

THESIS

ENGAGING REALITY: EXAMINING HOW MIXED REALITY MOBILE APPS AND  
GAMES FACILITATE SENSE OF PLACE DEVELOPMENT FOR A MORE ENGAGED  
CITIZENRY

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## ABSTRACT

### ENGAGING REALITY: EXAMINING HOW MIXED REALITY MOBILE APPS AND GAMES FACILITATE SENSE OF PLACE DEVELOPMENT FOR A MORE ENGAGED CITIZENRY

Growing concerns regarding declining community and civic engagement as a result of increased access to new technologies calls for research on purposeful design that could have a reverse impact. Location aware mixed reality mobile apps and games may be one such technology that, with purposeful design, have such potential. It is possible that this technology could be purposefully designed to facilitate sense of place development among users, which can lead to outcomes like engagement in one's community. According to sense of place theory, sense of place is made up of place identity, place attachment, and place dependence, which relate to how a person experiences place. To assess this possibility, twelve users of either *Pokémon Go*, *Ingress*, or *iNaturalist* were interviewed and their experience of place was analyzed. All of the apps required users to spend time in place in order to use them, a key part of sense of place development. The game apps encouraged exploration, spending time in place, and noticing unique place features due to using unique place features as a key game mechanic. *iNaturalist* similarly encouraged exploration, spending time in place, and noticing unique features (nature) due to allowing users to take geotagged photos and upload them for identification. Competitive and team-work-oriented game mechanics facilitated online and in-person social encounters, and *iNaturalist*'s commenting function encouraged online social interactions about place. Features of these apps facilitated experiences that relate to sense of place, suggesting that future studies on the impact that these apps have on sense of place development would be worthwhile.

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## CHAPTER 1: INTRODUCTION

In her book *Reality is Broken*, Jane McGonigal (2011) discusses different ways that purposeful design in games and gamified reality can enhance people's real-world experiences, leading to more real-life engagement and higher life satisfaction. She offers this as a counter-argument to concerns that technology is pulling an ever-increasing number of people away from engagement with the real-world. McGonigal asserts that although technology can lead to disengagement, certain design elements of technology like games and mobile apps may have the potential to build engagement as well. Understanding these design features could allow developers to purposefully build such elements into their games and apps, or at least demonstrate the positive impact that such design elements have on their users.

In order to better understand the benefits of certain design elements, this thesis explores user experience of sense of place (SOP) when using location-aware mixed reality mobile apps and games. SOP describes the experience-based connection that individuals have with a place (their home, their city, their country, and other locations). People who have a higher SOP for a particular location are more likely to engage with that place, participate in maintaining the place, and even working to make the place better (Steele, 1981). Location-aware mixed reality mobile apps have the potential to influence a user's SOP by introducing new activities, social outlets, and information channels into a place, changing the experience that people have with place.

Presently, this technology is used extensively by museums, educators, game designers, and other agencies for various levels of engagement and enhanced sense of place. Despite its wide use for these purposes, few studies focus on user experience of place in order to determine how these apps impact SOP. Due to recent developments related to this technology, now may be

a prime time to study the potential of these apps. The successful launch of Niantic's mixed reality mobile game *Pokémon Go* in 2016 raised speculation that app stores may see a rise in similar mixed reality mobile apps in the near future.

Niantic president John Hanke (2017) has stated that this technology “offers the potential to enhance our basic functions as human beings as we lead our lives in the physical world” due to its ability to “transform the mundane into something more colorful and fun and [to] provide a useful nudge to go off and see new places and do new things” (paragraph 2). Like McGonigal, Hanke believes that “when used correctly, [this technology] can be a powerful way to enhance [user] experience with the physical world” (2017, paragraph 5), suggesting that purposeful design of mixed reality apps has the potential to facilitate engagement with the real world.

The following overarching question guides this thesis: How can mixed reality apps and games be used to connect people to their communities, stimulate community engagement, and encourage global citizenship? Our world is becoming more connected, leading to a need to cultivate a sense of being a global citizen, making this question fairly pertinent today. Unfortunately, this question is too large for a single study to answer. It first requires smaller investigations that explore the types of engagement practices that can lead to engagement on more localized levels.

## CHAPTER 2: LITERATURE REVIEW

Location-aware mixed reality mobile apps and games have the potential to increase individuals' sense of place (SOP), which Steele (1981) argues increases the likelihood of engaging in their surroundings. This literature review describes SOP by breaking it down into smaller constructs that these games and apps have the potential to influence. It starts with an examination of the role of social identity in SOP construction, followed by an overview of sense of place theory and an examination of three constructs of SOP. Finally, it discusses the consequences of the loss of SOP and possible positive outcomes that these apps and games may have on SOP development. This section will focus on the elements of SOP and place that these apps and games have the potential to influence.

### **Social Identity Theory**

Social identity theory provides an insightful look into key social frameworks that contribute to sense of place. According to social identity theory, an individual's identity is made up of their individual and social identities (Ashforth & Mael, 1989). A combination of a person's unique characteristics and interests make up their individual identity (O'Connor, Longman, White, & Obst, 2015). Social identity requires a bit more explanation, but essentially, it is composed of the social categories that an individual organizes themselves into, or that other people consider them to be part of. These social categories serve as a way to define and organize people based on specific characteristics (Ashforth & Mael, 1989). Categories may separate people by age, religious affiliation, geographic location, school, job, class, hobby, and other characteristics.

For each social category, individuals build an idea of what a prototypical member (a typical member) looks and acts like based on a combination of experience and salient information gained through communication and social channels (Ashforth & Mael, 1989). For example, a prototypical sports fan might wear sports team logos, attend or watch sports games regularly, and be in rivalry with fans of other teams. By comparing these prototypical models with those of other categories, people develop a sense of the boundaries between categories and what sets members of one category apart from members of another, such as what sets a Denver Broncos fan apart from a New York Giants fan (O'Connor et al., 2015). Membership in a category often shapes an individual's behaviors and social identity, with the individual identifying as an in-group member and seeking to act like other in-group members (Ashforth & Mael, 1989).

When a person is aware of their membership in a group (in-group) and feels emotionally involved in the group, the norms of that group are more likely to shape their behavior and attitudes (Ashforth & Mael, 1989). A stronger sense of membership influences their emotions, goals, and sense of self-esteem (O'Connor et al., 2015). Individuals typically stick to prototypical group behavior in order to fit in with other in-group members and to gain approval from other in-group members (Ashforth & Mael, 1989). People who are not part of the group are out-group members, and their behaviors are often contrasted with the behaviors of the in-group (Ashforth & Mael, 1989). Consider, for example, flappers from the 1920s. A woman identifying with being a flapper would likely behave as other flappers did, dressing in fashionable and "daring" flapper styles, and dancing at clubs. She would likely avoid doing something like wearing modest clothing at a club or scolding alcohol and cigarettes because that behavior would be judged by other flappers.

Three major components make up social identity: “the cognitive awareness of one’s membership in a group, a sense of emotional involvement in the group (affective), and the group-based self-esteem (evaluative)” (Morschheuser, Riar, Hamari, & Maedche, 2017, p. 173). Social identities can be activated depending on the situation, such as a person who identifies with being a student using student behavior in school settings, but not in mall or zoo settings. People usually belong to more than one social group at a time, such as an individual who identifies as a World of Warcraft player (O’Connor et al., 2015) and as a member of the marching band. That person will shift into their player identity when playing the popular game, and their band identity when attending practice.

### **Sense of Place Theory**

Sense of place (SOP) theory describes how a person experiences a place (usually in reference to physical locations), which is influenced by a variety of factors. SOP is a multifaceted construct that incorporates different aspects of the everyday lived experiences of being in a place. It is made up of a sense of belonging, identity, concern, attachment, and dependence related to that place (Cheng, Hou, Pan, Sung, & Chang 2015). Patterns of social experience, geographical and cultural aspects, quality of life and general place aesthetics, individual and group identity, meaning-making, and personal history with place all contribute to SOP (Seamon, 2014; Uzzel, Pol, & Badenes, 2002; Steele, 1981).

Due to the experiential nature of SOP, one person’s SOP in a given location will be different than another person’s (Steele, 1981; Relph, 1976). While one person may understand a particular park to be a place of relaxation that offers clean lawns to lie in, another person who prefers playing soccer will experience the park as an active place that offers space to play. The two people have a similar sense that the park is up-kept and safe enough for recreation, but they

each have different feelings of what types of behaviors they conduct in that place. In a similar way, an individual visiting a local historical site with a printed page of history about the place will have a different sense of that place than another person who visits without the informational page.

There are places where most users will experience a similar SOP due to culturally salient significance, or grandeur of place (Steele, 1981, Relph, 1976). A person visiting the National Mall, for example, likely has a culturally salient expectation of what that place will be like. They can expect to encounter a great deal of national history, large crowds, and beautiful sights based on widespread social information. The grandeur of a place, which Steele (1981) calls ‘spirit of place’, can also cause multiple people to experience similar SOP. Visitors to Pikes Peak, for example, may experience similar senses of awe at the enormity of the mountain and its beauty.

Place can refer to a number of different micro and macro locations, such as a person’s living room, their house, their neighborhood, their city, their country, and the Earth itself (Steele, 1981). Physical characteristics make up part of place, but considering place as only these physical aspects means overlooking its other parts. Meyrowitz (1985) breaks place into six major components: 1) the internal site characteristics and network connections to other places; 2) the nature and culture of that location; 3) spatial interactions within that location; 4) location within a larger context (such as a library within a city, or a town within a state); 5) the historical elements and the new elements combining (or the ways in which the new replaces the old); and 6) meanings that the place holds for people. Steele (1981) offers a similar, more condensed definition of place as being a combination of the physical and social features of that location.

Both Steele (1981) and Meyrowitz (1985) seem to agree that a physical setting requires social elements in order to be a distinct place. Neither element can be taken on its own, as the

social and physical elements of place influence one another in an interplay similar to the one that exists between SOP and social identity, discussed shortly. Users make meaning from their interactions with a place and with other users, and their experiences often contribute to shaping what that place looks like and what behaviors and activities occur there (Steele, 1981). Likewise, the physical characteristics of the place may influence what kinds of activities are practical there, or what types of interactions people can have with that place (Meyrowitz, 1985). It should be noted that digital places also exist, but it is beyond the scope of this thesis, which focuses on digital technology being used in physical, real-world locations.

A person's experience with place combined with their own needs and attitudes creates their SOP (Steele, 1981). Consider, for example, that a person living in a particular city will have a sense of place of that city, along with more micro senses of individual places within that city. They likely have a sense of the city's size, language, and general culture. If they have lived there long enough, they might know where good restaurants and shops are, or where to find local public art and green spaces. They probably have social experiences with neighbors, friends, acquaintances, and strangers in different locations around the city, and might even have a few spots where they like to meet up with people. They likely know about significant local history, public spaces, public utilities, cleanliness, safety, public transportation, and other similar factors related to quality of life. Each of these contributes to SOP and might even contribute to that person's social identity of being an in-group member of that city (Steele, 1981).

Engagement with and involvement in a place is heavily influenced by SOP (Steele, 1981). If a person has a strong SOP, they are more likely to go out and engage in that place in multiple ways (Uzzell, Pol, & Badenes, 2002). They are also more likely to actively get involved in making that place better, or maintaining its present satisfying state (Steele, 1981). When a

person or a group of people feel connected with their place, they become more involved in sustaining it, and their efforts contribute to improving conditions, which inevitably contributes to other people's SOP (Steele, 1981). Uzzell, Pol, and Badenes (2002) point to an increase in environmentally sustainable action as one example of such involvement that may result from a person's heightened SOP.

As sense of place is a complex construct, it is useful to break it into smaller constructs in order to study and understand it. Three particular constructs are of especial interest to SOP related to location-aware mixed reality apps. These constructs are place attachment, place dependence, and place identity, as highlighted by the framework developed by Cheng et al. (2015) for the creation of their heritage site mixed reality (MR) guidance app for enhancing visitor experience and SOP. These three constructs resemble the three aspects of place that Uzzell (1996) highlights as commonalities among literature on SOP: "physical elements, activities, and meanings or 'concepts'" (p. 3). Place attachment deals with characteristics of the physical place of interest, place dependence involves actions in the place, and place identity involves knowledge-based aspects of place (Cheng et al., 2015).

The following sections lay out aspects of SOP by explicating each smaller construct. Due to the experiential nature of SOP, there is some overlap in what elements of place and place experience may influence each construct. Given this, these elements are not intended to be mutually exclusive. What is intended, however, is to develop an organizational structure for understanding the identity aspects of SOP that all of these combined experiences can influence.

**Place attachment.** The elements of place that impact the development of affective, emotional characteristics of sense of place make up place attachment. In this construct, "visitors associate personal characteristics and experiences" (Cheng et al., 2015, p. 169) with the place,

and develop (usually positive) emotional bonds with it. Feelings of affection toward and interest in this place are highlighted in Cheng et al.'s framework, though these are not the only emotional connections.

Seamon's (2002) description of place attachment further breaks down what elements make up place attachment. He describes place attachment as being made up of six components: place interaction, place identity, place release, place realization, place creation, and place intensification (Seamon, 2002). These first four, interaction (both social and environmental interactions with the location), place identity (the social identity formed around a location), release (unexpected social encounters), and realization (the geographic and human characteristics of a place) mesh well with Cheng et al.'s (2015) framework of place attachment as an affective element of SOP, as these components of experience may impact emotional connection. The last two, place creation (participating in the building and development of place) and place realization (enhancing and making a place better), however, appear to be potential outcomes of SOP rather than characteristics of place attachment. When a person feels strong emotional connections with a place, they are more likely to actively participate in creating and re-envisioning that place (Seamon, 2008; Steele, 1981; Uzzell, 2002).

The expectations that a person brings to a place also impact their experience of that place (Steele, 1981). What a person expects to experience when visiting a place may impact how they use that space or how they feel about it (Steele, 1981). These expectations may be the result of previous experiences or salient social and cultural constructs of that or similar places. Another influencing emotional factor to consider is the mood of the place itself, which may impact a user's sense of place (Steele, 1981). A person experiencing the playful, family-oriented mood of New York's Central Park in the daylight, for example, will have more positive emotional

connections with the place than someone visiting the same park in the evening, when the mood is more intimidating than inviting.

Taking these aspects of place attachment into consideration, place attachment for this study will be understood as a person's affective experience with and connection to place. This will include emotions toward place, place interest, sense of place uniqueness in the present, sense of pride with place, social interaction in place, and social identity associated with place. App and game design features that may impact place attachment include place-specific photos, place-specific nodes (such as the PokéStops in *Pokémon Go*), in-app place features, chat or messenger features, and commenting features. As was the case with discussing place elements that impact place attachment, there is likely to be some amount of overlap of app and game design features between each construct of SOP.

**Place dependence.** The second construct of sense of place in Cheng et al.'s (2015) framework is place dependence. Place dependence does not relate to a "dependence" as far as someone relying on a place, but rather describes the conative aspects of sense of place—the behaviors and actions that a person does in a place (Cheng et al., 2015). The types of activities available to someone in a place is dependent on the features available or unavailable in that location. There are many different types of behaviors and actions that can be conducted in a place that may impact SOP, and these may be influenced by both social and physical aspects of that place (Steele, 1981; Meyrowitz, 1985). Activities, situations, and events unique to a place fall into this construct. Likewise, active exploration of the place and active engagement with the place also contribute to place dependence. Macro social actions and behaviors also fall under place dependence, including community engagement and prosocial behavior such as cleaning up trash.

According to Cheng et al.'s (2015) framework, place dependence also includes the unique characteristics of that place, but this seems disconnected from their previous description of this construct as conative. There may be some connection when considering the unique actions that a place's physical and cultural uniqueness inspires. A skate park's unique features, for example, encourage skateboarding due to the concrete bowls and ramps built in that space. The culture of the skate park combined with the salient understanding that skate parks are designed for skateboarding will also encourage that type of behavior to occur in that location instead of other behaviors such as having a tea party. A high school campus may also encourage skateboarding if it has railings and interesting concrete features conducive to skateboarding. The social expectation that a school is not a place for skateboarding may prevent such activity from occurring there, as will the addition of skate-stopping studs on these features.

