CHAPTER SIX

ARIS: Augmented Reality for Interactive Storytelling

Christopher Holden

Several of the authors in this book use the Augmented Reality (AR) game design and storytelling platform ARIS in their work. Rather than have them explain the basics of the tool in each chapter, or send you off somewhere else (e.g. Holden et al., 2014) to read about ARIS just to make sense of our authors' use of it, we have chosen to describe the ins and out of this popular tool for creating augmented reality stories and games separately here. The editors have all used ARIS extensively, and—disclaimer—also have been involved with the ARIS project itself. Although we specifically sought submissions for this book from those not using ARIS, and the stories we share in the book are a clear indication that there are other games in town so to speak, we have come across a great number of people who have used ARIS to do some really interesting work. It is powerful, yet malleable and the price—free—is right.

This chapter should serve a conceptual as well as practical purpose. After all, the mobile landscape itself is changing quite rapidly. Details that felt practical as I write this for you will likely soon feel out of date as the world and software within it change. There is a lot of turnover among apps, platforms, and methods in mobile. It is unusual enough to see something like ARIS grow and stick around, and I wouldn't want the book to feel pointless if ARIS is gone or greatly changed by the time you read this.

So below, consider how the features and uses of this software do more than help you visualize the other ARIS experiments in this book or inspire your own use of ARIS this year. Details about ARIS here can inform in a concrete way perennial discussions about how a platform may function as a bridge between ideas and people. As other technologies come into play, we can look back at this time to see how ARIS looked to realize the concept of AR in a way that empowered regular people as explorers of new terrain, cutting across a lot of traditional boundaries like discipline, age, and individual educational settings in its creation and use. We can find, in this example, the questions that we need to find answers for in the software of the future.

The first lesson ARIS provides is the organic and collaborative nature of its development. Originally, it grew from a class game design by David Gagnon and Chris Blakesley in 2007, using a local art

museum as a mobile game space. The following semester, Seann Dikkers joined them to develop a prototype design tool (that would become ARIS) in an independent study under Kurt Squire. Since then, ARIS has continued to evolve due to the attention and contributions of many more volunteers and programmers.[1] ARIS has gone through many iterations, seen new funders, team members, and has led to the creation of a Mobile Learning Lab (MLL) at UW-Madison and been used by thousands of people around the globe. Gagnon et al. are at the time of my writing, near the release of a much revised ARIS that should welcome even more people through an increased ease of use and reach.

The organic way ARIS has grown and continues to develop, and its life as free, open source software, is not something that makes sense within most institutions. It is also a little convoluted to describe briefly here. But I believe it is a major reason for its resilience and usefulness. ARIS has been free to become what it needs to be and the result is something a lot of people love, often for very different reasons.

In the sections below, first we give a basic overview of what ARIS is and how it works. Then we highlight some of the more popular kinds of experiences people create using ARIS. Finally we look at some of the many contexts in which ARIS creations find relevance. We describe each of these as separate categories, but they should be read more broadly as themes. Typical projects involving ARIS participate in many of these areas simultaneously to a greater or lesser degree.

DESIGN AND FEATURES OF ARIS

ARIS works by combining three pieces of software:

- Client - an iOS app to play games, take tours, collect data, etc.
- Editor - a web based, drag and drop authoring tool for making games and other experiences.
- Server - a database where the game contents are actually stored. The Client and Editor read from and write to the server to do what they do.

The server isn't very important for users to think about most of the time, but there are a couple of factoids of general interest. First, games do not need to be published as a separate step from being written. Working in the Editor updates the games' entries in the server which the Client can then read. For game authors, this minimizes the workflow of testing, debugging, and deploying. It also makes multiplayer games possible. The downside is that players need access to the internet to play. This complicates use, especially in scenarios without extensive WiFi and with WiFi only

[1] A more complete retelling of the history of ARIS up to 2010 can be found in David Gagnon's UW-Madison Master's Thesis (Gagnon, 2010). At the end of the chapter we mention a few further contributions to its development. For the last few years, Philip Dougherty has been the lead programmer of ARIS. The total list of contributors however is too numerous to list here.

devices (e.g. when school based teams go outdoors or leave campus); involving work in very remote locations without cellular data; and where WiFi service is present but authentication is problematic. At the same time, ARIS users have come up with creative solutions to these problems. Some use portable routers like MiFi's to provide internet connections to many devices simultaneously and paid for on prepaid plans, others negotiate with IT Departments to whitelist the arisgames.org domain on the local network. In practice, handled idiosyncratically, this complication of using ARIS, like the problem of getting devices in the right hands, turns out to be much more tractable than it would appear.

