

## GAMES, STORIES AND LANGUAGE: MOTIVATING SECOND LANGUAGE ACQUISITION WITH PLAY

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This paper reports a design case for a story-driven language learning game called *Arena*. *Arena* was developed in the design science tradition, where purpose-built artifacts are used as a springboard for scientific inquiry. As such, *Arena* is a vehicle for designers and researchers to study the effectiveness of story-based games for engaging learners, as well as to explore some of the various challenges that manifest when designing and implementing gameful educational experiences. In this design case, we—myself, as author, and by extension, my design team of 14 undergraduate developers and researchers—report on the theoretical underpinnings of *Arena* and then draw contrasts between these and our experiences as practical designers. The contrasts we note include: (a) second language storytelling as a wicked challenge, (b) managing competing requirements for ease-of-use versus meaningful learning and engagement, (c) making playful connections between play and work, (d) the subtle impact of player point of view, and (e) designing for our target demographic of young male gamers.

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### INTRODUCTION

An excellent way to learn a second language is to live in a place where it is spoken (Polanyi, 1995). So begins the design journey of *Arena*, a second language (L2) learning game where “life” is play and “place” is virtual: a futuristic Spanish mining colony on a desert world orbiting the star Tau Ceti in 2410 A.D.

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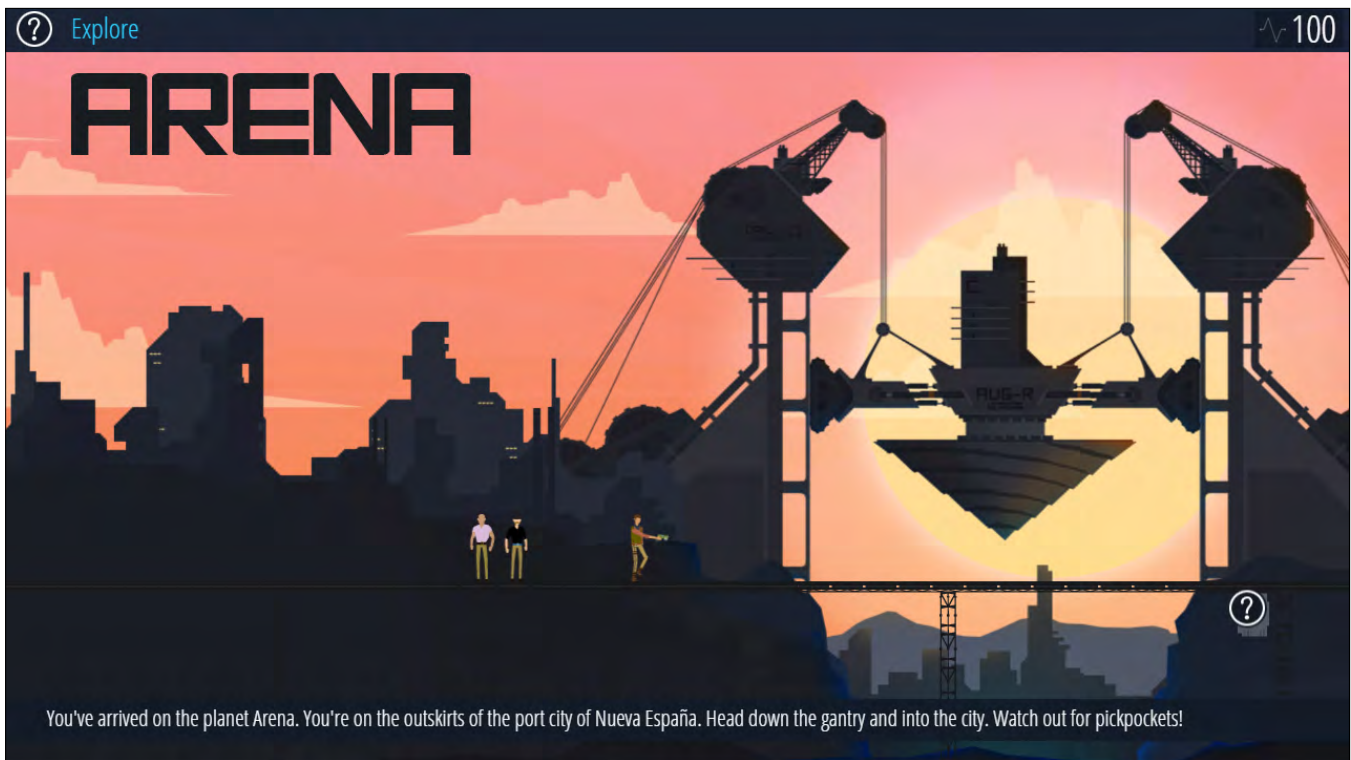
Throughout this design case, I use the term “we” to refer to myself, as author, as well as to my broader design team, describing points for reflection that we have encountered while designing a language learning experience for gamers. *Arena* is a work in progress, and so this design case is also an opportunity to interrogate our theoretical motivations and starting assumptions with an eye toward future design iterations.

Our most notable reflection points so far include: (a) second language storytelling as a wicked challenge, (b) managing competing requirements for ease-of-use versus meaningful learning and engagement, (c) making playful connections between play and work, (d) the subtle impact of player point of view, and (e) designing for our target demographic of young male gamers.

All of these reflection points relate to our overarching design context, namely that *Arena* is an example of design science research in human-computer interaction (HCI; Hevner, 2007; Hevner, March, Park, & Ram, 2004; Prestopnik, 2013). Design science emphasizes the creation and study of technology-driven creative works, placing its practitioners in a dual role as both designers and scholars.

As computer scientists, much of our work emphasis is focused on the details of implementation—programming code, asset generation, and the like. Yet as researchers, we must always be mindful—often we must *remind* ourselves to me mindful—of our larger scholarly objective: the study of play experiences as they relate to purposeful activities (von Ahn, 2006; von Ahn & Dabbish, 2008). With this in mind, we report these various reflection points not as examples of success, but rather as instructive contrasts between guiding theory and practical experience.

To begin the design case, we provide a brief overview of the game world, gameplay, and player character. We then discuss several theoretical framings that have helped us shape our design. Finally, we explore several unique and surprising challenges we have encountered, with an eye toward future directions for our design activity and our research.



**FIGURE 1.** *Arena*, a 2D action role-playing game (ARPG). Players navigate a 2D world that has been represented in a stylized manner. The world is populated by Spanish-speaking characters and with a wide variety of objects that can be interacted with in order to learn target language (TL) vocabulary.

### ARENA: BRIEF OVERVIEW

In 2410 A.D., the planet *Arena* has been settled by a reinvigorated Spain. The 2400's are an age of space colonization, and *Arena* is an epicenter for mining, especially for *Brens*, a local mineral with a wide variety of commercial uses. In Spanish, the word “arena” means “sand,” and the planet *Arena* is a desert world. Thematically, we use the English meaning of arena to emphasize the world’s dangerous, competitive, arena-like environment. This is the backdrop against which players of the game begin their adventure (see Figure 1).

Our game puts the player in the role of Brock Springer, a young man who has journeyed to *Arena* to find his parents, David and Alice Springer. Brock must navigate the dangerous environs of the planet, learning the local language—Spanish—as he goes.

Play in *Arena* is a mix of exploration, puzzle-solving, and action-adventure. Brock must find clues to his missing parents by exploring several game levels, including an arrival port, a small city (Nueva España), and an abandoned Bren mine. These locations include many objects for Brock to interact with using a tool called the *Explorer*. This tool gives Brock the opportunity to translate Spanish into English. *Arena* is a dangerous world, and so much of the play involves combat with local bandits and dangerous wildlife.

Crafting the world of *Arena* required our design team to think extensively about the intersection of language learning, play, and video game design. Accordingly, we begin with an overview of four theoretical bases that have influenced the gameplay of *Arena*.

### THEORETICAL MOTIVATIONS

#### Psycholinguistic Second Language Acquisition (SLA)

Psycholinguistic SLA theorizes that learning can occur when learners have an opportunity to participate in goal-based communicative activities (Gass, 2000; Petersen, 2010); learners can find success when they are exposed to a comprehensible form of the target language (TL) and are given opportunities to negotiate its meaning through interaction (Long, 1985, 1996).

The theory of psycholinguistic SLA relies upon rich interactions where meaning can be negotiated and feedback can facilitate sense-making (Petersen, 2010). Real world experiences certainly afford these kinds of interactions, and we adopted the perspective that interaction-rich virtual worlds could do so as well. In games, virtual interactions can include quest-based conversations, interaction with the world, economic interactions (e.g., purchasing equipment or resources with in-game money), and much more (Rogers, 2010).

The authenticity of linguistic tasks is also an important success factor for Psycholinguistic SLA (Petersen, 2010). In virtual environments, tasks can be designed at varying levels of authenticity to recreate realistic interactions. However, games also afford opportunities to leverage whimsical elements (Garris, Ahlers, & Driskell, 2002; Malone & Lepper, 1987; Rieber, 1996) to create tasks that *feel* authentic but still provide otherworldly, novel, and playful moments of interaction.

