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Preface

This volume contains the proceedings of ICIDS 2012: The 5th International Conference on Interactive Digital Storytelling.

ICIDS is the premier international conference on interactive digital storytelling (IDS), bringing together researchers interested in presenting recent results, sharing novel techniques, and exchanging ideas about this exciting new media. After the successful edition in North America last year, it returned to Europe reinforcing its worldwide nature.

IDS redefines the narrative experience by empowering the audience to significantly participate in the story owing to advances in technology. As such, it offers new possibilities for communication, education, and entertainment, through the enriching of characters with intelligent behavior, the collaboration of humans and machines in the creative process, and the combination of disciplines for improving the user experience.

Therefore, IDS is inherently a multidisciplinary field. To create novel applications in which users play a significant role during the development of a story, new concepts and theoretical works on digital humanities, new media studies and interactive arts are needed.

ICIDS emphasizes several aspects of computer science, including artificial intelligence, virtual environments and human–computer interaction; topics include automated reasoning, computational creativity, multi-agent systems, narrative intelligence, natural language generation and understanding, user modelling, and smart graphics.

The review process for ICIDS 2012 was extremely selective, and many good papers could not be accepted for the final program. Altogether, we received 48 submissions. Out of the 48 submitted full papers, the Program Committee selected only 14 submissions for presentation and publication as full papers, corresponding to an acceptance rate of 29% for full papers. In addition, six submissions were accepted as short papers. In total, the ICIDS 2012 program featured contributions from 19 different countries worldwide.

The conference program also highlighted three invited speakers: Mirjam Eladhari, senior lecturer at the Faculty for Knowledge and Media Sciences at the University of Malta, whose research approach includes exploration of the social multi-player game-design space through experimental implementations of prototypes where both novel and established AI techniques are used; Richard Evans, co-founder, along with Emily Short, of Little Text People, developing real-time multiplayer interactive fiction. He is also known worldwide as the AI lead on The Sims 3 and was responsible for the design and implementation of the AI for Black & White; and Noah Wardrip-Fruin, Associate Professor of Computer Science at the University of California, Santa Cruz, where he co-directs the

Expressive Intelligence Studio, one of the world's largest technical research groups focused on games.

In addition to paper presentations, ICIDS 2012 featured three pre-conference workshops: (1) Nordic Roleplaying Games — The Narrative Approach: A Practical Introduction, (2) Where's the Story? Forms of Interactive Narrative in Current Digital Games and other Digital Forms, and (3) Sharing Interactive Digital Storytelling Technologies.

We would like to express our sincere appreciation for the time and effort invested by our authors in preparing their submissions, the diligence of our Program Committee in performing their reviews, the insight and inspiration offered by our invited speakers, and the thought and creativity provided by the organizers of our workshops. Special thanks are also due to our sponsors and supporting organizations: GraphicsMedia.net, AAAI, ECCAI, AEPIA, SCIE, Vicomtech and the Department of Education, Universities and Research of the Basque Government; and, of course, to the ICIDS Steering Committee for granting us the opportunity to host ICIDS 2012. Thank you!

November 2012

David Oyarzun
Federico Peinado
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Table of Contents

Theory and Aesthetics

Authoring Tools and Applications

Evaluation and User Experience Reports

Virtual Characters and Agents

New Storytelling Modes

Workshops

Suspending Virtual Disbelief: A Perspective on Narrative Coherence

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Abstract. The paper accommodates Espen Aarseth's concept of *virtuality* and Samuel Taylor Coleridge's concept of *suspension of disbelief* to the context of modern story forms. The primary focus will be on the videogame. The premise is that suspending disbelief at narrative improbabilities is a skill required to construct narrative coherence. Constructing narrative coherence of stories that contain virtual elements entails supplementary suspension of disbelief at virtual improbabilities, suspension of *virtual disbelief*. Since increasing the degree of virtuality often increases the requisite traversal effort, virtuality can be said to set increased demands on story traversal as well. This results in the dilemma of *virtual balance*: while virtuality has the potential to strengthen diegesis, it on the other hand sets heightened demands on story traversal and narrative coherence. The concluding argument is that these heightened demands may be turned into rhetorical tools.

Keywords: Virtuality, suspension of disbelief, aesthetics, narration, rhetoric.

