space that has been endowed with personal value. An environmental image is the mental image that results from a deeper understanding of and connection to a space (Lynch, 1960). These terms are also similar in that they relate the physical world with an abstract component produced by the individual or individuals who use it. In both works, the authors provide similar theories that convey place as a working relationship between the outward, physical composition of a space and the abstract value placed on it by those who experience it first-hand.

Physical components. Creswell uses geographer John Agnew's theory of the composition of meaningful locations to deconstruct place. This theory claims that place is composed of three main characteristics: location, locale, and sense of place. According to Creswell (2015), when these three elements – location, locale, and sense of place – are effectively brought together, their synergy leads to the creation of place.

Locale and location provide the physical context for a

place. Location is where a space exists. For example, a plaza can be located at the heart of a downtown and Grand Central park is located in Manhattan, New York. The location of a space does not need to be stationary; an example of this might be a subway train car which remains the same space even when its moving.. The locale of space is the physical traits which influence the way an urban space is used (Creswell, 2015). In the example of the subway train, the train car remains the same in its locale, or material and physical attributes, even as it moves. This interplay between physical attributes and behavior is a major field of study within the discipline of environmental psychology. This concept was partially studied during William Whyte's Street Life Project and provides a basis for his ideas on how public spaces ought to be designed (Whyte, 1980). Kevin Lynch also took notice of the physical attributes of space's influence on peoples understanding of it.

In his book, *The Image of the City*, Kevin Lynch (1960) describes how an individual's mental image of the environment relies on the existing visual quality, physical components, and meaning of that space. Lynch uses city legibility and imageability to explain the effects that physical components and visual quality can have. The legibility of an environment refers to a space in which the physical organization (i.e. buildings, landscape, landmarks, infrastructure, etc.) and visual quality provide clear cues that define its purpose. The imageability of an environment refers to its ability to evoke a vivid mental image of the space based on the consistency of its form and context. This basic image provides a deep level of understanding despite minor changes in the environment. Lynch (1960) describes an imageable city as follows:

...one that could be apprehended over time as a pattern of high continuity and with many distinctive parts clearly interconnected. The perceptive and familiar observer could absorb new sensuous impacts without making disruption to his basic image, and each new impact would touch upon many previous elements (p. 10).

Intangible Components. Both Cresswell and Lynch agree that there is an abstract force at play in the creation of place. Cresswell calls this component sense of place while Lynch refers to it simply as meaning. Cresswell describes a sense of place as the personal ties that an individual or group of people might have to a space for their own subjective reasons. These ties can be explained through Lynch's examination of meaning. According to Lynch, meaning is composed of the behaviors, interactions and events that occur in an environment as well as the memories that are created in them. Therefore, like sense of place, meaning is also subjective to the experiences of a person or group of people that occupy a space.

Definition of Place

Developed from the exploration of place above, the following definition of place is to be used for the purposes of this project:

A place is a physical space that is endowed with a greater symbolic or subjective meaning by an individual or group of people over time because of the interactions that occur within it or the social context by which it is experienced.

Scaling Place

Jon Lang acknowledges the importance of recognizing settings within settings in urban design. That is, understanding how place exists or can exist within a greater network of spaces in the built environment. (Lang, 2014). This project discusses place and placemaking in both macro and micro settings. Macro refers to larger geographic spaces such as corridors, districts, neighborhoods, and even entire cities. The downtown district of a city may be considered a macro-place because its layout and context lend to social activity. Macro-places provide the stability needed for the concept of imageability of place discussed by Lynch. These places provide larger physical and geographic settings for a variety of connected interactions. Generally, changes to the macro-level must be dramatic in order to impact place, such as the construction of a new building, removal of a landmark, or infill of an old lot. On the other hand, micro-places refer to smaller areas like parks, plazas, and squares; these areas are what Lang (2014) refers to as behavior settings where the given physical form encourages recurrent human activity. A single plaza within the downtown area is considered a micro setting. The locale of this place may be changed to fit the context of an event or season, but the changes only impact the behavior setting. Distinguishing between places at a macro and micro level allows for a better understanding of the impacts that the addition of new elements can have on a space.

Placemaking

Placemaking is the process by which people attempt to convert spaces to places. “Strengthening the connection between people and the places they share, placemaking refers to a collaborative process by which we can shape our public realm in order to maximize shared value” (Project for Public Space, 2018, para. 1). The mention of “shared value” is crucial to a critical examination of placemaking and the levels at which it occurs. The value or value system emphasized by the individuals involved in the placemaking process is often engrained in the method of creation and resulting spaces. These values can manifest in the urban form, official documents, and across the arts (Stevenson, 2003). Placemaking, like place, can be categorized into two methods based on their purpose and extent: 1) place making through intervention; and 2) placemaking through urban form. Since placemaking cannot impose meaning on a space or force people to engage in behaviors that may make the space meaningful, it instead focuses on the manipulation of the physical environment.

Placemaking through Urban Form

As discussed in the exploration of place above, places are influenced by experiences, physical components, and visual quality. Placemaking through urban form refers to placemaking that occurs in larger settings and contexts and aims to create macro-places. Placemaking through urban form can be done through the creation and preservation public spaces, codification of place, and through actual development practices. A good example of this type of placemaking is the development of transit-oriented developments (TOD).

The Transit Oriented Development Institute (TODI) defines TODs as compact, pedestrian oriented neighborhoods characterized by mixed use buildings and proximity to a transit system. They have become increasingly popular as urban populations have grown, demographics have shifted, and sustainability policies have changed (TODI, 2019). They provide placemaking strategies for transit-oriented developments that include tips for land use, building types, scale, and promoting walkability (TODI, 2019). Consider a scenario in which a TOD is proposed for development in a given city. The city takes the proposal and works with the developer to refine it to meet the needs of the community. They also encourage public participation in the planning and development process which contributes to the residents' sense of ownership of their city and pride in the new spaces (Nair, 2017). Next, the local government adopts a resolution legally requiring the development to preserve the established pedestrian-oriented environment and provide publicly accessible spaces. Finally, the project is built and succeeds in becoming a hub for activity.

In this scenario the city is participating in placemaking by manipulating the urban form. First, the city is maximizing the shared value of sustainability by helping create a new, pedestrian friendly and transit-oriented community. Second, they are promoting personal ties to the project and the city through opportunities for public input. Third, they are codifying place by adopting a resolution with regulations attached to placemaking principles. Finally, the construction of the development itself will add a new physical and visual element to the cityscape.

Placemaking through Intervention

Place making through intervention refers placemaking strategies focused on smaller spaces and behavior settings (i.e. micro-places). Placemaking by intervention takes place through minor changes that impact a person's behavior within a space or their ability to interact with it. A presentation from the City of Minneapolis, Minnesota provides a series of ideas for place making through intervention. They are divided into categories which include events and activation, art, and urban agriculture or community gardening (City of Minneapolis, 2015). Examples of these types of placemaking include the introduction of seating, interactive art, or local vendors as shown in Figure 1. These changes in locale can be permanent or temporary but affect the frequency and type of interactions that occur within a place.



Figure 1. A Farmers Market that repurposes a street in downtown San Luis Obispo, CA is an example of placemaking through intervention. Reprinted from the San Luis Obispo Tribune by N. Lucero, 2017, Retrieved from <https://www.sanluisobispo.com/news/local/article159774509.html>. Copyright 2017 by the San Luis Obispo Tribune.

3 Models of Placemaking

Various methods of placemaking exist that are tailored to specific purposes; however, the end goal remains the same, creating place. This section will provide a summary of three popular types of placemaking as identified by Mark Wyckoff, Senior Associate Director of the Land Policy Institute at Michigan State University: creative, tactical, and strategic.