### *Authentic artificiality*

With stories, action, excitement, and authentic linguistic interaction in mind, we selected *Arena's* science fiction world and the year 2410 A.D. very intentionally. Though our setting is entirely fictional, it is also a vehicle for many authentic interactions that we consider desirable. The setting is far enough in the future to emphasize fantasy but close enough to our contemporary world to convey the TL in its modern form and usage.

*Arena* includes missions that the player can undertake in their ongoing effort to find David and Alice Springer. These missions require explanation and instruction, providing opportunities to engage with the TL in an authentic yet controlled manner. Unlike the real world, ad hoc conversations of living in a place (Polanyi, 1995) in *Arena's* virtual conversations and interactions can be crafted to supply desirable language inputs (e.g., vocabulary, grammar forms, colloquial expressions, etc.). These are intended to have the appearance of informality but are still highly controlled.

### **Diegesis**

Diegesis is a term used to draw a distinction in various forms of media—films, novels, games—between things that are “of” the story world, and things that are not (De Freitas & Oliver, 2006; Galloway, 2006; Stam, Burgoyne, & Flitterman-Lewis, 1992). The difference between the diegetic “story world” of the game and the non-diegetic “real world” of the player can be understood through an example: the label on a treasure chest found in a game during play.

Deeply etched into rusty metal by a rough hand and a dull knife, the misspelled word “Tresur” suggests the former owner of the chest—perhaps a vicious and unlettered pirate, perhaps a highwayman or bandit. This is a diegetic approach, where the label itself is part of the story, enriching and expanding the game world, while also conveying important contextual information and usability cues to the player.

Depending on the sophistication of the design, game developers sometimes refer to this approach as “environmental storytelling” (Rogers, 2010; Schell, 2008) because of the way it takes advantage of the game world to convey meaningful story information, sometimes using written language, and sometimes not. A non-diegetic alternative

could be a pop-up label that hovers in space, informing the player about the contents of the treasure chest, but working outside the boundaries of the game’s world.

Of course, it is possible to turn a non-diegetic pop-up into a diegetic element by giving a story or world-driven reason for its existence, for example, a helmet that provides the player with a heads up display, or perhaps an augmented reality tool that enhances the game world through visible metadata.

In *Arena*, we strongly favored a diegetic approach. We intentionally directed our design efforts into aspects of the game that deliberately use the story approach to justify as much of the experience—and L2 exposure—as possible. We sometimes crafted our language activities so that they fit the story, and sometimes crafted our story so that we have diegetic “permission” to present the player with certain kinds of language learning tasks.

### *The explorer: Justifying the use of language tools*

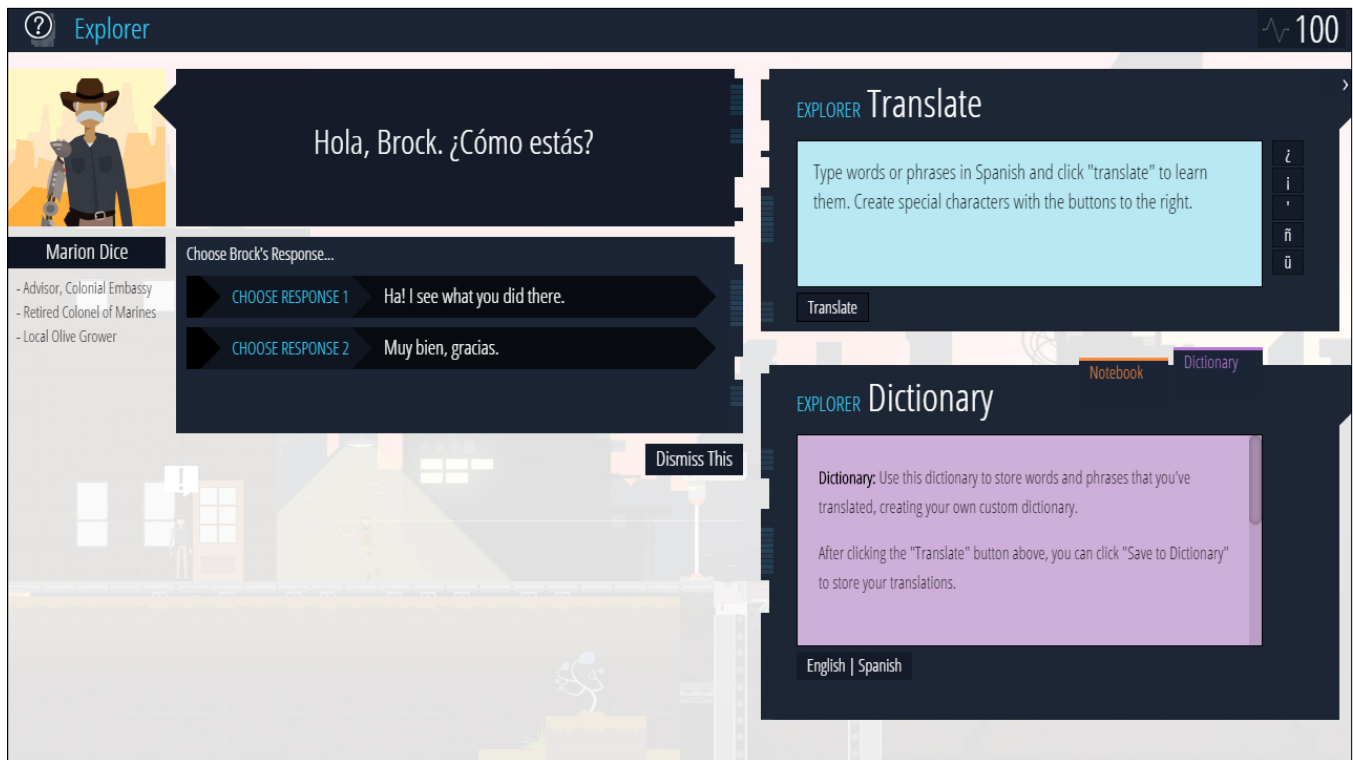
Early portions of *Arena's* story revolve around a device called the *Explorer*, an augmented reality (AR) tool that can be used to translate Spanish into Brock’s native tongue (American English) during conversations or at any other time. The *Explorer* allows Brock to interact with many items and objects in the world, learning Spanish phrases through typing and translation (see Figure 2).

More than just a language interface provided to the player by us, the game developers, the *Explorer* is a device—an integral part of the game world—given to Brock by a friend, Colonel Marion Dice, as a form of assistance and in the context of the story.

Our diegetic approach gives us the flexibility to modify the rules of the *Explorer* in beneficial ways for the learner. For example, players might find themselves in a story moment where they must convince a local bandit leader that they are allies. Using the *Explorer* would give away the ruse, so players would need to successfully navigate this conversation without help.

Rather than being perceived by players as a teacher-imposed test or quiz, such an event would become a language-oriented “boss fight” that tests player knowledge, makes sense within the story, and has playful impacts upon the experience.

The *Explorer* also gives us a diegetic way of exploring language through objects situated in *Arena's* world. As an augmented reality device, it affords the ability to click on items within the environment (dozens of individual objects in our current vertical slice; perhaps hundreds or thousands in a fully developed experience). Clicking on the world to acquire information could be perceived as an unnatural



**FIGURE 2.** The *Explorer*, shown in use during a conversation. The *Explorer* affords translation at any time during play, and also includes features to save translations in a Spanish-English dictionary and to store important quest information for later use.



**FIGURE 3.** *Arena's* story is conveyed via conversations with a large cast of NPCs, each of whom can speak in varying proficiencies of English and Spanish.

thing to do—this is not how we normally operate in our own non-virtual world. The diegetically introduced *Explorer* justifies this activity and makes it natural, turning a click into a reasonable approximation of pointing an AR device at items to see what they are called.

#### *Diegetically motivated tasks*

We designed early quests so that non-player characters (NPCs) could comment on Brock's limited Spanish and urge him (and thereby, the player) to improve (see Figure 3). NPCs assign missions that Brock can take on, including story-based opportunities to improve reading and listening comprehension. As the story unfolds, NPCs compliment and encourage





**FIGURE 4.** Players encounter mysterious graffiti on the walls, clues to a story-based puzzle, and also a vehicle for learning numbers and counting.

Brock as his abilities grow. This is the Psycholinguistic SLA notion of an “authentic linguistic task” made concrete.

In an early level, Brock encounters a series of unusual graffiti messages spray-painted on the walls of an abandoned mine, for example, “El número uno es seis;” (The number one is six). Later, Brock learns that bandits have been publicizing clues about a secret access code: the first number (uno) indicates which position in the combination, and the second (seis) indicates what number to select for this position (see Figure 4).

This specific puzzle gives players a reason to explore and click in the world, and also helps them learn counting and numbers. We designed the puzzle format to be generic, envisioning additional activities about colors, dates, times, food, or household items.