1 Introduction

In his article "Doors and Perception: Fiction vs. Simulation in Games" Espen Aarseth presents *virtuality* as a descriptive term for simulated diegetic[1] objects [2]. In *Biographia Literaria* Samuel Taylor Coleridge presents *suspension of disbelief* as a descriptive term for readers' inclination to overlook improbabilities of stories because of their willingness to construct narrative coherence [8].

This paper begins by introducing and redefining virtuality and suspension of disbelief as understood by Aarseth and Coleridge. The concepts are accommodated to the context of modern story forms with the primary focus on the videogame. Suspending disbelief is defined as a skill that is required to construct *narrative coherence*, and virtuality is introduced as an element that calls for an additional suspension of disbelief, suspension of *virtual disbelief*.

[1] In this paper "diegesis" refers to the sphere of artificial realms, often initiated by narrative works. Ergo, a diegetic object is an object of an artificial realm.

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 1–17, 2012.

It will be shown how virtuality has the potential to strengthen diegesis whilst it simultaneously tends to hinder story traversal. This conflict is termed the dilemma of *virtual balance*: on the one hand fluent story traversal, on the other hand strengthened story diegesis with the additional requisite of suspending virtual disbelief. The complicating effects virtuality has on storytelling are lastly argued to function as rhetorically operative tools.

2 Virtuality

When a story is considered *fictional*, its objects are typically considered fictional too. Some diegetic objects, nonetheless, seem to involve properties that separate them from purely fictional objects. Aarseth terms these extra-simulated objects *virtual*, as they have an additional dynamic model "that will specify [their] behaviour and respond to our input" [2].

The distinction has raised controversy, which has concentrated on the confrontation between the adjectives fictional and virtual [e.g. 37, 39]. These misunderstandings can be explained by the dual role of the word "fiction" in Aarseth's article as **"**we are clearly looking at two very different types of fiction, with only the first type being similar to fictional phenomena in all other media." To avoid further misunderstandings, the concept will be redefined along with Grant Tavinor's critique. The initial perplexity concerns the dynamics of virtuality:

> the videogame gun is very similar in terms of media to a computer-generated film gun, so on Aarseth's logic – where virtual is seen to rely on an artifact being a dynamic graphical model – if one is to be virtual so should the other. [37]

Yet the function of Aarseth's dynamic model is not graphical. As cited earlier, the dynamic nature of virtual objects refers to their behavioral properties and capability to respond to the user's input, not to their visual appearance. And as Marie-Laure Ryan's [34] properly remarks, if virtuality is understood synonymously with being computer-generated, it will not tell us anything of interest about the phenomena it refers to.

A probable reason for the confusion is that instead of describing the responsiveness of virtual objects more profoundly, Aarseth refers to them as simulations. Connecting virtuality to simulation does not, however, provide a sound footing for the concept. Because all semantic expression is essentially simulative—a term normally associated with imitation, with the Greek *mimésis* [19]—linking virtuality to simulation would suggest that the histories of writing technologies [34] as well as pictorial representation [11] are both tales of ever-increasing virtuality [see 26]. This stance is highly susceptible to Ryan's remark, and thus rejected.

Since the peculiarity of virtual phenomena appears to be primarily related to the means that enable the manipulation of the provided content, Aarseth could have given a more distinctive depiction of virtuality through his earlier concepts of the *explorative* and the *configurative* user functions [1], for instance. Whereas the former refers to the user's capability to affect the appearing of an object's content, the latter refers to the user's capability to modify the content. In practice, then, the more explorative and configurative means to manipulate to the object are present, the higher its degree of virtuality.

If a theory of virtuality is to capture the dynamically exceptional nature of the phenomenon, it cannot, nevertheless, be defined solely by the provided user functions either. This is because diegetic objects may hold dynamic behavior (indeed a mode of simulation) outside the scope of the user's explorative and configurative capabilities. In the same way as mundane world objects maintain their dynamicity even when they are outside the scope of human manipulation, so do virtual objects maintain their virtuality even when they are outside the scope of user manipulation. In both cases the defining factor are the objects' *behavioral properties*, that is, properties that are functionally interrelated to other properties of the realm. The facet will be returned to later on. At this point, in place of simulation, virtuality will be redefined in combined terms of user functionality and behavioral properties that are functional in a diegetic context. It is fitting to give a definition.