Tactical placemaking. Tactical placemaking refers to a strategy that might be better recognized as tactical urbanism and the “lighter, quicker, cheaper” approach (Wyckoff, 2015). Tactical urbanism was developed by the Street Plans Collaborative, an urban planning, design and research and advocacy firm based in Florida. In their first version of the Tactical Urbanism Guide to Material and Design, the Street Plans Collaborative (2016) provides the following definition of tactical urbanism:

Tactical Urbanism refers to a city, organizational, and/or citizen-led approach to neighborhood building using short-term, low-cost, and scalable interventions to catalyze long-term change. (p. 11)

The Project for Public Spaces provides a similar definition for what is essentially the same strategy under a different name, “lighter, quicker, cheaper.” The Project for Public Spaces (2018) writes the following:

“Lighter, Quicker, Cheaper” is a phrase we borrowed from Eric Reynolds to describe the simple, short-term, and low-cost solutions that are having remarkable impacts on the shaping of neighborhoods and cities.

In short, tactical placemaking can then be summarized as small-

scale attempt at making places in purely experimental ways. When these experiments go well, they may lead to permanent changes to improve a community by contributing to a stronger sense of place.

Creative placemaking. Creative placemaking was developed by the National Endowment of Arts. The main distinction between creative placemaking and other types of placemaking referenced in this paper is that creative placemaking occurs with the primary purpose of promoting and empowering artistic culture and economy. This model of placemaking aims to revitalize communities and spaces by investing in artistic and cultural projects. An emphasis on this type of placemaking can help promote communities' character, boost local economies, and establish healthy cultural industries.

Creative placemaking capitalizes on those aspects of a community which make it distinct. By homing in on local culture, creative placemaking is able to shape communities and program spaces in a manner that resonates with locals and draws in diverse peoples. Creative placemaking is also incredibly versatile in application. It can be a stand-alone project in one geographic area (i.e. an art district), a widespread project with exposure in different spaces (i.e. city parks), or it can even be used in areas specific to certain industries (i.e. Retail). In their report entitled *Creative Placemaking* Ann Markusen and Anne Gadwa (2010) write the following:

Arts and culture at this historic juncture are proving their power as economic and social catalysts. Through smart collaborations with other sectors—government, private business, foundations—they are creating opportunities for rejuvenation and economic development, anchored

in and tailored to diverse communities. The arts can be a fulcrum for the creative transformation of American cities. (p. 6).

Creative placemaking is intended to preserve and promote both new and existing artistic and cultural resources in communities. To be successful, creative placemaking must be implemented not only through small projects, but also through policy and partnerships. Some cities and developers have engaged in creative placemaking in large projects by establishing arts districts or facilitating the establishment of museums, cultural centers, and performance halls. However, funding these structures and attracting these developers willing to assist in this kind of development is not an easy task for all cities; thus, other cities have engaged in creative placemaking by simply programming public spaces and creating events that are oriented around arts, culture, and education. These may look like outdoor performances and public art shows (Wyckoff, 2015).

Strategic placemaking. Strategic placemaking allows for the creation of quality places through a focus on job creation and income generation. It can be seen as a strategy for the economic development of the space. The MIplace Partnership Initiative is a major contributor to the body of knowledge for this specific type of placemaking and a major advocate for its use (Steuteville, 2014).

This type of placemaking is often targeted and tailored towards a specific user of a proposed space. Projects that use the strategic placemaking model are often undertaken to attract workers who have an expertise of high demand which provides them more flexibility to choose to where they work

(Wyckoff, 2015). In theory, a particular type of place will attract a labor force with a particular skill set, which will, in turn, benefit the local economy. Moreover, strategic placemaking typically targets small geographic locations. These locations are usually urban cores in the form of nodes, corridors, and downtowns that can support quality, multimodal forms of transit with special considerations for pedestrian amenities and the human scale (Wyckoff, 2015). This process limits viable locations in an effort to obtain a greater return on investment. Strategic placemaking in these areas can capitalize on these capacities by increasing density, improving mobility, establishing or improving open spaces, and allowing for entertainment to occur. The public sector usually initiates the process through policies for development aimed to attract the desired workforce. Interest from the private sector grows when the skilled labor force concentrates in the area. Planners may then look for these spaces to be programmable for recurring events that are of interest to the professionals who are being targeted. Furthermore, any activities that activate an area with recreational, cultural, and artistic events can help create a place that is beneficial to the overarching community.

Strategic placemaking can occur concurrently and share many measures with both creative and tactical placemaking. What makes it different is its targeted nature. Projects that make use of the strategic placemaking model should 1) coordinate various strategies to improve urban form over short periods of time, 2) not be stand-alone projects but instead build upon existing assets to maximize outcomes, and 3) always be oriented towards the desired skilled labor force. In his 600-page manual for placemaking, Mark Wyckoff claims that as long as projects

fulfill the three criteria above then they are considered strategic placemaking.

Place branding. Place branding, also known as place marketing, refers to finding the unique qualities of a space and raising awareness of these qualities across target populations. Place branding is different from strategic placemaking though they can be linked if place branding is an aspect of a strategic placemaking approach. In short, strategic placemaking refers to the creation of opportunities and amenities while place branding refers to the way these amenities and opportunities are conveyed to target audiences. Strategic placemaking refers to the process under which a combination of goal-oriented policies and positive development trends provide a space with unique or desirable amenities and opportunities (Daye, 2014). Once these amenities and opportunities exist, place branding is implemented as a way to convey them in a marketable way to potential residents, businesses, investors, and tourists. This is done through a method comparable to a marketing campaign for a commercial product.

Implications of Strategic Placemaking. The focus of strategic placemaking on creating environments that are attractive to a talented workforce is problematic. Wyckoff writes, “This adaptation of placemaking especially targets knowledge workers in the global New Economy who, because of their skills, can often live anywhere in the world, and tend to pick quality places with many amenities and other talented workers” (Wyckoff, 2017, p. 1-29). One issue with this statement is that it does not address systemic injustices that exclude specific groups from developing the skills that may allow them to become

part of a talented workforce. As a result, the spaces created through strategic placemaking would be manifestations of these inequalities and exclusionary in their own right. Another concern is that, although in theory the value system on which the “New Economy” is based would account for these issues, the transition to this social institution is one that is arguably in its early stages (Ghosh, 2015). Since the new economy is theoretical, then the focus shifts to the definition of knowledge workers. Definitions of the term knowledge workers vary but the term is most often associated with expertise in a field of work and considered the opposite of manual laborers (Morgan, 2016). There are concerning social implications in this nuanced statement which include the potential for gentrification and displacement. For this reason, the third criterion will be slightly modified as follows: it should always be focused on the inclusive, economic development of the area.

A Word on Gentrification

Placemaking is a means of activating existing spaces and designing new ones in a way that increases social and environmental interactions. However, some placemaking strategies when successful, promote gentrification. Gentrification is, “... the arrival of affluent people in a low-income urban neighborhood,” (Plunkett, Novak, & Lee, 2016, para 1) as well the impact this arrival has on existing communities. Their arrival can be partially attributed to the success of placemaking in creating attractive public spaces with a variety of uses. The success of these spaces attracts people and increases investment interests in the surrounding areas. As investment increases in the area so does the cost of

living. Additionally, placemaking models, like strategic and creative placemaking, can promote investment that is tailored to an exclusive group of people. Historically, the impacts of gentrification include the displacement of marginalized people and the racial homogenization of new and existing neighborhoods (Plunkett et al., 2016). Those who engage in placemaking need to consider the impacts their projects may have on the existing community. In particular, they need to develop a nexus between the existing sense of place and proposed placemaking strategies.