ARIS Objects

There are three basic objects to make games and stories using ARIS: plaques, items and characters. Each is a bit different.[2]

- *Plaques* are points of information. They can include text and media. They can also give out and take away items to and from players. The metaphor that gives *plaques* their name is an informational plaque next to a point of interest in the world; a statue in a public square may have a plaque telling visitors who the statue is of, when it was commissioned, who the sculptor was, etc.
- *Items* are the things in the virtual world. Players can pick them up, trade them with other players, drop them on the map, get them from *characters* or have them taken away. Players can have more than one of an item and when the last one is taken from a game map it is gone.
- *Characters* are virtual people. Players interact with them via multiple-choice style dialogue. They can exchange items with players in each bit of conversation.

Each of these three objects acts a bit differently and can be used for things other than their basic metaphors might suggest. All three objects can contain various forms of media (photos, images, and text) or reference other media through URLs, rendering webpages in an embedded web browser.

Locations in ARIS

One of ARIS's main functions is to coordinate media and place. Players access ARIS objects primarily through their locations. Originally, this was solely done with players' physical proximity to GPS coordinates: In the ARIS Editor, an author creates a location for an object by dragging it out to a place on a Google map to which the player would be directed. While within a certain distance from that point, a player has access to the content at that location.

[2] This description is basic and incomplete. It is accurate to guide an understanding of its use by our authors but not entirely so for the soon-to-be released update of ARIS you may soon be using.

More recently however, other methods for the ARIS Client "knowing location" have been developed, stretching the metaphor. An author can choose to have locations accessed via

- Quick Response (QR) code (e.g. an author places a QR code for a *character* on a museum wall and a player scans the code to interact with the *character*),
- alphanumeric string (instead of a QR code, a player enters information into the decoder in ARIS to interact with authored content),
- directly from another ARIS object (e.g. after a conversation with a *character*, the player's screen immediately and automatically displays a *plaque*), or
- by the player touching a location's icon on their on-screen map (i.e. Quick Travel).

Authors no longer need to directly place locations on the map to make them available for players. In addition to the above player-facing generalizations of location, instead of placing objects at locations, an author can specify parameters and intervals of time according to which these objects will regularly generate for players. This is called *spawning*. Together, these options in the ARIS Editor give authors flexibility in how they make use of location of game content in ARIS.

The ARIS Notebook

The ARIS Client, in addition to allowing the play of pre-authored AR games, has data collection features: the Notebook. Players can take photo, video, and text notes, and map, tag, and share them using the Notebook. The Notebook can interact with other parts of ARIS (e.g. a *character* shows up when you take a photo in a certain place) and players can communicate with each other about the notes they share using likes and comments.

Requirements

The glue that holds ARIS experiences together—what gives authors the ability to structure interaction beyond simply having a bunch of geolocative media present on a map—is *requirements. Requirements* drive the Interactive and the Story part of ARIS, and should be familiar as the basic if, then logical structures that glue together other computer programs. In ARIS, an author can for example ask for a player to have seen one of two possible *plaques* or to be carrying a blue key before gaining access to a character. This is also what allows individual bits of dialogue within *characters* to come together into interactive, branching conversations.

As we mention below, *requirements* in ARIS lean heavily in favor of a storytelling approach as opposed to helping to establish a virtual world. Most of them depend on the state or history of an individual player rather than the state of the virtual world or non-player objects within it. Besides the low level of graphical capabilities in ARIS, this is the area where is ARIS is least like typical game

engines. Most other platforms have worlds and non-player characters whose internal states help determine outcomes in their games.

WHAT CAN YOU MAKE WITH ARIS?

Since ARIS is used in a lot of scenarios, by people with different goals in mind, using different methods, it is not straightforward to answer the obvious question "What is ARIS for?". We will mention some of the stories/games/tours/experiences that people have made, and how the creations fit into various purposes for their authors and players. Whether youth are playing ARIS games or making them, with adults or their peers, in school or on their own, one of the most exciting aspects of this project is considering some of the emergent mobile activity types encompassed by different ARIS projects. Below, we present examples of the major types of ARIS creations we've seen before, within the next section, describing the general types of scenarios we've seen ARIS used in.

Tours

We already discussed some of the possible benefits of MML tours in Practical Considerations (chapter 3). Here, we can describe more closely the choices a specific tool allows you. The concept of a tour is quite simple across media formats: Players travel to areas of significance and are presented with media on the mobile device (text, audio, images, video) providing information about what is at those locations. To make an ARIS tour, the basic authoring procedure described above suffices: simply create objects like *plaques*, upload media assets to them, and drag them to the map.

SIDEBAR: TOURS — MORE THAN MEETS THE EYE

As a kind of interactive content, Tours may not push the envelope in terms of what is possible with mobile. They are nonetheless an important example to remember. Because tours are simple to understand and familiar to pretty much everyone, the fact that ARIS makes the creation of geolocative or QR code based tours easy signifies an accessible on-ramp to creating with AR and mobile technology. There are four significant ways that people can be held back from agency with digital tools like these, and being able to put together a simple tour after an hour of training helps with all four.