The physical characteristics of place impact how it is used and what behaviors are conducted there, but it is not the biggest factor to consider in the shaping of place dependence. As Meyrowitz (1985) explains, the "overall patterns of situated behaviors" (p. 42) significantly impact the ways that people use a place more so than its physical characteristics. When actions or behaviors associated with a place are salient, those behaviors and actions occur most often in that place. Libraries, for example, are known as places for silent behaviors and study, while parks are for athletic activities or relaxing, and malls are for hanging out, family outings, and shopping.

Behavior and activity within a place is also influenced by "the patterns of information flow" (Meyrowitz, 1985, p. 36). As Meyrowitz describes it, the flow of information is largely social in nature. While physically in a place, people have the opportunity to observe the behavior of others and use that to inform what activities and behaviors belong in that place. Often, this

information comes to a person through their observations while in that place, or through person-to-person interactions with other people within the place (Meyrowitz, 1985). There is some overlap between the social design features of place attachment because communication features change the flow of social information from face-to-face to computer mediated.

Elements of a place that impact place dependence include activities, events, explorable space, engagement with place, prosocial behavior, community engagement, place creation, and unique physical, social, and cultural characteristics. A number of items that influence this construct (including engagement in prosocial behavior and place creation) are noted as resulting from strong place attachment (Steele, 1981). App and game design features that may influence place dependence include individual or group goals, interactive elements that encourage participation, place photo submissions, prosocial functions, events, sharing capabilities, and features that require the user to do something in the real world or with other nearby users.

**Place identity.** The third construct of sense of place relevant to this thesis is place identity. Cheng et al.'s (2015) framework identifies place identity as the cognitive aspects of place. It includes knowledge of the place such as historically and geographically significant information, as well as global implications. Salient aspects of geographical and historical significance belonging to a place enhance overall SOP (Lalli, 1992). Knowledge enhances a place's uniqueness, and can lead to people having a stronger connection with, or pride in, that location (Uzzell, 1996).

Meyrowitz's (1985) discussion of information flow, mentioned above, also applies to a person's cognitive understanding of place. Place features such as informational signs explaining the significance of a log cabin, for example, would offer visitors knowledge that enhances their SOP. In some situations, such information is not available when a person visits a place, and must

be discovered elsewhere or not at all (Meyrowitz, 1985). Other aspects of information flow include access to knowledge of where things are in a place, such as the location of a mural in a city center, or the location of a park.

Strong place identity influences familiarity with the history and geography of that place, self-efficacy, and place intensification (making conscious efforts to improve the place) (Steele, 1981). Location aware mixed reality app and game features that may influence this aspect of SOP include features that highlight place history and physical features (explorable), availability of place-specific photos, availability of other place-specific information, user-submitted cataloguing (an overlap with place dependence), and crowdsourcing features related to place and place-oriented group goals.

**SOP and Social Identity.** Social identity theory contributes to understanding sense of place as well, showing the ways that sense of place (SOP) influences social identity and vice versa. Social categories help individuals to define neighborhood, town, and even country characteristics and prototypical behaviors and attitudes of in-group members. These categories play an essential function in developing a concept of self and understanding of a particular place by providing a way to differentiate in-group members from one location from out-group members from other locations (Lalli, 1992). A person from Colorado, for example, has an idea of what Coloradoans are like (in-group membership) compared to people from other states such as Texas (out-group members).

Identifying with a social category gives an individual a sense of location-based category membership, which influences, and is influenced by, SOP. When a person feels like they belong to the community of a place, they feel a stronger attachment to that place and its community and thus develop a stronger SOP (Relph, 1976). At the same time, having a stronger SOP makes us

more likely to feel a connection with a place's community (Relph, 1976). Social interactions are a key part of this sense of community and group belonging, implying that social interaction is a requirement of belonging to a community and thus is an important element of SOP development (Steele, 1981).

Social categories influence both social behaviors and activities within a place. Group norms and behavior patterns impact how a place is used and what types of developments are implemented in that place (Steele, 1981). Social identity and SOP influence one another in such a way that it appears that the two processes develop almost side-by-side, rather than having a cause-and-effect relationship.

**Loss of sense of place.** While rich experiences, personal and local history, physical location, social encounters, and other factors can enhance a person's sense of place, certain factors may cause a person to experience a loss of sense of place (SOP). One cause of this decline includes features of a place that may result in a negative place experience for an individual (Steele, 1981). Negative features may include overcrowding, noise and air pollution, and loss of green spaces (Steele, 1981).

Relph (1976) discusses a different cause of loss of place, which he refers to as "placelessness" (p. 79). He describes placelessness as being a loss of genuine experience in and connection with place, pointing to an increase in "look-alike landscapes resulting from improved communications and increased mobility and imitation" (p. 79). In his argument, he notes that these look-alike landscapes (which he colorfully dubs "flatscapes") decrease people's sense of localism and lead to mediocre and inauthentic experiences in those places. The largest culprit that Relph points to for the spread of these flatscapes is an increase in mass communication, which "appears to result in growing uniformity of landscape and lessening diversity of place" (p.

92) by creating wide-spread ideals of what certain spaces should look like. This mass understanding of design also leads to the implementation of generic solutions in place of unique, place-specific solutions to problems of place design (Relph, 1976).

Similar to Relph, Meyrowitz (1985) also points to forms of mass communication as causing a loss of SOP among individuals. Meyrowitz writes specifically about electronic media (radio, TV, the internet), which was rising in popularity and evolving rapidly during his time. He argues that “electronic media destroy the specialness of place and time” (p. 125) by allowing individuals to experience a place or place-related behaviors without visiting those places. People can experience the zoo from their living room, see all of the restaurants available on the local Main street without walking the strip, or visit the library archives from across town. Meyrowitz argues that people’s SOP comes largely from their behaviors and experiences while physically in those places, and that by changing what behaviors are possible and expected in any given location, electronic media cause a decline in SOP.

Although Relph and Meyrowitz developed their definitions of the loss of SOP long before the types of mobile technology in use today, similar concerns are still in the public consciousness. There are widespread concerns about people spending more and more time with new media than with people or the world around them (Frith, 2014). No one solution can adequately address this problem, but combined innovations aimed at addressing it may start making some inroads. The emphasis placed on electronic media, mass media, and mobile technology in regards to this issue shows that focusing efforts in these areas may be beneficial addressing this issue.

Exploring features of these new technologies that may instead aid in developing stronger SOP will help to address such concerns. This thesis seeks to explore what features of location-

aware mixed reality mobile apps may enhance user SOP in order to understand whether it is possible to purposefully design new technology with features that contribute to place connections. Although this technology cannot solve the issue of flatscapes and placelessness, it may be able to emphasize what makes a place unique from other places despite generic features. With strong and well-informed design, future apps could even help users envision place-specific solutions to design problems to tackle the generic issue that Relph (1976) mentions.

Providing place-specific experiences and activities through these apps and games may also address Meyrowitz's (1985) claims regarding place behavior and experience being displaced by new media. This technology may facilitate people physically visiting and spending time in a place rather than making that place's features available over a long distance. For example, a *Pokémon Go* user who wants to visit a PokéStop they see on their map, they must physically walk over to that location because they cannot access it from a distance. In order to understand the potential that location-aware mixed reality mobile apps and games have to influence these concerns, it is important to define mixed reality and have an established idea of the features of these technologies.

### **Mixed Reality, Augmented Reality, and Virtual Reality**

With recent advances in GPS and smartphone technology, alongside increased public access to GPS-enabled mobile devices, there are a growing number of location-aware mixed reality mobile apps available to connect users with the world around them. Mixed reality (MR) is a technology that takes digital information and overlays it alongside reality in some way without replacing the real environment (Pettine, 2017). Location-aware apps use the user's geolocation data (a feature in most of today's smartphones) to connect them with digital information about that location.

MR does not require the use of a special headset, only that the user have a device with a screen, built-in GPS, and the associated apps. Some MR apps include audio information, some include text-based information, some use static images, and others use in-device cameras to superimpose visual information on the real-world environment through the device's screen. Each of these provides new information without replacing the real environment.

Another term used to describe this technology is location-aware augmented reality (AR) rather than mixed reality. Like MR, AR describes technology that takes digital information and overlays it alongside the real world (Milgram & Kishino, 1994). Although the terms are nearly interchangeable (AR is often considered to be a category of MR), the term AR has become widely associated mainly with technology that takes visual digital information and overlays it in the real world through the use of a camera and a device screen (Wüest & Nabiker, 2017). An example would be an app that allows the user to see a digital cartoon dragon superimposed on the real world through the use of a mobile device's screen. To avoid confusion with this type of augmentation, the term MR will be used for this thesis in order to avoid being limited to this one type of augmentation.

Another emerging technology that people often confuse with both AR and MR is virtual reality (VR). This technology takes a real-world space and replaces it with digital information, usually requiring the use of special viewing devices such as the Google Cardboard or Oculus Rift (Milgram & Kishino, 1994). When using VR, the user no longer sees the real environment around them. VR has its own uses for experiential learning regarding place, but it is beyond the scope of this thesis. Because it replaces the real environment entirely, and because it requires a controlled environment for safety, VR does not yet offer much for the development of a sense of place while physically in real-world spaces.

MR can further be understood using Krevelen and Poelman's (2010) definition of augmented reality. They define AR as technological systems that "combine real and virtual objects in a real environment" (p. 1), connect real-world objects to digital ones, and are interactive, 3-D, and real-time. Their definition of AR also describes MR because it does not limit these technologies by describing the types of technology capable of AR, or by narrowing the functions of AR systems. It should be noted that MR does not require the use of 3-D images, as it can include audio or text-based information with no associated graphic.

Milgram and Kishino (1994) define MR similarly, describing it as a mixture of virtual and real objects presented together through a single display. Their definition is a bit more restrictive than Krevelen and Poelman's, as they focus largely on the concept of MR requiring a screen of some sort to convey information. In an article describing AR used in museum spaces, Mandy Ding (2017) also describes AR in a context of seeing digital information in real spaces through a screen. To clarify, it is not necessary for a user to interact continuously with a screen when experiencing MR. These two definitions of AR as requiring the use of a screen support the use of the term MR for this study. Audio and text information related to the real world for the purpose of enhancing a user's experience with the real environment should also be included in MR.

To narrow the scope from all possible MR technology, this study will take a look at location-aware mixed reality mobile apps. These apps take digital information such as audio, text, image, and other forms of information and overlays it alongside the real environment based on a user's geolocation. The information is intended to enhance the user's experience in that place. The information presented is location-specific, and will not be available when in other locations.

Location-aware mixed reality has already found successful use for engaging visitors and increasing sense of place (SOP) at museums and heritage sites (Cheng et al., 2015; Jin, 2017; Pettine, 2017). Many museums (historical, science, natural history, art, and others) and cultural sites have developed MR guide apps as the primary immersive source of information for visitors to experience exhibits (Cheng et al., 2015; Valmestad, 2013). Visitors view these apps as fun, challenging, and interesting ways to get first-hand experience with exhibits (Cheng et al., 2015).

A notable example is the multi-media AR app designed by Cheng et al. (2015) with the goal of enhancing user experience and sense of place development within the context of a particular heritage site. They found that visitors who used the guidance system had higher learning outcomes, higher sense of place identity, and higher sense of place dependence compared to audio-only and non-guided visitors. MR-guided visitors also expressed higher levels of enjoyment, stronger learning motivation, higher interest, and a stronger sense of learning acquisition (Cheng et al., 2015).

Another example of MR being used to enhance visitor experience and engagement is the University of Manitoba Public Art Project. The project sought to engage citizens with local public art installations (Valmestad, 2013). It used QR codes to connect people with an online database of information about local art pieces when walking around and coming across the art installations. Unlike Cheng et al.'s (2015) work, this project developed no method for monitoring student use of and experience with the system, though it did earn national recognition for its efforts.

Various forms of MR have also been applied to spaces outside of museums, such as the CHICAGO 00 project. Conceived in 2013, this ongoing project uses extensive museum databases to create mobile app-based historical journeys to offer people a new way to experience historical sites. The project aims “to activate archives by creating history experiences outside the

museum walls” (Chicago00.org, 2013), engage new communities by bringing history to them, and combine new and old media to create live historical experiences.

MR apps do not necessarily need to be long-term to create a sense of place among users. The 2018 art installation *Coming Home*, a collaboration between Lava Mae and ZERO1, allows San Francisco locals and visitors to learn the stories of 8 homeless individuals at certain locations using QR codes. The project seeks to connect people separated by the housing divide and create a sense of understanding and compassion for homelessness (cominghomesf.org, 2018).

As MR is a relatively new facet of mobile app design, there is a current scarcity of literature studying exactly how it can similarly enhance engagement and user experience in local/community spaces beyond these location-specific self-guided tours. Of the examples above, only one actively studied user experience with the MR app and evaluated the success of the app in enhancing user engagement and sense of place. The same scarcity of literature exists for different types of MR apps such as games, databases, and crowdsourcing. There are a small number of studies that examine concepts related to place experience related to use of mixed reality mobile apps and games. Studies most closely related to the current topic of interest are limited. Two were published fairly recently (within the last 3 years), and both focus on users of *Pokémon Go*. Although they do not use sense of place theory specifically, both studies are worth noting here. They provide examples of work examining ways that app use may impact people’s connection with the community around them by facilitating time spent in places and social connections with other game users.

### **Pokémon Go related to sense of belonging, well-being, and place attachment**

The first of the recent studies related to *Pokémon Go* and place comes from Vella et al. (2019) and examines social connectedness and sense of belonging as it relates to *Pokémon Go*.

The researchers wanted to know if the game might improve health and wellbeing outcomes. They investigated the possibility that *Pokémon Go* might indirectly influence player lifespans because it might decrease sedentary lifestyles and social isolation, which “have been found to increase morbidity” (Vella et al., 2019, p. 584). They posited that “social connectedness may be facilitated by gameplay that draws players into public spaces” (Vella et al., 2019, p. 584), thus decreasing social isolation and sedentary behavior. They also suspected that playing in public spaces could build players’ sense of place identity, though this was not the focus of their investigation.

Data collection occurred in two parts. The first part involved intercepting 15 *Pokémon Go* users found near PokéStops and conducting semi-structured interviews which were later analyzed. The second set of data consisted of 880 user-generated posts related to *Pokémon Go* posted in popular online forums, which were also analyzed. During analysis, three strong themes about social experience emerged: the game strengthened ties with family and friends, acted as an ice breaker for social encounters with strangers, and facilitated a sense of belonging by connecting users to other users and connecting them with place.

The study found that playing *Pokémon Go* “produced a sense of belonging, linked to a sense of place, as well as facilitating conversations with strangers, and strengthening social ties” (Vella et al., 2019, p. 583). The game also reportedly fostered outdoor play, decreasing sedentary behavior among players. The researchers connected these findings with the accessibility of the game itself, people’s shared love of the game (related to nostalgia), and the game mechanics that require players to be out and about while playing.

Although Vella et al. didn’t focus on place experience, they discussed findings related to place experience. They claimed that playing *Pokémon Go* placed players in new settings as they

formed relationships with others, which “helped [players] see their local area in a new light, and [made] them more aware of their everyday surroundings” (Vella et al., 2019, p. 599) and that playing in place may cause players to develop “memories for future recollection that are tied to physical places and feelings of belonging ” (Vella et al., 2019, p. 600). Another possible benefit to place relationships that the researchers discussed was the potential that the game has to impact “individuals and communities who typically feel excluded from public spaces, or find them challenging to inhabit” by facilitating spending time in public spaces (Vella et al., 2019, p. 600).

Social experiences, experience with place, and time spent in place are all related to sense of place (SOP) as it is described in the literature (Steele, 1981; Relph, 1976). Being in a place opens up opportunities for social engagement in that location, and social engagement becomes part of a person’s memory related to that place. Vella et al.’s findings that users spent more time in place, and that the game facilitated social encounters in these spaces suggest that games of this sort may influence people’s SOP development. The researchers also assert that the game caused people to feel more aware of and connected with their surroundings, which is another important aspect of SOP.