#### *Using diegesis to reframe “failure”*

Making a mistake in an L2 conversation—in a classroom or in the real world—can be a socially embarrassing and psychologically stifling moment, raising feelings of failure and an unwillingness to take chances and try again (Krashen, 1985; Petersen, 2010; Warschauer, Turbee, & Roberts, 1996). In *Arena*, a single player experience, we have an opportunity to diegetically reframe such moments.

Consider a player who has “failed” a conversation check by misusing a particular vocabulary term. In a classroom, this

would be embarrassing. In *Arena*, players might instead find that they have unlocked a new mission. Having misused the local language, they now must undertake an adventuresome escape that reinforces the missed vocabulary (e.g., by talking or fighting their way past several guards while following signs to a secret exit).

#### **Fantasy**

As with diegesis, we also designed *Arena* around the notion of “fantasy” (Garris et al., 2002; Malone, 1980; Malone & Lepper, 1987; Prensky, 2005). Fantasy refers to how games can, “evoke mental images of physical objects or social situations that are not actually present,” (Malone & Lepper, 1987, p. 240). In a play experience, fantasy is implemented through the game world and story, allowing players to safely experience events, risks, and rewards that are not possible in the real world (Qin, Rau, & Salvendy, 2009). Malone and Lepper (1987) have argued that fantasy is one of the most important features of educational video games.

Rieber (1996) identifies two conceptions of fantasy: exogenous and endogenous. Exogenous fantasy describes how whimsical material can be layered on top of the educational content. For example, a player might be given a vocabulary test in order to open a door. Dry educational content leads to fantasy feedback, but there is not much of a connection between the material and the playful result. Endogenous fantasy is a more diegetic approach, framing educational

activities, so they are thematically and/or narratively linked to the game world. In *Arena*, we adopted endogenous fantasy as a major driving principle. It would be easy to reject our science fiction world and adventure story as frivolous and unserious, but we agree with Malone and others (Garris et al., 2002; Malone, 1980; Malone & Lepper, 1987; Prensky, 2005) that fantasy can be a powerful tool for motivating learning. As such, we have embraced the playful fun of our unique game world, and we are constantly seeking ways to leverage it to enhance our players' learning experience.

### Reinforcement Learning

Reinforcement learning is a short-term neurocognitive process that can enhance engagement through dopamine release and uptake in the brain (Eyal, 2014; Howard-Jones, Demetriou, Bogacz, Yoo, & Leonards, 2011; Koeppe et al., 1998). Reinforcement learning relies upon environmental triggers that can inspire curiosity and motivate players to take actions in anticipation of variable rewards. This process is also sometimes colloquially referred to as a "dopamine loop." Players encounter objects that can be interacted with, ultimately resulting in a variable reward. The variability of the reward and the player's ability to reinvest it into the game give it endogenous value (Schell, 2008), propelling players through additional such trigger-action-reward-reinvestment cycles (Eyal, 2014).

Our current version of *Arena* does not take very good advantage of reinforcement learning, but the role-playing game (RPG) genre is well suited to leverage reward cycles and reinforcement learning techniques. Our future work on *Arena* involves expanded thinking about the role of "loot" mechanics like those found in many RPG video games as a mechanism to motivate learning.

For example, furniture in various locations throughout *Arena's* world could be clicked on, leading to beneficial language-image pairing (Jones, 2004). Some furniture might also provide randomized bonuses or rewards. These rewards—money, weapons, power-ups, etc.—could be "reinvested" into the game, making the player more powerful or giving them new or improved abilities. This reinvestment would encourage further exploration in pursuit of new rewards, and thus continued exposure to Spanish.

### DESIGNER'S INSIGHTS

Our theoretically-driven approach guided our design of *Arena*, enabling us to make many design decisions along the way. Yet the act of building a working version of the game also became an important source of insight over time, revealing a number of surprising—and surprisingly interesting—challenges. In the remainder of the paper, we note a series of important designer's reflection points that

have inspired us, confronted us, and motivated us to begin an entirely new version of *Arena*.

### Reflection Point 1: Second language Storytelling

Our reliance upon diegesis, fantasy, and naturalistic interactions created significant challenges for us, especially the challenge of telling a compelling story in a language players do not know. Many language games eschew diegesis, relying more on puzzle, matching, or quiz mechanics, including points, badges, and the like. We wanted to avoid these techniques, creating a sensation for players of having been "dropped into another place."

However, we have begun to recognize the challenge of delivering language at a preschool or elementary level while telling a story that can capture the imagination of young adults. We consider this juxtaposition of conflicting requirements as a "wicked" problem, which Rittel and Webber (1984) characterize as having, among other things, good versus bad (rather than true-or-false) solutions, extreme uniqueness, vague formulations, and divergent possible solutions.

The "wickedness" of the second language storytelling problem came through most clearly for us during several playtests that we conducted as part of our design journey. These tests included: (a) a sequence of early observations and interviews conducted by an undergraduate research student with five test players; (b) two individual "think-aloud" observations conducted by our design team later in development using a more complete version of the game; and (c) two focus groups (4 participants in group one and 5 in group two) directed at our most complete version of the game to date, where participants played the game and participated in a semi-structured group discussion. None of these tests were formal scientific evaluations that produced generalizable, empirical data. They were open-ended and design-oriented, quick explorations of how different players reacted to the game we were building. Yet they were highly instructive, delivering many design-oriented insights.

In very early prototypes of *Arena*, our interest in authentic tasks and interactions, as well as diegesis and fantasy, saw us favoring detailed, sophisticated stories, which we would write in English and then translate into Spanish (see Figure 5). These featured complex storylines with many characters, dramatic twists, subtle nuances of plot, and meaningful character arcs—the stuff of good fiction writing (Vogler, 2007).

Despite our ambitions, our initial approach did not work. Our first observations and interviews helped us to recognize that our nuanced storytelling came bundled with many undesirable language requirements: complex grammar, changing tenses, shifting emotional tone, and advanced vocabulary. Players commented on their inability to understand what was going on and the fatigue that our lengthy conversations

**PART 4:** “Emerge into the desert. You run into a friendly prospector with her drilling rig parked near the gate. She warns you about the dangers of the desert and suggests that you borrow a small pistol to protect yourself from wildlife. You ask her about Diego, and she thinks she knows who you mean. She suggests checking a campsite near a large rock formation known as *Oso de Roca*. It is located somewhere to the northwest.”

**FIGURE 5.** Early takes on *Arena* included complex storytelling. Here, we summarize part 4 of a 6-part opening quest. Note the sheer amount of background information we wanted to convey through conversations meant to be delivered only in Spanish.

caused. Our approach to story deterred many of our play-testers from making much effort to engage with Spanish.

We tried a new approach. Recognizing that too much information was overwhelming players, we pared down the story to its most basic essence. We wrote and translated dialogue options that were very short (around 4-10 Spanish words per dialogue option). This sacrificed a lot of story detail, but we hoped it would make the conversations more digestible and understandable for players.

Our two later think-aloud sessions and our focus groups showed that our much simplified conversations still felt long, complex, and tiring. Even the simplest possible version of a rich, interactive story seemed to be too complex to deliver in the TL alone. This was—and is—a significant frustration because our interest in diegesis means we have invested a lot into using naturalistic narrative to convey the TL in *Arena*.

In the real world, a trip to another country necessitates deep immersion in the local language, a sometimes frustrating, confusing experience (Polanyi, 1995). We wanted to recreate this immersion in a virtual world, including the attendant challenges. At the beginning of the *Arena* project, this felt like it had a lot of potential to be fun and exciting. Our practical work so far on second language storytelling has shown that this starting assumption may not be true.

#### *Next steps: New approaches to L2 storytelling*

We retain our interest in rich storytelling, but we recognize two problems: (a) we must not overload players with information—in any language—and (b) we need to start our second language experience at a much more basic level than we first thought. Drawing inspiration from language activities found in applications like *Duolingo* (<https://en.duolingo.com/>), we have prototyped a new conversation mini-game that simultaneously conveys narrative and gives players an opportunity to learn introductory vocabulary through a matching exercise. Paper prototypes are helping us to test and understand whether this new approach will be successful.

Players who encounter an NPC will be presented with a short sentence in English that captures the essence of what this character is about. Several words in the sentence will be highlighted, and the player will be given a short menu of between 3-8 Spanish words. Players must drag and drop the correct translation onto the highlighted English. Doing this successfully will “win” the encounter, ending the mini-game and revealing a more detailed (but still brief) monologue, and variable reward drops (in the spirit of reinforcement learning) make these encounters meaningful and useful. Mistaken translations can be corrected—for a price.

Though this feels less diegetic than our earlier “natural conversation” approach, we have adjusted our story to justify the vocabulary matching activity. In the new version of the game, Brock has been implanted with a robotic artificial intelligence called a “Spider.” This device gives him special powers, but also saps his intellect over time, necessitating that the player “help” him through L2 interactions. We believe this diegetic justification will keep our NPC interactions feeling natural, authentic, and relevant.