Explorative and configurative user functions are the primary conditions of virtuality. (i) If a diegetic object is manipulable by means of exploration or configuration, it is also virtual. The secondary condition of virtuality is the functionality of its behavioral properties. (ii) If a behavioral property of an object is functional in a diegetic context, the object is behaviorally functional, and also virtual (ii). In sum, if an object has (i) or (ii), the object is virtual. Tavinor's guns shall elucidate the definition.

Since the film audience cannot explore or modify the filmed gun, the gun has no primary virtual status. The screenplay may mention the gun to hold behavioral properties, such as the physical characteristic of weight that would grant it a secondary virtual status, yet those properties cannot be functional in the predetermined world of the film. The filmed gun is not virtual. In *Fallout 3* (Bethesda, 2008), in turn, a gun is explorable as well as configurable. It also has the behavioral property of weight that is functional in the game: the protagonist cannot carry more than her or his strength allows. The fallout gun is (doubly) virtual.

Tavinor appears to end up with a similar conclusion, though he asserts that the way in which virtual objects are functional is not exclusive to diegetic contexts:

> [In movies] the interaction occurs during the process of production of the fictive artifact by actors, writers, and directors, in [videogames], during the audience's engagement with the fictive artifact. [37]

It is true that user functionality is not exclusive to virtual objects; mundane world objects are positively manipulable for all capable beings. It is also true that mundane world objects are functionally interrelated; they positively involve behavioral properties that are functional in the mundane world where natural phenomena like gravity prevail. Ultimately, virtuality depends on the context in which behavioral properties and manipulability function:

(a_1) The weight and manipulability of the fallout gun are functional in *Fallout 3*.
(a_2) The weight and manipulability of the fallout gun are dysfunctional in the mundane world.
(b_1) The weight and manipulability of the filmed gun are dysfunctional in the movie.
(b_2) The weight and manipulability of the filmed gun are functional in the mundane world.

The fallout gun and the filmed gun are both behaviorally functional and dysfunctional as well as manipulable and unmanipulable, but what makes the first one virtual is the diegetic context of its interrelated behavior and manipulability. The fallout gun has real consequences in a diegetic context.[2] This is also the sense in which Aarseth calls game labyrinths real: their twists and turns have real functionality for those who traverse them. And these special objects that are simultaneously fictional and real position games "between fiction and our world: the virtual" [2].

It must be conceded that not all Aarseth's examples illustrate his theory to the full. At one point he refers to the doors of *Return to Castle Wolfenstein* (Grey Matter 2001) as objects of which some are virtual (can be opened) and others fictional (cannot be opened). The alleged fictional doors, however, are scripted with behavioral functionality too: they can be barged into, but not walked through. In the same sense as the walls of game labyrinths are real for their solvers (and hence virtual), so are all the doors that restrict movement in *Return to Castle Wolfenstein.*

This is not to say that all game objects are virtual. In *Half-Life 2* (Valve 2004) the sky and the mountains hold no behavioral functionality in the diegetic game world, neither does the game provide means to explore or configure them. The player may observe both objects by means of visual perception, but there is no feedback. The sky and the mountains are ontologically mere textures of purely fictional nature. Outwardly similar objects in text-based *Dracula* (CRL 1986) clarify the difference. The game begins with a short description of the environment:

> Here in the Carpathian mountains, I am a day's journey from my client's abode. But first some rest! East lies the hotel.

Whereas in this case the mountains seem equally fictional, they are actually virtual. The player is able to explore them by typing "examine mountains," to which the game responds: "High towering mountains hide the setting sun from a cold, still sky, far away in the distance." But if the player examines the sky, the meaningless response goes: "I can't see any such thing." While neither the sky nor the mountains in *Dracula* hold any behavioral functionality in the diegetic game context, the former is scripted with an explorable function that makes it virtual. Since explorability, among configurability and behavioral functionality, is lacking from the latter, it is contrariwise ontologically fictional. The tangible difference is, one can play with the mountains but not with the sky.

As mentioned earlier, a user is not a necessity of virtuality. A property that grants an object a virtual status may be behaviorally functional in a diegetic context without the player (character) being able to explore or configure it. While the player might never be able to use the fallout gun, it might still be functional for a diegetic character. To reiterate once more, the virtuality of a diegetic object does not derive solely from its explorative or configurative relation to the non-diegetic player but may alternatively (or concurrently) derive from the object's functionality in the diegetic context; from the behavioral interrelations between the diegetic object and other diegetic objects.

