Augmented Reality and Urban Exploration

Sarah M. Kaufman, NYU Rudin Center

Abstract

Augmented Reality is beginning to shift the landscape of urban exploration, making the experience ever-more informative, from language translation applications to cultural enrichment tools. It will likely lead people to be more informed, advertised to, and assisted on every urban excursion, removing the traditional happenstance from urban exploration. It is unclear whether Augmented Reality (AR) will truly enhance experiences, lead to over-saturation of information and advertising, or a combination of the two. This paper will discuss the current and near-future uses of AR for city dwellers and the projected implications of ubiquitous information.

1. Introduction

Augmented Reality provides a layer between the actual and the virtual worlds to deliver context-specific information. AR is already used for various purposes, like navigation through location-aware devices and real-time translation of signs, and will become more widespread as these technologies develop to enhance experiences like tourism, task completion, and gaming. Immersing users in more information and exciting technology can both vastly improve and inform and experience, but also detract from the actual event. As AR infiltrates day-to-day city life, it begs questions of how widely will it be used and whether its effects on urban exploration will be positive.

2. Current and Future uses of Augmented Reality

Augmented Reality is already being used in day-to-day life in several contexts, but more applications are in development or planned:

Current

- Navigation: Mobile phone applications direct users to nearby resources (like subway stations), overlaid on the actual scene in front of them. (e.g. Across Air's NYC Subway App[1])
- Advertising: Ads are catered to users based on their locations and personal profiles, projected on their mobile phones. This technology is currently available, but not yet widespread due to its conflicts with users' privacy. (e.g. Placecast[2], Layar[3])
- Special Assistance: Navigational and task-oriented applications for the disabled are emerging as an important AR niche. (e.g. BlueEyes for blind Paris Metro riders[4])
- Translation: Applications are beginning to be able to convert text into different languages in real-time. (e.g. WordLens[5])
- Shopping: Using avatars and imaging software, shoppers can try on clothes virtually, while product packaging allows for more information about products. (e.g. Zugara's social webcam shopper[6] and Lego's digital boxes[7])
- Task support: Resources like virtual support for using city tools like parking meters, or furniture pieces with virtually-labeled instructions for assembly, will improve day-to-day living. (e.g. GE Throttle Up[8])
- Arts & Media: While arts and media themselves will become more interactive, art houses will provide more information for viewing the work more holistically. (e.g. Layar for enhanced magazine reading, MoMA Uninvited Exhibit[9])
- Gaming: Physical gaming is emerging more fully as game elements are superimposed on actual environments. As AR technologies improve, AR gaming will grow substantially. (e.g. AR Defender[10])
- Tourism: Historic scenes may be projected on to landmarks; information about important locations will be pinged to tourists passing by. (e.g. Museum of London's StreetMuseum app[11])

Future

- Emergency Services: AR will provide blueprints to emergency responders entering a building, the ability to diagnose medical conditions from afar[12] and the tools to project crime scene re-enactments in physical spaces.

---

[1] Nearest NY Subway: http://www.acrossair.com/apps_newyorknearestsubway.htm
[2] Placecast: http://placecast.net/
[3] Layar: http://www.layar.com/
[4] FaberNovel, "BlueEyes RATP Experiment," http://www.fabernovel.com/en/works/90-blueeyes-ratp-experiment
[5] WordLens: http://questvisual.com/
[6] Zugara's webcam shopper: http://zugara.com/
[7] Lego's digital boxes: http://www.metaio.com/projects/kiosk/lego/
[8] GE Throttle Up: http://gethrottleup.tumblr.com/
[9] "MoMA NYC Augmented Reality Exhibition," http://www.youtube.com/watch?v=b9T2LVM7ynM
[10] http://toucharcade.com/2011/10/31/ardefender-updated/
[11] Museum of London, StreetMuseum: http://www.museumoflondon.org.uk/Resources/app/you-are-here-app/home.html

Specifically, several augmented reality technologies for urban exploration already exist or are in development. Google's Project Glass, perhaps the most widely known AR project, aims to project information about the surrounding environment, like weather, navigation and friends' locations, onto the user's eyeglasses.[13] Other AR uses are more creative, like Squidder t-shirts that display a hologram of the wearer's most recent Twitter post onto a user's phone.[14] And several relate to advertising, from both sides: Layar brings magazines and their ads to life[15], while Artvertiser repurposes billboards to display art instead of ads.[16] These burgeoning technologies indicate a clear path toward greater influence on everyday life through augmented reality's applications to navigation, socialization, attire, advertising and art.