The Conceptual framework of augmented reality. Newcomers ask "What is AR, how does it relate to my other interests, and how do I even think about a game-like thing that combines media, storytelling and physical place?" Tours fit many areas of content and are a relevant activity type for many situations. They show off the basic forms of interaction made possible by ARIS and readily suggest types of engagement that are just a bit deeper. After making their first tour with ARIS, a newcomer may ask "What if this location asked a question instead of simply presenting information? Could my tour branch into a non-linear story?"

Technical experience with the ARIS Editor. New tools, especially those built non-professionally on a shoestring budget, have a style of their own. New authors can make a tour as a way to trade the cognitive load of game authorship for time spent adjusting to the actual mechanics and vocabulary

(con't on next page)

Variations may include the use of contextual information (e.g. the player enters an address into the decoder) or QR codes (common in indoor spaces like museums where GPS doesn't help much). Information can be simple media or simulated text-based dialogue with *characters*.

When many people have the means to easily create them, we have found that many tours get made that otherwise would not. The democratization of authorship that is possible with tools like ARIS means that tours that were once only inside a single person's head or never published professionally because they addressed a small or marginal audience or a tour guide could not always be present can now see the light of day. Tours have been created to serve a wide variety of community needs, and even more often to provide unofficial tours to compete with the sanctioned ones in more popular locations. Just because tours are simple, and we have all been on deadly boring ones, does not mean they are not worthy of attention.

Scavenger Hunts

Like tours, Scavenger Hunts predate the widespread use of mobile technologies and have become an interesting target for mobile learning. ARIS is well suited for the creation of scavenger hunts because they are similar to tours but with an added element of gaminess. Scavenger hunts introduce competition and winning to the simple and often unmotivated basic tour. A tour focuses on the transmission of information while a scavenger hunt typically uses a place as a play space. Traditionally scavenger hunts have relied upon players collecting physical artifacts. In the mobile space this can be combined with collections of a more general variety, including snapshots, interviews, and virtual items. ARIS can be used to unlock certain content within a

SIDEBAR

(con't from previous page)

of the ARIS Editor. Just as building a tour may suggest deeper forms of interaction to a newcomer, letting a novice brush up against but not be overwhelmed by technical complexity exposes just enough of the editing environment to begin to make an author feel comfortable enough to click on some unfamiliar buttons and begin to dive deeper.

Access and suitability. The details of implementation also include actually obtaining any additional software or logins needed, as well as negotiating any licensing terms. ARIS is free and open-source in part to limit the difficulty of users at this juncture, but for open-source to mean actually usable, potential users need to be able to get all the pieces and see them running together to feel comfortable. Because tours are easy to get off the ground, rather extensive evaluation of ARIS can be quickly made by potential users.

Familiarity with the logistics of running mobile-based implementations. There are a lot of details between making a game as personal prototype and actually going on location with a say a group of students to use that game for a specific purpose. Again, it is better for newcomers to learn to manage the logistical details of devices, internet, and such without unnecessary complexity in the activity itself. Novice users are likely to be familiar with tours as well, and even with new hardware in their hands and new software to learn, the basic idea of getting to the next point and reading what's there is transparent. Teachers in particular can quickly assess their comfort and ability to add augmented reality gaming to their classrooms by trying a simple tour out early on.

scavenger hunt sequentially, making progression through the uncovering of a place possible. ARIS can also keep track of players' scores and other attributes through the use of *items*.

Interactive Stories

If there is a classic genre emerging within the nascent field of AR gaming for learning, it is the interactive story. Early examples like MingFong Jan's 2005 *Mad City Mystery*[3] have inspired many. Most of the ARIS experiences created by our authors who use ARIS as well as those that appeared in the previous MML book are interactive stories. There is something special to the idea of giving players not just a sequence of content to discover, but a role to play and a narrative that responds directly to their participation.

The basic idea of an interactive story is rather simple. Players are given roles to play and through these roles they interact with virtual and/or live characters and other parts of the world in which the narrative takes place. There is usually some motivating context like a mystery to solve. As the story unfolds through time and space, the outcomes depend on choices players make.

Users have many goals in mind when they use ARIS to make interactive stories, and they include a wide array of educational activities. At the same time, shared interest in them stems from a basic desire to create something rich and meaningful for others to fall into. To take presence in place, awareness and observation, and media on the device, and roll them into a context where content takes on meaning and has consequences, and where the player has a role to play in that situation aims directly at creating a truly immersive experience. Many scholars have described the power of situating content within meaningful contexts, or the agency to be gained by having a learner inhabit a role and extending participation beyond listening and responding.