The second study of interest comes from Olesky and Wnuk (2017), who studied overall well-being by focusing on the relationship between experience of place and *Pokémon Go* use through the lens of place attachment theory. Place attachment theory, not to be confused with the SOP construct of place attachment, is similar to sense of place theory in that it tries to describe how people experience place. The theory focuses on how people develop relationships with place based on how that place fulfills their goals and emotional needs (Olesky & Wnuk, 2017). The researchers claimed that “AR games often include elements that are known to predict place attachment: exploration, social relations or the experience of enjoyment in a place” (Olesky &

Wnuk, 2017, p. 3), making them a good technology to investigate related to this topic. As examples, they pointed to the education and tourism industries, explaining that augmented reality games can change people's attitudes and habits about a place by gamifying the experience. They claimed "that positive emotions triggered by playing can influence players' place attachment via the process of gamification" (Olesky & Wnuk, 2017, p. 3).

The researchers used an online questionnaire to collect data from 279 Polish participants from *Pokémon Go* fan group pages. They found that "satisfaction from playing and the social relations made during play positively predict place attachment, but the amount of time spent on playing does not" (Olesky & Wnuk, 2017, p. 3). Overall game satisfaction, social relationships, and place attachment were indirectly impacted by how the user felt about the place they played in (in this case, measured by viewing the place as exciting).

Based on their findings, Olesky and Wnuk suggested that there is a "possible implicit effect of gamification when positive experiences from playing could be translated into more positive attitudes towards ordinary places of playing" (p. 6). If playing a game facilitates spending time in place, and the activity of playing a game there impacts a person's attitude toward that place, it is not a far leap to suppose that apps like *Pokémon Go* might impact SOP. In the end, Olesky and Wnuk pointed out that understanding the "emotional transfer between positive experiences from playing and place attachment" may be beneficial for other fields. Physical or behavioral health interventions, the tourism industry, education, and other fields and industries could potentially benefit from such an understanding, but so could communities. SOP literature describes positive outcomes that may occur as an individual's SOP increases, such as place intensification or place creation.

## **The Potential of Location Aware Mixed Reality Apps and Games**

The purpose of this thesis is to explore the ways that location-aware mixed reality mobile apps and games influence the ways that their users experience sense of place. The ability that these apps have to change the flow of information, making information more accessible within a place make them likely influencers on SOP. This capability of mobile MR technology gives it the potential to influence a user's experience of place attachment, place dependence, and place identity, which may depend on the features and design of the apps and games.

McCall, Wetzel, Löschner, and Braun (2011) point out that “location-aware augmented reality games provide players with a rich and potentially unlimited range of interaction possibilities” (p. 25), a statement which could also hold true for apps. Mobile MR technology may influence place attachment by making affective aspects of place more salient. An app that uses GPS coordinates to provide information about local flora and fauna, for example, may enhance a person's feelings that the place is unique or provide additional place-based information. Social features such as the ability to comment on user submissions may influence affective aspects of place by changing what social interactions are possible in a location.

For place dependence, these apps and games may bring new forms of behavior to place by changing boundaries and access to events and behaviors (Meyrowitz, 1985). Location-aware MR may provide users with a new activity to associate with a place. A person using the Geocaching mobile app, for example, has the added option of participating in geocaching activities in any place that they visit. When a person engages in a place through behavior and action, they often develop a stronger SOP as a result (Cheng et al., 2015). Likewise, having a stronger SOP influences the types of behaviors and actions a person uses in a particular place.

Changes to the flow of information also influence a person's experience of place identity (Meyrowitz, 1985). Some apps and games make local information available through features that pull up local history or geographic information. This new flow of information can be a direct function of the app, such as an app that tells users about local history, or a side function, such as attaching game places to unique real-world locations, some of which may have historical context. Similarly, some app designs make them conducive to encouraging and supporting prosocial behaviors, self-efficacy, and, on some level, place intensification.

After considering these features of location-aware mixed reality apps and games, it is possible that exploring the impact that this technology has on SOP development may benefit society and its technology-using populations. With growing concern that mobile technology is removing people from their real-world communities, it seems prudent to explore possible avenues for re-engaging people in their communities. If this technology can be harnessed to increase users' SOP, developers may be able to purposefully design future apps and games with this in mind in order to increase the likelihood of people engaging in their communities.

### **Research Questions**

The growing concerns regarding mobile technology distancing people from their real-world communities and lives prompts new research in finding ways to prevent such distancing from occurring. While it is unlikely that solutions urging people to stop overusing their mobile technology will prove successful, it is possible that purposeful design intended to keep people engaged and connected with their real-world communities could have a positive impact. The purpose of this thesis study is to explore location-aware mixed reality mobile apps and games in order to understand how this technology could be designed in order to connect people with their

communities and encourage global citizenship. This paper considers the following research questions:

*RQ1: How do location-aware mixed reality mobile apps and games facilitate the development of a sense of place among users?*

*RQ2: What features of location-aware mixed reality mobile app and game design facilitate sense of place among users?*

*RQ2a: How do features of location-aware mixed reality mobile apps and games facilitate place attachment?*

*RQ2b. How do features of location-aware mixed reality mobile apps and games facilitate place dependence?*

*RQ2c. How do features of location-aware mixed reality mobile apps and games facilitate place identity?*

## CHAPTER 3: METHOD

This thesis seeks to explore the experience of sense of place (SOP) when using location-aware mixed reality mobile apps and games. Understanding the ways that certain design elements of these games may impact the development of SOP could allow app developers to purposefully design apps with features that enhance user SOP.

### **Respondent Interviews**

Data for this study was collected through respondent interviews. Generally, due to their conversation-like nature and flexibility, respondent interviews provide a closer look at the experiences of individuals, and reveal narratives about their experience for later analysis (Silverman, 2013; Guest, Namey, & Mitchell, 2013). Because of the way that they “elucidate subjectively lived experiences and viewpoints from respondents’ perspective” (Tracy, 2013, p. 132), interviews are an appropriate method for collecting experiential data. This research strives for an exploration of people’s experiences that lead to the development of SOP, as well as explanations of what those SOPs look like.

Respondent interviews invite interviewees to speak about “their own motivations, experiences, and behaviors” (Tracy, 2013, p. 141). With this in mind, participant interviews are an appropriate method for gathering data due to their flexibility to allow interviewers to develop further questions based on responses (Wimmer & Dominick, 2006). Respondent interviews provide opportunities to explore the experiences of individuals and delve into where those experiences come from and how they impact the individual.

## **Sample**

A sample of 12 participants (4 for each of the 3 selected apps) was used for this study. If a participant used more than one of the selected apps, that participant was only interviewed about the app that they were selected for. Participants were self-selected, recruited from public online message boards related to those apps on sites like Reddit, Google+, and Facebook. Specific forums and open groups related to the apps were selected on these websites. The researcher posted a recruitment text asking for volunteers to participate in the study and detailing participant rights. Interested parties were asked to email the researcher, leave a comment on the forum page itself, or use the website's unique communication channels. When possible, permission to post a recruitment text in the forum was requested prior to posting. Once recruitment was complete, the recruitment texts were marked inactive, and a copy of the recruitment text was sent to each participant.

Participants were considered if they used one of the selected apps for at least one month, used the app at least once per week, and used the app in a town or city that they frequented or lived in. Although SOP is relevant to travel, travel SOP is different than SOP experienced as a local (Steele, 1981). Considering this, people who used the app primarily when traveling instead of in their local place were not included in the study. People who used the app both while traveling and when at home were still considered.

No restrictions were placed on country of origin, gender, ethnicity, income level, education level, or language when considering, though out of necessity of communication, it was not possible to recruit non-English-speaking participants. This exploration focuses on adult experiences with SOP, so although there was no cap on maximum age, minimum age was a factor and children and persons under the age of 18 were not included.

Participants were between the ages of 20 and 69, with the majority being between 31 and 69 (*iNaturalist* had one participant in their mid 20's, and three participants between 50 and 69 years of age. *Pokémon Go* had two participants in their early to mid 20's and 2 participants between 31 and 45 years old. *Ingress* had 4 participants between 30 and 45 years old). Five of the 12 participants were female (Half of the *iNaturalist* participants were female, One of the *Pokémon Go* participants was female, and half of the *Ingress* participants were female). Two participants lived outside of the United States, with one *Ingress* participant living in Australia and one *Pokémon Go* participant living in Argentina. Coincidentally, all participants came from large cities.

### **App and Game Selection**

Location aware mixed reality apps and games offer users location-specific digital information alongside real-world information. This information can be passive (text- or audio-based informational content that requires little to no action from the user) or interactive (requiring the user to take action in response). In order to get an idea of how these apps and their specific design elements may influence SOP development, only location-aware apps were considered. These apps included relevant information associated with GPS coordinates, and the information was available in the form of text, audio, or visual information. The information in these apps is user-created or system-provided, but had to be linked to specific locations to be considered. Under these criteria, the following location-aware mixed reality mobile apps and games were selected: *Pokémon Go*; *iNaturalist*; and *Ingress Prime* (which will be referred to as *Ingress* in order to include the former version of the game, now called *Scanner Redacted*). The main differences between the two game versions is the way that the narrative is conveyed. Of the

*Ingress* users selected, only one used *Ingress Prime*, as the game update had only recently been released in November 2018).

Apps designed specifically for navigation were excluded from the study. While serving the function of improving a person's navigation experience, these types of apps do not usually serve to enhance people's experience with a place beyond helping them to finding their way around.

**Pokémon Go.** *Pokémon Go* is a mobile game designed by Niantic and launched the summer of 2016 (Hanke, 2017). One of the main objectives of the game is to capture many creatures called Pokémon, which can be found on the game's map (Niantic Labs, 2018a). The game uses the player's GPS location to provide a cartoon map representing the real world, and an animated character (an avatar) walks around the map to visually show the player's real-world movement (Davison, 2016). The map displays real-world roads, building footprints, and waterways to help the player navigate. Pokémon appear randomly on the map, and a player is more likely to encounter them while walking around. When the player is stationary, new Pokémon will not usually appear. Players must use special items to capture Pokémon (Niantic Labs, 2018a).

Items are collected from PokéStops, which are game nodes with fixed locations in the real world (Davison, 2016). Each PokéStop is attached to physical features such as art installations, religious spaces, public spaces (such as libraries and cafés), green spaces or parks, or other interesting place features such as a historical markers (Niantic Labs, 2018a). Each PokéStop includes a photo of the real-world place and a name for it. PokéStops are created through crowdsourcing by asking players to submit place photos and coordinates for locations that fit the extensive criteria listed on Niantic's website (Bogle, 2016). Because they are user-

generated, the quality of the name on PokéStops varies, but it is not uncommon for historic features and art installations to have informative names that tell other users what that object is. Players must move close to these PokéStops in the real world in order to interact with them and get the digital items out. Players can attach an item called a lure to a PokéStop in order to cause Pokémon to frequently spawn at that location for a limited time without the player needing to walk around (these typically last for 30 minutes).

The game also uses another similar game feature: the Pokémon gym. Gyms are special PokéStops where players can battle with other players and take control of the point (Niantic Labs, 2018a). Taking control of a gym allows a player to earn in-game currency used to purchase additional game items that cannot be collected from regular PokéStops (Niantic Labs, 2018a). Special events called Battle Raids (commonly referred to simply as raids) can occur at gyms at random. Raids allow users to fight powerful Pokémon called Raid Bosses, with a chance to capture the boss if they win. These special events typically require teamwork to complete successfully due to the strength of the Raid Boss combined with a short battle time limit mechanic. Some high level players may be able to win against a Raid Boss alone.

Other features of the game also require players to walk around. Players can hatch Pokémon eggs that require them to walk a specific distance (usually between 2 and 10 km) to hatch (these items do not hatch if the player is traveling faster than walking or running speeds)(Niantic Labs, 2018a). A recent update added a feature that rewards players with items and points for walking around as well (Niantic Labs, 2018a).

The game has limited in-game social functionality. Players can “make friends” by entering special codes from other players (Niantic Labs, 2018a). The codes must be exchanged by players directly and cannot be searched for in-game, although players often exchange codes in

online forums. Players can give gifts containing game items to players who they have friend codes for (Niantic Labs, 2018a). Like other game items, gifts can be found at PokéStops and gyms; each gift shows the recipient what PokéStop or gym location it came from (Niantic Labs, 2018a). The game has no built-in chat or messaging functions.

Another notable feature of the game is the existence of goals. Players collect “research opportunities” at PokéStops, and these act as in-game goals that instruct the player to complete tasks such as capturing a certain number of a type of Pokémon, or visiting a certain number of PokéStops (Niantic Labs, 2018a). The game also features events called Community Days, where users can encounter special Pokémon or earn special rewards by playing during a specific timespan (typically over weekends). Community Days also often feature special raids.

*Pokémon Go* was selected for this study for a number of reasons. The first is its wide use (a total of 800 million downloads reported by Niantic in 2018)(Niantic Labs, 2018a). Although numbers have dropped since its launch, *Pokémon Go* still has a large player base and is available in more than 130 countries (Bradford, 2017). This game was also selected because of features that may contribute to SOP, including the map view, the real-world PokéStops and gyms (game nodes) with real-world pictures, and the play features that require walking.

**iNaturalist.** *iNaturalist* is a citizen-science app put out by the California Academy of Sciences and launched in 2008 (iNaturalist, 2018). This app allows users to take pictures of nature (plants, animals, insects, fungi, and mold) and upload them to the app (Silverman, 2016). The app uses image-matching combined with the photo’s geo-location information to suggest identification matches for the image (iNaturalist, 2018). Once the user selects an identification for their image, they may upload it to the shared world map using its geo-location data (Silverman, 2016). A pin is created where other users can view, comment on, verify, or suggest a

new identification for it. If another user verifies an identification, the posting is labeled as being “research grade” to indicate that it has been verified (iNaturalist, 2018).

Users can access the map under a tab labeled “explore” and learn about nature in their area by viewing the pins from other users (iNaturalist, 2018). The map is highly detailed, showing a satellite view under the observation pins. A user’s location does not determine what areas of the map are visible, but it does determine what location the map opens to first. The map allows users to choose any location around the world to view, but photo geo-location data dictates where a photo is pinned on the map (iNaturalist, 2018). Users can also join “projects” that request help in collecting specific types of data, such as compiling a list of nature found in cities across the world (iNaturalist, 2018).

*iNaturalist* was selected for this study due to its map-based real-world photo submission feature, as well as the map feature that allows users to see the types of nature around them. The social element of the app (commenting on user submissions) also contributed to its selection. Finally, the app was selected because users can take a photo of something in nature and use *iNaturalist* to identify the photo, which increases the likelihood that users can learn about the place around them using the app.

**Ingress & Ingress Prime.** *Ingress* is a mobile game from Niantic, which was launched in 2013 (Android) and 2014 (Apple). A redone version of the game, *Ingress Prime*, was released in November 2018 and automatically updated from the *Ingress* game already downloaded on players’ devices. Some users continue to use the former version of the game, which is now called *Scanner Redacted*.

*Ingress* was used as a base for the creation of the *Pokémon Go* app, resulting in several shared elements. Like *Pokémon Go*, *Ingress* displays a cartoon map that matches the player’s

GPS location (Lagace, 2018). The map displays real-world road features that help connect the game map with reality for ease of navigation. Another shared feature with *Pokémon Go* is the use of real-world nodes that players must travel to, called “Portals” in this game (Niantic Labs, 2018b). Each Portal includes a name and photo of the real-world object or place that it represents. *Ingress* also includes a counter that increases every time a player encounters a new Portal that they had not interacted with before. Users refer to this unique Portal counter as their “uniques count”.

The Portals allow players to collect items that they need in order to play the game through “hacking”, and a player must walk close enough to a Portal in order to interact with it (Niantic Labs, 2018b). Unlike the PokéStops in *Pokémon Go*, these Portals are a key game element beyond item delivery. A player can attack Portals that are controlled by opposing team members, or take control of unclaimed portals in order to gain control of it for their team (Lagace, 2018). There are two teams, one green and one blue, and they compete to control the most map area overall (Niantic Labs, 2018b). Players can contribute to their team’s control by hacking a single Portal, or they can find three or more Portals located relatively close together and link them to cover even more area (Niantic Labs, 2018). This linking function of the game may require players to be a little more aware of where they can find Portals and may encourage them to spend more time walking around in the real world in order to gain more control.