Augmented Reality

Augmented reality refers to an altered experience of the real-world environment through the imposition of computer-generated elements. Augmented reality works by overlaying digital information on the real world which impacts the way users perceive their environment. This involves using a combination of technology which synthesizes data about what is occurring in the outside world and adds a digital overlay (Reality, n.d.). Augmented reality has already impacted many industries including education, health, engineering, and design by contributing more interactive methods of engagement.

Types of Augmented Reality

There are currently five distinguishable models of augmented reality (iGreet, n.d.):

1. Marker based augmented reality
2. Markerless augmented reality
3. Projection based augmented reality
4. Outlining augmented reality
5. Superimposition based augmented reality

Marker based augmented reality is the most commonly used model across different industries followed by markerless augmented reality (Prabhu, 2017). Each of these augmented reality models provide different end products and are better suited to serve specific purposes than others. Notably, all of these augmented reality models augment only the visible environment and don't focus on other senses. Augmented reality for other senses, as well as multi-sensory augmented reality, will

be covered in a section below.

Marker based augmented reality. Marker based augmented reality, also known as recognition augmented reality, uses an augmented reality marker to identify what space it will visually alter. Augmented reality markers may be specific to an application but often come in a QR or 2D code that is readable by a camera on the device being used. Once the application recognizes the marker, it will alter it using the assigned augmented reality component (RealityTechnologies, n.d.). Figure 2 shows an example of a mobile device recognizing a marker and introducing an augmented component on its screen. This model of augmented reality is also associated with translation applications, especially the Word Lens Feature on Google Translate.



Figure 2. A smart tablet application uses marker based augmented reality to read a 2D code on a wall and produces the augmented sink shown on the screen. Reprinted from Villeroy & Boch, by Villeroy & Boch, n.d., Retrieved from <https://pro.villeroy-boch.com/nl/nl/badkamer-en-wellness/producten/product-nieuws/augmented-reality-app.html>

Markerless augmented reality. Markerless augmented reality, also known as location based augmented reality, uses sensors on a phone including the geospatial navigation system, accelerometer, and compass to identify its placement and display augmented components through the screen on the device. This model is referred to as markerless augmented reality because it does not require the recognition of a marker to display an augmented component (RealityTechnologies, n.d.). Augmenting specific locations can offer more information based on a user's location. It can also create new experiences such as those exemplified by urban gaming and can allow users to digitally change a space by adding their own components. Two applications that are well known for their use of location based augmented reality are Yelp Monocle and Nokia City Lens. Figures 3 and 4 show how these applications augment real world locations by overlaying visual information about nearby businesses when the camera is pointed at them.



Figure 3. Nokia City Lens application uses markerless augmented reality to provide information about local businesses. Reprinted from PocketNow, by A.Z. Lein, 2012, Retrieved from <https://pocketnow.com/nokia-city-lens-nyc-walk-through>. Copyright 2018 of PocketNow.



Figure 3. A screen shot of the Yelp Monocle application which augments digital information about nearby businesses onto the screen of a mobile device using markerless augmented reality. Reprinted from Technologist by H. McCracken, 2009, Retrieved from <https://www.technologist.com/2009/08/28/yelp-augmented-reality/>. Copyright 2014 by the Technologist.

Projection based augmented reality. There are three types of projection based augmented reality. The first, shown in Figure 5, is the projection of light onto a flat surface that allows for individuals to interact with the projected features by touching them. Sensors are able to recognize touch by reacting to changes that occur in the projection when the light is intercepted by a person's body. The second type is the use

of laser plasma technology to launch 3-dimensional holograms that appear in a given space and can be programmed to respond to touch (Crooks, 2018). Figure 6 provides an example of an image of an apple created using this technology. Projection mapping is the final type of projection based augmented reality. This technology uses depth sensors and preprogrammed light displays to manipulate non-flat objects by changing their visual qualities and making them interactive (Jones, n.d.). Changing the visual qualities of building facades is a popular application of projection mapping (Figure 7).



Figure 5. Projection based augmented reality dial pad created by SixthSense that can sense when a finger touches a number. Reprinted from SixthSense, by L. Barry, (n.d.), Retrieved from <http://www.pranavmistry.com/projects/sixthsense/#PICTURES>



Figure 6. Apple figure created by Burton Inc. using laser plasma technology. Reprinted from Burton Inc., by Burton Inc., (n.d.), Retrieved from <http://burton-jp.com/en/producten.htm>. Copyright 2018 by Burton Inc.



Figure 7. Projection Mapping created by Obscura for theMart building exterior in the City of Chicago. Reprinted from Installation, by J. Brott, 2018, Retrieved from <https://www.forbes.com/sites/juliabrenner/2018/10/09/vornado-realty-trust-gifts-30-year-long-public-art-program-to-chicago/#7cd282ae3ea5>. Copyright 2019 by the Obscura Digital LLC.

Outlining augmented reality. Outlining augmented reality uses sensors to identify features that may be difficult to observe otherwise. Some argue that outlining augmented reality is a different application of projection based and recognition based augmented reality. However, the purpose of it is to help individuals identify boundaries and shapes in their environment that may not be immediately identifiable (RealityTechnologies, n.d.). The biggest application of outlining augmented reality is its use in the automobile industry with driver assistance technology as shown in Figure 8. These are features in cars that help drivers identify traffic lanes or curbs, especially when doing so may be difficult do to outside conditions.



Figure 8. GM Motors showcases a head up display that uses outlining technology to assist drivers in low visibility environments. Reprinted from TopSpeed, by GM Motors, 2010, Retrieved from <https://www.topspeed.com/cars/car-news/introducing-gm-s-next-generation-head-up-display-ar86547.html>.

Superimposition based augmented reality.

Superimposition based augmented reality uses environmental data, especially in the form of object recognition, to fully or partially alter the environment being observed. This may be by recognizing and then replacing a particular object or by adding a separate feature (RealityTechnologies, n.d.). This model may also be seen as an application of other models discussed in the previous sections. However, this model does not require a marker or specified geolocation to be able to process the placement of a component. A well-known example of this type of augmented reality is the IKEA Place feature on the IKEA mobile application as shown in Figure 9. This feature allows the user to focus their camera on an area of a room and insert augmented furniture to preview how it would look. Other applications have similar functions for modelling eyeglasses and clothing.

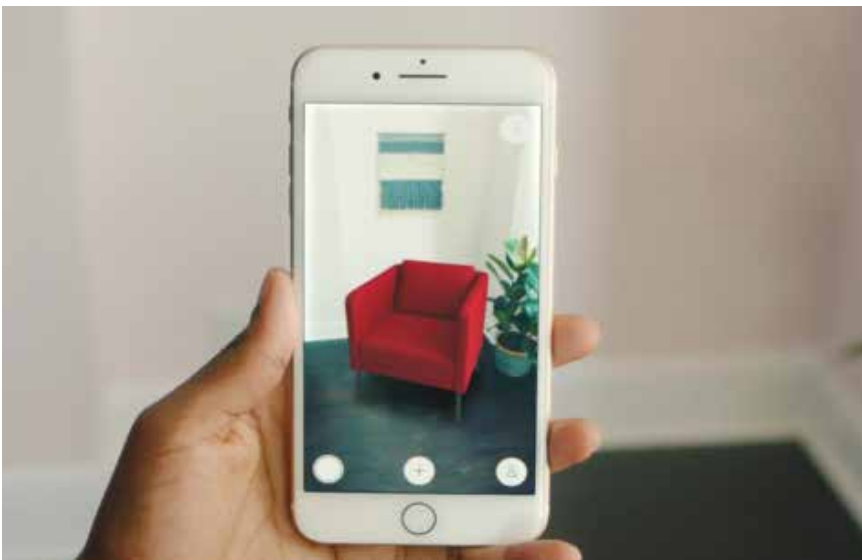


Figure 9. IKEA Place application superimposes a digital image of a couch, allowing a user to preview their product. Reprinted from IKEA, by IKEA, 2017, Retrieved from <http://highlights.ikea.com/2017/ikea-place/>. Copyright 2019 by IKEA.