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[2] A property of an object may simultaneously have behavioral functionality in the mundane world and in a diegetic context, as in the case of alternate reality games.

3 Suspension of Disbelief

The concept of *suspension of disbelief* was put forth by the philosopher-poet Samuel Taylor Coleridge who sought a way through which he could express fictitious elements in his poetry so that they would not break its coherence. For Coleridge, a well-written poem was able to convince the reader to overlook its improbabilities, to willingly suspend disbelief at inconsistencies such as supernatural characters, so that she or he would have "poetic faith" in the story as a whole [8]. In this framework coherence becomes an aesthetic end, pursued by both the author and the reader. Not merely signifying the causal logic between diegetic sequences of events but the consistency of diegeses in general, this Coleridgean coherence will be henceforth referred to as *narrative coherence*; thereby stressing the emphasis on narrative works[3] while not limiting to their event structures alone.

Coleridge's idea has increasingly been used to describe the mental processes of users involved in virtual environments. While Janet Murray [30] employs the concept to explain her notion of immersion, Tavinor [37] rejects it because to "suspend my disbelief in *Grand Theft Auto* and other fictions would cause me … running out of the room screaming every time someone aimed a rocket launcher at me." These views cannot be fitted to the Coleridgean narrative framework—not even within the broad understanding of coherence given above—in which the story, independent of the medium, is not a plain copy but an elegant imitation:

> A poem is that species of composition, which is opposed to the works of science, by proposing for its immediate object pleasure, not truth [8]

By contrasting poetry with truth Coleridge does not mean to reject its potential for presenting truths or realness. Contrarily, his thinking can rather be seen to question the exclusiveness of the truths and realness of the mundane. In Richard Fogle's [16] interpretation, for Coleridge "the dramatic and the poetic truth is the real, the essential; while the literal or scientific truth is merely apparent and extraneous."

Fogle's interpretation conceals a definition of realness according to which everything one believes in is real, and nothing is real before one believes in it. This comes close to the approach taken by this paper as presented in the previous section. The walls and doors in videogames become real at the moment when the player notices they have behavioral functionality in relation to other diegetic entities or affect her or his own vicarious actions. This leads the player to interpret these virtual objects as if they actually were what they present or represent (to degrees of substantial variation). Objects, truths and realms of stories can be equally or even more real than those of the mundane, regardless of whether they represent it or not. The willing suspension of disbelief is therefore not an attempt to deceive oneself into believing something false to be true, or something unreal to be real, since both truthfulness and realness are independent of all reference.

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[3] "Narrative works," for want of a better term, points here at novels, films, poems, plays, videogames and other cultural works that are employed to convey stories. Ergo, "readers" and "readings" neither point at engagement with literary works alone.

As philosophers and poets have shown, even the most absurd statements can be proven to be true within the rules of logic, and even the most fantastic stories may become real in the minds of readers. Hence, suspending disbelief in reading, watching, listening or playing a story is understood here as an attitude that is required to overlook the improbabilities that threaten the particular truths and logics of particular stories; their coherence in relation to their distinctive diegeses. This coherence can be constructed and perceived from a distance, without being mentally immersed in the story. Consequently, and contra Murray, Tavinor and several others [e.g. 11, 22, 25, 31, 32, 33] who have suspension of disbelief refer to some of the innumerable modes of sensory immersion, the point of departure of this paper is the concept in its narrative sense: in the overlooking of improbable story components that inhibit the construction of coherent readings, that is, narrative coherence [cf. 6, 13, 23, 24, 27, 38].

Like virtuality was found to be mixed with simulative elements, the difference between narrative coherence and sensory immersion is not palpable either. Taking consideration of Marshall McLuhan's [29] tag of technology being fundamentally just part of the evolution of the physically extending human body, for instance, results in the conclusion that all reading, independent of the medium and the form, is first and foremost a sensually immersive act. Yet McLuhan's and others' [e.g. 5, 11] standpoint falls into the same category as the theories that consider virtuality a property of all semantic expression. If one holds that texts have been virtual objects from the Mesopotamian ages [28], virtuality loses its function as a descriptor of the phenomenon at issue. Likewise, if sensory immersion—as haptic sensation of simulation—is attached to all media, the specialized modes of modern interaction get vastly neglected.