Another element of this game that encourages player movement within a place is the collection of a game substance called XM (Lagace, 2018). This substance is a major element of the game, allowing players to level up, a gameplay mechanic that causes the player to become more powerful by reaching set thresholds of experience (in this case, experience comes in the

form of collecting a certain amount of XM)(Legace, 2018). XM floats throughout the map, and players collect it by walking around or visiting Portals (Niantic Labs, 2018b).

Players can also participate in missions created by other players (Niantic Labs, 2018b). These missions require a player to visit specific nearby Portals in a sequence. Each mission gives an estimate of how long it will take to complete, and displays the number of other players who have completed the mission. Mission pages often include either a short history/description of the area, or a story element to enhance gameplay.

There is a voiceover element to the game where a character speaks through a “communicator” to alert players to the game’s story as it unfolds or to provide other game information (Niantic Labs, 2018b). Upon launch, the gam displays a message recommending that users wear headphones in order to use the audio function more effectively. Additionally, this game includes a social element. All players have access to a local “comm,” a text-based group chat between same-team, nearby players within a set radius (Niantic Labs, 2018b).

*Ingress* was selected for its real-world nodes, missions, and other elements requiring a user to walk around. The social chat feature also influenced its selection. Additionally, the recent makeover and re-launch of the game in November 2018 may result in an increased or rekindled user base over the course of the next few months.

## **Interview Questions**

The questions for the interviews were developed with the SOP literature in mind. Questions explore user experiences with the apps related to SOP development. In order to tease out the many components of SOP, interview questions were designed around the smaller constructs of SOP discussed above. Questions regarding place attachment revolve around users’ emotional connections with, interest in, sense of uniqueness of, pride in, and social interactions

in the place or places where they use their app. Place attachment questions also explore users' social identity regarding place.

Questions for place dependence focus on activities or behaviors, events, exploration, physical engagement, prosocial activity, and community engagement in place. Users were asked questions about where they used the apps most often, and what types of activities they conducted in those locations. They were also asked questions about place creation, questions seeking to discover whether users have any thoughts about contributing to creating features of their community.

Place identity-related questions explore users' knowledge of place in regard to the app. These questions ask about users' knowledge of place (physical, cultural, social, and historical features), especially in regard to app features that may impart such information. Users were also asked about their self-efficacy in place. Finally, users were asked questions about their participation in improving their surrounding community in order to explore place intensification. A complete list of interview questions can be found in the appendix.

## **Procedure**

A sample of 12 participants (4 for each of the 3 apps) was collected for interview. The sample was collected using public message boards and other online social spaces where discussions about the apps occur, including Reddit and Facebook. Interviews were conducted by phone or Skype audio call depending on the participant's preference. Each interview took between 40 and 70 minutes. Participants were scheduled for interviews in advance using email communication. Before the interview and at the start of the interview, participants were provided with a participation statement that outlined what the data would be used for and outlined their right to withdraw at any time.

The researcher conducted the interviews and used a question sheet during the interview, and asked questions largely based on the question sheet. Due to the more flexible nature of the selected interview type, the interviewer was also free to ask follow-up questions where appropriate. For transcription purposes, each interview was audio recorded using a mobile phone voice recorder or a built-in Skype call recording feature and the recordings were transcribed. Participants were notified of the audio recording in advance.

### **Pilot Interviews**

The researcher conducted 2 pilot interviews separate from the 12 interviews prior to the start of the study. Participants for the pilot interviews were recruited through an informal snowball sample conducted locally. These interviews took place in-person. The pilot interviews were used to refine interview schedule. Pretesting the interview schedule in this way is important for checking question quality and clarity. Further, these interviews provided an opportunity to discover questions that would enhance the interview schedule, as well as to identify questions that were unnecessary. Data collected during the pilot interviews were not be included in the final data set.

### **IRB Approval**

IRB approval was acquired from Colorado State University's IRB prior to implementation of the study.

### **Data Analysis**

Following completion of the interviews, each was transcribed for further analysis. MAXQDA was used to code and analyze the data. During transcription, participant names were replaced with identifiers to protect confidentiality. Interview data were looked at under a sense of place lens in order to examine responses as they detailed place experience and app use. An initial

reading was conducted after the transcription and prior to coding. The data underwent two rounds of coding conducted by a single coder. These multiple coding cycles are important for thorough analysis of patterns and meaning (Saldaña, 2012). The coded materials were analyzed for patterns of user experience and SOP development.

Based on the literature, *a priori* categories were used to code data for the first round of coding. The interviews were coded following a code book, and coded data were organized into four major categories from the literature: place attachment (the emotional, affective experiences with and connections to place), place dependence (the behavioral, connotative experiences with and connections to place), place identity (the knowledge-related, cognitive experiences with and connections to place), and loss of sense of place. Experiences were categorized according to the criteria of SOP that define each of these categories.

The codes organized under place attachment include emotion toward place, place interest, sense of place uniqueness, sense of pride in place, social interaction in place, and social identity of place. The codes organized under place dependence include activities associated with or done in place, place events, exploration in place, engagement with physical elements of place, prosocial behavior in place, community engagement, and place creation. The codes organized under place identity include knowledge about physical/social/cultural features of place, familiarity with history of place, self-efficacy in place, and place intensification. The codes organized under loss of sense of place include expressions about being disconnected from place, low knowledge of place, and lack of connection with place. For the codebook, see appendix B.

## CHAPTER 4: RESULTS

Sense of place (SOP) is made up of a combination of a person's experiences in a location that form their sense of what that place is like and how they feel about it. Many participants of the current study showed an awareness of place features and an interest in their city or town or specific areas in the city or town. There were a number of notable cases where users learned about place features or learned about new places as a result of their use of the app. Eight notable themes emerged from the interview data.

Users expressed feeling connected to a community of other users through their selected app. Through these communities, users had social learning experiences, both related to learning about app functionality, and learning about the place around them. They described times when they stayed in a location in order to use their app, or made a special trip to use it. Users felt interested in place features or expressed noticing objects from the app in the real world more frequently. The apps were noted to motivate exploration in place, which notably lead several users to discover new areas. In several cases, the apps were used to supplement activities that users were already doing. In general, users seemed to know the best places to use the apps as well, and tended to express positive affect toward place when describing things they had learned or come across while using the app.

### **Connection with a community**

When talking about built-in and external social functions of the apps, users expressed feeling a sense of community among other local app users. Half of the game app interviewees mentioned using external communication services set up by other users such as *Whatsapp*, *Google+*, or *Discord* as a regular part of their app experience, so these interactions were

included in the coded data. This type of external chat use was not reported among *iNaturalist* users. It should also be noted that some users talked about playing the game with spouses or friends they had prior to starting the game as well.

In explaining how she and her team communicate, one user said that her team uses *Discord*, and referenced using other communication platforms in the past (Harley, *Ingress*). These external chats served to connect users for strategizing and for socializing. One user explained that “the *Discord* is a really big part of [the experience]. It's all people playing *Pokémon* and coordinating” (Theresa, *Pokémon Go*). A user who described himself as “a casual rogue player” mentioned that he didn’t spend a lot of time on the parts of the game that he described as “meta,” the more collaborative aspects of gaining high-level items and experience points. This user described occasionally using external chat services as well, saying “every once in a while, I'm on a couple different chat groups. There will be something that comes up where there's a group event that sounds interesting, but that's rare” (Gary, *Ingress*). Another *Ingress* user also talked about using external communication apps in addition to the built-in communicator function (Sandra, *Ingress*). She went on to describe monthly get-togethers she and her local external chat community would have where they would meet up and go out for drinks or dinner. Two other users described coordinating strategic meetups through external chat services.

Users generally had positive feelings toward the community of other users that they felt connected to and commonly referred to them as a community. One *Pokémon Go* user explained that her local *Discord* group gave her a sense of community, saying “I don't use *Discord* for any other reason than the *Pokémon Go* community” (Theresa, *Pokémon Go*). In some cases, users expressed feeling connected to neighbors, as this *Ingress* user did: “I love the way that this game

sort of lets you meet people in your area, you know, and like actually interact with your neighbors” (Sandra, *Ingress*). This user went on to describe that instead of having a sense that she was walking past faceless people every day, she would notice people in the game (in the chat or capturing Portals on the map), and said that it “helped build up this very friendly, kind of neighborly vibe” (Sandra, *Ingress*). Negative experiences with external chat communities came up once where a user described a situation where she felt that the team she was part of was “toxic” because of their discourse in the chat. She switched teams because “they took in-game rivalries to these insanely serious [levels]... ” (Sandra, *Ingress*), referring to the negative way that team members talked about players from the opposite team.

Another type of social interaction mentioned was noticing or meeting up with other users in the real world. “You have all sorts of interactions with people,” one user explained, referring to both in-person and computer-mediated interactions (Theresa, *Pokémon Go*). As mentioned above, some of the meetups were coordinated through external communication services. Not all meetups were coordinated, however. Users described times when they went to Portal/PokéStop-dense areas (areas with many of these in-game nodes) and ran into other users. While describing a Portal-dense area near her, one user explained that she typically runs into other players when playing there (Sandra, *Ingress*). *Pokémon Go* users talked about seeing or talking with other users in relation to raids (Kyle, *Pokémon Go*; Richard, *Pokémon Go*) and Community Days (Kyle, *Pokémon Go*; Richard, *Pokémon Go*; Theresa, *Pokémon Go*), with players mentioning that there are a lot of people out on Community Days (Kyle, *Pokémon Go*; Esteban, *Pokémon Go*; Richard, *Pokémon Go*).

Some users described being motivated to interact with other people who looked like they were also playing the game. Richard, who did not mention participating in an external chat

service, described a few situations of this nature, including one where he took on a raid. He said that “as soon as we get done, I'm looking around for the person who's looking at their phone because you know... where is this person?” in the end, he wound up finding an entirely different *Pokémon Go* user than the one who had taken the raid with him. One user, who stated that he didn't have many face-to-face interactions while using the app, talked about a time when another user (who he had been battling in-game) approached him at a brewery, saying that it “was just kind of cool to [...] put a face to the name of the guy I keep trading Portals with” (Roland, *Ingress*). These social situations tended to involve short-term conversations with other users, or simply seeing other users playing the game and feeling connected as a result. One *iNaturalist* user also described a situation where he interacted with another user who he ran into at a town event. He helped the other user set up a project for her garden like the one that he had for his own garden, though this type of interaction only came up with one user (Cody, *iNaturalist*). Social encounters in place contribute to SOP. Although *iNaturalist* did not seem to facilitate in-person social engagement, the game apps were reported facilitating social encounters multiple times.

Game users also described making friends with other users they met during game sessions and through external chats, or recognizing other users they saw frequently (Kyle, *Pokémon Go*; Theresa, *Pokémon Go*; Esteban, *Pokémon Go*). Another user described not knowing anyone playing *Ingress* before she began, but that changed after she started playing and she felt that she met most of her friends through the game (Harley, *Ingress*). She went on to explain that “I would say at this point I play *Ingress* because of the other people that play *Ingress* and the friendships that I've made and... the kind of community that I'm part of as part of the game” (Harley, *Ingress*). The *Pokémon Go* user who played primarily on his campus and

expressed low place knowledge for his city described liking that he got “to meet other players as well” (Kyle, *Pokémon Go*). He described that “we kind of form a little friendship bond. Like we always say ‘hi’ to each other when we see each other. I like it very much” (Kyle, *Pokémon Go*). He went on to describe noticing the same players throughout the semester and feeling connected to them because of it. Two *iNaturalist* users mentioned other users who frequently posted quality observations or gave good or frequent feedback, but they did not meet these users in real life (Erin, *iNaturalist*; Mandy, *iNaturalist*). Another user described *Pokémon Go* Community Days as “the days where you really get to [...] if you're not on the *Discord*, [...] meet other people, make friends with them... trade friend codes, that sort of thing” (Theresa, *Pokémon Go*).

Another common type of social experience described mostly by game users was strategizing with other users or participating in events with other users. This type of interaction tended to occur through external communication services. These interactions included “doing the farms where we get a bunch of people together and you get the higher-level gear” (Sandra, *Ingress*), referring to more powerful items that players can collect from stronger portals, a feat more easily accomplished in groups. Other coordinated efforts occurred where “people will ask where they can go to farm for gear, or people will ask questions about operations and stuff like that” (Harley, *Ingress*). Some collaborative efforts occurred by coincidence, more often for *Pokémon Go* users such as a user who described that sometimes he’ll “luck into a situation where [he] will have happened upon a group of people who are playing the game. And then [they] can coordinate and take down a raid or whatever” (Richard, *Pokémon Go*). One *iNaturalist* user described coordinating with other users as well, in regard to taking on the yearly City Nature Challenge competition, “So that means I'm kind of charged with trying to get more participation, trying to get more people out in activities and so on” (Cody, *iNaturalist*).

*iNaturalist* users tended to express feeling connected to other citizen scientists or people interested in nature, and expressed being better able to participate in these groups by using *iNaturalist*. One user described that she “just love[s] that it incorporates other citizen scientists to come and contribute data that it can be used worldwide” (Erin, *iNaturalist*), suggesting that she feels connected to other users participating in the observation data sharing. Another user felt that it didn’t matter if a user considered themselves a citizen scientist to be one, saying “I think even people that don't consider themselves citizen scientists, if they're using *iNaturalist* at all, then they really are. It's a really fantastic tool for citizen science” (Daniel, *iNaturalist*). He felt that just being involved in the app constituted being a citizen scientist, allowing them to participate in a community of citizen scientists without even trying. A user with experience using similar nature-tracking services felt like *iNaturalist* was “much more social, so it's much more encouraging for citizen scientist approach” (Cody, *iNaturalist*). Citizen science is one way for people outside of the science field to get involved with science that interests them. If users of *iNaturalist* feel more connected to other citizen scientists and more able to participate in citizen science, they may also feel more connected to this identity or more encouraged to participate in citizen science.

*iNaturalist* users also referenced commenting on or approving other people’s observations. All users of this app said that they liked having people comment on and approve their observations. One user said that she did not participate in commenting on or approving other people’s observations because she didn’t feel like she was “at that level” (Mandy, *iNaturalist*), but liked when other people commented on and approved her observations. She felt like she learned a lot from this type of feedback. Another noted that she didn’t approve observations very often because she wanted to make sure that she was “a hundred percent

accurate” (Erin, *iNaturalist*) before agreeing on the identification of an observation. Other users liked that the app made it so they could “provide identifications to other people” (Cody, *iNaturalist*) by approving observations or making comments. One user described looking

“pretty much daily because I'm looking to see if the things that... the ones that I've got posted, if they've been identified, confirmed by other people. And then sometimes I just look at what other people have posted and help identify their observations.” (Daniel, *iNaturalist*)

Game app users tended to feel more connected to other people even when playing alone. One *Ingress* user liked playing the game in more populated areas because she liked feeling connected to the people around her “even though [she’s] staring at [her] phone” (Harley, *Ingress*). Another *Ingress* user experienced something similar related to other *Ingress* players. She described the difference between just walking around and not paying attention to the people around her verses feeling more connected to people after seeing other users active on the game map (Sandra, *Ingress*). Even though these users were talking about times that they played the game alone, they felt connected to a community of other users through the app. It seemed to transform walking alone into a new type of social feeling experience.

### **Social learning**

Among the social experiences described in the interviews, a separate, distinct type of social experience came out as well: social learning experiences. Social learning occurred when users learned information related to the app or the world around them from other app users. *iNaturalist* is an app that lends itself to social learning because of the user-submitted nature observations and ability to comment on and approve other people’s observations. Users of the game apps also experienced social learning despite not being designed to promote such a thing.

Game user social learning occurred largely as a function of the external chat services. Some of this social learning related to learning about place, and some related to game strategy.

Among *iNaturalist* users, learning about nature species after seeing other people's observations or from observation feedback came up frequently. Users described times when comments from other users told them "things that [they weren't] aware of and so [they're] constantly learnings stuff from them" (Daniel, *iNaturalist*). One user described that "there are people who respond immediately to let [her] know whether [her] observation was correct," which helped her learn species names (Mandy, *iNaturalist*). Users also learned about new species "from seeing what other people have observed" (Cody, *iNaturalist*) or "because of the photographs that everyone else posts" (Erin, *iNaturalist*).