Tools for Augmented Reality

There are various technologies that make augmented reality possible. Furthermore, the components that make it possible vary depending on the type of augmented reality being considered or how the technology is being used. This paper does not strictly adhere to any one technology or method. Any augmented reality model that can impact, improve, or modify the practice of placemaking is considered. This section is meant to provide a brief overview of the technologies used in the development of augmented reality.

The components needed to create and manage augmented technologies can be separated into three categories: 1) Software, 2) Hardware, & 3) Remote Servers (Kumar, 2016). The first step in creating augmented reality is understanding the scope and purpose of the project.

Augmented reality requires specific software and hardware depending on the needs of the product. There are multiple augmented reality programs that make a desired product possible. The choice often depends on the desired level of user engagement. For example, a product used for creating an active, and dynamic game will vary from that which is used for a static digital art piece. The prior will likely require a game engine, while the latter may use a simpler platform for 3-dimensional rendering. The setting or context of these digital overlays will also impact hardware choice (Kumar, 2016).

There are two subcategories for hardware devices: display devices and input devices. Input devices refer to sensory equipment that is connected to a server through a processor. Examples of input devices include cameras, global positioning systems, and other motion sensors. Often these input devices

and processing equipment are already built into a display device but are distinguished from it because they may serve multiple purposes. The display device must be connected to the input devices that collect the data necessary to augment the real world. The devices often have a built-in processor that couples the sensory data from the input device with the augmented reality components retrieved from the server. The coupled data is then transferred to an application which displays the augmented content on the display device for the end user to interact with. The developer needs to choose whether to create their own application or use an existing application or plug-in that is compatible with the device being used dependent on the product's technical specifications. Figure 10 shows a graphic that summarizes the relationship between the three key components (Kumar, 2016).

Affordability

Affordability is considered because the technology must be financially attainable and sustainable prior to adoption in wider societal practices. If there is a new digital environment to be built, it is important for it to be created and inhabited by people from diverse socioeconomic backgrounds. However, the price to be involved in the creation and use of augmented reality can often be steep and is what has stalled its adoption across many industries. As augmented reality products emerge, financial limitations must be addressed with regards to the equipment and resources necessary to use and develop the technology.

Development costs. Development costs for augmented reality vary depending on the desired product and

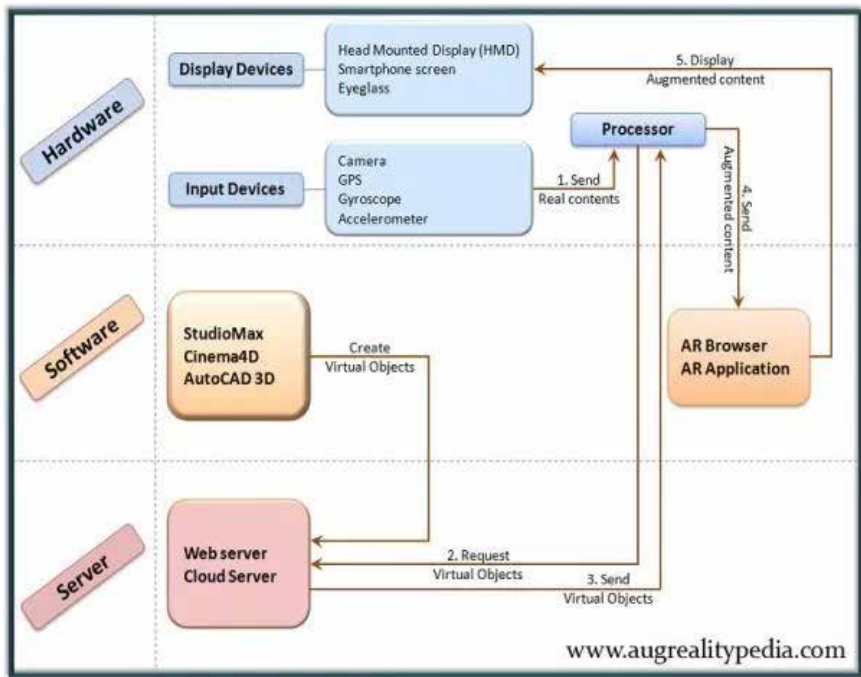


Figure 10. This chart shows the relationship between the three key technology components needed to create and use augmented reality. Reprinted from AugRealityPedia, by S. Kumar, 2016, Retrieved from <https://www.augrealitypedia.com/7-amazing-facts-augmented-reality-tech/>. Copyright 2019 by Satish Kumar.

its application. Variations in cost can be dependent on the entity developing the application, staff resources and technical knowledge, the device for which the application is intended, the time it takes to create the application, and inclusion of associated features (i.e. account management, language, analytics, and technical support) (Tecsyt Solutions, 2018). An article for Medium summarizes what an individual investor could expect to spend for an application developed by an eastern European developer. The author claims that a complex application that uses location based augmented reality can take a developer up to 800 hours to create and cost an investor up to

\$28,000. Less complex applications can require up to 150 hours of work and cost an investor nearly \$8,750 (Tecsyntax Solutions, 2018). This makes the actual cost of developing a deterrent for potential investors.

Understandably, many of the well-known applications for augmented reality have been developed by industry giants which include names like Disney, Coca Cola, and Nike. These companies are able to have their own custom applications created at costs that can exceed \$25,000. Other estimates claim that this cost can actually be much higher – with some high-end development firms that only take contracts upwards \$500,000 (Eisenburg, n.d.) Smaller corporations and businesses have cheaper options. However, the amount they can budget for the creation of a new application or the use of an existing application will greatly impact their return on investment (Calloway, 2017). Though this may seem discouraging for independent developers and investors, the past few years have also seen the rise of augmented reality software development kits. Augmented reality software development kits are frameworks that allow individual developers to create their own custom applications using tools and sample codes (Summerson, 2018) that would otherwise be inaccessible to them (Franzen, 2017). Well known augmented reality software development kits include Android's ARCore, Apple's ARKit, Google's Tango, and Wikitude. Ideally, these software development kits will help stymie financial limitations associated with the development of augmented reality and promote the ubiquity of the technology (Munster, 2017).

End user costs. On the opposite end of this topic is affordability for the end user. The end user, or the user who

will ultimately utilize the application, will need the equipment and software that allows them to view the augmented material created by the developer. As described above, this person will need a device with the correct input and display devices as well as the processing capability that is required by the application. Currently there are three widely used devices for augmented reality applications: 1) hand held devices, 2) head-mounted displays, 3) holographic devices (Kore, 2018).