3. The Four Threads of Experience

While current augmented reality technologies are still in their infancies, the measurable effects can be considered in levels of user immersion. According to McCarthy and Wright, this factor is measurable through four core threads of experience:[17]

- The **Sensual** thread refers to "our sensory engagement with a situation, which orients us to the concrete, the palpable, and visceral character of experience."[18] In other words, with greater engagement of each of the senses in the experience, resulting in the unification of the technology and its user, comes a more meaningful and memorable experience.

- The **Emotional** thread "refers to value judgments that ascribe to other people and things importance with respect to our needs and desires," and aims toward a desirable outcome.[19] As such, technology users perceive the environment to their preferences, make decisions based on emotionally-influenced input, and expect certain results.

- The **Compositional** thread considers how people make sense of their surroundings and events, the narrative of the story unfolding before them. The more immersed an individual becomes in this narrative, the less separation she sees between herself and these objects and events.

- The **Spatio-temporal** thread affects the user's sense of space and time: "In our construction of the spatio-temporal aspect of an experience, we may distinguish between public and private space; we may recognize comfort zones and boundaries between self and other, or between

---

[12] http://medgadget.com/2012/02/augmented-reality-system-helps-astronauts-diagnose-medical-problems-in-outer-space.html
[13] http://www.youtube.com/watch?v=9c6W4CCU9M4
[14] http://www.trendhunter.com/trends/augmented-reality-twitter-shirt
[15] http://www.layar.com/
[16] http://theartvertiser.com/
[17] McCarthy, John and Peter Wright. Technology As Experience, The MIT Press, Cambridge, MA; 2004. p79.
[18] Ibid.
[19] Ibid.

present and future."[20] In the realm of technology use, spatio-temporal senses determine a user's comfort level and sense of potential of the tool.

Taking into account these four threads of experience, it is also essential to remember their ever-renewing qualities as the experience of using technology continues; as described by McCarthy & Wright, unlike watching a play, where the potential outcomes decrease as the plot goes on, the use of augmented reality provides for a continual stream of new experiences, stimuli and responses. AR's various applications will thus never be used the same way twice, and so their evaluations according to these threads must hinder on the typical use. When the threads align, "the elements of experience so interpenetrate each other that we lose our sense of the separation of self, objects, and events."[21]

How do these threads of experience affect urban exploration? When the user forgets about the technology, is more informed about her surroundings, and finds points of interaction for a positive experience, the augmentation of reality has been a positive experience for urban exploration. (This seamless integration may also lead to over-reliance, which will be discussed in Section 4.)

Specifically, the previously noted applications for AR applications can be measured according to the number of core threads of experience they fulfill; the number indicates the level of user immersion in urban settings. The matrix below shows each of the categories of urban exploration and its fulfillment of the four threads before and after AR integration.

	Sensual		Emotional		Compositional		Spatio-temporal		Immersion Score	
	Present	Future	Present	Future	Present	Future	Present	Future	Present	Future
Navigation	✓	✓			✓	✓	✓	✓	3	3
Advertising		✓	✓	✓					1	2
Special Assistance		✓	✓	✓			✓	✓	2	3
Translation		✓		✓	✓	✓		✓	1	4
Shopping	✓	✓				✓	✓	✓	2	3
Task Support	✓	✓			✓	✓		✓	2	3
Arts & Media		✓	✓	✓		✓		✓	2	4
Gaming	✓	✓		✓	✓	✓	✓	✓	3	4
Tourism		✓	✓	✓	✓	✓	✓	✓	3	4
Emergency Services		✓			✓	✓	✓	✓	2	3

---

[20] Ibid.
[21] Ibid.