Users talked about learning strategies or finding out about the best places to play from other users. In one user's case, she described situations where her *Discord* community actively communicated to other users about places where it was inappropriate to play, such as a funeral home that had a gym attached to it in the game map (Theresa, *Pokémon Go*). Some users learned about new places as a result of strategy shared by other users, such as Esteban, who's *Telegram* group pointed him to a location he had never heard of that was "awesome for farming XP" (Esteban, *Pokémon Go*). Most strategy-related social learning was related to farming, a game process where users set up areas to easily and quickly earn higher-level items and XP. In reference to other game strategies, one user described that there were times when he would learn something new from other users, or he might share something he learned with his group (Kyle, *Pokémon Go*).

*iNaturalist* users largely expressed having an interest in getting other people to notice the nature around them. One user talked about her experience using *Instagram* to collect photos of

local nature when she was trying to stop a development in her rural area, and related the experience to her use of *iNaturalist* “because it gives you the excitement of finding a new species” even after her *Instagram*-based project (Mandy, *iNaturalist*). Two users felt that *iNaturalist* was a good way to get people engaged with nature or to show other people what nature was nearby, with one expressing this when she said “I love using *iNaturalist* as a tool to kind of show the community around me that [...] we're actually in a biodiversity hotspot” (Erin, *iNaturalist*). One user also mentioned that he liked commenting on or approving other people’s observations as a way to provide gratifying feedback that might encourage those people to continue using the app or continue being interested in observing and caring about nature. He stated, “if more people would try it, we would start to get them a little more interested” (Daniel, *iNaturalist*). A similar sentiment was echoed by another user who explained that making comments that encouraged other people to continue to use the app “is the whole point of something like this, that you really do want to encourage people to get out and make observations” (Cody, *iNaturalist*). Feeling like they could influence people’s interest in nature by supporting their learning through the app seemed important to the users. It seemed to give them a sense of participation and efficacy in nature social learning experiences, especially with people in their local area.

### **Time spent in place motivated by app**

The game apps were used to motivate spending time in places that the users would not necessarily be spending otherwise. In some of these cases, extra time was spent walking or hiking around. As one user explained, “It gives us an excuse to explore parts of the city but also go out and do our exercise, walking, and then also we get to play *Ingress* and find unique Portals

and new art and stuff” (Gary, *Ingress*). *iNaturalist* inspired similar time spent in place, but to a different extent than the game apps.

Users talked about times when the app motivated them to make special trips to familiar or unfamiliar places in order to use the app, with some calling it an “excuse” (Gary, *Ingress*; Harley, *Ingress*; Roland, *Ingress*) to visit those places. Users also talked about spending more time hanging out in particular areas in order to use the app. One user described visiting certain areas she hadn’t been to before specifically to play *Ingress* after being invited there by other users (Harley, *Ingress*). In some cases, users talked about returning to or regularly hanging out in areas discovered through the app even when not using the app. For example, one *Ingress* user talked about a neighborhood she discovered while playing the game, where she now often went because she liked the food trucks in the area. The *Pokémon Go* user who expressed low interest in going places in his city said that he “would rather study than go to the park for no reason” (Kyle, *Pokémon Go*) when asked if he would be spending time in places he played *Pokémon Go* in if it weren’t for the game. Finding new places while wandering around playing the game also came up. Sandra described a time when she followed a path while playing *Ingress* and discovered a park she didn’t know about before (Sandra, *Ingress*).

Users of both types of app referenced taking extra walks or hikes, or going further during a planned activity than they had planned in order to use the app. “It gets people who weren’t active, active,” (Richard, *Pokémon Go*) one user stated, echoing much of the public sentiment about *Pokémon Go* since its launch, “and it’s done that for me. I’d find myself walking further, walking to specific places that are a little bit out of my way so I can find a PokéStop or a gym”. One *Ingress* user even started kayaking in order to reach Portals only accessible by water, an activity that he continues to do now even when not using the app (Roland, *Ingress*). An

*iNaturalist* user said that she walked more because of the app, describing it as “kind of fun... you can kind of have a reason for taking a hike” (Mandy, *iNaturalist*). The app motivated extra hikes for two other users as well, with one saying “I love hiking, but it gives me motivation to go out there and really see what’s out there” (Erin, *iNaturalist*), talking about making observations during these extra hikes. Time spent in a place and the kinds of activities that a person does in a particular place contribute to their SOP formation. Users taking extra hikes and walks means that they are spending more time in place, and doing activities in place, creating time for SOP development.

### **Noticing or interest in seeing app objects in the real world**

Users of all three apps expressed noticing interesting features in the real world more often. In some cases, they also expressed being motivated to look for these things in the real world after noticing them in the app maps. For *iNaturalist* users, these features were natural features like plant and insect species. For game users, these interesting features included things like murals, statues, historic markers, and other notable objects.

Game users described actively looking for real-world objects that they saw represented by PokéStops, gyms, or Portals. A few users mentioned that they would notice a game node, and “actually wander over to wherever it is, and [...] see what that it represents. And [they] wouldn't necessarily have seen that otherwise” (Richard, *Pokémon Go*). A user explained that “it's kind of nice to know what those little details are” (Harley, *Ingress*). In describing seeing PokéStops or gyms on the map, another user said “you go ‘I want to check that out’ and you end up wandering down all these ways that you never would have seen before, which is really cool” (Sandra, *Ingress*).

Users were also able to recall specific objects that they've encountered as a Portal or PokéStop. One user mentioned that she “became so much more aware of the specific sculptures and where they're located and even the names of them and who did them, because they're in the name of the Portal” (Harley, *Ingress*). Similarly, another user described that after encountering certain features as Portals, she could name the statues when trying to coordinate meeting up with someone because “[she] know[s] exactly what it is now” (Sandra, *Ingress*). Each user was able to talk about Portals or PokéStops that they were aware of such as a memorial on their campus (Kyle, *Pokémon Go*), historical sites (Theresa, *Pokémon Go*), or a solar system model built into a park (Roland, *Ingress*). Another user explained that he has “seen and found tons of things that [...] friends, other people who are from the city didn't know about” after seeing it in the game map (Gary, *Ingress*). Although most users were interested in the real-world objects, one user explained, “I guess I'm too busy playing *Pokémon Go* to even care about” (Kyle, *Pokémon Go*) the real-world places and features, though he was able to name a few PokéStops or gyms and described ones that he considered to be “special” or “dumb”.

Similarly, users described checking to see if a specific object they saw in the world was a PokéStop or Portal, or checking the game map for any of these game objects nearby while out and about. A *Pokémon Go* user described that when he goes to areas he hasn't been to, he'll fire up the app and look around to see if there are any PokéStops or gyms nearby (Richard, *Pokémon Go*). One user explained that if he's somewhere new and notices “maybe a mural or a fountain or something, [he'll] probably pull [the game] out to see if it's a Portal” (Roland, *Ingress*). One user describes that

“It's just so second nature from playing the game, is that any time I see a mural or... a statue... or... a bench or mosaic that somebody's built... I always open the app to see if it has already been submitted.” (Gary, *Ingress*)

In addition to being able to recall specific features and actively looking for features, many users felt that they were noticing these types of features more often outside of the game. One user who expressed that she liked exploring stated that when she started playing, she started noticing things that she hadn't before (Harley, *Ingress*). In reference to Portal-type objects, another user said that he probably wouldn't have noticed those types of objects prior to playing the game (Roland, *Ingress*). Noticing more features in a place creates a sense of that place's uniqueness, which is an important aspect of SOP.

Checking to see if objects in the real world were Portals (or, in the case of one *Pokémon Go* user in a region with open PokéStop submissions, PokéStops) and submitting them if they weren't also came up multiple times. Users described having “started really looking around and seeing other things” (Sandra, *Ingress*) or “just walk[ing] around [their] city” (Esteban, *Pokémon Go*) to see if they could spot anything that should be a PokéStop or Portal. Users in regions where Portal and PokéStop submissions are not open tended to “have places in [their] head that [they] think would be great submissions” (Richard, *Pokémon Go*), or expressed some interest in submitting PokéStops or Portals when the feature became available. The interest in submitting PokéStops and Portals seemed to enhance motivation to be aware of interesting features in the world around them in order to check and see if that object was already represented in the game.

*iNaturalist* users felt that they were noticing nature that they had seen on the app submitted by other users that they had not been aware of before. One user described that he “learned a lot about what's out there.... from seeing what other people have observed” (Cody,

*iNaturalist*). He went on to explain that he felt like he could keep an eye out for that species and possibly see it as well. Another user described going on hikes and noticing more species “now that I've taken the time because of *iNaturalist*, and because I've learned all of the observations because of the photographs that everyone else posts” (Erin, *iNaturalist*).

Additionally, *iNaturalist* users felt like they were noticing more species more often or being able to identify them more regularly. Each user felt that they were aware of and knowledgeable about their local nature before using the app, but felt that this had increased after using the app. One user credited the app as being “the reason why I understand or am able to identify insects and plants the way I do, because it's such a great visual representation” (Erin, *iNaturalist*). “I was already interested in botany before I started using *iNaturalist*,” another user said, “but *iNaturalist* definitely expanded my knowledge a lot and... it... expanded my learning ability quite a bit” (Daniel, *iNaturalist*). Users also described being able to see change over time by returning to the same place multiple times to observe the same specimen (Daniel, *iNaturalist*), or watching how “ranges of species are expanding with climate change” (Cody, *iNaturalist*). Similar to noticing unique features in a place, noticing nature species more often creates a sense of uniqueness which contributes to SOP.

Three *iNaturalist* users talked about their prior interest in observing nature and using books to identify species. These users felt that the app made finding a species ID easier, and liked that the app made tracking their observations over time easier as well. A user who was interested in observing insects in his garden, for example, described that “it’s a really good way to document my observations from my garden” (Cody, *iNaturalist*) because the app kept the observations organized and made them searchable. Another user felt that the app helped him keep a record of where and when he made observations as well as helping him to observe plants

he didn't know the names of (Daniel, *iNaturalist*). Two users also mentioned that the app made it possible to observe the range of invasive species “and [see] how much of a problem they actually [were]” (Erin, *iNaturalist*). Having the ability to more easily track nature observations was useful in users' preexisting interest in knowing more about the nature in their area. It also allowed them to more easily see patterns in the nature around them, building on their understanding of the nature in place.

### **Motivated exploration of new or familiar places**

Several game users confirmed that they generally enjoyed exploring. Users who liked exploring tended to feel that they were exploring more as a result of using the app. Users often expressed that they liked exploring before the app, but “didn't have quite.... as much of an incentive just to sort of go everywhere” (Harley, *Ingress*) before. Similarly, *iNaturalist* users confirmed that they were interested in nature prior to the app, but felt that they were noticing more nature or learning more about it after using the app.

Both game and *iNaturalist* users experienced times where the app motivated them to explore new or familiar areas, or felt like the app generally encouraged all users to explore. One user recounted a monthly outing where he and his wife travel to other areas of their city to “explore places [they] would have never been or wouldn't even have known about” (Gary, *Ingress*). A user with an interest in exploring that conflicts with her agoraphobia said that the game “motivates” (Theresa, *Pokémon Go*) her to explore despite her anxiety. Another user described liking the augmented reality aspect of the game because he would be “actually going to the different locations in the area that [he lived] and kinda seeing the different places” (Roland, *Ingress*). The app also occasionally motivated users to travel, with one user saying that she had gone “out of town several times, many times even... for the game,” calling the game a

“structured excuse to be out and about” (Harley, *Ingress*). This same user also talked about times when she would visit inconvenient neighborhoods or neighborhoods she had no other reason to visit in order to play the game. Some motivated exploration took the form of walking further than originally planned in a given situation or taking extra hikes or walks in order to use the app.

Related to this motivated exploration, one *iNaturalist* user described having a similar motivation to explore, saying that the app “definitely really motivated me to go out and go to different places, or even go to the same place over and over again and see if there's any changes in what I've seen” (Erin, *iNaturalist*). A second user described being motivated to return to an observation site to see if any changes had occurred since the last observation (Daniel, *iNaturalist*). Most of the motivated exploration experienced by *iNaturalist* users drove them to make observations of nature in new areas once they felt that they had observed most of the observable nature in their area.

Another often-mentioned occurrence among game users was finding new places as a result of exploring. The user with agoraphobia said that the game had caused her to find “newer places a little more out of [her] comfort zone, which is mentally something [she] need[ed] to be doing” (Theresa, *Pokémon Go*). In many cases, they noted that their home city is large, and that the areas they found through the game were just not on their radar previously or they had no reason to go there before. A user describing a neighborhood she found by playing the game and now loved spending time in said that she “had been there prior to playing *Ingress* at some point, but [she] had never really spent a lot of time there” (Harley, *Ingress*). A different user talked about a “mega spawn [...] near some storage sheds that are near the river that [he] never went to, and it's a cool place in the city [he'd] never been to” (Esteban, *Pokémon Go*), which he later

mentioned was a location that he and his friends started regularly meeting at even when not playing the game.

Several users noted that when they were in new locations, they were very likely to use the app to see if there were any game objects nearby. A user talking about traveling to other nearby cities described wanting to know if there were any PokéStops or gyms nearby, (Esteban, *Pokémon Go*) and noted that he usually checks. Some *iNaturalist* users expressed similar motivation, saying that being in new areas motivated them to look around for unique nature to observe. One user said, “I use it almost always in my city, but I’ve started branching out because I think I’ve named everything around here” (Mandy, *iNaturalist*). Exploration requires a person to spend time in a place, and allows a person to find unique features in a place that they might not have been aware of before. In some cases, it makes people aware of a place. Spending more time in place and being familiar with unique features in a place contribute to SOP.

### **Supplementing activities they’re already doing**

As noted previously, some of the game users said that they enjoyed the mixed reality aspect of their selected app because it could be used nearly anywhere, and during most activities. Users who did not directly state that they liked this type of feature of the selected app still reported using the app during a variety of activities in addition to times when they specifically went somewhere to use the app. *iNaturalist* users didn’t talk about this aspect of their app as often, though it did come up occasionally when users talked about how easy it was to use the app during breaks, on hikes, or when visiting certain places.

Some participants reported feeling motivated by their app to take more walks or hikes, or to walk further than they would ordinarily. Some users also described using the app during walks or hikes that they would have been on regardless of using the app. In these cases, the app was

used to enhance the walk or hike, but was not the cause of the activity. As an example, one user mentioned, “I mostly play *Pokémon Go* when I'm walking” and later added that “sometimes, I play *Pokémon Go* when I'm doing exercise” (Esteban, *Pokémon Go*). Another user said that the app is “part of [his] daily exercise routine, and [his] routine is walking the same kind of neighborhood every day” (Gary, *Ingress*). He liked using the app during the exercise and felt that it enhanced the experience, but said that he would be doing the exercise regardless of using the app. In cases like these, users explained that they “would still do those walks if there weren't Portals. So it's just like an addition to the walk, just something that [...] makes it a bit more fun” (Sandra, *Ingress*). Some *iNaturalist* users expressed similar situations, where they used the app during their regular walking or hiking activities, with the addition of “tend[ing] to take pictures and put them on *iNaturalist*,” (Daniel, *iNaturalist*).

Users also reported using the app while running errands or while transitioning from one area to another during their daily routine or while commuting. One user noted that his play time was mainly comprised of him going about his day “doing [his] normal things” (Richard, *Pokémon Go*). In this way, the apps seemed to pair well with doing anything “kind of mindless like being on the bus... running an errand” (Harley, *Ingress*). Having the freedom to supplement daily activity in this way seemed to be fun for users, and provided a new activity that could be done anywhere. Having an activity that could even be used when doing mundane activities around town has the potential to change people’s experience with the places they are in by associating an interesting or fun task with that area. The activities that a person associates with a place or does in a place are part of their SOP. The apps can easily integrate into walks, hikes, and other forms of exercise, adding a new activity that they can do while exercising in various places.