Hand held devices, such as phones and tablets, can vary in price because they are often sold on behalf of a service provider that may subsidize the price of the device with a subscription to a service plan. The focus of handheld devices in this paper is on smart phones with the ability to support augmented reality applications. In general, most smartphones and tablets developed within the last two years by industry leads, such as Apple, Google, and Microsoft, should have be a able to support augmented reality applications (Riddick, 2018). However, prices of smartphones have been continuously rising since 2017 (Growth from Knowledge, 2019). In a 2019 press release, Growth from Knowledge reported the following:

Around 12% (up from 9% in 2017) of smartphones sold were priced at more than \$800 in 2018. The mid-segment of \$150 to \$400 continues to be an important competitive battleground, accounting for 46% of smartphones sold globally in 2018 (up 2% from 44% in 2017). (para 4)

Further, forecasting from Statistica estimates that the average price of smartphones will rise from \$567 in 2018 to \$887 in 2023. Still the prices for the newest smartphones on the market often surpass these estimates. An example is the unveiling of

Apple's iPhone X in 2018 which was priced at \$1,000 (Molla, 2018). These prices do not include the cost of a service plan. In the United States monthly fees for service plans with unlimited data for one device can range from \$65 to \$80 with one of the "Big Four" mobile virtual network operators (AT&T, Sprint, Verizon, & T-Mobile) (Fowler, 2019). By contrast, Statistica forecasts a reduction in tablet prices from an average of \$266.87 in 2018 to \$228.84 in 2023. A reduction in average price is also expected to be seen for head mounted displays.

There are a variety of head mounted displays – headsets and glasses – on the market some of which are used specifically for augmented reality applications and others which can be used for both augmented reality and virtual reality. Head mounted displays vary in computing capabilities. Briefly explained, there are headsets which are designed to function independently from any other computer hardware and others that require some level of interface with another device to function (i.e. mobile device or PC) (Virtual Reality Society, n.d.). Other features such as optics and controls may vary between devices, but the differences are often due to user preference. Examples of head mounted devices compatible with augmented reality technologies include Microsoft HoloLens, Magic Leap Lightwear, and Google Glass. According to Statistica, the average selling price for stand-alone head mounted displays increased from \$967 in 2015 to \$2,880 in 2016; however, the price is expected to decrease to an average of \$1806 by 2020.

There are few augmented reality projection systems available commercially for individual use, therefore it is difficult to estimate the average cost of these products. The lack of information is likely due to the wider application of this

technology at the industry level rather than individual projects. Among the currently available projection based augmented reality products are Lightform and Nord Project's Lantern. Lightform is a device that can be attached to most projectors which allows it to read the dimensions and physical attributes of a space. The user can then create augmented features using the associated software, Lightform Creation. This product went to market with a price of \$699 for the device alone with an entire kit available for \$1,499 (Levy, 2018). Lantern on the other hand was created through a collaboration between Nord Projects and Android Things. This lamp uses a simple computer, a projector, and an IKEA lamp to create simple augmented reality components. The project was crowd sourced and designed to be replicated by anyone. Free instructions, materials, and codes can be found online. The most expensive piece is the projector which can cost approximately \$400 (Lynn, 2018).

Augmenting other senses

The technologies discussed above have only dealt with the augmentation of vision. In other words, these models and devices work by changing what you can see or how you see it in the real world. This paper focuses on visual augmented reality because it is the most developed and may have the most value in application for placemaking. However, augmented reality does not only need to apply to sight or vision.

There are areas of technological development that focus on the augmentation of other senses including touch, balance, acceleration, and even temperature. These technologies are often discussed in terms of virtual reality and mixed reality systems that go beyond the parameters of this paper. Example

of these include flight simulation systems and virtual gaming (Naimark, 2018). Augmented reality has also made an impact on hearing through the creation of augmented sound. This is exemplified through products like Bose AR and MIXHalo. Bose AR is the name of augmented reality glasses developed by the audio corporation, Bose. These glasses are equipped with global positioning system tracking and other sensors that identify an individual's location and the direction they are facing. Once this data is processed, the glasses provide the user with audio information about the location they are facing (i.e. restaurant, store, etc.) (Roberston, 2018). MixHalo is an application that allows for concert goers to experience the most ideal sound quality regardless of their location in a venue. The application provides a user's phone with audio from the stage mixer with very few delays or inconsistencies with the live performance. In essence, it eliminates bad quality audio caused by factors like distance and acoustics. Finally, augmenting other senses and sensations, such as taste, smell, or gustation, has yet to be fully researched. Most of the information currently available relies on chemical reactions and sensations (Naimark, 2018). One example of this is a machine that sends vibrations through a lollipop that gives the taster the sense that they are "tasting fireworks" (Smith, 2010). Others stimulate bodily reactions using fake essences or a virtual food product (Naimark, 2018).

The Application of Augmented Reality in Urban Planning: Precedents

Immersive technologies like augmented reality have already made an impact on how cities, urban designers, and developers are able to share new projects with their stakeholders. In particular, augmented and virtual reality is being used to drive inclusive and engaging development processes. The use of immersive technologies like augmented reality, mixed reality and virtual reality allows for users to experience what a neighborhood may look or feel like by superimposing that development over a 2-dimensional plane. One such initiative is HoloLens City Model Viewer which was developed to help a Chinese city experience proposed urban developments (Ong, 2017). Another use for these technologies in urban planning is in the education of local residents about issues that affect their communities. An example of this is briefly discussed in an issue of Planning Magazine (American Planning Association, 2017). The article describes the use of virtual reality technology on a pier in Santa Monica, California to graphically show the impacts of sea level rise on waterfront communities and introduce residents to possible mitigation strategies. Figures 11 and 12 show the device used and the view it provides of the surrounding environment. Both of these examples show the potential role that immersive technologies can play in urban planning but only the latter example in the City of Santa Monica shows how it can impact placemaking.



Figure 11. A community member uses virtual reality equipment on a pier in Santa Monica, CA as part of a climate change awareness campaign. Reprinted from City of Santa Monica, by City of Santa Monica, 2017, Retrieved from https://www.smgov.net/uploadedFiles/Departments/PCD/Plans/Local-Coastal-Plan/Owl%20Survey%20Attachment_Layout%206.26.17.pdf.

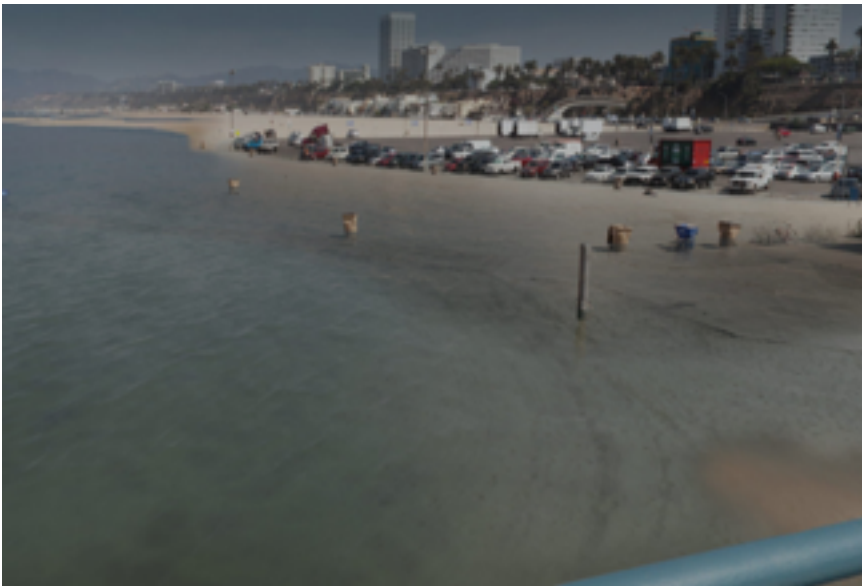


Figure 12. Virtual reality depiction of potential flood conditions in a scenario where a big storm and high tide occur at the same time. Adapted from MobileOwl, by MobileOwl, 2019, Retrieved from <http://www.mobileowl.co/samo/tour/2/index.php#close>.

