A Step Towards the Future of Role-Playing Games: The SpyFeet Mobile RPG Project

**Aaron A. Reed, Ben Samuel, Anne Sullivan, Ricky Grant, April Grow, Justin Lazaro,
Jennifer Mahal, Sri Kurniawan, Marilyn Walker, Noah Wardrip-Fruin**

Expressive Intelligence Studio / Natural Language and Dialogue Systems Lab
University of California, Santa Cruz
1156 High Street, Santa Cruz, California
{aareed,bsamuel,anne,rgrant,agrow,jlazaro,jkmahal,srikur,maw,nwf}@soe.ucsc.edu

Abstract

Meaningful choice has often been identified as a key component in a player's engagement with an interactive narrative, but branching stories require tremendous amounts of hand-authored content, in amounts that increase exponentially rather than linearly as more choice points are added. Previous approaches to reducing authorial burden for computer RPGs have relied on creating better tools to manage existing unwieldy structures of quests and dialogue trees. We hypothesize that reducing authorial burden and increasing agency are two sides of the same coin, requiring specific advancements in two related areas of design and technology research: (1) dynamic story management architecture that represents story events abstractly and allows story elements to be selected and re-ordered in response to player choices, and (2) dynamic dialogue generation to allow a single story event to be revealed differently by different characters and in the context of dynamic relationships between those characters and the player. This paper describes SpyFeet, a playable prototype of a storytelling system designed to test this hypothesis.

Introduction

Players have been embarking on adventures in computer Role-Playing Games (RPGs) for decades. From the dark dungeons of Richard Garriott's *Akalabeth* (Garriott 1980) to the twelve million subscribers enjoying *World of Warcraft* (Pardo, Kaplan, and Chilton 2004), the computer RPG has proven itself a captivating form of entertainment. Over the years RPGs have grown in scope tremendously, both in terms of player base as well as in the visual complexity of the stories they tell. Yet the way these stories are internally represented has changed very little since the genre's inception, leading to difficulties in advancing RPGs to the next level of interactive storytelling. In 2011, *Akalabeth*'s creator Garriott said, "it's hard to identify any significant progress with story in over at least a decade" (Walker 2011).

Meaningful choice has often been identified as a key component in a player's engagement with an interactive narrative (Murray 1997; Crawford 2003; Sullivan, Mateas, and

Wardrip-Fruin 2009). To give players meaningful choice in a story-based game has traditionally required the creation of tremendous amounts of hand-authored story content. This authoring paradigm tends to introduce both structural and workload problems for RPG designers. Traditionally, story is presented through dialogue assembled in fragile, ad-hoc structures glued together with quest flags and conversation trees. These brittle operational logics are prone to error since the relationship between each plot element or conversation point must be created and maintained by hand. Wardrip-Fruin details a typical example of the way such structures can fail in the award-winning RPG *Knights of the Old Republic* (Hudson 2003) where visiting two locations in an unexpected order causes a character who had just participated in an emotional episode with the player to act as if they had never met (Wardrip-Fruin 2009). Bugs like these have severe consequences for narrative continuity, but are difficult to fix because the complexity of flag-driven code can mask serious structural problems in quest logic.

Moreover, each additional player choice point increases the amount of necessary content exponentially rather than linearly (Sullivan, Mateas, and Wardrip-Fruin 2009). The script for *Fallout 3* (Pagliarulo 2008) had 91,000 lines of dialogue; for *Baldur's Gate II* (Ohlen and Martens 2000) it was a staggering 3,257 pages long (Wójcik 2008). Some RPGs such as *Planescape: Torment* (Avellone 1999) contain nearly a million words of dialogue in an attempt to satisfy player demand for more quests, more solutions, and more custom story content for their chosen class or play style (Gillen 2010). Brute-force approaches can only go so far in solving this problem: BioWare's new space epic *The Old Republic* (Ohlen 2011) has had authors developing content since 2006, with a team of at least twelve full-time writers producing hundreds of thousands of lines of dialogue (Thorsen 2008). BioWare's James Ohlen has said "The biggest challenge for this game is the sheer amount of content you have to create... it has more story content than every single other BioWare game that's come before together" (Hidalgo 2010).