From the tabulation above, an "Immersion Score," in both present and expected future applications, has emerged. The chart below displays this score across applications.
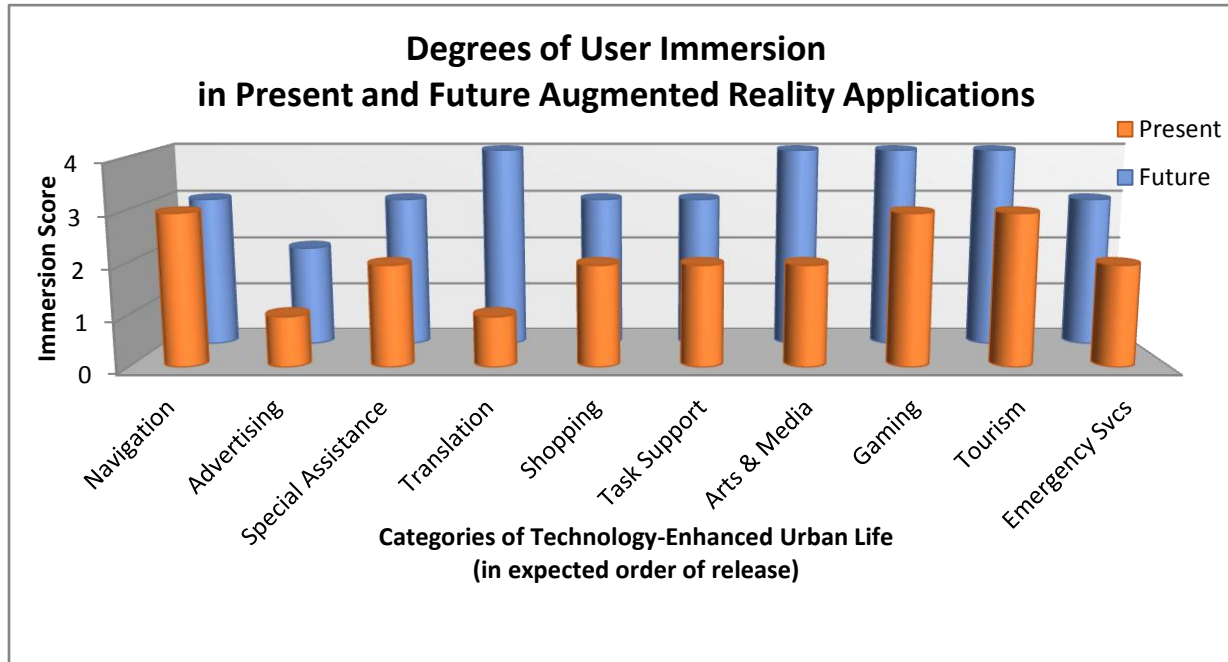
From the chart above, several factors can be inferred:

- Future technologies will be more immersive than those we have now, fulfilling more core threads in nearly every application. This means there will be greater contextual information, social and object-oriented interaction, and potentially, unwanted activity, like excessive advertising, widely available in future technologies.

- The potential for an entirely immersive urban experience is high, with applications in nearly every category. As new AR technologies emerge and are improved upon, they will be felt throughout the urban experience of walking, work, culture and advertising.

- The immersion scores are likely much lower for non-urban regions, related to the reduced walking-related chance encounters, diversity of languages, tourism, and opportunities for physical gaming. In rural and non-walking areas, AR will primarily be based on vehicle-based and indoor uses, like driving accessories and task support.

- Of the four threads, Emotional and Spatio-temporal were the least available in present technologies, as the two-dimensional quality of most applications is preventive in significantly shifting users from the current sense of space and time and altering their emotions. Nearly all future AR technology categories aim to address the spatio-temporal thread.

- Emotional was the least achievable thread in future applications, as many applications focus on core information rather than a holistic experience. Potential for emotional response is

high in several categories, but is limited by the design quality of the user experience. For example, AR-generated translation may be easy to achieve if done accurately and in a social setting, but will produce a frustrating experience if inaccurate, and a non-emotional experience if only used for factual information.

In sum, the potential for immersive AR experiences in cities is extremely high, and will likely affect the patterns, desires, and takeaways of urban exploration. The net effect of that change is worth considering.

4. Evaluating AR Immersion in Urban Exploration

The potential benefits of adding contextual information and opportunities for socialization in urban environments are plentiful. With applications to improve navigation, a wealth of knowledge to be tapped at any point, streamlined access to social contacts, an educated shopping experience, and immersive entertainment, the positives of AR are numerous.[22] More specifically, AR tools applied to urban exploration significantly enhance the experience:

1. With a recent study showing the willingness of individuals to walk farther from home when carrying a mobile device[23], it can be inferred that AR-enabled urban explorers will be more willing to venture farther than they would otherwise, allowing for more exploration and new encounters.