There is simulation in every story [cf. 18], but the way in which the mimesis is perceived does not necessarily pursue (let alone result in) the sensory immersion that has recently become a considerable subject of study due to the development of digital technology. Accordingly, and despite some natural overlapping, there seems to be a strong justification for examining the narrative dimension separately from immersion theories that concentrate on the mental processes of sensory, physical, haptic, bodily, or carnal involvement in stories.

3.1 Suspending Disbelief at Narrative and Discoursive Improbabilities

The structure of stories has been divided in two numerous times, the criteria depending on the motives of the theorist in question. Story, plot, narrative and discourse are key terms that alone create various confrontations. Regardless, the components of a narrative work are extremely challenging to bisect for the sides of oppositions repeatedly turn out to be indissociable; a position shared even by renowned structuralists such as Émile Benveniste [3], Gérard Genette [18, 19] and Seymour Chatman [7]. There is no narrative work without a medium, as a result of which stories will always be tied to the means they are expressed through. For the purpose of analyzing the improbabilities that threaten narrative coherence, it is nevertheless necessary to make a distinction at least between the most diverse

components of narrative works, notwithstanding that the dichotomy might not be applicable to every component to the full.

In what follows the potentially improbable components of narrative works are termed *story components*, the word *story* thus signifying the narrative work with all of its components. The components are tentatively divided into *narrative* and *discoursive* ones, the division being moderately comparable to Chatman's split between "(story) content" and "(discourse) expression." Narrative components refer to the described events and details; discoursive components refer to the means through which the narrative components are presented, the semantic and somatic tools of the discourse. The narrative components of a novel are the textual descriptions that ultimately construct the story; the discoursive components are the language and the signs through which the descriptions are expressed. In film, narrative components are expressed additionally by means of sight and sound, which multiplies the number of discoursive components. In practice, narrative components can be considered independently as they tend to be easily transferable from one narrative form to another, whereas discoursive components are more specific to forms (novel, poem, graphic novel, hypertext, text adventure) and media (print, drama, radio, film, computer).

A certain understanding of discoursive components is always compulsory for accessing narrative components. One cannot read an English novel without understanding English. Yet, what are of interest here are not the technical minimum requirements—such as basic language skills—but the means that storytellers employ in order to help their audiences attain narrative coherence. Coleridge describes this as a "unity in variety," by which he implies that certain improbabilities actually belong to all arts. A landscape painting can never be equal to a mundane landscape, yet it is not the painting's intention in the first place:

> If the panorama had been invented in the time of Leo X, Raphael would still have smiled at the regret that the broom-twigs, etc., at the back of his grand pictures were not as probable trees as those in the panorama. [9]

The plausibility of components in all artworks must not be judged against the mundane but against the means of the medium and the logics of the work. This principle explains the ambivalent role of improbabilities in Coleridge's narrative aesthetics. While improbable components inescapably distract the reader, they are at the same time indispensable for the story to rise above the mundane—to separate it from the "apparent and extraneous." An improbability may function simultaneously as a vital, positive feature and as a disturbing, negative one. Hence, it is the role of the author to construct the story so that its narrative and discoursive components, which overlap more or less depending on the medium, create a coherent whole; and it is the role of the audience to suspend their disbelief at the (intentional or unintentional) improbabilities. Examples shall explicate the approach.

When Molière's play *Don Juan* is presented in London, it is most probable that the French protagonist speaks all his lines in English. While this discoursive improbability does not directly improve the story, it is one of the basic drama conventions in front of which the audience is most likely ready to suspend their

disbelief. The improbable character of Don Juan—the godless, immoral seducer endowed with innumerable gifts and prosperity—stands in turn as a narrative improbability that is "the very circumstance which gives to this play its charm and universal interest" [8], as Coleridge has it. The unbelievability of Don Juan is the motor of the entire play and hence corresponds with the logics of the story, making it easy for the audience to suspend their disbelief at the character's eccentric nature.

The coherence of the novel *Frankenstein* (1818) gets questioned on the basis of the improbable narrative component of human resurrection. In this case the author, Mary Shelley, helps her readers to sustain their poetic faith by not explaining how the unnatural act is done but instead letting the protagonist declare that the consequences of distributing that information would be fateful. Shelley's choice of words corresponds to what Coleridge was after in his poetry. A reasonable excuse for not giving a flawed formula of human resurrection facilitates sustaining the coherence of the diegesis that attempts to follow the rules of the mundane.