Previous approaches to reducing authorial burden have relied mostly on the creation of tools for managing existing structures of quests and dialogue, such as the Aurora

Engine Toolset (BioWare 2002), Elder Scrolls Construction Set (Bethesda Softworks 2002), and Telltale Tool (Carless 2008), or the use of complex AI drama management to manage relations between story events (Mateas and Stern 2003; Thue, Bulitko, and Spetch 2008; Chen et al. 2009). Though we build on this useful prior work, our hypothesis is that reducing authorial burden and increasing agency are two sides of the same coin, requiring specific advancement in two intertwined areas of design and technology research:

1. A dynamic story management architecture that represents story events abstractly (e.g., in terms of information learned, actions taken, etc) and allows story elements to be selected and re-ordered in response to player choices, while remaining simple enough to allow authors to generate content without learning a complex system.

2. A dynamic dialogue generation engine that allows the same interaction (e.g., revealing a plot point) to take place with different characters, at different moments, in the context of shifting relationships between players and NPCs (non-player characters). This requires generating language sensitive to player choices and the history of dialogue interaction.

This paper describes SpyFeet, a playable prototype of a storytelling system designed to test this hypothesis. SpyFeet's design was inspired by our experience writing previous narratively complex interactive stories (Reed 2010) and with expressive language generation for dialogue (Mairesse and Walker 2010). We were further inspired by research showing that physical activity declines precipitously in adolescence, particularly in girls and minorities (Troiano et al. 2008; Arteaga et al. 2010; Ogden, Carroll, and Flegal 2008). These declines tend to track into adulthood (Spruijt-Metz and Saelens 2005; Spruijt-Metz 1995) contributing to a national obesity crisis. Marrying our social and technology goals together, we created an outdoor augmented reality RPG targeted at adolescent girls, implemented using the Android operating system on a smartphone. Rather than replicate existing RPG or exergame systems, we are excited by the possibilities opened up by merging strong narrative with physical movement and travel between real-world locations. We aim to test whether a compelling episodic story whose progression is tied to exercise activities can promote physical fitness in our players by merging the addicting and entertaining quality of RPG play with the flexibility and personalization afforded by the systems outlined above.

Spyfeet Overview

Our first version of SpyFeet demonstrates what we believe to be a novel means of representing story structure in RPGs that is easier to author, enables more player choice, is less prone to error, and is appropriate for use with hand-authored dialogue, generated dialogue, or a combination of the two. While this system has been informed by work in using declarative knowledge representations in interactive storytelling (Charles et al. 2003; Meehan 1977), it is important to note that SpyFeet is not a story generator, and does not use a planner. Rather, we focus on creating a highly authorable, simple-to-represent story structure that is accessible to both non-programmer authors and understandable by middle-school aged players.

To date, we have built an integrated playable prototype and performed preliminary testing with our target user group, constructed SpyPhone, a smartphone thin client that manages the user interface and tracks player movement, and made progress on the two core components of our architecture: (1) Informant, a server-side story manager that simulates the model world and handles knowledge representation (see Dynamic Story Management Architecture); and (2) SpyGen, a dialogue generation engine (see Dynamic Dialogue Generation).

The Story. SpyFeet's story invites players to enter a hidden world where their special powers let them communicate with guardians of nature in the form of animal spirits. As budding Nature Wardens, players uncover a mystery while journeying through familiar streets now alive with animals to befriend, missions to accomplish, and secrets to unlock. The non-linear story system gives players the freedom to investigate characters or story elements that interest them while ignoring others. SPYFEET: MISSION ONE introduces five animal spirits: Wolf, Otter, Tortoise, Tiger Beetle, and Sparrow, each of whom knows a subset of facts about the plot. By performing themed exercise tasks for animals—such as gathering cabbage leaves for Tortoise, or walking near water to try to find Otter—the player gains their trust, which leads to more plot points and "journeys," special challenges which advance the plot upon completion.