#### **Reflection Point 2: Ease-of-use Versus Real Engagement**

Ease-of-use is normally considered to be an essential aspect of interface design (Febretti & Garzotto, 2009; Nielsen, 1993; Norman, 2002; Schell, 2008). Yet in a learning environment, making things too easy can sometimes be detrimental: mistakes, false steps, and struggles are important. We have encountered an interesting conundrum related to our storytelling challenge: how to design the *Explorer* so that it makes language interactions easy, yet not so easy as to suppress active learning.

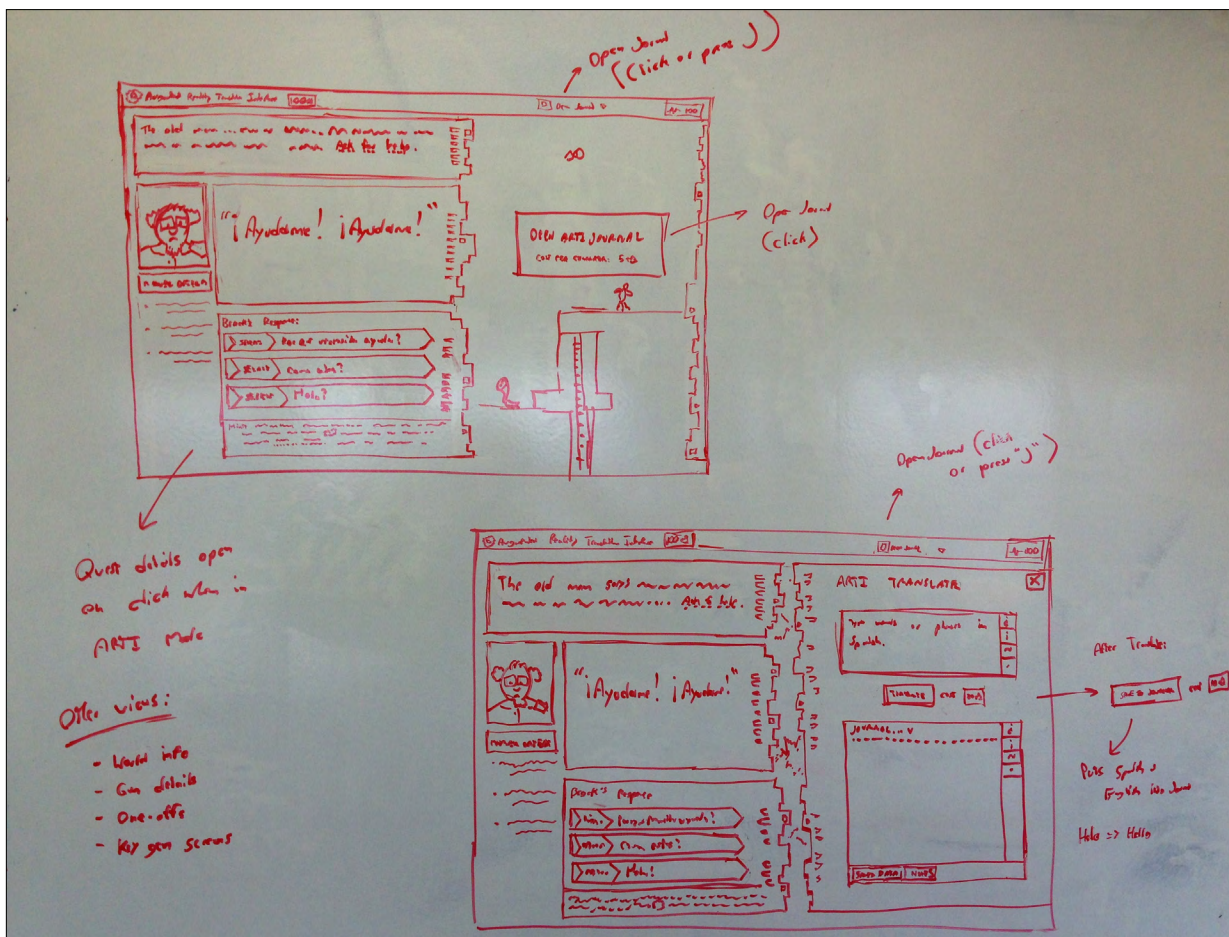
In early versions of *Arena*, we were concerned that the *Explorer* does not become a drain on player patience, so we implemented a low-effort, easy-to-use click interaction for translation. As an NPC talked, players could simply click on words or phrases, and a brief translation would appear (see Figure 6). We initially tied this to a cost: a finite supply of electrical “charge” for the *Explorer*. Keeping reinforcement learning in mind, the cost was meant to incentivize players to click less, encouraging them to commit frequently used vocabulary to memory so that they could spend their resources wisely.

In our playtests of this early prototype of the *Explorer*, we noticed that many players were clicking thoughtlessly and passively. Furthermore, our cost mechanic had very little impact on decision-making, and actually surprised several players when they noticed it—probably because the “charge” did not feel like a reward and had no real value anywhere else in this early version of the game (see Figure 7).



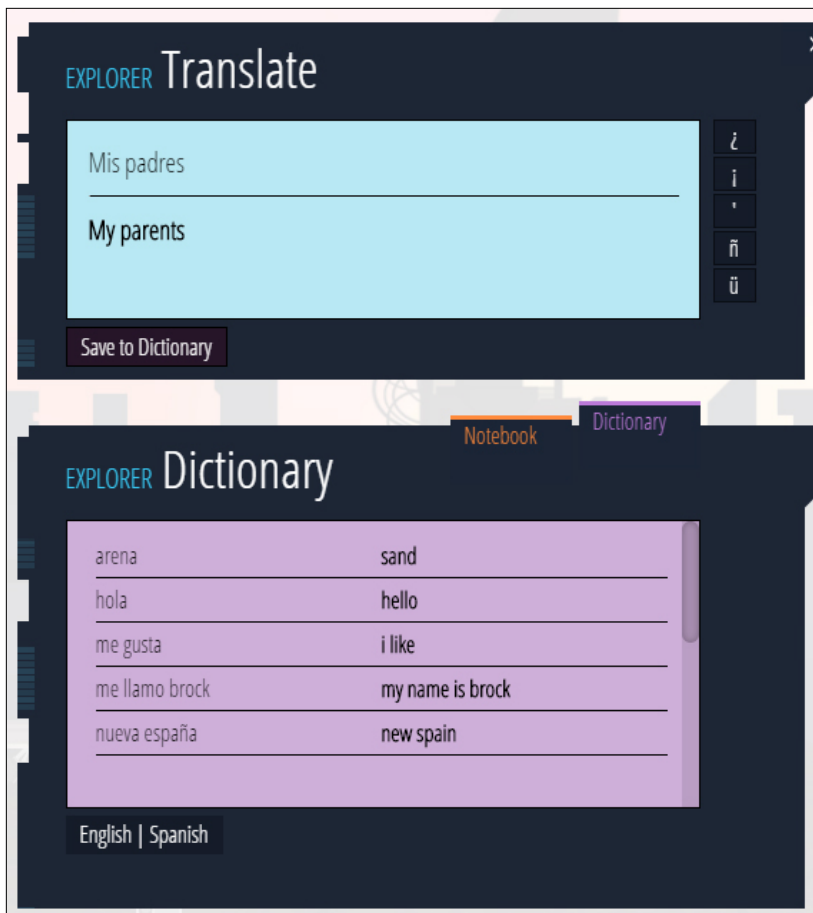


**FIGURE 6.** An early version of the *Explorer* used a click interaction. When the player clicked on a word, a translation (e.g., 'Help me!') would appear. This version of the *Explorer* used a number of temporary graphics that were replaced as our design of *Arena* progressed.



**FIGURE 7.** We redesigned the *Explorer* interface to emphasize a more active approach to translation, but did not focus enough on incentivizing players to use this interface in fun, playful, concrete ways.





**FIGURE 8.** The current version of the *Explorer* uses a typing interaction, and also allows players to save translated words and phrases. However, this version of the *Explorer* is very fatiguing to use and not well connected to other play mechanics.

Ultimately, instead of trying to actively learn the TL, players simply clicked and clicked and clicked in order to see the English version of the story. When they ran out of charge, they were immediately frustrated and annoyed. Our emphasis on making interaction simple and painless had resulted in a deeply negative outcome for learning.

In a few tests, however, we noticed that players would quiz themselves, working out a translation on their own, then clicking to test how correct they were. For example, “I think when Colonel Dice says ‘manzanas’ he means apples; is that right?” This was a very desirable behavior that we wanted to model in future versions of the interface, giving the player active ownership over their learning experience. Two key considerations seemed to be at issue: (a) designing an interaction that would encourage less passivity, and (b) incentivizing the player to use the redesigned interface.

Perhaps incorrectly, we focused primarily on the first issue. We changed *Arena* so that *Explorer* translations would be based on typing rather than clicking, a more active way to interact with the TL. We also eliminated the cost mechanic,

making it possible for players to type as much as desired and at any time. Players who typed would necessarily spend cognitive effort thinking about the words, wording, spelling, and pronunciation, leading to more repetition, memorization of key vocabulary, and a more engaged role as learners (e.g., Carter & Matre, 1975).