Case Studies

Sense of place cannot be artificially created because it is subjective and relies on interactions that occur as a result of a deep understanding of the physical composition of an environment. However, augmented reality can affect the way humans perceive a physical space by introducing new digital elements. These case studies explore how augmented reality products are changing perceptions of existing spaces and potentially influencing peoples understanding of them.

Augmented art gallery in Orlando. In November of 2018, Snap! Orlando, a contemporary art organization based in Orlando, Florida, unveiled City Unseen, an augmented reality gallery showcasing digital art throughout the City of Orlando. The city-wide art exhibit requires a mobile phone application in order to view how augmented reality artists have augmented different sites throughout the City. This project was even used to restore and revitalize damaged and dilapidated murals across the city as exemplified by Figure 13. One such example is a series of portraits dedicated to individuals who had taken advantage of the United States' Deferred Action for Childhood Arrivals (D.A.C.A.) immigration policy. The actual project was completed in November of 2018 but was eventually taken down the following January (Reep, 2018). In City Unseen, the project was changed into a digital medium and placed in its former location (Figure 14). Furthermore, some murals now include a video of their subjects telling their stories and sharing sentiments about the policy. While motives for individual art installations may be novel, the purpose of the gallery is to promote art in the city and restore damaged art through an emerging medium, augmented



Figure 13. Smart phone view of *City Unseen* installation that digitally recreates a mural by artist Mark Ghemling that was lost due to water damage. Reprinted from BrandXR, by BrandXR, (n.d.), Retrieved from <https://brandxr.io/cityunseen>. Copyright 2019 by BrandXR.

reality (Connolly, 2019). In an interview with the Orlando Sentinel, Director and Curator of Snap! Orlando, Michael Khan gives his remarks on the importance of the projects, “It is very important that the art doesn’t fall behind and that we, as a city and as an art organization, are not left behind... It’s almost like having a museum throughout the city. That’s the idea” (Connolly, 2019).

Disney Parks. Disney theme parks rely on various design innovations to create a sense of place that tailors to their slogan, “The Happiest Place on Earth.” This has been done, in part, through the use of projection based augmented reality to change the visual qualities of existing architecture, interior spaces and objects, and even actors. A process called projection mapping, which uses the contours of surfaces to create visual illusions with a projection, allows Disney theme parks to



Figure 14. This is a digital recreation of *Inside Out*, a mural by artist JR created from portraits of DACA students which was washed away in its original location. Reprinted from Orlando Weekly, by Snap Orlando, 2017, Retrieved from <https://www.orlandoweekly.com/orlando/augmented-reality-artists-add-a-new-layer-to-your-world-in-snaps-ambitious-city-unseen-exhibition/Content?oid=20370354>. Copyright 2019 by Snap Orlando.

transform the exterior of its buildings and display different scenes (Nile, 2017). This temporarily changes the visual qualities of the locale around the audiences gathered to see the displays. Early examples of this technology were used to make statues in the Haunted Mansion ride come to life (Mine, Rose, Yang, van Baar, & Grundhofer, 2012). Newer examples of this can be seen on Disneyland's famous castle during night time exhibitions (Figure 15) and in the show *Frozen Live* to make an actor appear frozen. Figure 16 shows the how the Refik Andohol Studion recently used projection base augmented reality to create scenes on the facades of the Walt Disney Concert Hall building in downtown Los Angeles.

For Disney, augmented reality has provided a relatively affordable method to enhance their parks and properties.



Figure 16. Projection mapping used on the Disney Concert Hall in downtown Los Angeles, CA. Reprinted from Refik Anadol Studio, by Refik Anadol Studio, 2018, Retrieved from <http://refikanadol.com/works/wdch-dreams/>. Copyright 2018 by Refik Anadol Studio.

As mentioned in an article from the journal *Computer*, “... projection-based [augmented reality] is an affordable and excellent way to augment and activate existing spaces, transforming them without making significant structural and facility changes” (Mine et al, 2012, p 2). Other benefits of the projection systems include being able to create shared, dynamic environments with technology that is easy to conceal and has few technical issues.

District. District is an application for urban exploration. Users in participating areas are shown checkpoints and are encouraged to travel to those checkpoints within a certain time limit in order to earn points on the application. The creators of this application have also used it to create District Urban Races, a series of events that gather large groups of people in a competitive setting and encourages exploration of new areas



Figure 15. Projection Mapping used on the Magic Castle at Disney World. Reprinted from Display Devices, by Display Devices, (n.d.), Retrieved from <http://www.displaydevices.com/disney-magic-kingdom-projector-enclosure/>. Copyright 2019 of Display Devices.

in their cities. Though the name may imply a competition, the level of participation in the competitive portion is up to the users (District, n.d.). The application utilizes augmented reality to make starting points and checkpoints more engaging as seen in Figure 17 (Wong, 2018). Although, the function of the application does not rely on augmented reality, it is a new way to use the technology to allow people to discover areas in their cities that may have gone overlooked. Although, the function of the app does not rely on augmented reality, it is a new way

to use the technology to allow people to discover areas in their cities that may have gone overlooked.



Figure 17. Screenshot of an augmented reality check point on the District application. Reprinted from Men's Health, by G. Wong, 2018, Retrieved from <https://www.menshealth.com.sg/running/district-race-singapore-review-urban-exploration-augmented-reality/>. Copyright 2018 by SPH Magazines PTE LTD CO.

The Application of Augmented Reality in Urban Planning: Possibilities

There are several examples of how augmented reality can be integrated into the practice of placemaking using various approaches and technologies to achieve their purpose. These examples do not necessarily show the deliberate use of augmented reality for placemaking, but they do introduce new insights into their future relationship. To understand this relationship, one needs to comprehend the functions of emerging technologies and the ways in which they are being implemented into the placemaking process.

Future Considerations for Placemaking

The populations of urban areas across the world are expected to increase through the year 2050 (United Nations, 2018). Residents and leaders of urban areas are using placemaking to adapt to this growth in two methods that can often contradict each other. The first method is the creation of new spaces and attraction of new investment and people (CBRE Group, n.d.). The second is the movement towards livable environments that reflect local values and identities (Kent, 2015).

The first method shows a growing interest in strategic placemaking. Strategic placemaking is a process by which cities and regions use urban commodities and development to attract residents and spur economic growth and activity. The increasing use of strategic placemaking necessitates an equivalent increase in consideration to how it impacts existing residents. Underscore (2018), a brand strategy agency, notes a trend of increasing support of localism, the latter method of engaging in

placemaking. Underscore (2018) writes the following:

We are in a time where the impact of globalisation is under increasing scrutiny and a backlash in consumer preference has emerged towards embracing and celebrating the local. This is helping us to foster deeper connections with the spaces around us and the people within it by looking at the histories, the people and the sensitivities of the area that make up the ‘soul’ of an area.
(para. 2)

Placemaking practitioners must work toward reconciling the benefits and liabilities that are attached to both of these placemaking philosophies. The Project for Public Spaces recommends that more responsibility for placemaking be given to communities rather than experts. This would promote a focus on people and allow individuals to define and preserve the uniqueness that may attract outside investors (Kent, 2015).

Digital place and digital placemaking. A major consideration for the future of placemaking is the integration of technologies such as AR in the urban design and planning practice. Digital place is a concept discussed by Tim Creswell (2015) that covers how emerging technologies add a layer of digital information to physical spaces. The existence of this data may positively and negatively influence how knowledge about places is created and disseminated. For example, research shows that the digital information about a location can often fall subject to information ranking that occurs on online search engines. The increasing influence of technology on physical spaces has led to the development of the digital placemaking model.