Design Considerations

The story and gameplay evolved from a series of design conversations informed by an effort to avoid certain gameplay patterns that have been identified as unfriendly to girls. Laurel's research suggests that girls "are more likely to take their time and explore" (Laurel 2001) while others have identified the mystery genre as one particularly attractive to girls because of its focus on complex plots and intelligent action (Brunner, Bennett, and Honey 1998). We also ran a pitch session with a small focus group of girls in our target demographic to select the final scenario.

Designing for Future NLG Integration. SpyFeet's characters were designed concurrently with SpyGen, a new natural language generation system described in more detail in Dynamic Dialogue Generation below. SpyGen is a descendant of the PERSONAGE generator, which produced utterances manifesting personality in the restaurant recommendation domain (Mairesse and Walker 2010). SpyGen takes as input a set of character traits, a content plan and story situation variables representing the current context of the story.

We wanted to build on PERSONAGE and design characters which the new system could fruitfully represent, without constraining authors to a predetermined personality model. To address this, we first had authors write sample lines of dialogue for each character, which were used to generate a list of general traits for each NPC. PERSONAGE used Big Five personality traits (Goldberg 1990) as parameters to differentiate character utterances, so we next tried mapping the general traits to Big Five parameters and experimented to determine which variables had maximal effect on the percep-

tion of a character's personality. Of the existing PERSON-AGE techniques, we found hedges, stuttering, and repetitions were most powerful, but much work remains to build a system supporting the level of variation and realism we hope to achieve. Some initial results can be seen in Table 1.

Table 1: Character creation process for two SPYFEET: MISSION ONE NPCs.

Name	Sparrow	Otter
Hand-authored dialogue sample	Hello there! Hello? Hey! Hi! I can see that you're new to this. Look down. The small brown bird? That's me.	Gosh, I don't think anyone knows more about your Aunt Elsebeth than Sparrow?
General Traits	gregarious, social, impulsive, flighty	playful, child-like, eager, curious
NLG Params	Repetition, exclamations, short sentences	Expletives, in-group address terms, tag questions, disfluencies
NLG Sample	Oh I mean, you must thwart Cartmill. You need to stop Cartmill. No one is worse than Cartmill.	Well, mmhm... no one is worse than Cartmill, so Cartmill cannot be permitted to continue.

Encouraging Physical Activity. Another core idea was that players would have to burn calories to advance the story. Many console games based around physical activity such as Wii Sports ask players to move in place, either using a step-platform or tracking gyroscopic motion via a Wiimote or similar handheld device (Ohta, Shimamura, and Yamashita 2006). We made outdoor walking the primary calorie burner, monitoring movement via GPS.

Smartphone Client

SpyPhone is the mobile phone software component of the SpyFeet project, presenting story information to users, relaying their decisions to the server, and tracking physical movement and moment-to-moment exercise progress. SpyPhone runs on the Google Android platform and uses GPS to track the player's location and movement. Movement generates *warden energy*, a story device which prevents communicating with animal spirits until the player has attuned enough with nature. SpyPhone enforces which actions are allowed given the current energy level and increases or decreases warden energy based on player movement and their interaction with the other characters.

Players also move to complete *journeys*, special challenges which advance the story upon completion. Each journey is an exercise task tied to a story goal, such as "To befriend Otter, walk near the water." We have designed a range of journey types that track various patterns and styles of movement. Four journey types are fully implemented in our current prototype. These range from the simple *Basic Movement*, which requires a distance moved at an average speed, to the more elaborate *Evade*, where the player must keep a certain distance from one or more moving points.

Some journey types make use of GIS data, a standard for storing geographical and map information. These journeys request additional constraints based on urban or natural features near the player's location. The GIS data used in Spyfeet is obtained from the Open Street Maps database (OSM), a crowd-sourced data set with a custom ontology for mapping semantic information to locations in the physical world.

To communicate with the server, SpyPhone opens a socket connection via WiFi or a cellular data connection to a listener application online. SpyPhone then sends a packet with a command for Informant (the story manager), the player's location and current time, and the user's phone number to uniquely identify the session. Commands translate player UI actions (such as selecting a dialogue option) and physical movement into abstracted story-level commands, such as WALK 1, COMPLETE ELECTRONIC-SJOURNEY, or ASK WHOISCARTMILL. The server returns an XML-formatted string with information relevant to the client, such as new characters encountered, conversation options, or newly-available journeys (see Figure 1).