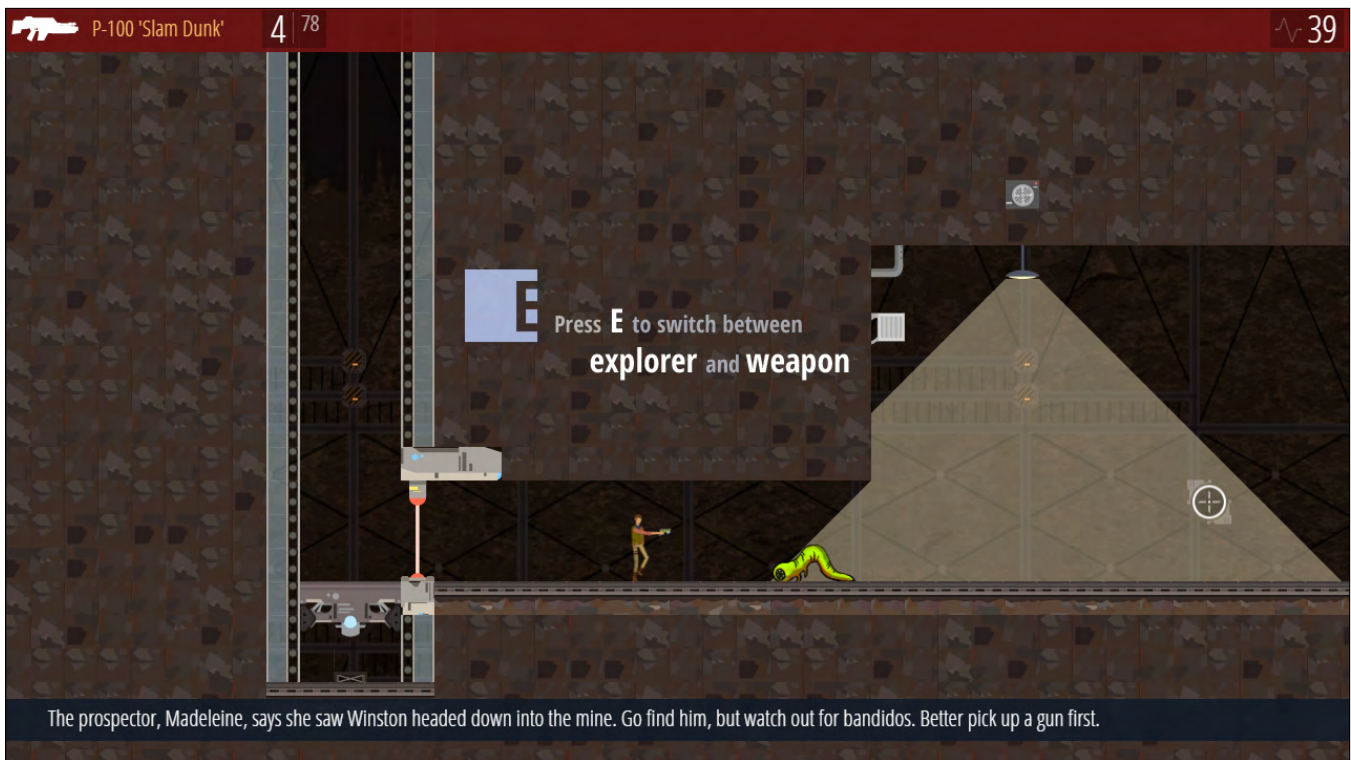
We understood that asking players to type would be risky, but our redesigned *Explorer* also put a variety of useful active learning tools into the player’s hands (see Figure 8).

Many players, however, far from taking on a more active role with our cognitively demanding and more fully featured interface, simply skipped over translation altogether. We had actually made our problem worse. For players who knew almost no Spanish, translating even simplified conversations was an enormous and time-consuming chore. Because *Arena*’s quests were linear and could not be “failed,” and because clicking on the world was largely optional, fatigue was a far stronger force for players than their desire to understand the story.

#### *Next steps: A new explorer interface*

As designers, we suspect that for most players, a concretely incentivized, more “game-like” and “less tool-like” (Prestopnik & Crowston, 2012) *Explorer* interface will be necessary. Our new, more game-like interface should be: fun, quick to play, repeatable (so learning is reinforced), only moderately demanding from both cognitive and kinematic standpoints, tailored to the player’s current language abilities, bound to the story, and tightly integrated into the rest of the game through a variety of specific mechanic-based incentives (e.g., power-ups, experience points [XP], in-game currency, and the like).

As described earlier, we are actively working on a conversation mini-game that, in addition to accommodating our story-based concerns, also addresses our desire for a non-fatiguing, easy-to-use *Explorer*. The quick drag-and-drop interaction style eliminates the need to type but requires players to actively think about the vocabulary and its meaning. The “monologue” approach means that individual NPC interactions are brief and therefore much less fatiguing than longer back-and-forth conversations. The connectivity to other mechanics—Brock’s Spider, variable reward drops—keeps the language activity interesting and relevant to the overall game.



**FIGURE 9.** Combat is an important part of the overall experience. Combat is a primary vehicle for fantasy, and is intended to give players a break from the fatigue of L2 immersion experienced during conversations, puzzle solving, exploration, and translation.

### Reflection Point 3: Connecting Combat (Play) to Language (Work)

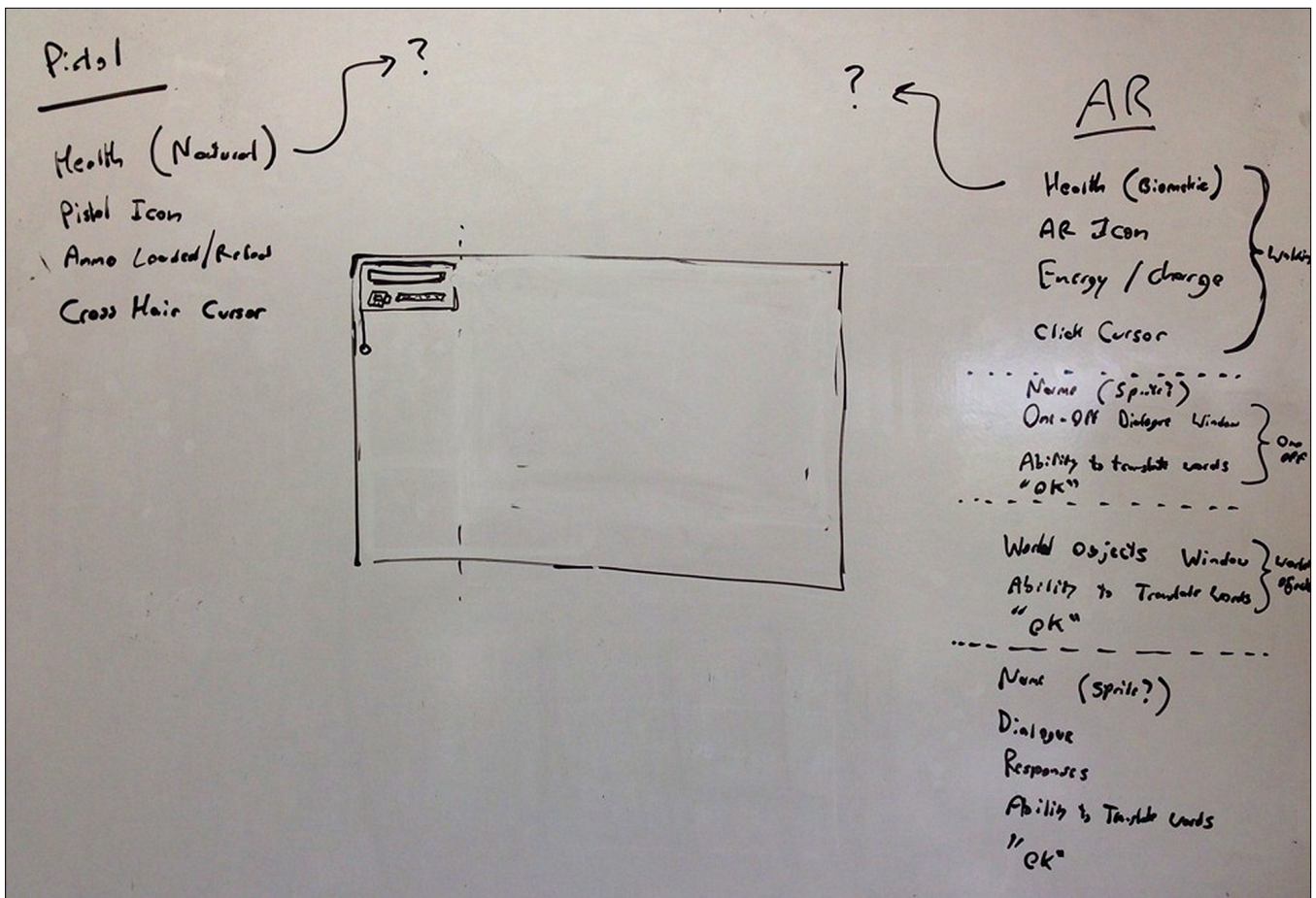
From the beginning of our design process, we conceived of combat as a critical element of *Arena's* play style. Many learning games eschew fighting and combat, considering these staples of modern video gaming to be somehow inappropriate in an educational context. On the other hand, we consider action to be a compelling ingredient for a game meant to reach our target demographic: younger male learners. Commercial games for young male gamers often feature combat and conflict and yet can still be noted for their educational potential, for example, the *Civilization* series (Shaffer, Halverson, Squire, & Gee, 2005). We also take the view that combat and conflict are integral aspects of many computer games—and, indeed, the human experience—and therefore entirely appropriate (perhaps even necessary) for attracting and engaging certain kinds of learners.