The Digital Placemaking Institute (n.d.) describes digital

placemaking as follows:

In practical terms it is the installation or utilization of digital technologies in the public space to enhance culture; facilitate urban regeneration programs; deliver education and cultural events; promote public participation and the democratization of public space. (para. 6)

The term digital placemaking refers to a relatively new but growing field that addresses the implications of digital place in innovative ways. Digital placemaking can aid in establishing a nexus between emerging urban technologies and social issues that may not be thought to have technological solutions. In the context of this paper, it provides guidance to understanding the role of augmented reality in placemaking.

There are several examples of how augmented reality can be integrated into the practice of placemaking using various approaches and technologies to achieve their purpose. These case studies do not necessarily show the deliberate use of augmented reality for placemaking, but they do introduce new insights into their future relationship. To understand this relationship, one needs to comprehend the functions of emerging technologies and the ways in which they are being implemented into the placemaking process.

Identifying Trends and Possible Applications for Augmented Reality

The research conducted for this essay suggests three main applications for the use of augmented reality in placemaking. These trends are based on several case studies that follow similar trends and uses or show a similar end goal.

Application #1: Facilitate orientation.

Background. Orientation refers to the ability by which a person is able to navigate an environment without the fear of becoming lost (Lynch, 1960). Orientation helps people feel safe especially in large, new environments. Facilitating orientation can lead to the development deep spatial knowledge (Tuan, 1977) and the creation of a vivid environmental image. One-way people orient themselves is through the use of various wayfinding systems. Wayfinding allow individuals to navigate their environments by providing directory aides such as graphic and architectural markers (street signs, building signs, directional signs, landmarks, etc.) (City of New York, 2001). Wayfinding and navigation have already been made more accessible through the use of global positioning systems and geolocation software. However, these technologies require the user to disengage from their setting which may reduce their spatial understanding of an environment (Milner, 2016). This is as opposed to more traditional wayfinding features like signs or landmarks that are embedded in the real-world setting.

Application. The use of augmented reality features in emerging navigation applications and wayfinding techniques can further promote orientation by increasing interactivity and ease of use; promoting engagement with the physical environment; and promoting flexibility and adaptability to physical spaces and wayfinding systems. Inserting augmented reality would allow existing navigation technologies to encourage orientation rather than only providing direction. Utilizing marker based, markerless, and outlining augmented reality with camera and mapping features on a smart device could help individuals

recognize and process visual clues in their physical environment (e.g. bus stops, roads, buildings, landmarks) by overlaying them with directory or supplemental information about their location. This would allow users to increase their first-person frame of reference and later navigate their environment with minimal technological assistance. Projection based augmented reality can be used to promote orientation by making spaces and wayfinding more visually impactful and therefore contributing to the environmental image. Projection based augmented reality can also be used as stand-alone wayfinding system to create signage and overlay visual features that may be more readily adapted to changes in the physical environment.

Relevant Case Studies. The Perficient Digital Labs design and technology studio exemplifies how augmented reality can be used to create navigation applications that promote orientation. They developed an augmented reality application to help facilitate the use of public transit within the City of Chicago. The application uses marker based augmented reality to supplement Chicago Transit Authority's bus stops and allows viewers to switch between a traditional map mode and an AR mode to help them visualize their route (Hasbrouk, 2019). Figure 18 shows what the application looks like on a smart phone.

Another example of how augmented reality is being used to promote orientation is through the use of three-dimension augmented signage. Technology company Burton, Inc. creates three-dimensional imagery and signage using an augmented reality known as laser plasma projection (Burton, n.d.). The ability for their models to exist in actual space would make it comparable to physical signage (Figure 19). However, this

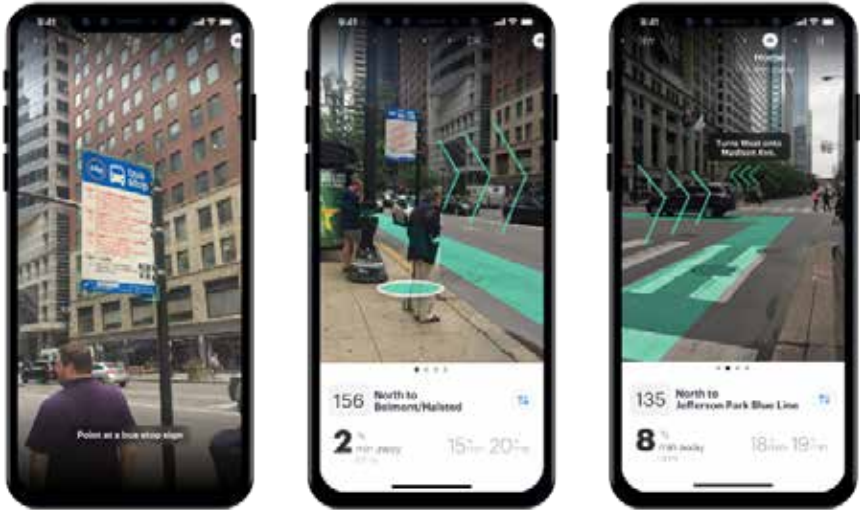


Figure 18. Smart phone view of Perficient Digital Labs' augmented reality transit application. Reprinted from Perficient Digital Labs, by Perficient Digital Labs, 2019, Retrieved from <https://blog.truthlabs.com/chicago-cta-augmented-reality-sign-detection-visualization-bus-data-application-design-7f8fe2f2f6b7>.

projected signage could potentially provide more flexibility because the light features could be reprogrammed to relay a variety of messages. This adaptability makes augmented reality a particularly useful tool in redefining wayfinding and landmarks especially in terms of permanence.

Application #2: Promote personalization and participation.

Background. Placemaking is a method by which community members might exercise their agency to transform locales and promote the creation of desired places. The word agency refers to the ability to exert one's individual power in everyday life. Agency often exists and is understood within parameters created by other social structures and stratification



Figure 19. Laser Plasma projection of arrows for directing traffic. Reprinted from Burton Inc., by Burton Inc., (n.d.), Retrieved from <http://burton-jp.com/jp/VRen.htm>. Copyright 2018 by Burton Inc.

systems (e.g. economic class, race, education attainment, etc.) that influence how and when people use their power and the extent of its impact (Cole, 2019). Therefore, the placemaking process and tools used to implement it must also be understood within these parameters. Augmented reality for examples requires a certain level technical competence and resources. Thus, the integration of this technology into the placemaking process should focus on inclusivity and access.

Application. One method by which augmented reality can be used to enhance placemaking is by offering more choices as to how an individual uses a setting. Augmented reality can activate spaces by augmenting digital features that provide new activities or repurposes them altogether. For example, a park can be turned into a pop-up gallery or be used for virtual scavenger hunts. Individuals could also decide to replace and remove certain elements from public spaces based on preference. These preferences and uses could be simultaneously recorded using surveying technologies and provide user insight that can guide future capital projects. This would likely require



Figure 20. Screenshot taken of a video showing developer Abhishek Singh playing an augmented Super Mario Bros. game on a walkway in Grand Central Park, New York. Reprinted from Business Insider, by A. Singh, 2017, Retrieved from <https://www.businessinsider.com/super-mario-bros-central-park-abhishek-singh-augmented-reality-video-2017-6>.

a larger crowd sourced platform where augmented reality can be contained, as well as improved connectivity with other data gathering devices (Warner, 2017).

Relevant Case Studies. Technology companies and individual developers have already begun moving toward this application of augmented reality. The growth of urban gamification can be seen as reflection of this trajectory. Urban gamification is defined as the use of the physical environment to provide a setting for videogaming by making use of surrounding buildings, streets, and landscapes (Qabshoqa, 2018). Since urban gamification uses augmented reality to change physical setting into ones that coincide with elements of game, it therefore also repurposes that space. Developer Abhishek Singh exemplified this application when he used augmented reality to transform New York's Grand Central Park into a game of Super Mario Bros. (Singh, 2017) (Figure 20).