The film adaption *Frankenstein* (James Whale) was released in 1931, and with the supplementary expressive means of sight and sound it provides multiple discoursive improbabilities when compared to Shelley's novel. For a present-day audience, the most visible ones are its black-and-white cinematography and the heavily dramatized methods of acting. While a filmgoer of today may find these components distracting, the audience of the time supposedly suspended their disbelief at both improbabilities with ease. This outlines the concept's redefinition: suspending disbelief is a skill of reading that is crucial for understanding the differing modes of expression of different narrative forms.

Although people naturally and expertly construct narrative coherence, the skill of suspending disbelief is not a property equal to all human beings but depends on the individual's aptitude and knowledge. Per each form, the skill is largely associated to the knowledge of its conventions. McLuhan provides an enlightening example of film:

> Our literate acceptance of the mere movement of the camera eye as it follows or drops a figure from view is not acceptable to an African film audience. If somebody disappears off the side of the film, the African wants to know what happened to him. … For even when natives have learned to "see" pictures, they cannot accept our ideas of time and space "illusions." On seeing Charlie Chaplin's *The Tramp*, the African audience concluded that Europeans were magicians who could restore life. They saw a character who survived a mighty blow on the head without any indication of being hurt. [29]

While accepting the movement of the camera eye is essentially a medium-specific skill (the film), the overlooking of consequence-free violence rather relates to the knowledge of the form (the silent slapstick). Again, the line between forms and media is arguable and becomes even more so in literary works. Iterative wording stands as a common convention that has its roots in the everyday use of language. When Marcel Proust recounts a dinner scene with richness and precision of detail and refers to it as a weekly one, he does not assume the reader to seriously believe that it occurs and reoccurs without any variation [see 18]. All the same, there is no question that forms and media carry form-specific and medium-specific conventions, which eventually entail form-specific and medium-specific suspensions of disbelief.

Before proceeding to the conventions of stories that contain virtual elements, and videogames in particular, a consequential objection must be brought up. What is seriously misleading in labeling suspension of disbelief a skill of reading is its implication that the more one suspends disbelief, the more skilled she or he is in the art. This is obviously not the case. In Genette's words, all it requires "to seek 'unity' at any price, and in this way to force the work's coherence … is a little interpretive rhetoric" [19]. Constructing illogical coherence is no more an attainment of *poetic* faith, but rather that of a child's.

Every narrative form involves conventions the acknowledging of which facilitates its reception by systemizing suspension of disbelief at the conventionalized components. By acquiring this knowledge of conventions, the reader becomes more refined in terms of attaining coherent readings of works of different narrative forms. But when it comes to improbabilities that cannot be justified in terms of a conventionalized medium, form, genre, author or other motivating context, the skill is to leave the disbelief unsuspended. Recognizing these motivating contexts can be considered a methodological proficiency of hermeneutically evolving interpretation concerning categorized works—an ability to construct readings by overlooking improbabilities on a rational basis.

3.2 Suspension of Virtual Disbelief

Gordon Calleja suggests that suspension of disbelief is needed more when the audience is limited to interpreting a written text or a film than in videogames "where belief (if the term still applies at all) is created through action, movement, navigation, communication and other forms of interaction" [6]. Calleja is correct in that explorative and configurative engagement with games does strengthen their diegeses. One does not have to suspend disbelief in front of what is real, as in front of labyrinth walls, doors and guns that may hold a reality status for those who (vicariously) operate them. From the perspective of narrative coherence, however, game realities often ask players for a supplementary belief: belief in simulated behavioral properties, that is, suspension of *virtual disbelief*.

The virtuality of videogames is next examined through virtual conversations. *Fallout: New Vegas* (2010, Bethesda) offers an example to begin with. Despite holding the dialogue record for role-playing videogames, with no less than 65 000 pre-written lines [21], its conversation system appears relatively abstracted. At one point in the game the player may contact a guard via an intercom to receive an answer: "Stop messing around with the intercom." The guard can be contacted several times, but the reply is always the same. This replay feature is fixed to most of the game's menu-based exchanges, which let players choose their lines from pre-written options to get pre-written answers.