Combat mechanics in games can afford challenges that engage players' minds and reflexes, helping them to achieve a flow state (Csikszentmihalyi, 1990; Fu, Su, & Yu, 2009; Rogers, 2010; Schell, 2008; Sweetser & Wyeth, 2005) wherein they become so engaged as to lose track of time. Combat mechanics can also be designed to enhance uncertainty (Costikyan, 2013) and connect to reward feedback systems, causing or enhancing a variety of cognitive and motivational benefits (Koepp et al., 1998).

In the current version of *Arena*, we start the player unarmed and unprepared for the dangers they might encounter. Early in the game, helpful characters explain some of these dangers: bandits, local wildlife, and agents from two warring crime families. The players are eventually given a weapon so they may defend themselves (see Figure 9).

We designed *Arena* with an underlying assumption that combat would be a key aspect of the fantasy world, and a welcome break for players who are feeling overwhelmed by the language-centered portions of the game. *Arena* would intentionally oscillate between cognitively challenging moments of learning (quest conversations, exploration, puzzles) and faster-paced, exhilarating moments of combat that challenge players' senses of timing, strategy, and planning (see Figure 10). We favored the "oscillation" approach so much, in fact, that we designed few provisions to connect combat to language. We expected that a player's desire to engage in combat "play" in *Arena* would inherently make the language both useful and exciting.

Our assumptions about combat were deeply embedded in *Arena's* design from the beginning. Indeed, some of our earliest discussions as a design team were about the ways that players could explicitly switch between "exploration" and "combat" modes (by pressing the "E" key, with different functions available in each mode). Yet our playtesters across all our various evaluation exercises have reported feeling a strong "disconnect" between combat and language. *Arena's*



**FIGURE 10.** A very early whiteboard sketch that emphasizes *Arena's* two modes of play: combat (pistol) and exploration (AR). Note the concern about reflecting player health in both modes, with no decision about how to do this yet made. With a polished vertical slice behind us, we are revisiting our foundational assumptions about how *Arena* can more explicitly tie combat to language and vice versa.

moments of play do not seem bound to its moments of work, reducing enthusiasm for combat and language alike.

*Next steps: A new approach to conflict*

As with our revised language mini-game, we have re-envisioned combat as an “arcade” event that is more directly connected to language.

In our new design, language activities result in variable “loot” drops, which include weapon upgrades of various kinds. These weapon upgrades have a finite lifespan, so players will constantly be on the hunt for new ones, motivating them to explore the world and seek out NPC encounters. Additionally, combat—as well as puzzles within the game—will require the player to use the powers afforded by Brock’s AI Spider. These include abilities such as enhanced speed, telekinesis, the ability to hack enemy robots, and more. We have designed a mechanic such that each use of the Spider injects “venom” into Brock’s mind, gradually making language tasks more challenging. To reduce this venom and stave off death, the player can do extra language activities, spawning additional loot drops as well as making language tasks easier

again. This is to say that combat and language now coexist in a dynamic relationship where player performance in one can impact performance in the other.

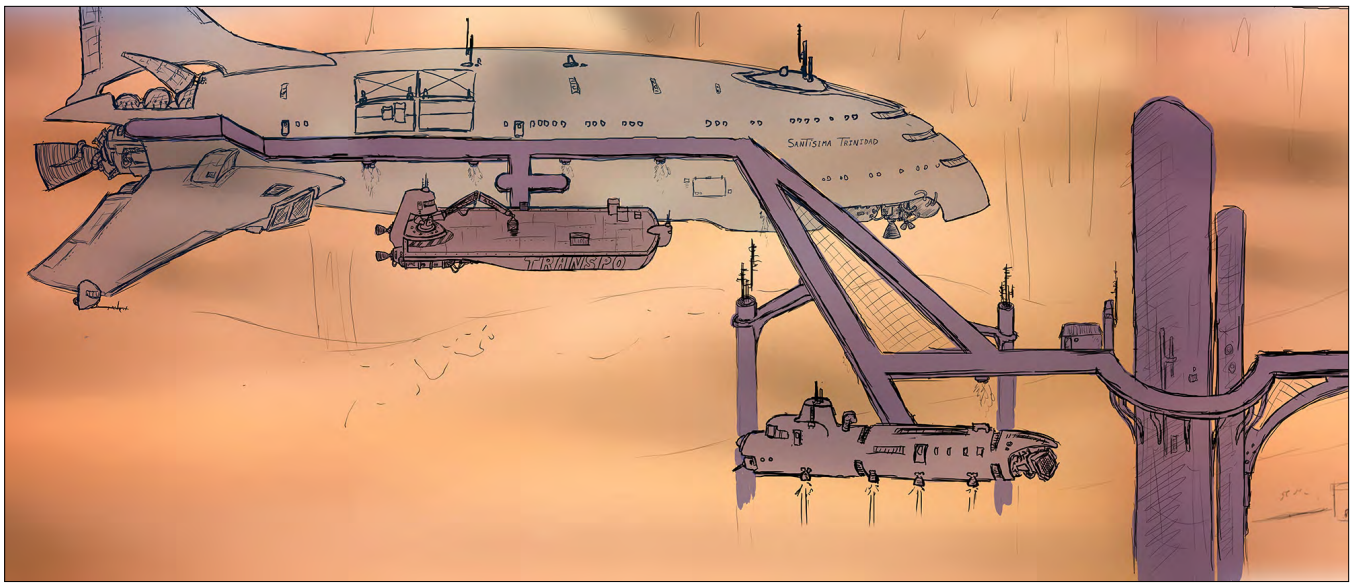
To connect work and play, we are heavily drawing upon notions of reinforcement learning and the dopamine loop. In addition, we are carefully crafting every aspect of each game level, no longer placing enemies, objectives, or information in an ad hoc way. We have learned a great deal from our current version of *Arena*, and we are drawing upon those lessons to carefully construct the next version with both play and work interactions in mind.

**Reflection Point 4: Point of View**

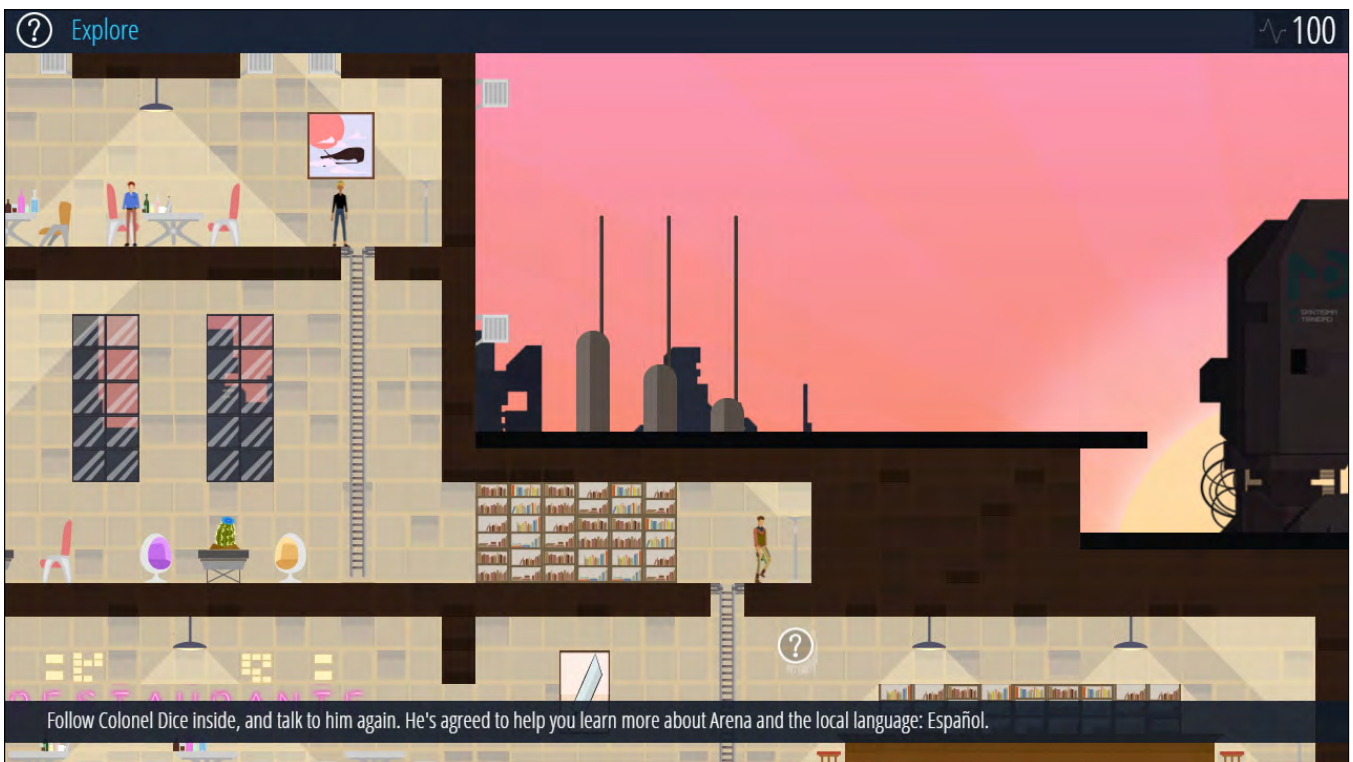
The term “point of view” (POV) refers to the visual frame of the game, the view through which players see and experience the action. POV is an important decision to make about any game. It is a choice that requires both technical and experiential factors to be taken into account.