Dynamic Story Management Architecture

To meet the need for a dynamic story manager we created Informant, a novel system to manage a SpyFeet story session. Informant is written in Inform 7, a domain-specific language for standalone works of text interactive fiction (Nelson 2006); to our knowledge it has never been used before as a component in a larger storytelling architecture. Informant defines the basic molecules of SpyFeet's abstract story representation: journeys, knowledgeWMEs, and characters. The primary unit of story is the *knowledgeWME* (or just WME, short for Working Memory Element) which repre-
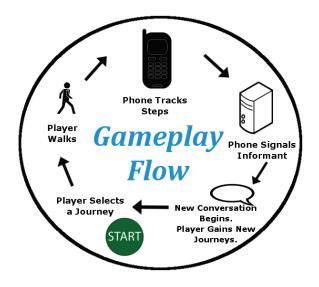

Figure 1: Spyfeet's Flow of Gameplay

Table 2: Example WME definitions from SpyFeet Mission One.

WME	Prerequisites	Known By	Revelation (Generic)	Inquiry (Generic)
elsebethIsWarden	personElsebeth	friends with Elsebeth	Your aunt Elsebeth is a Nature Warden, one of the most powerful in the world.	Do you know anything else about Aunt Elsebeth?
wardenBasics	n/a	animals	You're a Nature Warden, charged with protecting the environment alongside animal spirits like me.	Tell me about being a Warden.
elsebethWantsInvestigation	elsebethIsWarden, wardenBasics	allied and friends with Elsebeth	Aunt Elsebeth has noticed other animal spirits becoming agitated. Your first task is to speak with some of them.	Do you know anything about Elsebeth's investigation?

sents a plot point in a particular story. Authors create a story by detailing a set of WMEs, and the ways they relate to each other—some can require others to be known before becoming available—and to characters. Characters are defined with an author-selected set of traits (such as *flying* or *hunter*), relationship values (like friendship) to other characters, and journey templates that they might assign. Only characters with the trait *hunter*, for instance, might assign a stealth and tracking themed friendship journey. Informant loads a mission-specific set of characters, WMEs, and journeys to simulate a SpyFeet story world (see Table 2).

A New Way of Thinking About Quests. A traditional RPG conversation tree consists of a series of nodes representing a question from the player character and answer from a specific NPC. Each node typically has one parent node and some number of child nodes. Some systems also allow for nodes to be tagged with logic controlling whether or not they are currently available, such as a boolean flag unlocking a particular node after a quest has been completed or node in a different conversation has been seen.

SpyFeet's knowledgeWMEs relate to each other in a non-hierarchical and character agnostic structure. A node can require another node or nodes to have been seen before it becomes available. This often eliminates the need for boolean flags, which can be hard to debug or diagnose problems with due to their one-sided nature, allowing the full logic of conversation flow to be explicitly encoded into the system. In addition, nodes are not "conversation specific" but rather tagged with a description of the types of characters who can reveal them in conversation. These descriptions, written in Inform 7 natural language phrases, can be dynamic and updated during gameplay. One example might be to tag a node as revealable by characters who are "flying allies." This means any character who can fly and has reached the "ally" level of friendship with the player can reveal this node if the conversation leads to it.

Authors can use these definitions and the WME requirement relations to build a plot that can be traversed in many different ways. For instance, players do not have to meet every animal spirit to finish Mission One: if they don't like a given character, they are free to ignore it and get the same information through a more favored NPC. Following the chain of connections also makes it easy to systematically determine the plot threads a certain WME might lead to, and how subplots are related to each other. For example, a hint mechanism might pathfind the quickest route to an important revelation from revealed nodes through nodes that can be re-

vealed by befriended characters, and send an in-game message to the player from an animal spirit who can reveal the first node in that path urgently requesting a meeting. Systematizing the connection between plot points thus allows for smarter and dynamic story management systems to be easily implemented without using fragile, case-specific structures.