A simple example to illustrate the concept and purpose of interactive AR stories as course curriculum is *Mentira*.[4] *Mentira* is a game for Spanish classes at the University of New Mexico in Albuquerque. The story unfolds much like a historical novel, where fact and fiction combine to set the context and social conditions for meaningful interaction in Spanish. While playing *Mentira*, learners must investigate clues and talk to various *characters* to prove they are not responsible for a murder in a local neighborhood. Players visit the local neighborhood where the story is set to collect additional clues and ultimately solve the mystery. *Mentira* feels like a natural fit to a Spanish class instead of technology that has been shoehorned in for its own sake because the goal of a Spanish class is to bring students into contact with Spanish in the world. It is a story told through the Spanish language and which takes place in a place where the language has been relevant for more than 300

[3] See (Squire & Jan, 2007) for a description of how role and story are imagined to be productive for engaging students in scientific inquiry.

[4] For more about Mentira see my and Julie Sykes' chapter in Mobile Media Learning: Amazing Uses of Mobile Devices for Learning (Holden & Sykes, 2012).

years. Instead of regurgitating vocabulary and grammar—the focus of much classroom instruction and almost all mobile games for language learning—in *Mentira* students use Spanish to understand and participate meaningfully in a situation.

Later in this book, there are several examples of interactive stories made with ARIS. Bressler has a multiplayer forensic mystery *School Scene Investigators* (chapter 7) similar to Jan's *Mad City Mystery*. Many of the creations detailed by Adam and Perales (chapter 10) start from the basic structure of an interactive story. And all the designs described in the Design Challenges section of the book are also interactive stories: May's *Quest for the Cities of Gold;* Dikkers, Rieder, and Soloman's *ParkQuest*; Blakesley and McIntosh's *Lift Off;* and Fisher and Dikkers' *Horror on the Ridges* (chapters 15 through 18).

One reason for the popularity of the interactive story genre among ARIS users is the universal nature of storytelling. We share ideas with each other in the form of stories. Regardless of the subject, audience, or setting, stories are the oldest and most used communicative strategy we have. Story connects people to ideas, and ideas to places. Time, intention, action, and reflection take form within stories. So when thinking about AR as a technology for uniting content and place through interaction, interactive narratives look like a natural format.

The interactive narrative is not only a preference of users, but also a central aspect of the original design of ARIS. The acronym ARIS stands for Augmented Reality for Interactive Storytelling. Many features were specifically designed to support the creation of interactive narratives distinctly as a certain type of game or experience. This preference is obvious when you look at what exactly ARIS makes it easy for authors to do:

- *Plaques*, *items*, and *characters* are author-centric. To a large extent, what the player does with them is read their contents.
- Multiple choice based dialogue with virtual *characters* is a heavily foregrounded feature.
- The requirement system allows future interactions to depend on logical consequences of the state and history of the player more than on the current state of the virtual world or its contents.

Although the lines between game genres, types, or even between games and other kinds of content can be rather fuzzy, generally a focus on storytelling means that ARIS is not so much a platform for action games, geometric puzzles, or interactive simulations. Our focus on interactive storytelling may take us away from some of the most popular areas of commercial mobile game design, but it allows us to reach out to very diverse audiences, help them to connect readily to what otherwise might be an uncomfortable space, and create games that have immediate relevance to their own subjects, places, and contexts.

The situated documentary is another story-based AR genre, often an interactive story with the added notion that the story being lived through is tightly based upon actual events at a location. This concept was coined by James Mathews, who created *Dow Day* for his high school students, originally on MIT's Outdoor AR platform like Jan's *Mad City Mystery.* We later ported the basic story from this project to ARIS to be used as a concrete demonstration of AR storytelling (figure 1). In *Dow Day* players take on the role of a reporter in 1967, Madison, Wisconsin with the goal to interview virtual characters connected with student protests on campus regarding the Vietnam War. Historically, these protests culminated in a brutal conflict known as Dow Day. Participants in *Dow Day* view video and images surrounding this event in the media's authentic locations, situating them within the event.

Generally, authors of situated documentaries want to know whether and how combining physical location and documentary materials can result in compelling, immersive storytelling of real-life events. A key mechanic is being able to physically situate this historical media in relevant physical locations. In *Dow Day,* the use is similar to what one finds in the popular *Then & Now* photo books, where a contemporary photograph accompanies a historical one taken from the same place and in the same direction. The familiarity of the modern landscape helps us get into the historical context, noting similarities and differences. In a situated documentary, players are not given a contemporary photo to establish context. Instead, they are physically present where the original events took place and their senses provide the contrasting reference while the mobile device provides the details of the historical setting. Adam and Perales describe some of their and their students' creations as documentary (chapter 10), and Owen Gottlieb also uses the term refer to his ARIS game, *Jewish Time Jump*.[5]

Figure 1. A screenshot from the ARIS port of Mathews' *Dow Day.* An archival photo is used to illustrate and situate the story in the game.

[5] *Jewish Time Jump* was a finalist for a G4C award at the 2013 Games for Change Festival.