2. Most shoppers prefer input from other product users; 84% of Millennials and 70% of Baby Boomers indicated that at least some information, like whether the product matches the description, affects their purchases.[24] With AR-generated connectivity to other product users, customers are well-informed about product quality and competitors' prices, making for a better shopping result.

3. Many AR technologies for gaming and entertainment will revolve around the social aspects, providing new social interactions and connections with friends surrounding game strategy and meeting up with friends nearby. Users will have a new way to meet people in their cities and a new channel for meeting up with existing friends.

4. Art and cultural experiences will be vastly improved by both interactive functionality and more informed viewers. For example, as shown in a recent study, museum visitors using AR tools for education about specific paintings enjoyed the contextual information that allowed for an immersive experience, resulting in a longer viewing of AR-informed works.[25] Similar AR

---

[22] Future Conscience, "Augmented Reality: The good, the bad, and the ugly (part one: the good)," August 29, 2009. http://www.futureconscience.com/augmented-reality-applications-good-bad-ugly/
[23] Mondschein, Andrew 2011. *Passeggiata Nuova: Social Travel in the Era of the Smartphone.* Rudin Center for Transportation Policy and Management. New York University. Working Paper. October 10, 2011.
[24] "Gen-Y Won't Buy Without User-Generated Input," MarketingProfs, January 31, 2012. http://www.marketingprofs.com/charts/2012/6969/gen-y-wont-buy-without-user-generated-input
[25] Tillon, Anne Bationo; Isabelle Marchal; and Pascal Houlier. "Mobile Augmented Reality in the Museum: Can a Lace-like Technology Take You Closer to Works of Art IEEE International Symposium on Mixed and Augmented Reality 2011, Science and Technology Proceedings, 26 -29 October, Basel, Switzerland.

applications can be developed for theater and musical performances, overall enriching users' cultural experiences.

AR developments in these categories – social activity, informed purchases, and immersive cultural experiences – will profoundly alter both the purposeful and happenstance aspects of urban exploration, most likely for a more educated, connective and memorable experience.

AR is also a potentially great new tool not just for AR users, but for creators: while advertising is often considered a negative requirement, it will be better tuned to users' locations, patterns and needs, thus evoking a less frustrating experience. Furthermore, artists will begin to use AR as a medium of expression, allowing users to interact with and understand their messages better than they would a two-dimensional work.[26] Some AR developers are calling for artists to help shape the future of technology, providing a different perspective on experiential tools than the technologists involved.[27]

In turn, arts and culture appreciators will find new ways to learn about "performance art around the corner"[28], while people, in general, will walk farther and for longer periods of time, because they are so inclined to do so with more information in pocket.[29] Arts and culture, as well as navigation, tourism and translation, are the most promising areas of AR's benefits to urban exploration, as they provide both immersion in the experience accented by information and assistance through technology.

Conversely, Augmented Reality will detract from, and even negatively affect, aspects of urban exploration. The downsides exist primarily in the categories of technology, intrusion, privacy, social detachment, and over-use[30]:

1. AR technology is not yet close to providing many of its promised benefits: GPS is still imprecise, especially indoors; depth perception is often off in AR-functioning eyeglasses (with near-field information and far-off objects); facial recognition is still being developed (and could pin the wrong person); and the over-reliance on users carrying mobile phones with limited battery life and costly data plans.
2. The danger of always-on information is the lack of a limit on incoming information: a great deal of data could be unwanted; endless social connections can be intrusive, and the inevitable advertising applications will morph into a new level of spam. If users are unable to limit AR uses, they will forgo the technologies entirely.
3. When users receive enhanced information, it is often the result of their sharing personal information. AR technologies will work with certain pieces of data – location, facial recognition,

---

[26] Papagiannis, Helen. "The Role of the Artist in Evolving AR as a New Medium," IEEE International Symposium on Mixed and Augmented Reality 2011, Science and Technology Proceedings, 26 -29 October, Basel, Switzerland.
[27] Ibid.
[28] Alang, Navneet. "Google Glasses and the Myth of Augmented Reality," *The Atlantic*, April 5, 2012.
http://www.theatlantic.com/technology/archive/2012/04/google-glasses-and-the-myth-of-augmented-reality/255508/
[29] Mondschein.
[30] "Limitations and the Future of Augmented Reality," Howstuffworks.com.
http://computer.howstuffworks.com/augmented-reality4.htm

user preferences – that compromise users' privacy, leading to abuses of information, like a home robbery when a user is known to be out. Similarly, meeting a new person and immediately being exposed to their social media profiles and comments made about them can be seen as invasive, libelous, and hobbling of new interactions. In both scenarios, privacy-seeking users would be rightfully concerned about the ability to turn off the tools, but social dictation to keep them on.