We found authoring for this unique system to be an interesting but rewarding challenge. Rather than craft trees of question/answer conversation defining all possible communication with each character, authors rely on the system to procedurally assemble dialogue options based on what is currently known by both the player and the conversant. Since players effectively use known WMEs as conversation verbs to inquire for more information about a given subject, we had to make a conceptual leap from thinking of each WME as representing a "question and answer" node, as in traditional RPG authoring, to thinking of each one as a "revelation and inquiry," meaning that each WME both reveals the plot point it instantiates but also can be used to ask for further information that follows on from that node. A revelation must be written so it can serve as the "answer" to the inquiry from any prerequisite WME, and inquiries must be generic enough to make sense as a lead-in to revelations from any subsequent WMEs. While this requires a paradigm shift for authorship, it makes it easier to connect plot nodes in complex ways without introducing unexpected inconsistencies. Authors must still carefully think through the prerequisites and follow-up links for a given WME to ensure a consistent story world. The advantage comes from not having to keep a larger plot structure in one's head while authoring, and the ability to add new characters, plot points, and even whole subplots later on without having to rework existing elements. Our system lets authors focus on smaller chunks of the story at a time, and feel secure that the larger structure will be kept intact.

Dynamic Dialogue Generation

While NLG as part of a larger storytelling system has been attempted as far back as the Mumble component of Tale-Spin (Meehan 1977), attempts to incorporate such systems in industry, as in the ambitious early plans for flexible dialogue variation in Spore (Grundstrom 2008), have not yet been successfully implemented. However, several projects have recently been focusing on integrating NLG into interactive stories for both narrative and dialogue generation (Walker, Cahn, and Whittaker 1997; Cavazza and Charles
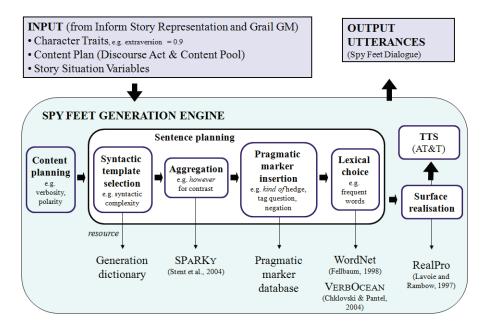
Figure 2: SpyGen Architecture

2005; Rowe, Ha, and Lester 2008; Callaway and Lester 2001). We have been informed by this work as we attempt to incorporate NLG into SpyFeet.

In parallel with building a playable prototype, we have been developing a new natural language generation engine, SpyGen (Figure 2), a descendant of the PERSONAGE generator which produced utterances manifesting personality in the restaurant recommendation domain (Mairesse and Walker 2010). See Table 1 for examples of what SpyGen can generate now for each character. We are currently refining the character generation modules so that we can generate variations within and between characters that are sensitive to the context and the history of the relationship with the player.

One of the first things we noticed when attempting to adapt PERSONAGE into the RPG domain is that SpyFeet's simulation of character affinity networks required us to create new content selection scales for indexing content. We started off with only a polarity scale which differentially selects for positive or negative content. In PERSONAGE's restaurant domain, low polarity are negative facts about a restaurant. In SpyFeet, the new scales control content selection based on relationship and attitude to the player.

Beyond these first steps, we have ambitious long-term goals. We hope to build on the Big Five/PERSONAGE framework by bringing social relationships, characters' emotional states, and personal history to the discourse generation level. PERSONAGE dynamically selects content solely using an index based on the content's polarity (positive or negative). In SpyGen we are developing techniques to select satellites of narrative knowledge by using content selection scales such as trust, respect, or style to label plot points.

Conclusions

The current implementation of SpyFeet creates a solid foundation for future work incorporating more advanced systems to improve player experience. Primarily these include integration and further development of the SpyGen NLG component, and improvements to Informant to use smarter selection of possible story nodes to reveal. In the longer term, we hope to develop SpyFeet into a releasable mobile game with multiple episodes of content available for players to explore.

Early Evaluation. In fall 2010 we carried out a playtest of a preliminary version of SpyFeet with six middle school students aged 10-13 years old (five girls and one boy). The study provided heartening results, indicating that, in general, our participants responded positively to the idea of using story-based games to exercise (Reed et al. 2011). In spring 2011 we began a second evaluation, consisting of an A/B test comparing a narrative vs. non-narrative based version of the game. Though results are still being analyzed, preliminary findings continue to favor narrative-based motivation.