In addition to using the apps to supplement activity, game users talked about using the app while hanging out or spending time in places that they were visiting for other reasons. The game apps lent themselves to being “something that I can just do idly while I’m waiting for someone” (Sandra, *Ingress*) or “if I’m just sitting and having a beer” (Roland, *Ingress*), or when doing something like having dinner out with friends (Harley, *Ingress*). One user mentioned that the gym where she works out is attached to a Pokémon gym, referencing a special type of PokéStop in *Pokémon Go* where players can battle Pokémon owned by other people. She explained that “sometimes if [she was] just playing on a stationary bike kind of a thing, [she would] tend to open [the game] so [she could] keep spinning to get gifts or take over the gym” (Theresa, *Pokémon Go*). Users of each app also reported using the app at the college campus where they worked or went to school (Erin, *iNaturalist*; Mandy, *iNaturalist*; Kyle, *Pokémon Go*; Harley, *Ingress*).

Users also described using the app when traveling both near home and far from it. One user regularly worked an *Ingress* day into travel plans with his wife (who also played) where they would go on a walking tour based on Portals they had seen on an online version of the *Ingress* Portal map (the “Intel Map”). He said that they enjoyed these outings, explaining that “we often make [a] tour of a city that we’re traveling to. Our destinations are based on different Portals that we’ve seen” (Gary, *Ingress*). Another user said that he also used the game when traveling, and described times when he found points of interest by using the game, such as a memorial plaque about Winston Churchill’s home. He also noted a time when he wandered off to a Pokémon gym he saw on the map and

“ended up wandering further than I thought, so I ended up going away from where the rest of the tourists were congregating[...]. I wound up getting a much better view of the

scenery because I wandered away to find this particular gym that I wanted to take down.”

(Richard, *Pokémon Go*)

Travel didn't come up as often for *iNaturalist* users, though one did mention using the app to make observations when visiting family in other states (Daniel, *iNaturalist*). Otherwise, *iNaturalist* users mentioned being motivated to use the app when visiting somewhere they hadn't been before or anywhere with interesting nature. Using the apps while traveling gives users a new activity that they can do in a new place, which impacts their experience of that place. Additionally, some users experienced discovering new things while traveling, which they credited to the app. In these cases, the app may have enhanced SOP by creating more place awareness.

### **Knowing the best places to use the app**

As mentioned before, the types of activity that a person associates with and does in a place impact their sense of place. When users have certain types of locations where they tend to like using the app the most, they may come to associate using the app as an activity that they can do there. Users generally had an idea of the best kinds of places to use their apps in, which were also places where they tended to use the apps often.

Game users often talked about walkable areas with lots of unique features as being good places to play the games. These areas were often city centers or parks. One user noted that “downtown is my favorite because the Portal density is just so high you can... walk five or ten blocks and have a hundred different Portals that you can interact with” (Gary, *Ingress*). When describing an area she likes to play, especially during Community Days, one user said “it's a place that everyone tends to go because of its walkability and having so many PokéStops there” (Theresa, *Pokémon Go*).

Proximity to home or work also came up as a factor that made an area good to use the game apps in. One user described a park near his house where he liked to play “just because it's so easy to just walk out the door in five minutes and be playing” (Gary, *Ingress*). Another user, who noted that she also traveled to highly walkable, Portal-dense neighborhoods that were out of her way explained that she played in her neighborhood the most “because it's an interesting place that [she liked] to live, and there are also a lot of Portals in it, so [she doesn't] have to go very far to be able to play” (Harley, *Ingress*). Another *Pokémon Go* user described spending the most time playing on his college campus (where he lived) and parks close to the university that were easy to get to (Kyle, *Pokémon Go*).

In several cases, users noted that the best areas to use the apps were places where many people tended to gather to play, especially during Community Days for *Pokémon Go* users. Community Days are special events in *Pokémon Go* where users are encouraged to go out and play the game in order to earn special rewards or capture special Pokémon. A *Pokémon Go* user talked about a historic memorial in his city with many notable features, saying “that place is filled with PokéStops and gyms and during the Community Days, it's filled with” (Esteban, *Pokémon Go*) other users putting lures on PokéStops. Another user explained that he played primarily in the area where he worked “because of that university, [...] and all of the businesses, a lot of them being catering to the college students, there's actually way more Pokémon interactions, Pokémon activity, going on” (Richard, *Pokémon Go*) compared to where he lived. This user explained that he would play during his breaks.

Users also talked about a game mechanic known as farming, with several noting areas that they knew they could regularly go to farm. Farming is the mechanic where users can use nearby game nodes to easily and quickly gain experience points or high-level gear. This

mechanic was most commonly described by Ingress users, but came up with some of the *Pokémon Go* users as well. Users described having “a reason to be in” (Harley, *Ingress*) areas where their team’s farms were set up, so they were motivated to spend time in those particular areas because of the user-created farm. Farming was also mentioned by a *Pokémon Go* user who noted regularly going to a place that was “pretty good for farming and playing” (Esteban, *Pokémon Go*). These farmable areas tended to have a high Portal/PokéStop density that made it easy for users to set up the farm, and tended to be in areas where many users would visit to sustain the farm.

Examining all of these so-called best places to use the game apps, game users felt that walkable areas with a density of interesting place features such as downtown areas and parks were some of the best places to play the games. These areas offered the most PokéStops and Portals to interact with, and increased the likelihood of encountering other players. In several cases, proximity to home or work dictated which areas the users visited most frequently. Knowing that these types of areas tended to be the best places to play could change the experience that people using these apps have with these spaces. They may be more inclined to notice prominent features that are often game nodes in a place, and may be inclined to spend more time in areas with more of these features in order to play. The games give users new activities to associate with these types of locations. Users also seemed to spend more time in places near home or work where they could play. Spending more time in a place can increase SOP.

For the best places to use the app, *iNaturalist* users talked about areas with “interesting” (Daniel, *iNaturalist*) nature, or nature that they were not yet familiar with. Users also tended to talk about using the app in garden spaces (Erin, *iNaturalist*; Mandy, *iNaturalist*; Cody,

*iNaturalist*) or neighborhood (Erin, *iNaturalist*; Mandy, *iNaturalist*), around their city (Cody, *iNaturalist*; Erin, *iNaturalist*; Daniel, *iNaturalist*), parks (Cody, *iNaturalist*), and natural areas or state parks (Daniel, *iNaturalist*; Mandy, *iNaturalist*; Erin, *iNaturalist*). All of the users talked about using the app within their city. Two of the users felt like they had already observed most of the nature in their city, and preferred to observe other nearby areas as a result (Erin, *iNaturalist*; Daniel, *iNaturalist*). Because *iNaturalist* allows its users to learn about local nature, using the app in certain locations can increase the user's awareness of species in that location, which contributes to their SOP. Several users tended to prefer areas close to home and natural areas, but also talked about using the app to learn about nature around their city, which can increase their awareness of the species near them. Having different areas where they like to use the app also adds an activity type that they can associate with an area, which can contribute to SOP.

### **Affect toward place**

Affect toward place also emerged during the interviews. Most expressions of a user's feelings about their place (their city, their neighborhood, their school campus) were positive. There were also instances of users expressing their feelings about places where they liked to play or about certain PokéStops, Portals, or, for *iNaturalist* users, nature in general. Users talked about affect that existed before the app, as well as affect that came after the app. Users tended to express a general love for the place they lived, which seemed to exist before using the app. They also talked about areas or objects that they found as a result of using the app that they had positive feelings about.

Expressions of positive feelings toward place came out during the interviews. A number of users noted that they really liked where they lived, or described things that they liked about their city or town. They described their city as being "cool" (Esteban, *Pokémon Go*), pretty or

beautiful (Esteban, *Pokémon Go*; Mandy, *iNaturalist*; Sandra, *Ingress*), or having “interesting” (Esteban, *Pokémon Go*) and “friendly” (Sandra, *Ingress*) people. Users also described that they loved their area (Theresa, *Pokémon Go*; Mandy, *iNaturalist*), or described specific features that they liked, such as the town having a lot of art installations (Gary, *Ingress*), or being an “interesting” (Harley, *Ingress*) place to live. After describing his city, especially its climate, an *iNaturalist* user said “I give this area very, very high ratings” (Daniel, *iNaturalist*).

One *Pokémon Go* user, a first-year college student, showed low interest in the area where he lived but showed some attachment to campus where he spent most of his gaming time as well. When asked about how he liked his campus, he said “I think it's a pretty wonderful place. They definitely put a lot of effort into making this campus an actual college” (Kyle, *Pokémon Go*). After explaining that she didn't know much about her city prior to using the app, the *Pokémon Go* user with agoraphobia said that “after becoming involved in the *Discord* of *Pokémon Go* and meeting people,” (Theresa, *Pokémon Go*) she came to love her city. It is not known how much influence the game truly had on her affect toward place, but this user seemed to credit the game as being a large influencing factor in her ability to get out and enjoy her new city.

It is probable that users developed their love of their cities and towns prior to using the apps, however it is notable that users tended to have positive affect toward their cities and towns. It is possible that people who like where they live are more likely to use these types of apps, or that people who enjoy exploring are more likely to both use these types of apps and like their cities and towns. Future research may shed more light on these possible relationships.

Affect related to the quality of game nodes submitted by other users came up in several interviews. PokéStops and Portals are crowdsourced game elements. Users of *Scanner Redacted* (the pre-update version of *Ingress*) are able to submit Portals after reaching a certain level in the

game. In some regions, Niantic has also opened submission capabilities to *Pokémon Go* users, though this is not available in the United States at this time. Some of the game users described some submission types as being “garbage” (Sandra, *Ingress*; Harley, *Ingress*) or “dumb” (Kyle, *Pokémon Go*) (typically non-public objects such as household decorations or generic objects like utility poles), and others as “special” (Kyle, *Pokémon Go*) or “cool” (Roland, *Ingress*) (typically features like murals, memorial plaques, sculptures, and other installations). Related to this sense of worthy and unworthy game nodes, one *Pokémon Go* user described striving to send specific types of in-game gifts to a foreign friend because gifts show the recipient a picture of the PokéStop they came from. “I don't like to send him gifts that aren't interesting,” he explained, “because I feel like they have to positively represent the *Pokémon Go* scene in my country” (Richard, *Pokémon Go*). To this user, some PokéStops were unique and worthy of sending, while others were not, such as gifts collected from Starbucks PokéStops. The user specified that he would never send his friend a gift that came from Starbucks (the franchise has a deal with Niantic where their coffee shops are usually represented in the game). This user's gift behavior suggests some sense of pride in his location associated with unique features, prizing unique features over generic or uninteresting ones.

*iNaturalist* users all expressed feeling an attachment to nature, with one specifically noting that he felt “a very strong attachment to the southern California vegetation community because [he'd] lived in the area all [his] life” (Daniel, *iNaturalist*). After describing parks, private and public gardens, access to beaches, and nature-hunter activities like bird watching, a user living in a big city affectionately described his city as being “an interesting place to be a nature lover” (Cody, *iNaturalist*). Affect is an important part of SOP, whether it is a person's feelings about a small element of a place or their overall feelings toward that place. In the case of

*iNaturalist* users, the app was not the reason that users felt positive affect toward place— they all said that their love of nature motivated their app use. It is possible that the app could support user affect toward place by making it easier to see nature species in unexpected areas, such as around their city.

These findings show several overlaps between sense of place and user experience with the apps. The apps helped users become more aware of unique place features, motivated exploration, and often helped users discover new places. They created new activities that users associated with places, and often provided motivation to spend time in various places.

Awareness of place, activities associated with place, interest in place, and time spent in place contribute to SOP. Users also had social experiences related to the apps that connected them with local groups of people with similar interests who they often expressed feeling connected to.

Social experiences related to place contribute to a person's SOP as well. The data collected in the interviews suggest that certain app functionality and user experience may indeed influence user SOP. In the following section, these overlaps are discussed more in-depth.

## CHAPTER 5: DISCUSSION

The main aim of this research is to determine if location-aware augmented reality mobile apps and games may impact people's sense of place (SOP). SOP is made from patterns of everyday lived experience in place, including patterns of social experience, geography and culture, a sense of belonging, attachment, and other experiences related to place (Seamon, 2014; Uzzel, Pol, & Badenes, 2002; Steele, 1981; Cheng, Hou, Pan, Sung, & Chang 2015). Certain design features of location-aware augmented reality mobile apps and games appear to have the potential to influence the experiences that contribute to SOP. Understanding these features may allow future app designers to purposefully build them into apps in order to promote or support SOP development.

The users included in this study generally seemed to have a strong, positive SOP both for specific locations within their city, and for their city overall. They tended to be interested in spending time in or exploring their local areas. One *Pokémon Go* user who expressed only visiting three places in his city regularly, including his campus and a park where he used the app, was the exception to this. Across the three apps, app use showed several areas of overlap with SOP.

### **Place attachment (affective experience with and connections to place)**

Place attachment is made up of a person's affect toward place, place interest, sense of place uniqueness in the present, sense of pride with place, social interaction in place, and social identity associated with place.

Social identity related to place did not come up extensively in the interviews among the game app users. There was mention of being an Ingress player, a *Pokémon Go* player, and team-

related identity that occasionally motivated players to conduct specific behaviors. Social identity came up more often with the *iNaturalist* users, all but one of who talked about being a citizen scientist (each clarified that they were not formal scientists). These users talked about feeling connected with other citizen scientists through *iNaturalist*, which seemed to encourage participation. Social identity relates to SOP in that feeling connected with a community has the potential to influence a person's experience of and affect toward place (Relph, 1976).

In Relph's writing, he's referring to social identities such as being a resident of The Art District or of Denver more so than being an in-group member of something like a player base or citizen science community because these types of social identities were beyond his scope. These types of social identities were mentioned in the interviews, but seemed to have developed prior to app use and were supported by app use. At present, it is unclear how much of a role social identity has in app use and SOP development, but it is notable that associating with a social identity related to the apps seemed to encourage social interactions among users, which Steele (1981) asserts is important to building a sense of community. Feeling connected to a social identity encourages continued use of things like apps, but this is beyond the scope of the current study.

Social experiences and connectivity impact SOP, affecting the way that a person feels about a particular place (Relph, 1976; Steele, 1981). A notable number of game users talked about being involved in an external chat service that connected them to other users, especially users on their in-game team. They often referred to these groups as communities, and seemed to feel positively toward them. These external chat services prompted social experiences related to exchanging strategy advice, coordinating with other users, suggesting places to go play, and sometimes meeting up with other users. One user also talked about social expectations set by

other users in that community such as discussions on inappropriate locations to play the game. Users also described feeling connected to a community of users after seeing or interacting with other users in the real-world, especially among *Pokémon Go* users. Several users said that they made friends, mostly local, through their app use (either via the external chats, or seeing other users in the real-world) as well. In these ways, app use seemed to encourage social participation and connection with local communities by encouraging users to communicate with one another, which influence SOP.

*iNaturalist* users experienced social learning and felt connected to a community. Users talked about liking that other users could comment on and approve their observations. They felt like this was a helpful feature that connected them with other people interested in nature. Several users also felt like the app connected them with a community of citizen scientists, which made participating in citizen science more accessible. They discussed social learning as well, referring to learning from comments made by other users or from seeing observations posted by other users. Two users talked about being motivated to engage with other users by commenting on their observations in order to encourage their continued use and help them get closer to identifying their observed nature. These types of interactions seemed to encourage continued app use and made users feel more connected to a community of nature lovers.

Unlike with game users, *iNaturalist* was not often reported to involve in-person social interactions, though one user mentioned occasions when he hiked with friends who also used the app, and another user mentioned a time when he talked with another user in person. However, *iNaturalist* was involved in facilitating digital social interactions between users about place, specifically about the nature found in a particular area. It is not clear what relationship these types of digital interactions have with SOP. It is possible that these interactions may help users

feel more connected to like-minded people in their community, which may indirectly impact their experience with observing nature in place, thus impacting SOP.

For both the game and non-game app users, the apps opened new social channels for users to connect through. Among game users and some of the *iNaturalist* users, these social channels primarily opened connections with other local users. Social interactions are one of the building blocks of SOP (Seamon, 2014; Uzzel, Pol, & Badenes, 2002; Steele, 1981). These new channels influence the patterns of social experience that these users have access to, creating new social outlets that influence SOP. When using these apps, users have access to these new social channels from almost anywhere, enabling them to participate in the community without meeting up in a specific location and allowing them to socially learn about their surrounding area without necessarily connecting with other users in the real-world. Some users did meet up with other users in the real world, which offers another layer of social interaction in place created through using the apps.