One may question whether an interactive story can ever really be considered a documentary. Because we imagine giving the player a role to play and decisions to make, the result is necessarily ahistorical, at least in part. However, many authors will make player roles generic—i.e. the reporter you play in Dow Day is not an actual reporter and your actions do not affect the outcome of the protests—invented for the story rather than actual historical figures in an effort to lighten the disturbance. In practice, designs like Dow Day retain a documentary feel that is distinctly different from historical fiction like *Mentira*. Watching authors face this and other boundaries demonstrates the vitality involved with this creative act. In AR storytelling, fiction and non-fiction are clearly not opposites, but the foundation for broad experimentation. The intent to help others get inside past historical events may indeed be enacted most efficiently by pretending to be someone who never lived at all.

Data Collection Activities

ARIS can also be used to set up data collection activities, typically through use of the Notebook. Data collection activities turn authorship around by giving the players the primary responsibility for telling a story. By carefully selecting the data to be collected, an engaging game mechanic can be created, compelling players to fill the game world with content that then can become fodder for further investigations.

Possible content areas for data collection through the ARIS Notebook include anything from citizen science to community ethnography. An early entry in this genre, *Digital Graffiti Gallery,* is a curation activity developed by University of New Mexico undergraduate Ivan Kenarov in my *Local Games in ABQ* class. Players document graffiti on the UNM campus (figure 2). As the real graffiti is removed by cleaning crews, it remains in place in ARIS and can be revisited in the future. This collection activity serves to preserve a lasting, locative record of this ephemeral art form. Later in this book, Frandy has his students use the ARIS Notebook to practice ethnography (chapter 8), and Graza and Rosenblum's students use it to record observations of a neighborhood in East Austin (chapter 9).

Figure 2. Alyssa Concha plays *Digital Graffiti Gallery* by photographing graffiti.

Data collection activities have become popular with ARIS because they require less effort at upfront production and also perhaps because they give players a larger role to play, themes we mentioned in the previous chapter. To make a data collection activity, a teacher pretty much only needs to come up with an idea and a name. A couple words and checkboxes in the ARIS Editor and they are ready to go. In contrast to a tour, which takes about an hour to learn to make and at least ten times that to find and prepare the content for the tour, a data collection activity takes five minutes of training to author and just as little time to set up from scratch. The structure of the inquiry can be largely provided by the existing social environment and the technology serves to house and share the collection among all the players. And those players, instead of simply working through a path set out for them by the author, become the primary producers of content. By placing students' actions in the foreground, a data collection approach can quickly produce a context of productive inquiry among a group.

Geolocational Games

Despite our frequent use of the term games in talking about ARIS, a reader could be forgiven for not seeing how the above categories and examples above sound much like games at all. While I think the term itself is slippery[6] and justifying it here is not really to the point, there are some features and uses of ARIS that do feel a bit more gamey. *Items*, because they can be collected and referenced in quantity, have been used to create scores, scenarios of scarcity and completeness, and even crafting schema. The other major ARIS element that lends itself to gaminess is *spawning*. The ability for authors to *spawn* locations according to parameters rather than directly placing them on the map can be used to create familiar scenarios to many action-based games, the difference here being a human body traversing space instead of an avatar. Together, these features can be used by authors to explore the space of geolocational games directly.

Currently the most popular geolocational game made in ARIS is *Rupee Collector*. Virtual rupees (Zelda, not India; technically *plaques* that hand out *items*) spawn on the map around a player and last there a short duration. If the player can run to them and pick them up before they disappear, they receive points that depend on the color of the rupee. Another item in the player's inventory links to a webpage that references the statistics for the game. It is a leaderboard and players can compare their scores to all other players of *Rupee Collector* in the world. Although this game was made for its own sake, there is much interest in this kind of game mechanic for those coming to ARIS from the world of exergames. It seems possible that a fun geolocational game could be good exercise for its players.

[6] Wittgenstein famously used the word game to describe the difficulty with definitions generally in his *Philosophical Investigations*.

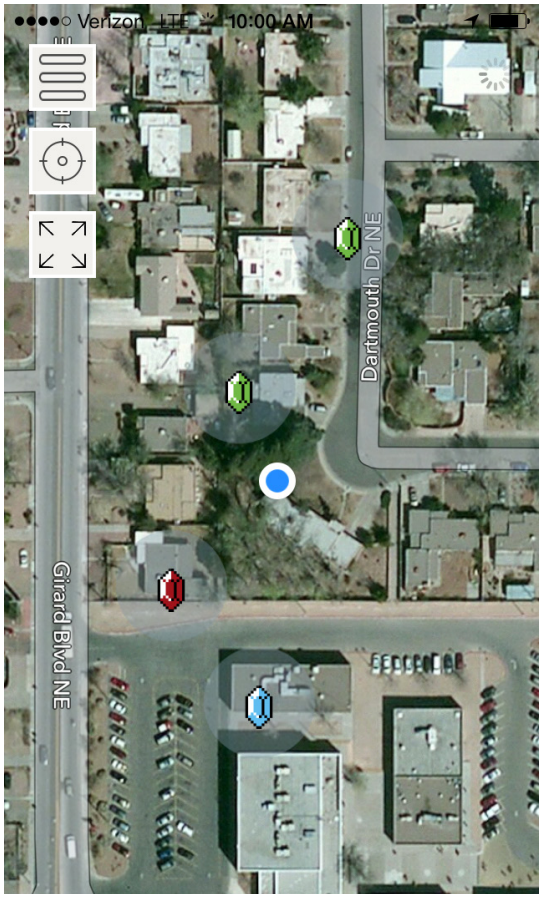

Figure 3. A screenshot from the ARIS game *Rupee Collector.* Gems spawn on the player's map and must be collected before they disappear or other players grab them.