Future Work. We are beginning analysis of our A/B test, to confirm that narrative is a stronger motivator for physical activity than abstract achievements or points. A second study currently underway will evaluate the performance of hand-authored, character-specific NPC dialogue with generic versions that are not customized for each NPC. This might verify that personalization of dialogue increases engagement, and in addition will produce a corpus of character-specific variations for each line of dialogue in the Mission One story, which can be used by the SpyGen team as they investigate techniques for generating these variations procedurally.

SpyFeet is an exciting first step towards a computer role-playing game infrastructure that significantly reduces authorial burden, thus lowering the barrier to creating experiences with increased player agency. As we continue to develop the

project, Informant and SpyGen will increasingly work together to simulate, manage, and voice the characters in our dynamic stories. The increased sense of personalization and choice afforded by the system will, we hope, not only build on what is already compelling about RPG gameplay, but also demonstrate the power of dynamic story management. We look forward to taking the next steps.

Acknowledgments

References

Arteaga, S.; Kudeki, M.; Woodworth, A.; and Kurniawan, S. 2010. Mobile system to motivate teenagers' physical activity. In *Proceedings of the 9th International Conference on Interaction Design and Children*, 1–10. ACM.

Avellone, C. 1999. Planescape: Torment. Black Isle Studios, Interplay Entertainment. Windows CD-ROM.

Bethesda Softworks. 2002. The elder scrolls construction set.

BioWare. 2002. Aurora engine toolset.

Brunner, C.; Bennett, D.; and Honey, M. 1998. Girl games and technological desire. In *From Barbie to Mortal Kombat*, 88. MIT Press.

Callaway, C., and Lester, J. 2001. Narrative prose generation. In *Proceedings of the Seventeenth International Joint Conference on Artificial Intelligence*.

Carless, S. 2008. In-depth: LucasArts alum on *Strong Bad*'s episodic gaming kick. http://www.gamesetwatch.com/2008/11/interview˙lucasarts˙alum˙on˙st.php.

Cavazza, M., and Charles, F. 2005. Dialogue generation in character-based interactive storytelling. In *AAAI First Annual Artificial Intelligence and Interactive Digital Entertainment Conference, Marina del Rey, California, USA*.

Charles, F.; Lozano, M.; Mead, S.; Bisquerra, A.; and Cavazza, M. 2003. Planning formalisms and authoring in interactive storytelling. In *Proceedings of TIDSE*, volume 3. Citeseer.

Chen, S.; Nelson, M.; Sullivan, A.; and Mateas, M. 2009. Evaluating the Authorial Leverage of Drama Management. In *Proceedings of the AAAI Spring Symposium on Intelligent Narrative Technologies II*.

Crawford, C. 2003. *Chris Crawford on Game Design*. Thousand Oaks, CA, USA: New Riders Publishing.

Garriott, R. 1980. Akalabeth. California Pacific Computer Company. Apple II.

Gillen, K. 2010. Re-retrospective: Planescape: Torment. *Rock, Paper, Shotgun*. http://http://www.rockpapershotgun.com/2010/09/28/re-retrospective-planescape-torment/.

Goldberg, L. R. 1990. An alternative "description of personality": The Big-Five factor structure. *Journal of Personality and Social Psychology* 59:1216–1229.

Grundstrom, E. 2008. The AI of Spore. Presented at the Fourth Conference on Artificial Intelligence and Interactive Digital Entertainment, Stanford University, CA.

Hidalgo, P. 2010. Storytelling in *The Old Republic*: News from Comic-Con and *Fatal Alliance* excerpt. *StarWars.com*. http://www.starwars.com/games/videogames/swtor˙comic˙con.

Hudson, C. 2003. Star wars: Knights of the old republic. BioWare, LucasArts. Xbox.

Laurel, B. 2001. *Utopian entrepreneur*. The MIT Press.

Mairesse, F., and Walker, M. 2010. Towards personality-based user adaptation: psychologically informed stylistic language generation. *User Modeling and User-Adapted Interaction* 1–52.