Affect toward place, pride in place, place interest, and sense of place uniqueness also overlapped with patterns of app use. The emotion that a person feels toward a place influences their SOP, with more positive emotions creating a more positive SOP (Seamon, 2008; Steele, 1981; Uzzell, 2002). Game users tended to describe areas where they liked playing in positive ways, calling them awesome, interesting, beautiful, and other similar positive expressions. Game users also expressed their feelings about types of Portals and PokéStops, referring to unique features in positive ways and generic features or inappropriately submitted private home items (such as garden gnomes) in negative terms. From their descriptions, these real-world objects seemed to be a point of pride as well. This was especially the case for the *Pokémon Go* user who

tried to only send gifts from interesting and unique PokéStops to a foreign friend in order to better represent his home area instead of sending gifts from generic PokéStops like Starbucks.

These features were often a point of interest for users as well. Users described being interested in finding real-world features after spotting them in the game. They also talked about being interested in finding unique objects that were not yet represented in the game in order to submit it themselves (primarily *Ingress* users, as many of the *Pokémon Go* users did not yet have this ability). This increased interest in spotting place features may influence SOP development by encouraging users to notice unique features more regularly, which may influence how they feel about a place overall. They may feel more positive affect or pride for that place as a result of their increased awareness of these unique features. According to Steele (1981), people make meaning from their experience with a place, which contributes to how they interact with and use that space. App use changed place experience from simply being spending time in a place to being a game space or a nature space. The apps may have transformed the meaning that users made in place by turning ordinary things like fountains (for game users) and insects (for *iNaturalist* users) into exciting opportunities related to the apps.

Exploration (part of place dependence) was often involved in users' awareness of unique objects, as users talked about discovering some of these features after seeing them in the game map. They also talked about noticing these types of features more frequently without seeing them in the game map as well. Curiosity seemed to be one driver behind this enhanced awareness, with users talking about seeing a feature in the game and wanting to find it in the real world. Game functions such as needing objects from PokéStops and Portals, increased unique Portal count, wanting to fight Pokémon gyms, needing to farm, and wanting to know if a feature was already submitted were also cited as reasons why these objects caught people's attention.

The existence of Portals and PokéStops in the real world at the least prompted users to visit these places in order to play the game, and at its most influential, prompted users to seek out those places to see what they were. Users with an interest in submitting new game nodes were also motivated to look for unique objects in the real world that they might not have looked for otherwise, in order to check and see if they needed to be submitted in the game world.

*iNaturalist* users also tended to feel that they were more aware of unique features (nature) in their local areas. All four users expressed being highly motivated to notice nature prior to using the app, but felt that they noticed more nature or knew the identity of more nature after using the app. Noticing more nature tended to be related to wanting to post more new observations in the app as well as seeing unfamiliar species observed by other users that they then wanted to look for. In addition to noticing nature more often, these users tended to be able to name species or types of species that they had become aware of through using the app, either due to identifying their own observation or seeing one posted by another user. Noticing more nature or being more aware of the types of nature around them may influence affect toward and pride in place because these users are motivated by their love of nature.

These themes suggest that location-aware mixed reality apps and games may heighten awareness of unique place features, building on people's SOP. Salient place features contribute to SOP development (Lalli, 1992). Knowing about specific features in a place enhances the sense of uniqueness of that location, which influences SOP and can lead to a stronger sense of connection with that place, as well as increased affect and pride in place (Uzzell, 1996). These apps made users feel like they were more aware of the unique features around them, which is promising for the relationship between this technology and SOP development. If these apps can

increase awareness of unique place features, they may indirectly influence SOP and facilitate the potential for users to feel stronger connections with place.

Users tended to have positive affect toward place, as well as a sense of pride. *iNaturalist* Users excitedly referred to nature in positive terms, with two users expressing feeling attached or connected to nature in their area. When asked how they felt about their city or town (or, in the case of the interviewee who spent time primarily on his college campus, campus), users of all apps largely expressed positive feelings. They did report on negative qualities of their cities, but overall affect was positive. *iNaturalist* users also expressed noticing the unique nature around them more than they had before, even though they had been highly motivated to notice nature before using the app. They attributed this to the app helping them identify things they had not identified before, or showing them things that other users had posted that they could then look out for. *iNaturalist* users all seemed to have a sense of pride in the nature around them.

Affect and pride toward place is influenced by a number of factors, including social encounters, available activities, and knowledge of unique features (Steele, 1981; Uzzell, 2002). Most users seemed to have positive feelings toward place, but it is unclear to what extent this positive affect was influenced by app use, influenced app use (especially among *iNaturalist* users), or perhaps both. What can be said is that the apps provided users with a new, enjoyable activity that they associated with place. This new activity increased their interest in the unique features around them, heightening their awareness of these features. Because activity and place interest influence affect, it is possible that app use may indirectly impact affect toward place.

Based on these findings, it is possible that certain features of location-aware mixed reality mobile apps and games may support SOP development by creating or enhancing place attachment. App features that encourage users to comment on or interact with postings made by

fellow users (*iNaturalist*'s observation approval system), events that require users to congregate in certain types of areas (*Pokémon Go*'s Community Days and special raids), and features requiring teamwork for success (*Ingress*'s area-capture mechanic, *Pokémon Go*'s gym and raid mechanics) appear to encourage these types of social dynamics to develop. Interestingly, the built-in chat feature available in *Ingress* did not seem to influence social interactions much. App features encouraging users to take pictures of real-world objects and upload them, features that show users pictures of unique real-world objects, or features requiring users to be near or visit unique objects appear to have the potential to support SOP. Future research on this topic could provide more information.

### **Place dependence (conative experience with place)**

Place dependence is made up of people's experience of place related to activities they can do in or associate with a location, events that occur there, explorable space, ability to physically engage with place, prosocial behavior, community engagement, and place creation (Cheng et al., 2015; Meyrowitz, 1985; Steele, 1981).

When asked if they liked exploring, the majority of game app users agreed that they did, with several also noting that they enjoyed exploring prior to the app. Users often spoke about feeling more motivated than before to explore areas in order to play their game, which was also true of users who said that they also liked exploring before using the app. In some cases, exploring involved extra walks, walking further than planned, or choosing to wander around in order to play the game and see what was around them. This motivated exploration was related to place attachment, since exploring allowed users to discover unique features in a given place. Knowing of unique geography and place features builds SOP, creating an awareness of what that place is like (Lalli, 1992; Cheng et al., 2015)

Although exploration is largely related to place identity because it creates a new activity available in a given place (Steele, 1981), it also relates to place dependence because it can create awareness of new place features (Meyrowitz, 1985; Steele, 1981; Lalli, 1992). Two *Ingress* users talked about purposefully traveling around their city to areas they weren't familiar with in order to explore, play the game, and increase their unique Portal count. In several cases, this exploration resulted in users discovering new areas that they were not aware of before, with some of those users returning to those areas either to play the game or to spend time. Several users mentioned using the game while traveling, with one citing times when he found unique features because of his game activity while traveling out of country as well. Users also tended to express feeling like these types of games encourage people to explore more and be more active. Exploration tended to result in users being aware of specific real-world features with digital representations in the game as well, which related to place attachment. It is likely that by making users more aware of locations and unique features, this motivated exploration increased users' SOP.

*iNaturalist* users also engaged in motivated exploration, but in a different way than game users. Instead of actively wandering around, these users tended to be motivated to keep an eye out for species they had seen other people observe. These users also talked about times when they made a special trip or took an extra walk in order to find new species to observe. As a result, *iNaturalist* users likely do not experience the same sort of place-discovery as game users, but experience similar discovery of unique features (nature, in this case). Their SOP is likely to be increased by their familiarity with unique natural features, but their knowledge of nearby places may not increase like it seemed to for game users who discovered new places while investigating game nodes.

It is notable that both game users and *iNaturalist* users who acknowledged being motivated explorers or nature observers prior to using the app felt that the app had further motivated these behaviors. Future research on this topic could explore whether both users with highly motivated and less motivated exploration behavior prior to use experience increased SOP while using these types of apps.

Another consideration about the impact these apps may have on SOP development related to exploration has to do with the information flow discussed by Meyrowitz (1985). Meyrowitz claims that the information available to people in a place influences how they experience that place. A person who has an informational page about a historic site, for example, will experience the place differently than someone who does not have this information. The apps under investigation create a new source of place information for their users. Game users may see unique place features on the game map without seeing them in the real world. Likewise, *iNaturalist* users may see unique nature in the observation map that they can't immediately observe (such as a deer that has left the area) or might not have looked for on their own (such as lichen or slime mold). This extra layer of information seemed to encourage exploration among the app users, especially with the game users who wanted to find game nodes in the real world. Even when not encouraging exploration, this new layer of available information may change how users feel about place by showing them the number of unique features nearby.

The types of activities a person associates with or can do in a place also contribute to their SOP (Cheng et al., 2015; Meyrowitz, 1985; Steele, 1981). The exploration that the apps motivated influenced the types of activities that users associate with a location. The game apps, for example, turned areas like parks and downtown districts into centers for exploration. Game users seemed to associate populated areas containing unique objects such as art and memorials

with gaming opportunities, and described the games as becoming activities when visiting new places as well. Given the broad number of place types described by game users, the game apps created the potential for new activities to be associated with a wide variety of locations, with certain locations being more popular due to the presence of many game nodes (parks, city centers, art and historic districts). *iNaturalist* users seemed to use the app as a new activity they could use close to home or in natural areas they visited. Meyrowitz (1985) and Steele (1981) discuss that the types of activities available in or associated with a place impact the affect a person feels for a place, and impacts how they interact with the place. The apps turned most places into places for exploration activities, and provided new activities (using the app) that users enjoyed doing in certain other types of locations as well. By offering new types of activities, the apps have the potential to impact user SOP by changing the way that users engage with place they visit while using with the apps.

One notable activity change caused by the apps was that they encouraged users to spend more time in various places they otherwise might not spend time in. Users of both of the game apps and *iNaturalist* talked about ways that the apps inspired them to spend more time in various places or take extra trips to those places. Users, especially game users, reported spending time in certain places in order to use the app. In some cases, these were places where the user would otherwise not spend time, with one user expressing a preference for staying home otherwise. Game users also talked about taking extra walks, participating in new activities, wandering around, or lengthening their planned walks in order to play more. Similarly, *iNaturalist* users described making special trips to natural areas, taking extra hikes, or visiting nearby green spaces in order to use the app more.

This motivation to spend more time in place came up in the discussion about place attachment above, and is significant for place dependence as well. Spending more time in place influences SOP development (Steele, 1981; Cheng et al., 2015; Relph, 1976). Meyrowitz (1985) talks about patterns of information flow that occur when a person physically spends time in a place as well. Part of this information flow is largely social in nature, coming from observing other people in the space or from social interactions in that place. People must spend time in a place in order to be exposed to this social information flow, though the apps may add a layer of digital social information flow to time spent in place.

Other elements of place dependence did not come out as strongly in this investigation. Community engagement came up as far as feeling connected to a community of other users, but the topic of feeling connected to a smaller community of neighbors (which the SOP literature seems to focus on) came up less often. It is possible that feeling connected to a digital community of other users influences SOP. Given the connections that users seemed to feel with their digital communities, it would be worth investigating what influence connections to digital communities has on SOP.

Prosocial and place creation aspects of place dependence came up with one of the *Pokémon Go* users, who described times when her *Pokémon Go* community advised other users on locations where they shouldn't play, looked out for younger players, and occasionally cleaned up trash while playing. The creation of new PokéStops and Portals was also a type of place creation. Users were enthusiastic about adding to their game space by adding unique place features. They often talked about this in terms of wanting to include unique features in the game map, going so far as to describe submissions that were not worthy of inclusion. *iNaturalist* users were interested in the app's potential to get other people interested in nature, and viewed the app

as a vehicle for teaching other nearby people about nature. One user used the app as a way to show other people the pollinator garden he had created. Each user seemed to feel that the app had applications for getting people more interested in protecting nature.

These examples suggest that prosocial activity may result from a connection with a close app community if the community encourages such behavior to occur. In this way, these types of apps may potentially facilitate prosocial behavior in place, but wouldn't directly cause it without, say, making suggestions to users to do such activities. However, in the SOP literature, prosocial behavior is not described as a requirement of SOP development. It is described as more of a positive outcome of strong place attachment (Steele, 1981). This suggests the possibility that in facilitating the development of stronger senses of place among users by encouraging them to spend more time in place, these apps may position users to have a higher potential of conducting prosocial behavior. This type of behavior may also relate to the situated patterns of social behavior and information flow as described by Meyrowitz (1985), where people may take up behaviors in a place after observing other users conducting these behaviors. In this way, these apps may encourage users to spend time in locations, where they may observe other people or other users conducting prosocial behaviors and do the same. App features that promote exploration (such as the real-world game nodes and observation map), encourage cooperation with other users (observation approval, team dynamics), facilitate interest in noticing place features (user-submitted game nodes, observation count), and similar features may support SOP development. It is possible that other features such as *Ingress*'s unique portal count feature or *Pokémon Go*'s gift system may also support SOP development.

### **Place identity (cognitive experience with place)**

Place identity is made up of a person's familiarity with the history and geography of a location, sense of self-efficacy, and place intensification. Uzzell's (1996) patterns of information flow apply to the influence that these apps appear to have on place identity. The apps encourage users to spend more time in places, opening more opportunity for place identity growth.

Aside from the prosocial activities discussed under place dependence where one *Pokémon Go* user's community cleaned up trash, place intensification behavior related to the apps didn't come up. Similar to prosocial activities, place intensification was discussed as more of a positive outcome of increased SOP (Seamon, 2002).

Familiarity with place history and geography, a building block of SOP (Seamon, 2002; Meyrowitz, 1985; Relph, 1976) came up among all of the apps. For the game apps, users were aware of place features highlighted by the app, and discovered new areas in place while exploring. The apps did not necessarily facilitate an in-depth familiarity with the local geography otherwise. However, several users reported learning about local history after the app caused them to notice historical plaques, memorials, monuments, and other history-related features of place. *iNaturalist* users, similarly, were made more aware of nearby nature, which is related to geography. Several users reported visiting nearby natural areas more often to use the app, which could potentially facilitate more in-depth geographic knowledge.

Knowledge of salient aspects of a location's history and geography enhance overall SOP (Lalli, 1992). Technology that increases the salience of such features has the potential to positively impact SOP as a result. Additionally, Uzzell (1996) asserts that this type of knowledge may enhance a person's sense of an area's uniqueness, and increase their pride in the area. As has been discussed previously, having a sense of an area's uniqueness and a sense of pride in that

location increases SOP. The apps appear to facilitate awareness of local unique features and discovery of new areas, suggesting that they may support SOP development.

Self-efficacy related to the apps came up in more abstract ways. Users felt more able to notice the features around them (murals, fountains, statues, and other objects among game users, and nature among *iNaturalist* users). The game users who could submit game nodes felt more empowered to participate in building the game world, and *iNaturalist* users felt more self-efficacy related to being able to participate more easily in a citizen science community or community of other users interested in nature. In the case of one user with agoraphobia, the app provided a focus for her when it came to leaving her house, giving her a sense of self-efficacy in reclaiming her ability to explore and meet people. Meyrowitz (1985) describes that information flow in a place may impact a user's self-efficacy, which suggests that self-efficacy is impacted by SOP development. The users who felt more able to notice unique features experienced a change in information flow, which increased their self-efficacy in those places. Similarly, it is possible that *iNaturalist* users felt more connected with other like-minded people, and the user with agoraphobia felt more in control of her ability to leave her home due to changes in information flow in place facilitated by the apps.

The apps may add a new layer of information flow to Uzzell's concept by providing users with digital information that shows them the location of unique objects (i.e. Portals and PokéStops) or what types of nature are around them without relying solely on what they can immediately observe with their eyes. According to Meyrowitz (1985), changes to the flow of information in a place may impact people's self-efficacy and place intensification. From these examples, it can be said that location-aware mixed reality apps and games of the sort examined here may enhance user self-efficacy and place knowledge by introducing a new, highly

accessible layer of information to the information flow of a given location. Features that allow users to interact with an area map that highlights features around them appears to have strong potential for influencing SOP.