WHO USES ARIS AND WHAT FOR?

In the previous section, I described the *kinds of things* one might create using ARIS. In this section I'd like to describe the motivations of that use as an almost orthogonal concept. To begin, ARIS is loosely but consistently linked with use in educational environments. Its design does not directly seek to address functionality schools are interested in for managing their learners—there's no quiz template or student progress reports, no official distinction about who should be using ARIS and how—but it is certainly designed with learning in mind more than entertainment and the vast majority of users seem to be interested in this aspect of its use. There is a great variety in where and how ARIS is put to educational purposes too. There seems to be no natural limit to the content areas that are applicable. ARIS is used in schools, museums, after school programs, experiments for academic research, and community organizations. Players and authors range from middle schoolers to retired professors. In this section, we describe some of the more popular settings and uses for ARIS games.

AR Games as Curriculum

Garza and Rosenblum (Chapter 9) present their work in developing an AR game (close to a data collection scavenger hunt) for students in a design course. This, *Mad City Mystery, Dow Day*, and *Mentira* are examples of this once standard imagining of the use of AR for learning.[7] The basic method is to find an existing curricular area and design and implement an AR game within it. The play of the AR game can help connect content to context, find ways to include content and practices unfortunately absent from the classroom. Sometimes an AR game can be used to actually invert the values expressed by instruction taking a focus on textbook content and changing it to the local context.

[7] Most of the experiments run and written about by Klopfer and Squire for example use AR in this vein. See (Klopfer, 2008), (Klopfer & Squire, 2008), (Squire et al., 2007).

Place can make content come alive. *Mentira* again can be a helpful example to understand the general concept. Students learn Spanish in a classroom and don't often access the language outside that classroom. Yet the language is worth learning because it is used so widely. Especially in places like Albuquerque, NM, the Spanish language is deeply wrapped up with the place and the people. Scarcity of opportunity to use the language is an artifact of learning it within a classroom. If you can bring students into the lived world of Spanish, you might be able to help them find meaning in their practice. This is very similar thinking to the long-standing practice of study-abroad.

Typical implementations also are characterized by features and concepts stemming from research into games and learning. An example of something a researcher or instructor might seek to gain by implementing a game in a curriculum is for students to see failure as a productive opportunity for learning rather than an admonishment of their abilities. In most curricular situations, failure, say on tests, mostly is used to tell students that they are not doing well enough. In games, failure is an essential part of progress. You learn to beat games by falling down pits, getting killed, simply losing, over and over again until you are better (or give up). By making a game that is played by part of a curriculum, planners hope to infect students with a more productive attitude towards failure.

Museum Exhibits and More: Indoor, Semi-formal Uses

More and more people have been using ARIS indoors to add structure and content to installations like museum exhibits. Since GPS does not work well indoors, these games usually work through the use of QR codes. Just as tours give authors a chance to tell the story of a place, ARIS games that sit atop museum exhibits can take the artifacts and dates and weave them into an actual story, providing extra meaning and context.

Examples are far ranging. The Minnesota Historical Society has produced *Play the Past*, the biggest ARIS game ever in terms of players and production effort. It is a combination exhibition space and ARIS game. Players play as early white settlers in Minnesota. 100,000 people are planned to play this game over the next 10 years.[8] At the other end, an undergraduate student made a game for her local history museum last summer. May's *Quest for the Cities of Gold* (chapter 15) layers a story over an existing exhibit to help the museum try to reach a younger audience. In both cases, the basic intent is to use ARIS to create a story that links the artifacts in the museum to one another, the contexts in which they take on meaning, and pull players into those worlds.

[8] *Play the Past* won a 2014 Muse Award (Bronze) and an International Serious Games Award (Gold) for its design. Its early development is chronicled by Seann Dikkers in the previous volume of *Mobile Media Learning* (2012).