Figure 21. A person augments an art piece over a subway wall advertisement using the RE+Public NO AD application. Reprinted from NO AD App, by NO AD App, (n.d.), Retrieved from <https://noad-app.com/press/>.

While the Singh example show how a space might be reimaged to allow for new activities, other developers and companies have focused on showcasing specific environmental preferences. For example, Re+Public Lab Inc. uses emerging technologies to take over spaces used for commercial advertisements and encourage new, artistic uses on them (Re+Public, n.d.). This campaign used augmented reality to bring attention to the perceived control that private entities can have over public areas in the City of New York. The application provided users with the choice to digitally eliminate the presence of specific commercial advertisements from public spaces in the City and replace them with art (Figure 21). The aim of the project was to show how these advertisements could affect city health and help residents psychologically invest in their communities.

Application #3: Convey the subjective meaning of place and use digital placemaking to promote storytelling.

Background. Background. The definition of place includes the endowment of a space with subjective meaning to create a sense of place (Cresswell, 2015). The subjective nature of “sense of place” can be a source of conflict for individuals who attach different meanings to the same space. This is especially true within communities experiencing shifts in their demographic make ups. One example of this change is gentrification in which the influx of new residents can often result in changes to physical spaces and community character which influence the creation of place (Kennedy & Leonard, 2001). Additionally, it can be difficult for new residents to understand the meaning that long-time residents have assigned to a place. This contest over places requires a method for communicating and understanding the meaning and values that different people assign to them.

Application. Augmented reality allows for a new method to produce and compliment traditional way of storytelling. Specifically, the use of augmented reality for art is growing in popularity because it is an attractive and engaging method for artists and storytellers to speak about issues that matter to them and their communities. Assuming that accessibility to platforms that enable individuals to create their own augmented components improves, then augmented art can be used as a method for community members to communicate their perspectives on a place and even protest changes that

affect them. Moreover, communicating using augmented art or storytelling would likely face a less crowded regulatory environment and be more affordable than physical changes to any particular setting. Additionally, augmented reality can serve to preserve meaning in locations where places once existed. They can communicate context and digitally symbolize the transition of ownership even when new physical qualities do not reflect the old places. This is important because meaning and context are subject to change and obsolescence, but augmented reality can preserve the features and meanings that were once a part of a place.

Relevant Case Studies. Many artists and art organizations have already started to use art to communicate ideas about social issues and developments that impact their communities. One example comes from Los Angeles, where artist Nancy Cahill created an app to display augmented art along the Los Angeles River (Figure 22). While this project began as a concept for virtual art that brought attention to malpractices in urban development, it quickly transformed to include art pieces that tackled various social issues including climate change and colonization (Furman, 2018). Another example comes from augmented reality platform Artvive, which showcases how augmented reality can be used as a tool to teach and communicate unfamiliar ideas. The Artvive app is used by museums to help visitors better understand the art exhibits by providing the user with more information about the artist and the context that influenced the art piece (Smith, 2018) (Figure 23).



Figure 22. A Defining Line installation created by Carolina Caycedo named Curative Mouth shows indigenous fishing nets over the Los Angeles River and speaks to disparities in access to hydrologic resources. Reprinted from Los Angeles Times, by Carolina Caycedo, 2018, Retrieved from <https://www.latimes.com/entertainment/arts/museums/la-et-cm-4th-wall-vr-art-nancy-baker-cahill-20181029-story.html>.



Figure 23. Museum guest uses the Artvive application to augment a photograph over the Monet painting is depicting. Reprinted from Eagle News, by Eagle News, 2017, Retrieved from <https://www.eaglenews.ph/augmented-reality-brings-art-alive-in-vienna/>. Copyright 2017 of Eagle News.

Brief Ethical Considerations for the Application of Augmented Reality in Placemaking

As discussed earlier, augmented reality is not immune to the influence of social structures and contexts that contribute to its development. Thinking critically about who is included the creation of augmented reality technologies and associated hardware and software technologies will be crucial to understanding its capabilities and limitations for its application in placemaking.

Langdon Winner (1980) writes about the ability for any human made artifact to be a manifestation and perpetuator of power arrangements in society. He speaks to the ability of technological artifacts to be inherently democratic or authoritarian. His theory, applied to augmented reality technology, brings attention to the importance of transparency and participatory design in its development and use. This is especially true considering that much of this technology is being developed and distributed by private companies. The creation and management of these platforms by private entities creates concerns over the types of data collected by their applications and how it may be used or distributed later on.

Individuals who use augmented technologies should consider its limitations as a tool for placemaking, especially if it is being created or managed by someone who is not part of the community being impacted. Creating platforms that emphasize participatory development and open creation of augmented reality components can be one way of addressing this limitation. User experience designer, Lilian Warner, suggests that in the near future, "...users will also be able to easily create and share their own [augmented reality] content..." (Warner, 2017,

para. 9). Allowing people to create their own augmented content means that they would be able to contribute to meaningful placemaking for their own communities. However, the emergence of multiple realities and its impact on the users' psychological wellbeing, especially children and youngsters are subject to further studies.

Crowdsourcing placemaking through individual contributions of augmented components will likely require the use of platforms that provide clear structure for the stored components, and ease of access to the other users to retrieve the stored components. The way different augmented components are organized by any platform can have serious implications in understanding places. The algorithm behind ranking components has to be transparent and unbiased to provide fair access to the augmented reality contents.

Conclusion

Placemaking is continuing to grow in popularity as a tool to intervene in the sociocultural and economic environments, and ideally, change reality for better. Augmented reality can be used as a tool to engage with the physical environment with an added layer of information. The four potential applications of AR, as discussed in this essay, have one common purpose: producing and delivering new form of spatial information to the public, with the hope of enriching their living environments. This quality makes AR a useful tool in placemaking, and participatory design process. The most likely city planning applications of this technology in the near future will be in promoting public engagement and outreach. However, if this technology is to encompass the roles discussed above, it will need to so with

careful consideration to periphery societal impacts and ethical implications. Developers and practitioners will need to consider financial accessibility to the technology, privacy concerns, and the political implications in the creation and use of augmented content. The future impacts that augmented reality will have on society will likely vary depending on the trajectory set by the continued support of and investment in the technology. Furthermore, it is important to note that the development of this technology will be strongly linked with developments in other technical disciplines.

The current uses of augmented reality show an innovative approach to placemaking. These applications of augmented reality show promise in this technology's ability to encourage meaningful connections between people and their environments. This role will continue to be defined as the practice of digital placemaking continues to develop, innovations in immersive technologies continue to occur, and creative individuals continue to find ways to augment the spaces they inhabit.

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Abstract

This paper explores possible applications of augmented reality technologies in the practice of placemaking. Place is an abstract term used to describe physical spaces that are given subjective value by their users. This abstract value is created from interactions with and within the physical environment which provide a deeper understanding of the space. Augmented reality is considered an immersive technology and it provides a digital medium by which to connect people to the spaces they inhabit. This occurs through the creation of new interactions and changes to visual qualities of a space. Three trends are found in current applications of this technology in placemaking through a review of online sources and an examination of case studies presented. Inferences are then made as to what these trends may mean for the future of this technology in the field of placemaking. Other ethical and social issues are also considered in the scope of this paper as they relate to place, placemaking, and technology.

Keywords: Augmented Reality, Immersive Technologies, Place, Placemaking, Technology