4. Although AR aids in social interactions, it also detaches users from the existing social interactions in front of them, such as choosing an AR-enabled museum tour guide rather than a human one, although the latter might provide a more unique perspective and social interaction.[31]

5. Users may over-use AR technologies, removing themselves from the real world. For example, while historic markers shown on an app, are useful, they are secondary to a physical marker (like a plaque), available to anyone, not just those with the right software.[32]

6. Pedestrian safety may be seriously affected by the distraction of both walkers and drivers due to the novel technologies.

7. Who is providing the information that will pervade the experience? Everything from restaurant reviews to news filters may be controlled by corporate interests that differ from those of the user.

It can be said, then, that Augmented Reality has significant detrimental effects surrounding the extent, use, and quality of information received, and the extent to which users must surrender matters of privacy to best use the technology.

5. Conclusion

Some of the negativities mentioned above already exist, and are not specific to AR. People are already responsible for the social detachment and prejudice that comprise our confirmation bias, or the tendency to interpret information in the most personally preferable way. For example, it's widely acceptable to filter out certain unwanted sights, as one writer gave the example of pedestrians looking away from a homeless person lying on the sidewalk, and AR merely provides more tools to continue what's already being done.[33] So while AR may intensify confirmation bias, it does not create this selective state of interpretation through which urban exploration already occurs.

In addition, the balance of AR's benefits and negativity weighs heavily on whether users can turn off portions of the functions: can they eliminate spam, unwanted notifications, and limit social interactions? An ability to merge with—and not be interrupted by—the technology will enhance the user's regular

---

[31] Ibid.

[32] Ibid.

[33] Raven, Paul. "Re-skinning the city – the dark side of augmented reality," Futurismic.com, January 19, 2010. http://futurismic.com/2010/01/19/re-skinning-the-city-the-dark-side-of-augmented-reality/

activities. The goal of AR for urban exploration is to forget the technology is in use, having it seamlessly blend into the environment. Users should be immersed in their surroundings, enhanced by the technology, and not the other way around – immersed in their technology, only touching on their surroundings.

The over-supply of information enabled by Augmented Reality is both a boon and a burden to its users, enriching experiences while potentially inhibiting their enjoyment. The questions of effects on urban experience, which revolve on exploration, interaction and memories, mostly relate to the user's levels of immersion in the technology versus the actual experience. If the user is able to augment, for example, an art exhibit with new information, the goal has been reached and likely her experience enriched, but if she chooses to see the art only through technology, she has lost out on both the purpose of the technology and the cultural benefit.

It should be noted that the AR "killer app," or the application that everyone must use, has yet to be conceived. As many theorists have noted, AR apps are anemic at the moment and hold promise for specific applications, but no must-have, all-encompassing tools yet exist.[34] As email made the internet universally appealing, AR's app has yet to emerge. While it may be said that urban exploration's effects will depend on the emergence of that killer app, it is likely that the organic growth of applications is already shaping urban experiences, particularly with the advent of AR-enabled arts and culture, navigation, tourism and translation.

In sum, if the goal of urban exploration is to generate positive experiences and memories through enrichment and engagement, Augmented Reality achieves: it hinders traditional exploration, but creates a whole new form of exploration that includes a holistic absorption into cultural experiences, sharing experiences with others, and increased, rather than decreased, awareness of surroundings. The dangers of this technology are over-immersion, loss of privacy, and safety issues around distraction, of which users must be conscientious. In the end, the positivity of urban exploration relates to information learned, positive interactions, and good memories. It is likely that AR, if used with some caution, can greatly benefit that experience.

---

[34] "Has The Augmented Reality Bubble Burst?" Augmented Planet, February 15, 2012.
http://www.augmentedplanet.com/2012/02/has-the-ar-bubble-burst/