Given the mostly technical nature of our development team, as well as our interest in building out *Arena* from scratch,





**FIGURE 11.** Though we ultimately settled on a side-screen 2D POV, early on we instinctually felt the need to enhance player feelings of “presence,” going so far as to mock up levels in a 2.5D viewpoint that simulated some aspects of the more desirable 3D POV. Note the pseudo perspective visible in the paths and the tops of the ships.



**FIGURE 12.** Arena can be dangerous; bandits, thugs, and the environment itself give players action-oriented challenges and obstacles to overcome as they play through the game narrative. Yet our 2D POV pulls players out of the action rather than putting them into it, making combat less exciting and language less personal than it might otherwise be.

our early team discussions strongly emphasized programming languages, tools, and implementation techniques. Conversations about the experiential aspects of POV were overlooked.

The makeup of our team suggested that a web implementation using the HTML5 canvas element and a well-regarded game development application program interface (API) called Phaser (<http://phaser.io/>) would be a good choice. Phaser is a 2D game API, and so we quickly settled on making *Arena* a 2D action role-playing game (2D ARPG), favoring a side-scrolling viewpoint that limited player motion to two axes of movement (up-down; left-right). We were excited to begin breathing life into the world of *Arena*, so we thought little more about this seemingly minor decision for nearly three semesters as we worked.

Player POV has a powerful impact on how much players feel like they are “really there,” a feeling known as “presence” (Heeter, 1992; Lombard & Ditton, 1997). A 3D POV closely approximates our normal, human viewpoint, and can help players to feel like they are interacting with real characters speaking a real second language in a real world. We initially planned for a “2.5D” viewpoint (see Figure 11) that approximates an overhead 3D POV—not as strong as a fully 3D view, but stronger than most other 2D viewpoints. In the end and for technical constraints, we rejected our instincts and settled upon our side-view 2D POV.

With a fully implemented vertical slice of *Arena* behind us, we are starting to see how our choice of a 2D POV makes players feel less present, and therefore less connected to language-learning goals, our game world, and the non-player characters (NPCs) inhabiting it. For example, in a 3D RPG, talking to an NPC is as easy as walking up to them. As in the real world, the NPC fills the screen, faces the player, and can have a realistic conversation including gestures, eye contact, and more. In a 2D environment, much of this dynamic is lost. Walking up to an NPC involves moving “across” a level to stand near the NPC. The characters do not really face each other, certainly not in the dramatic first-person framing of the 3D world. Gestures and facial expressions are lost. The inauthenticity of this kind of interaction is subtle, but powerful. In *Arena*, conversations feel less real than in 3D games (see Figure 12).

*Next steps: Contending with the 2D POV*

Though our design team is not yet prepared to re-envision *Arena* as a fully 3D experience, we are planning to modify the player POV to take advantage of feelings of presence and the affordances of the 2D medium. *Arena* will now be played in three modes: (a) exploration, (b) combat, and (c) language.

We plan to retain the side-view POV for exploration. Players will operate as detectives in this view, navigating visually rich environments and looking for clues to various game

objectives. The 2D side-view affords an enhanced, “overview” POV on the world, making it easy to explore by clicking on objects, NPCs, and enemies as they are encountered. This works well in our current version of *Arena*; it is a viewpoint that we consider to be highly appropriate for exploration activities.

Combat will take place in a new 2.5D overhead view. This mode will open when players encounter enemies in the exploration view. Combat itself will occur in closed arena-like spaces (a thematic connection to the game title) that are dynamically styled to reflect the look and feel of the current exploration location. The 2.5D POV gives us the flexibility to craft a 2D combat experience that feels natural—a look down onto a battlefield, rather than sideways into an artificial 2D plane. As part of our redesign, we will reimagine the control scheme for combat so that it feels appropriate for a 2D adventure experience.

Finally, language activities will take place in a first-person (albeit still 2D) view. When players encounter NPCs or other clues during exploration, a first-person mini-game view will open, placing an image of the NPC front and center. We hope this view will enhance player feelings of presence, as well as the immediacy and naturalness of NPC conversations.

### **Reflection Point 5: Settling on a Target Player Demographic**

Why should players be forced to take on the role of Brock Springer, a young man? (see Figure 13). The question was raised in various forms by many of the domain experts we were consulting with, and we were initially caught off guard. The decision had been uncontroversial in our design team, even with the many women who are working on the game. We had also gone to lengths to ensure that our cast of characters represented a broad cross-section of humanity, from the peppery female prospector Madeleine, a friend and ally of Brock’s, to the vile bandit leader Pedro Ladrones, to his arch nemesis, Romona Soberbias, leader of the upscale Soberbias crime empire.

The questions about Brock were good for our team, forcing us to revisit a decision that felt right but had not been thoroughly articulated. *Why should* Brock be a young man? *Why not* feature a female protagonist instead? *Why not* give players a choice?

The concerns about Brock were important to us because identifying with the player character (PC) in a game is essential to feeling a sense of immersion during play (Schell, 2008). This is a question of point-of-view (POV) in the broadest sense: we wanted our players to become Brock and lose themselves in his world. If players could not identify with our protagonist’s POV, that would be a significant confound for our future research.



**FIGURE 13.** *Arena* has a male protagonist, Brock Springer, chosen initially because of the interests of the game developers, but later confirmed because of our interest in reaching younger male learners.

At the same time, we *liked* Brock, and so we could not help asking a counter-question: why *shouldn't* Brock be a young man? What was so wrong with that?

One of our domain experts, a Spanish instructor at the college level, related an anecdote that helped us to begin seriously thinking about our decision to frame the game through the eyes of Brock Springer. She related that in her experience most second language majors are women, and that few men stick with formal language instruction beyond the required courses.

The research supports her experience. In English-speaking countries, boys and girls do show a noticeable enthusiasm gap for second language learning, especially as they grow beyond required curriculum, with boys showing dramatically less interest (e.g., Jones & Jones, 2002; Pavey, 2006). Boys and girls also prefer different kinds of games, with boys typically preferring more action-oriented and violent forms of play (e.g., Cassell & Jenkins, 2000; Olson et al., 2007). We began to realize that our choice of a male protagonist might have been fortuitous and advantageous. We envisioned an archetypal “persona” player, a young man who had some formal Spanish language instruction but lost interest. We saw an opportunity for *Arena* to attract middle school, high school, and even college-aged young men back to language learning by delivering it in a form that was specifically appealing to them.

*Next steps: A male protagonist... for now*

Our decision to focus on male players was ultimately guided by our research interest, but our decision to limit ourselves

to *only* a male protagonist in the game is primarily pragmatic and may yet change. Providing a player with a choice of characters vastly expands the scope of the game and (especially) the amount of art that will need to be created. Adding a second female protagonist would effectively double the amount of art to be created for the player character, a steep challenge for a student-oriented development team. So with our research objectives and target demographic in mind, it makes sense to prioritize our design activities to give our players just one POV on the game world, at least for the time being. However, this is something we may revisit in the future, especially if we broaden our research interest to other populations.

## CONCLUSION

Our current implementation of *Arena* is a well-developed “vertical slice” of the larger game that we envision. It includes five levels, six full conversations with NPCs (in both Spanish and English), and prototype implementations of a wide variety of game mechanics, including combat and language puzzles. In many ways, it is a very successful demonstration of our core idea: that a virtual world might substitute for living in a place to learn its language. However, as this design case illustrates, our design journey has birthed many reflection points that suggest ways to refine *Arena* as a learning experience and vehicle for empirical study. This is a path we are now actively pursuing.