Student Design Studios

Probably the most common use of ARIS in classrooms and after school environments is to create opportunities for students to make games, an instance of student MML design as suggested in the previous chapter. Sometimes this is done generically, as is common with other technical design tools like Scratch, accompanied by similar rationales for such use fitting into existing educational paradigms.[9] Possibly more unique to ARIS however, are the student design studios organized around producing games that speak to a specific context of inquiry. Mathews (2010) described using mobile game design as a lens for doing community research and action and has inspired many to follow his lead, including the editors and some authors of this book.[10] Within these environments, AR game creation can be used as a way to interrogate the values, methods, and content of a discipline—i.e. if you learn a lot of content while playing a game, you would stand to learn even more by making a game. AR game design is considered as an example area for learning lessons from the act and practice of design; making ARIS games can be a way to learn about working with others to make something complex.

Not only are the learning opportunities presented by design deep and multifaceted, they can also be authentic. Within the nascent area of AR design, even inexperienced youth can come up with designs that can go beyond the classroom and take on life in the world. There are so many avenues of exploration and so many open questions that it is not hard to find new areas to contribute to. Finally, design studios, as with the data collection activities, do not take much preparation to enact. Certainly facilitating design studios successfully is no easy task, but for those who wish to take on the challenge, facilitation doesn't imply close preparation; the necessities are more along the lines of existing interpersonal skills than prior media production or acquiring new technical skills.

Design-Based Research

Not every ARIS game made for use in the classroom has the classroom as its main theater. Instead many games are designed primarily as instruments of research. In its early life, ARIS was thought of first as a tool to support design-based research experiments. Following Anne Brown (1992) and others, design-based educational research is characterized by the concept of making something to be used within an existing learning context rather than setting up a laboratory setting specifically for the testing of a theory. Usually accompanying this basic intent to study learning in situ, are preferences for including participants as co-researchers, iteration, and a desire to read beyond the immediate situation in analyzing the study. There is also a hope that the instrument developed is not just diagnostic for research but can play some meaningful role in the learning context after

[9] See for example (Resnick, 2008) to see a description of patterns of activity emerging from informal Scratch use as useful for encouraging computational literacy.

[10] Frandy also describes a student design studio in his folklore course, and May's work in chapter 15 began in a class of mine modeled after Mathews'.

the study is over or be scaled for use in other contexts. Although the lines between action and research are often fuzzy with design based research, Bressler's work (chapter 7), fits this paradigm neatly, and the artistic experiments taken on by Adams, Perales, and their students (chapter 10) share some features as well.

Contributions to Community Resources, Art, and Entertainment

ARIS is also used to develop AR games, tours, and data collection activities to be used generally by a community as a resource. We see this with Dikkers and his team in their development of *ParkQuest* (chapter 16) and Wagler and Mathews' development of *Up River* (Wagler & Mathews, 2012). There are millions of possible such designs, otherwise forever undeveloped for want of resources. Sometimes the design experiences organized for youth have a community resource as a specifically designated form of output for student work. Other times ARIS is picked up outside any formal context and used to make something some community needs. May's game fits this context.

Artists interested in examining the possibilities of combining mobile media and place have likewise made use of ARIS (e.g Adams and Perales). Though they involve their students in the design of ARIS games, they see the format itself not as a tool for learning, but a tool to be learned so they can use it to explore the possibilities of mobile cinema. Finally, ARIS has been used totally informally, without any serious intent of any kind. Scavenger hunts have been made for the birthday parties of young children. *Rupee Collector* and other titles of mine have been made just for fun. Fisher and Dikkers' *Horror on the Ridges* (chapter 18) looks to make an AR horror game succeed first as entertainment, with learning applications left for a later stage. The lasting fun with ARIS for me is that it draws attention from such diverse centers.

ARIS IS MORE THAN A TOOL

What makes ARIS feel really powerful to me is the way in which it has become more than just a tool. The collective actions and conversations among those who use it have made it into something alive in a sense that is descriptive of the kinds of deep change to teaching and learning I suggested might be possible in the second chapter of this book. ARIS is characterized, among other qualities, by:

- Multiple possible uses. ARIS is not derived from or towards a particular discipline, topic, or skill set. People who use it bring their learning contexts with them and an incredible diversity of activity is the result.
- Diverse, non-hierarchical models of participation and multiple portals through which people become involved. No one is in charge of how you're supposed to use ARIS. You might make games, teach others to do so, use the code to make a different AR engine, or simply underwrite the cost of development.

- Many forms of expertise around and with ARIS can be independently developed. Those who have developed expertise in their work with ARIS can emerge as guides for others to follow, and this is across many possible contexts: within a school, across the internet to other ARIS users, and through academic research for example.

In describing ARIS above, it was impossible to do so other than through the concrete and diverse uses people across many educational contexts are putting ARIS to; the technical structures of ARIS really have little meaning outside the kinds of creations being produced and the situations from which users are coming. They are a big part of what ARIS has actually come to be, inseparable from the software itself. Indeed, the meaning and uses of ARIS were not designed in advance by its creators but instead have emerged and evolved through the actions and inventiveness of its users. The whole is more than the sum of its parts.