Mateas, M., and Stern, A. 2003. Façade: An experiment in building a fully-realized interactive drama. In *Game Developers Conference, Game Design track*. Citeseer.

Meehan, J. 1977. Tale-spin, an interactive program that writes stories. In *Proceedings of the fifth international joint conference on artificial intelligence*, 91–98. Citeseer.

Murray, J. 1997. *Hamlet on the holodeck: the future of narrative in cyberspace*. New York: Free Press.

Nelson, G. 2006. Natural Language, Semantic Analysis and Interactive Fiction. http://www.inform7.com/learn/documents/WhitePaper.pdf.

Ogden, C.; Carroll, M.; and Flegal, K. 2008. High body mass index for age among US children and adolescents, 2003-2006. *Jama* 299(20):2401.

Ohlen, J., and Martens, K. 2000. Baldur's Gate II: Shadows of Amn. Black Isle Studios, BioWare. Windows CD-ROM.

Ohlen, J. e. 2011. Star wars: The old republic. BioWare, Electronic Arts. Windows DVD-ROM.

Ohta, K.; Shimamura, T.; and Yamashita, Y. 2006. Wii sports. Nintendo EAD, Nintendo. Wii.

Pagliarulo, E. 2008. Fallout 3. Bethesda Game Studios, Bethesda Softworks. Xbox 360.

Pardo, R.; Kaplan, J.; and Chilton, T. 2004. World of warcraft. Blizzard Entertainment. Windows.

Reed, A. A.; Samuel, B.; Sullivan, A.; Grant, R.; Grow, A.; Lazaro, J.; Mahal, J.; Kurniawan, S.; Walker, M.; and Wardrip-Fruin, N. 2011. Spyfeet: An exercise RPG. In *Proceedings of the 6th International Conference on the Foundations of Digital Games*.

Reed, A. A. 2010. Blue lacuna: Lessons learned writing the world's longest interactive fiction. In *Electronic Literature Organization Archive & Innovate*.

Rowe, J.; Ha, E.; and Lester, J. 2008. Archetype-Driven Character Dialogue Generation for Interactive Na rrative. In *Intelligent Virtual Agents*, 45–58. Springer.

Spruijt-Metz, D., and Saelens, B. 2005. Behavioral aspects of physical activity in childhood and adolescence. *Handbook of pediatric obesity: Etiology, pathophysiology and prevention* 227–250.

Spruijt-Metz, D. 1995. Personal incentives as determinants of adolescent health behavior: The meaning of behavior. *Health Education Research* 10(3):355.

Sullivan, A.; Mateas, M.; and Wardrip-Fruin, N. 2009. Questbrowser: Making quests playable with computer- assisted design. In *Proceedings of the Digital Arts and Culture Conference*.

Thorsen, T. 2008. *Star Wars: The Old Republic* revealed. *Gamespot*. http://www.gamespot.com/news/6199726.html.

Thue, D.; Bulitko, V.; and Spetch, M. 2008. Making stories player-specific: Delayed authoring in interactive storytelling. In Spierling, U., and Szilas, N., eds., *Interactive Storytelling*, volume 5334 of *Lecture Notes in Computer Science*. Springer Berlin / Heidelberg. 230–241.

Troiano, R.; Berrigan, D.; Dodd, K.; MÂSSE, L.; Tilert, T.; and McDowell, M. 2008. Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise* 40(1):181.

Walker, M. A.; Cahn, J. E.; and Whittaker, S. J. 1997. Improvising linguistic style: Social and affective bases for agent personality. In *Proceedings of the 1st Conference on Automous Agents, AGENTS 97*, 96–105.

Walker, J. 2011. Garriott says we've not mastered storytelling. *Rock, Paper, Shotgun*. http://www.rockpapershotgun.com/2011/02/01/garriott-says-weve-not-mastered-storytelling/.

Wardrip-Fruin, N. 2009. *Expressive processing : digital fictions, computer games, and software studies*. Software studies. Cambridge, Mass.: MIT Press.

Wójcik, M. 2008. Translation and Localisation: Characteristics of computer games localisation by the example of *Baldur's Gate II* and *Fallout 2*. Master's thesis, Pedagogical University of Kraków.