With our progress so far and the upcoming version of *Arena* in mind, this “conclusion” might better be described as one final point of reflection. Designing games with a purpose is a deeply challenging undertaking (von Ahn, 2006, 2013; von Ahn & Dabbish, 2008), and, as with all wicked problems, there is no definitive moment of completion built into our design process. Rather, we plan to iterate on *Arena's* design until our system accomplishes some of what we intend. An aspirational metric of success would be when *Arena* prevails in the marketplace as both an entertainment game *and* a language learning tool. That is, our approach could be considered “wrong” until it is as popular as *Angry Birds* (<https://www.angrybirds.com/>) and as useful as *Rosetta Stone* (<http://www.rosettastone.com/>).

Because *Arena* is a research tool, primarily meant to help us explore a problem space, rather than to definitively conquer it, we do not expect (or even hope) to reach these heights. However, we understand that many of our future playtesters and users may subconsciously apply this standard as they help us to evaluate and study our work. This will present significant additional challenges, as we contend with high



expectations for professionalism and polish while developing in a student-oriented, lab environment.

Perhaps our most significant insight from work on *Arena* so far is that injecting work-like activities into traditional genres of computer gameplay (such as an ARPG) is not so straightforward or obviously beneficial as might be imagined. When games like *Arena* emphasize play, learning objectives can sometimes feel like an afterthought; when learning is emphasized, often play mechanics and fun can suffer.

Finding a harmonious—even synergistic—balance between work and play in games with a purpose is an exceptionally wicked problem indeed. Nonetheless, our own design process, arduous and difficult though it has been, continues to be rewarding, informative, and worthwhile.

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## REFERENCES

- Carter, J. F., & Matre, N. H. V. (1975). Note taking versus note having. *Journal of Educational Psychology*, 67(6).
- Cassell, J., & Jenkins, H. (Eds.). (2000). *From Barbie to Mortal Kombat: Gender and computer games*. Cambridge, MA: MIT press.
- Costikyan, G. (2013). *Uncertainty in games*. Cambridge, Massachusetts: The MIT Press.
- Csikszentmihalyi, M. (1990). *The Psychology of optimal experience*. New York, NY: HarperCollins Publishers.
- De Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? *Computers & Education*, 46(3), 249-264.
- Eyal, N. (2014). *Hooked: How to build habit-forming products*. New York, NY: Penguin Group.
- Febretti, A., & Garzotto, F. (2009). Usability, playability, and long-term engagement in computer games. In *CHI '09 Extended Abstracts on Human Factors in Computing Systems*, Boston, MA, USA.
- Fu, F.-L., Su, R.-C., & Yu, S.-C. (2009). EGameFlow: A scale to measure learners' enjoyment of e-learning games. *Computers & Education*, 52(1), 101-112.
- Galloway, A. R. (2006). *Gaming: Essays on algorithmic culture*. (Electronic Mediations, Vol. 18). Minneapolis, MN: University of Minnesota Press.
- Garris, R., Ahlers, R., & Driskell, J. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, 33(4), 441-467.
- Gass, S. M. (2000). Changing views of language learning. In H. Trappes-Lomax (Ed.), *Change and continuity in applied linguistics: Selected papers from the annual meeting of the British association of applied linguistics* (pp. 51-67). Edinburgh, UK: British Association of Applied Linguistics.
- Heeter, C. (1992). Being there: The subjective experience of presence. *Presence: Teleoperators and Virtual Environments*, 1(2), 262-271.
- Hevner, A. R. (2007). A Three cycle view of design science research. *Scandinavian Journal of Information Systems*, 19(2), 87-92.
- Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly*, 28(1), 75-105.
- Howard-Jones, P., Demetriou, S., Bogacz, R., Yoo, J. H., & Leonards, U. (2011). Toward a science of learning games. *Mind, Brain, and Education*, 5(1), 33-41.
- Jones, B., & Jones, G. (2002). *Boy's performance in modern foreign languages: Listening to learners*. Homerton College, UK: Centre for Information on Language Teaching and Research.
- Jones, L. (2004). Testing L2 vocabulary recognition and recall using pictorial and written test items. *Language Learning & Technology*, 8(3), 122-143.
- Koepp, M. J., Gunn, R. N., Lawrence, A. D., Cunningham, V. J., Dagher, A., Jones, T., . . . Grasby, P. M. (1998). Evidence for striatal dopamine release during a video game. *Nature*, 393, 266-268.
- Krashen, S. (1985). *The input hypothesis: Issues and implications*. New York: Longman.
- Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication*, 3(2).
- Long, M. (1985). Input, interaction and second language acquisition theory. In S. M. Gass & C. G. Madden (Eds.), *Input in second language acquisition* (pp. 377-393). Rowley, MA: Newbury House.
- Long, M. (1996). The role of linguistic environment in second language acquisition. In W. C. Richie & T. K. Bhatia (Eds.), *Handbook of research on language acquisition: Vol. 2. Second language acquisition* (pp. 413-468). New York: Academic Press.
- Malone, T.W. (1980). *What makes things fun to learn? Heuristics for designing instructional computer games*. Paper presented at the Proceedings of the 3rd ACM SIGSMALL symposium and the first SIGPC symposium on Small systems, Palo Alto, California, United States.
- Malone, T.W., & Lepper, M. (1987). *Making learning fun: A taxonomy of intrinsic motivations for learning*. Hills-Dale, NJ: Erlbaum.
- Nielsen, J. (1993). *Usability engineering*. Boston, MA: Academic Press.
- Norman, D. A. (2002). *The Design of everyday things*. New York: Basic Books.
- Olson, C. K., Kutner, L. A., Warner, D. E., Almerigi, J. B., Baer, L., Nicholi, A. M., & Beresin, E. V. (2007). Factors correlated with violent video game use by adolescent boys and girls. *Journal of Adolescent Health*, 41(1), 77-83.
- Pavey, S. (2006). Boys learning languages. *Babel*, 41(1), 4-11.

- Petersen, M. (2010). Computerized games and simulations in computer-assisted language learning: A meta-analysis of research. *Simulation & Gaming, 41*(1), 72-93.
- Polanyi, L. (1995). Language learning and living abroad: Stories from the field. In B. F. Freed (Ed.), *Second language acquisition in a study abroad context* (pp. 271-291). Amsterdam: Benjamins.
- Prensky, M. (2005). Computer games and learning: Digital game-based learning. *Handbook of computer game studies, 18*, 97-122.
- Prestopnik, N. (2013). *Design science in human-computer interaction: A model and three examples* (Doctoral dissertation). Retrieved from [http://surface.syr.edu/it\\_etd/83/](http://surface.syr.edu/it_etd/83/)
- Prestopnik, N., & Crowston, K. (2012, October). Purposeful gaming & socio-computational systems: A citizen science design case. In *ACM Group: International Conference on Supporting Group Work*, Sanibel Island, FL.
- Qin, H., Rau, P.-L. P., & Salvendy, G. (2009). Measuring player immersion in the computer game narrative. *International Journal of Human-Computer Interaction, 25*(2), 107-133.
- Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research and Development, 44*, 43-58.
- Rittel, H. J., & Webber, M. M. (1984). Planning problems are wicked problems. In N. Cross (Ed.), *Developments in design methodology* (135-144). New York: John Wiley & Sons.
- Rogers, S. (2010). *Level up: The guide to great video game design*. Chichester, West Sussex, UK: John Wiley and Sons Ltd.
- Schell, J. (2008). *The art of game design: A book of lenses*. Burlington, MA: Elsevier, Inc.
- Shaffer, D. W., Halverson, R., Squire, K. R., & Gee, J. P. (2005, June). *Video games and the future of learning* (No. 2005-4). Wisconsin Center for Education Research Working Paper. Retrieved from [http://wcer-web.ad.education.wisc.edu/docs/working-papers/Working\\_Paper\\_No\\_2005\\_4.pdf](http://wcer-web.ad.education.wisc.edu/docs/working-papers/Working_Paper_No_2005_4.pdf)
- Stam, R., Burgoyne, R., & Flitterman-Lewis, S. (1992). *New vocabularies in film semiotics*. London: Routledge.
- Sweetser, P., & Wyeth, P. (2005). GameFlow: a model for evaluating player enjoyment in games. *Computers in Entertainment, 3*(3), 3-3.
- Vogler, C. (2007). *The Writer's journey*. Saline, MI: McNaughton & Gunn, Inc.
- von Ahn, L. (2006). Games with a purpose. *Computer, 39*(6), 92-94.
- von Ahn, L. (2013). *Duolingo: learn a language for free while helping to translate the web*. Paper presented at the Proceedings of the 2013 international conference on Intelligent user interfaces, Santa Monica, CA, USA.
- von Ahn, L., & Dabbish, L. (2008). Designing games with a purpose. *Communications of the ACM, 51*(8), 58-67.
- Warschauer, M., Turbee, L., & Roberts, B. (1996). Computer learning networks and student empowerment. *System, 24*(1), 1-14.