SpyFeet: An Exercise RPG

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ABSTRACT

One compelling aspect of computer RPGs is the promise of player agency: the ability to make significant and desired choices in a large, complex, and story-rich environment. Giving players meaningful choice 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. Our hypothesis is that reducing authorial burden and increasing agency are two sides of the same coin, both requiring advancement in three distinct areas: (1) dynamic story management architecture that allows story elements to be selected and re-ordered in response to player choices; (2) dynamic dialogue generation which takes history and relationships into account; and (3) an authoring interface that lets writers focus on quests and characters. This paper describes SpyFeet, a playable prototype of a storytelling system designed to test this hypothesis.

Categories and Subject Descriptors

I.2.1 [**ARTIFICIAL INTELLIGENCE**]: Applications and Expert Systems—*Games*; I.2.7 [**ARTIFICIAL INTELLIGENCE**]: Natural Language Processing—*Language generation*

General Terms

Design, Experimentation, Human Factors, Theory

1. INTRODUCTION

Meaningful choice has often been identified as a key component in a player's engagement with an interactive narrative but this typically requires the creation of tremendous amounts of hand-authored story content, introducing 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.
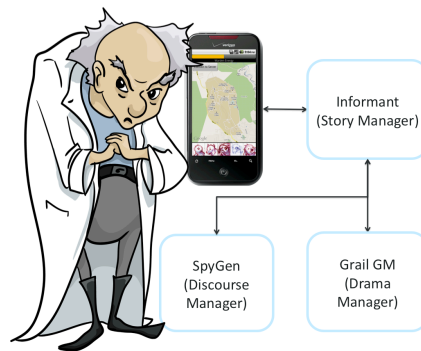
Figure 1: Dr Cartmill and the SpyFeet Architecture

Wardrip-Fruin details a common way such structures can fail in the award-winning 2003 RPG *Knights of the Old Republic* 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 [13]. 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 [10]. The script for *Fallout 3* had 91,000 lines of dialogue; for *Baldur's Gate II* it was a staggering 3,257 pages long [14]. Some RPGs such as *Planescape: Torment* 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 [4]. Brute-force approaches can only go so far in solving this problem: Bioware's space epic *The Old Republic*, slated for release in mid-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 [11]. 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 put together."

Previous RPG-specific 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[2], or the use of AI drama management to manage relations between story events [12, 3]. While these approaches are useful, our hypothesis is that reducing authorial burden and increasing agency are two sides

of the same coin, requiring advancement in three distinct areas: (1) A dynamic story management architecture that represents story events abstractly and allows story elements to be selected and re-ordered in response to player choices; (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, based on dynamic relationships between players and NPCs (non-player characters); and (3) An authoring interface that exposes these functionalities, so authors can focus on quests and characters, rather than the complex interactions between them.

We are investigating these in the context of SpyFeet, a playable prototype of a role-playing story system implemented on a smart phone. SpyFeet's design was inspired by our experience writing previous narratively complex interactive stories [8], with developing GrailGM, a dynamic quest management architecture [10], and with expressive language generation for dialogue [5]. We were further inspired by research showing that physical activity declines precipitously in adolescence, particularly in girls and minorities, and that these declines track into adulthood [9, 1], contributing to obesity. Thus SpyFeet's application area is an outdoor exercise game targeted at adolescent girls, implemented using the Android operating system on a smartphone. We aim to test whether an ongoing and compelling episodic interactive story, whose progression is tied to exercise activities, can leverage the addicting and entertaining quality of RPG play to promote physical fitness in our players.

2. SPYFEET DESIGN AND EVALUATION

SpyFeet demonstrates what we believe to be a novel means of representing story structure 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. To date, we have built an integrated playable prototype and tested it with our target user group. Figure 1 shows how our key modules interact.

The Story. SpyFeet's story invites players to enter a hidden world where their special powers allow them to communicate with guardians of nature in the form of animal spirits. SpyFeet: Mission One introduces five animal spirits: Wolf, Otter, Tortoise, Tiger Beetle, and Sparrow. Each knows different facts about the plot, which involves the sinister Dr. Cartmill's attempts to build a mind control ray in the player's hometown. By performing themed exercise tasks for animals—such as gathering cabbage for Tortoise, or walking near water to find Otter—the player gains their trust, which leads to more plot points and "journeys," special challenges which advance the plot upon completion.

SpyPhone Platform. SpyPhone, the mobile phone software underlying SpyFeet, presents story information to users, relays their decisions to the server and tracks 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. Warden energy can be accumulated even when the player is not actively playing the game by a GPS tracking process which stays active. 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.