Finally, we should recognize how users contribute to ARIS itself. There are too many examples to mention but a few should help convey this idea. I fit the well-known paradigm of the evangelist early adopter. I came to the platform as a simple user in 2009 before you could actually download the ARIS Client from the iOS App Store, but have ended up helping to design the tool, largely wrote the documentation (http://manual.arisgames.org), am responsible for much of the content on the project's homepage, and the most active member of a discussion forum for ARIS users. Oh, and I'm writing this chapter about ARIS right now. ARIS has also had investors, groups like Engage, The MacArthur Foundation, The New Learning Institute, and The Library of Congress: Teaching with Primary Sources Program who saw some potential in these ideas and funded them, and others like the Minnesota Historical Society who have funded ARIS and used it to develop the rather large *Play the Past* game/exhibit mentioned above. Owen Gottlieb through ConverJent has managed to fill both of these roles in his work to produce *Jewish Time Jump*. The support and use of ARIS by a few key people and groups has provided resources and concepts that have trickled back down to all users. On a less obvious level, each person who makes an ARIS game and uses it or tells someone else about it expands what has been previously done with the platform.

The diversity of work hinted at above and displayed by our authors is the outcome of a distributed conversation among many people experimenting and sharing. Seeing ARIS in this way prevents us from pigeonholing our efforts or the ideas of our users. We begin to understand how to think about tools like ARIS from a humanistic rather than instrumentalist point of view. We see ARIS as a community and not just a piece of software.

REFERENCES

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The journal of the learning sciences, 2*(2), 141-178.

Dikkers, S. (2012). History in our hands: mobile media in museum adventures. In *Mobile Media Learning* (pp. 171-184). ETC Press.

Gagnon, D. (2010). ARIS: An open source platform for developing mobile learning experiences. *Unpublished Master's thesis.* Available at arisgames.org.

Holden, C., Gagnon, D., Litts, B., & Smith, G. (2013). ARIS: An open-source platform for widespread mobile augmented reality experimentation. In M. Mendes (Ed), *Technology platform innovations and forthcoming trends in ubiquitous learning.* IGI Global.

Holden, C., & Sykes, J. (2012). Mentira: prototyping language-based locative gameplay. In *Mobile Media Learning* (pp. 111-130). ETC Press.

Klopfer, E. (2008). Augmented learning: Research and design of mobile educational games. MIT Press.

Klopfer, E., & Squire, K. (2008). Environmental Detectives—the development of an augmented reality platform for environmental simulations. Educational Technology Research and Development, 56(2), 203-228.

Mathews, J. M. (2010). Using a studio-based pedagogy to engage students in the design of mobile-based media. *English Teaching: Practice & Critique, 9*(1).

Resnick, M. (2008). Sowing the Seeds for a More Creative Society. *Learning & Leading with Technology, 35*(4), 18-22.

Squire, K., & Jan, M. (2007). Mad City Mystery: Developing scientific argumentation skills with a place-based augmented reality game on handheld computers. *Journal of Science Education and Technology, 16*(1), 5-29.

Squire, K., Jan, M., Mathews, J., Wagler, M., Martin, J., DeVane, B., & Holden, C. (2007). Wherever you go, there you are: Place-based augmented reality games for learning. The educational design and use of simulation computer games, 265-296.

Wagler, M., & Mathews, J. (2012). Up river: place, ethnography, and design in the st. louis river estuary. In *Mobile Media Learning (*pp. 39-60). ETC Press.

Mobile Media Learning: Innovation and Inspiration

Editors and Authors Biographies

In order of appearance

Christopher Holden is an Assistant Professor at the Honors College of the University of New Mexico. His research revolves around place based game design for learning. He makes games and helps others to make games for a wide variety of learning contexts, from language learning to community action, from classrooms to museums and community centers. He also helps produce ARIS, an easy-to-use, open source, augmented reality game platform. Chris teaches classes involving mobile game design, and directs the *Local Games Lab ABQ,* a fancy name for supporting unfunded faculty, students, and community members to make games and other interactive experiences to develop new forms of meaning within their local natural, cultural, and educational environments. Chris was once a number theorist but at some point went rogue thanks to the Games+Learning+Society folks at UW-Madison. As compensation, the group has generously set up Dance Dance Revolution for him each year at their annual conference.

Seann Dikkers is an assistant professor in the Educational Technology division of the The Patton College of Education at Ohio University. Formerly, Dikkers served fourteen years as a middle school history teacher, high school principal, and education consultant. Dikkers' work focuses on the integration of new media technologies for formal and informal educational settings. His books, *Real-Time Research*, *Mobile Media Learning,* and *TeacherCraft: How Teachers use Minecraft in the Classroom* are helping educational innovators to integrate technology into classroom learning. His projects include CivWorld, the Comprehensive Assessment for Leadership in Learning (CALL), Mobile Game Design, TeachOn!, and co-director of Playful Learning - Ohio. His current partnerships focus on the development of *Life Master: The Card Game that Just Happens* and *Just-inTime* teacher professional development systems.