## CHAPTER 6: CONCLUSIONS

Modern technologies take a prominent place in the lives of many people. From the internet to video games, there is a wide range of technology for us to immerse ourselves in. Advances in mobile technology have made it possible to carry these technologies with us wherever we go as well in the form of smartphones and other portable devices. Smartphones have encouraged the growth of location aware mixed reality apps and games, which use the user's geolocation data to provide location-relevant information. This technology has a wide range of possible uses. It can be used to create digital art installations, guide tourists through historic sites, or turn any place imaginable into a game space. As often is the case with mobile technologies, however, there are concerns about the negative effects of mobile technology disconnecting people from the world around them. However, it is also possible that this technology can be designed to facilitate connection with the world instead.

Some features of location aware mixed reality mobile apps and games seem to have the potential to facilitate behavior that is associated with sense of place development. The current study aimed to investigate ways that location-aware mixed reality apps and games can connect people to their communities, stimulate community engagement, and encourage global citizenship. In order to prepare for this larger problem, this study focused on the relationship that these apps may have with sense of place (SOP) development. Although the findings of this exploratory qualitative study are not representative and thus cannot be generalized, they do have implications for future mixed reality studies. Aspects of the app designs and user experiences showed strong overlap with elements of SOP, suggesting that location-aware mixed reality mobile apps and games may beneficially influence users' SOP development.

Users of all of the apps included in this study expressed noticing unique features of place around them more frequently after using the app (nature for *iNaturalist* users, and unique features such as fountains and murals for game app users). Awareness of unique features in a place is an important part of SOP development because it creates a sense of uniqueness that sets that place apart from other places. This awareness can overlap with other elements of SOP such as knowing place history, affect toward place, and pride in place. If these types of apps can enhance user SOP by making them more aware of place features through user-submitted information, game mechanics that attach functionality to representations of real objects in the game space, and other mechanics that motivate users to notice these objects, it could have important implications for the impact of these types of apps.

The apps also motivated exploration and activity in place. Users of all apps expressed feeling more motivated to explore in order to use their app. In a number of cases, users discovered new areas as a result of app-motivated exploration, and the user started spending time in that newly discovered place as a result. App use also influenced what activities users associated with and did in various places, encouraged or enhanced activities, and brought users to places to spend time. When people spend time in a place, it impacts how they experience and feel about that place. The types of activities that they do in the place also impact SOP. Mechanics that motivate exploration and cause users to spend more time in places they might not otherwise visit have the potential to influence SOP development, especially in users who would not otherwise spend time in those areas. By being highly portable, these types of apps make it possible to use them nearly anywhere, providing users with a new type of activity that they can do in most places and influencing their SOP as a result.

Understanding the ways that this technology influences SOP may have implications for understanding how people connect with and engage in their communities. A person's sense of place is made of their sense of belonging, identity (individual and social), concern for place, attachment to place, and dependence on place based on patterns from their everyday lived experiences (Cheng, Hou, Pan, Sung, & Chang 2015). A person's sense of place strongly influences how they engage with and participate in that place and their community (Steele, 1981; Uzzell, Pol, & Badenes, 2002). People with a stronger sense of place are more likely to participate in maintaining that place or improving it through place intensification. If these types of apps can facilitate sense of place development by encouraging people to spend more time in place and highlighting unique place features, then they may indirectly increase the likelihood of prosocial behavior like place creation and place intensification. In this way, these apps have the potential to foster engagement with community. Vella et al. (2019) examined how these apps might increase sense of belonging as well, which is an element of sense of place. They suggested that a greater sense of belonging might improve overall mental and social wellbeing.

Users also expressed experiencing social interactions and a sense of community connectivity related to the apps. Social experiences and feeling connected to a community are another component that make up a person's SOP. Users expressed feeling connected to a community of other users in one way or another. For game users, some of this sense of connectivity came from seeing other users playing the game in the real world, especially due to *Pokémon Go*'s raid and Community Day components. *iNaturalist* users experienced a similar sense of connectivity to other users because of the ability for users to comment on and approve one another's observations. This mechanic made users feel connected to other nature lovers and they expressed being more able to participate in citizen science. The game apps' competitive and

team-work oriented mechanics also motivated users to join social groups via external services. These communities of users were not a direct function of the apps, but sparked a sense of community among users related to the apps. Built-in social experiences like those in *iNaturalist*, or mechanics that encourage users to collaborate or increase the likelihood of spotting other users in the real world have the potential to influence user SOP.

The kinds of social experiences in place facilitated by the apps may facilitate sense of place development, which may impact how people connect with their community and environment (Steele, 1981; Meyrowitz, 1985). Among the game users, the social identity of being a game user seemed to connect users and encourage them to socially engage with strangers. Connecting with people in the community is beneficial for mental health outcomes (Vella et al., 2019), and opens opportunities for other types of community engagement. That the *iNaturalist* users felt more connected to other nature-oriented people through the app is similarly encouraging. By facilitating social engagement, this technology could potentially encourage people to get involved in their community and connect with others. These types of connections can increase a person's SOP, which can lead to sustainable community and social outcomes. Uzzell, Pol, and Badenes (2002) discussed a particular example where increased sense of place encouraged environmentally sustainable actions, which is one type of outcome that may occur related to place intensification and creation.

Based on the findings of this study, the potential for location-aware mixed reality apps and games to positively influence user SOP is high. However, it should also be acknowledged that they also have the potential to take away from SOP. Two game app users mentioned times that they were more interested in the game they were using than in the place they were in. Both of these users also talked about objects that they were aware of after discovering them through

the game. User motivation is likely a strong predictor of user SOP outcomes and would be a good choice for future research on this topic. Mixed reality mobile apps and games are growing in popularity, and more apps of this type are on the horizon. It is possible that these apps could be purposefully designed to have features that facilitate social engagement and sense of place development, which could connect and engage users with the world around them.

## CHAPTER 7: LIMITATIONS AND FUTURE RESEARCH

The goal of exploratory research is to investigate research topics and determine whether they are worthy of future investigation. The limitations of such work is that it does not offer conclusive evidence of the phenomenon it seeks to investigate, nor does it provide generalizable results. This study, being exploratory in nature, cannot define any relationship between location-aware mixed reality mobile apps and sense of place (SOP) development in a generalizable way. However, the intent of this study is not to define this relationship, but to explore it and determine whether this area of study may benefit from future research and to lay groundwork for future studies on this topic.

Another limitation of this study is that it uses interview data. Questions of whether interviews provide accurate experiential data inevitably come up with studies using this method of data collection. It is possible that data collected during the interviews was genuine or was not accurate (Silverman, 2013). To address this concern, interviewees were asked to talk about their app and place experiences using multiple questions intended to deeply investigate the phenomenon. Interviewees were also made to feel comfortable during interviews, and no value statements or implications were included in the interviews in order to limit social desirability effects.

Participants were from a range of ages between 20 and 65. People experience things differently at different ages, so it is good to consider a range of ages. However, including a large age group can also be a limitation due to diversity of experience. Older participants may experience SOP and app use in different ways than younger participants.

Participants were self-selected from messaging boards related to the apps they were interviewed for. Collecting participants in this way may have provided a sample of highly

motivated users who may have different SOP outcomes than less motivated users. Further, it is possible that those who use these types of forums are more likely to participate in the external communities noted in discussions of social encounters in the sections above. Another limitation of this study is that it includes only three location-aware mixed reality mobile apps, one of which utilizes a major intellectual property with an established fanbase that may be more motivated by nostalgia or loyalty to the established property.

Future research conducting experiments to examine this topic would benefit our understanding of the relationship between these types of apps and SOP. One experiment idea, for example, would be an experiment that compares the SOP development of an app-using group (preferably users who did not use the app prior to the experiment) of first year college students new to a city to a non-app-using group of first year college students new to the city. Experiments like this have the potential to tease out the relationship between SOP and location-aware mixed reality mobile apps and games in order to see if the relationships that emerged in this study occurred because people with high SOP are more likely to use these types of apps, because users of these types of apps are more likely to be motivated explorers, or because the users were using the app.

Studies that include participants from smaller cities and towns would also be beneficial to the field in future. Another limitation of this study is that by coincidence, all participants came from major coastal cities, with a notable number coming from California cities. There were no participants from small towns or cities.

Similarly, it would be of interest to research the potential relationship of socioeconomic and minority status, either of people or locations. One interviewee with a sociology background talked about there being a disparity between high- and low-income areas when it comes to the

number of available game nodes. She thought that low-income areas have fewer opportunities to have game nodes because they have fewer art installations, less foot traffic, and fewer players in those areas. This disparity between income areas has been noted by other fans of Niantic games as well. It would be beneficial to investigate what areas tend to have fewer game node areas. This research would also open up opportunities to investigate Vella et al.'s (2019) claim that games like *Pokémon Go* creates a chance for “individuals and communities who typically feel excluded from public spaces, or find them challenging to inhabit” to feel more included in public spaces (Vella et al., 2019, p. 600).

The impact of location-aware mixed reality mobile apps on mental health and self-efficacy would also benefit from future study. The interviewee with agoraphobia described situations where *Pokémon Go* helped her cope with anxiety in order to spend time outside of her home. The game seemed to afford her some self-efficacy, and she felt that the app had enabled her to get out, learn about her city, and meet new people. The topic of *Pokémon Go*'s impact on mental health, especially anxiety disorders and depression, has come up in media outlets and psychology blogs in the form of speculation (Wei, 2016) or first-person accounts (Grohol, 2018; Melville-Smith, 2016; Willett, 2016), but studies on this topic are sparse at best.

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## APPENDIX A: INTERVIEW SCHEDULE

### **Pokémon Go Questions**

1. *What is the name of your town or city?*
2. *How old are you? What do you do for work/school?*
3. *How long have you been playing Pokémon Go?*
4. *Why do you use Pokémon Go?*
  - a. *What do you like about it?*
5. *What is your town/city like? (this can include positive and negative things)*
6. *While playing Pokémon Go, have you ever discovered a new place or object in the world around you that you thought was interesting?*
7. *Are there any places where you like to play Pokémon Go the most often?*
  - a. *What do you like about these places?*
  - b. *Why do you play Pokémon Go in these places?*
8. *Are there any activities you find yourself doing that prompt you to use the app?*
  - a. *Are there places you find yourself in that prompt you to use the app?*
9. *When you use Pokémon Go, do you do any other activities at the same time?*
10. *Do you feel like you're the kind of person who likes exploring?*
  - a. *Do you feel like you would be doing the same amount of exploring without this app?*
11. *Do you ever use Pokémon Go when you are with other people?*
  - a. *Follow-up: do you use the app with other people who are also using it?*

12. *Have there been any times when you felt that the app taught you something new about somewhere around you?*
13. *When you play, do you stay within the same area or travel around a bit?*
- a. *if you start in one area, do you tend to stay there or do you tend to move on to other areas?*
14. *What kinds of public spaces are there in your town (examples: parks, art galleries, museums, cafes, libraries)?*
- a. *How often do you visit these places?*
- b. *what types of hangout places are there in your town, such as libraries, cafes, etc?*
- c. *How often do you visit these?)*
15. *Do you feel like a lot of people know about and/or use these places?*
16. *What kinds of places are PokéStops in your (town/city)?*
- a. *Were you aware of how many of these types of places your town/city had before you started playing?*
17. *Are you interested in finding out what local places and objects are PokéStops?*
18. *How do you feel about your town overall?*
- a. *What do you like about your town?*
- b. *What could be better about your town?*
19. *Do you feel like your town is safe/clean etc?*
20. *Do you ever use the Pokémon Go map to learn about the area around you?*
21. *What kinds of interactions do you have with other people when you're using the app?*

22. *Have you ever been surprised about something that was a PokeStop or gym?*
23. *Are there any areas where many people tend to go to play the game?*
  - a. *What makes people come to these areas to play?*
24. *Would you ever consider submitting a PokeStop if Niantic made the process easier?*
  - a. *Do you have any places that you would submit as PokeStops?*
25. *Is there anything that you would like me to know about your Pokémon Go experience?*

### **Ingress Questions**

1. *What is the name of your town or city?*
2. *How old are you? What do you do for work/school?*
3. *How long have you been playing Ingress?*
4. *Why do you use Ingress?*
  - a. *What do you like about it?*
5. *Do you use the group chat feature?*
6. *What is your town/city like? (this can include positive and negative things)*
7. *While playing Ingress, have you ever discovered a new place or object in the world around you that you thought was interesting?*
8. *Are there any places where you like to play Ingress the most often?*
  - a. *What do you like about these places?*
  - b. *Why do you play Ingress in these places?*
9. *Are there any activities you find yourself doing that prompt you to use the app?*
10. *Are there places you find yourself in that prompt you to use the app?*

11. *Do you feel like you're the kind of person who likes exploring?*
- a. *Do you feel like you would be doing the same amount of exploring without this app?*
12. *When you use Ingress, do you do any other activities at the same time?*
13. *Do you ever use Ingress when you are with other people?*
- a. *Follow-up: do you use the app with other people who are also using it?*
14. *Have there been any times when you felt that the app taught you something new about somewhere around you?*
15. *When you play, do you stay within the same area or travel around a bit?*
- a. *if you start in one area, do you tend to stay there or do you tend to move on to other areas?*
- b. *Do you ever try to link multiple portals together?*
16. *What kinds of public spaces are there in your town (examples: parks, art galleries, museums, cafes, libraries)?*
- a. *How often do you visit these places?*
- b. *what types of hangout places are there in your town, such as libraries, cafes, etc?*
- c. *How often do you visit these?)*
17. *What kinds of places are Portals in your (town/city)?*
- a. *Were you aware of how many of these types of places your town/city had before you started playing?*
18. *Are you interested in finding out what local places and objects are Portals?*
19. *How do you feel about your town overall?*

- a. *What do you like about your town?*
  - b. *What could be better about your town?*
20. *Do you feel like your town is safe/clean etc?*
21. *Do you ever use the Ingress map to learn about the area around you?*
22. *What kinds of interactions do you have with other people when you're using the app?*
23. *Have you ever been surprised about something that was a Portal?*
24. *Are there any areas where many people tend to go to play the game?*
- a. *What makes people come to these areas to play?*
25. *Have you or Would you ever consider submitting a portal?*
- a. *Do you have any places that you would submit as Portals?*
26. *Is there anything that you would like me to know about your Ingress experience?*

### **iNaturalist Questions**

1. *What is the name of your town or city?*
2. *How old are you? What do you do for work/school?*
3. *How long have you been using iNaturalist?*
4. *Why do you use iNaturalist?*
  - a. *What do you like about the app?*
5. *What is your town/city like? (this can include positive and negative things) OR what are these places like?*
6. *How often do you submit observations?*
7. *Are there any places where you tend to use the app the most often?*
  - a. *What do you like about these places?*



17. *Are there any activities you find yourself doing that make you want to use the app?*
18. *What kinds of public spaces are there in your town (examples: parks, art galleries, museums, cafes, libraries)?*
- a. *How often do you visit these places?*
19. *Do you feel like a lot of people know about and use these places in your town?*
20. *How do you feel about your town overall?*
- a. *What do you like about your town?*
- b. *What could be better about your town?*
21. *Is there anything that you would like me to know about your iNaturalist experience?*

## APPENDIX B: CODEBOOK

Data will be coded using the following codebook:

1. Place attachment: affective (emotional) experiences with and connections to place
  - a. Emotion toward place
  - b. Place interest
  - c. Sense of place uniqueness (present)
  - d. Sense of pride in place
  - e. Social interaction in place
  - f. Social identity of place
2. Place dependence: Connotative (behavioral) experiences with and connections to place
  - a. Activities associated with or done in place
  - b. Place events
  - c. Exploration in place
  - d. Engagement with place (physical)
  - e. Prosocial behavior in place
  - f. Community engagement
  - g. Place creation
3. Place identity: The cognitive (knowledge) experiences with and connections to place
  - a. Knowledge about physical/social/cultural features of place
  - b. Familiarity with history of place
  - c. Self-efficacy in place

- d. Place intensification
4. Loss of sense of place
- a. Expressions about being disconnected from place
  - b. Low knowledge of place
  - c. Lack of connection with place