Informant. Informant defines the basic elements of Spyfeet's story architecture: journeys, knowledgeWMEs, and characters. The primary unit of story is the *knowledgeWME* (or

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.

WME, short for Working Memory Element) which represents a plot point in a story. Authors create a story by detailing a set of WMEs and the ways they relate to each other—some require others to be known before becoming available—and to other characters. Characters are defined with a set of traits, certain relationship values (such as friendship) to other characters, and journey templates that they might assign. Only characters with the trait Hunter, for instance, might assign a tracking themed friendship journey. Informant loads a set of characters, WMEs, and journeys to simulate a SpyFeet story world (see Table 2).

As opposed to traditional RPG conversation options, SpyFeet's knowledgeWMEs relate to each other through a nonexclusive requirement relationship that determines which prior WMEs must be known before the given WME can be revealed. This means the logic of how each plot point relates to another is explicitly encoded and accessible from either side, rather than buried in dialogue implications and cross-referenced through looking up custom variables or ID numbers. Following the chain of connections also makes it easy to determine the plot threads a certain WME might lead to, and how subplots are related to each other. WMEs also have rules dynamically describing the set of characters who know them at a given time, such as "friends with Sparrow" or "allied water animals". Authors can use these WME properties to build a non-linear plot. 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.

GrailGM Quest Management. Another key component is GrailGM, a new quest management architecture to be incorporated into SpyFeet 1.1. GrailGM extends traditional RPG toolkits with a focus on creating emergent narratives based on player choices [10]. We believe that this type of personalization is important to maximize each user's engagement and to increase positive affect. GrailGM is built upon the Comme il Faut system [6]. It tracks characters' attitudes

Table 2: Example WME definitions from SpyFeet Mission One.

WME	Prerequirements	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?

towards each other and the player, their current emotional state, and how these variables impact the overall plot. Each character is represented by a series of traits which describe their base personality as in Table 1. Characters can also be assigned dynamic moods that change based on events in the game. Moods are used to capture current emotional state and other passing effects on the characters.

SpyGen Dialogue Generation. Another key component is dynamic dialogue generation, for which we are developing a new natural language generation engine, SpyGen. See Table 1 for examples of what SpyGen can generate now for each character. We are in the process of refining the character generation modules so that we can generate many variations within and between characters that are sensitive to the context and the history of the relationship with the player.

Evaluation Pilot. In fall 2010 we carried out a playtest of of Spyfeet 0.9 with six middle school students aged 10-13 years old (five girls and one boy), to test the hypothesis that using a dynamic RPG was a strong and fun motivator for exercise. Participants liked the idea of using story-based games to exercise. Five out of six participants stated that the story gave them a purpose for exercising and preferred it over a point-based game which features numeric rewards or achievements instead of plot developments. One participant said, "Point-based games make you competitive so you cannot play with your friends." Another said, "What's the point of having more and more points?"

Five participants felt that their friends would like to play this game. The participant who didn't think her friends would play did not attribute it to the design, but rather because "my friends don't like to walk at all," although she suggested that they may like the game if there were more varied types of exercise, such as jumping or running.

Our pilot study group was given an opportunity to reconceptualize the SpyPhone interface using PICTIVE [7], a participatory UI design technique in which participants use paper cutouts, pens and colored markers to design an interface. This feedback resulted in a number of new design ideas to integrate into a future version of the application, such as making the interface more colorful, and shortening the tutorial or giving the user the ability to bypass it entirely.

3. CONCLUSION

Since running the pilot study, we've completed SpyFeet 1.0, which incorporates more advanced systems to improve player experience. Primarily these include integration of the SpyGen and GrailGM components (see Figure 1). In the longer term, we hope to continue developing SpyFeet into a releasable mobile game with multiple episodes of content available for players to explore.

4. ACKNOWLEDGMENTS

5. REFERENCES

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

[2] BioWare. Aurora engine toolset, 2002.

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

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

[5] F. Mairesse and M. Walker. Towards personality-based user adaptation: psychologically informed stylistic language generati on. *User Modeling and User-Adapted Interaction*, pages 1–52, 2010.

[6] J. McCoy, M. Treanor, B. Samuel, B. Tearse, M. Mateas, and N. Wardrip-Fruin. Comme il Faut 2: a fully realized model for socially-oriented gameplay. In *Proceedings of the Intelligent Narrative Technologies III Workshop*, pages 1–8. ACM, 2010.

[7] M. Muller. PICTIVEan exploration in participatory design. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 225–231. Association for Computing Machinery, 1991.

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

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

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

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

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

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

[14] M. Wójcik. 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, 2008.