Similar to how a skilled filmgoer suspends her or his disbelief at the striking improbability of characters bursting into song-and-dance numbers in musicals, so do gamers (experienced videogame players) routinely ignore the replay feature of videogame conversations. Even though the repeated line surfaces as one of the story's descripted events (sjužet), a cultivated player does not let it interfere with her or his

interpretation of the story as a series of sequential events (fabula). This repetitive communication can thus be considered a videogame convention the ignoring of which is significant for constructing narrative coherence of videogame stories.

Although players willingly suspend their disbelief at virtual improbabilities, videogame artists have always pursued lower levels of abstraction by providing higher levels of virtuality. In text adventure *Mindwheel* (1984, Synapse) virtuality is used to produce a relatively low abstraction of conversations. The game provides a parser interface through which players converse via self-written input instead of pre-written lines. While the parser has its limitations [e.g. 1, 30, 36], it can be considered less abstracted than most commonly-used conversations systems, such menu-based ones [14]. Yet what makes *Mindwheel* of exceptional interest here is the way in which it employs narrative means to support the credibility of its conversations.

Despite the vocabulary of more than 1200 words, players eventually end up typing words and sentences that are not included in the script of *Mindwheel*. The author, Robert Pinsky, attenuates the improbability by setting the game in a meta-virtual environment created by a character in the story, Doctor Virgil. If the player inquires other story characters about a subject that is not included in the game's vocabulary, they simply refer to their meta-virtual nature:

> That is a kinda profound question, in a way. But as a real, but limited creature of Doctor Virgil, I don't know how to answer.

Since most of the story's characters are set in the meta-virtual environment, their lack of responsiveness is reasoned in the story context. In case the parser does not understand the player, the error still coheres with the narrative construct. Like Shelley helped her readers to construct narrative coherence by not trying to explain something that could no be explained, Pinksy befits the limited conversation model by transferring the responsibility of its flaws to a diegetic character [cf. 12].

3.3 Virtual Balance

The possibility to replay conversations was previously discussed as a feature that disintegrates narrative coherence in videogames. Leaning on Coleridgean aesthetics—according to which improbabilities belong to all art forms as their inherent expressive means—the improbable repeatability of videogame conversations has simultaneously a significant ludic function: repetition provides the player with an opportunity to recall information that can be crucial for advancing the game. Even though repeated lines disintegrate the coherence of the story, their ludic function is often crucial for traversing the story. This binary role must be approached from a practical perspective. Going back to the example of videogame doors, Aarseth sees the lack of virtuality primarily as a financial issue:

> freedom of movement and quality of world-representation are inversely proportional, given a fixed development budget. For every virtual door, an additional room must be created behind it; for every fork in the road, more graphics artists must be hired. [2]

Aarseth is mainly correct. The most common reasons for limited virtuality are no doubt financial ones. However, just like not every written description has a realistic effect in a novel [19], neither does virtuality always correlate with improved world-representation. The replay feature of *Fallout: New Vegas* conversations, for instance, adds one more virtual layer to the communication model but in the process makes its conversations less world-representative. The unrepeatable, albeit more world-representative, communication model would moreover entail ludic complications as conversations would no longer be a source for reacquiring information. Increasing virtuality does not directly improve world-representation, and increasing world-representation does not directly improve the game.

Making every door in *Return to Castle Wolfenstein* highly virtual—creating rooms, characters and objects behind them—would most likely confuse players, as they would have to try numerous doors to figure out which one will take the story further. Extreme world-representation would also make finding vital documents (the game conveys narrative information via clipboard texts) frustrating, as there would be loads of insignificant papers lying around. An ecstasy of mimésis does not result in an ecstasy of reading. In a treatise of the acclaimed text adventure *Deadline* (1982, Infocom), Aarseth rightly declares that

> The contract between user and text in "interactive fiction" is not merely a "willing suspension of disbelief" but a willing suspension of one's normal capacity for language, physical aptness, and social interaction as well. [1]

Whereas the possibility to converse by mundane means would initially have a pleasing effect on the user—like all novel attractions do—the role of social interaction is games goes far beyond the aesthetics of imitation. What if the player does not want to write or speak aloud tens of thousands of lines during the forty-hour story? What if the player is not able to find the correct question that would advance the story? Or what if one is simply not good with words? In addition to setting limitations, abstractions such as pre-written lines also function as instruments of game design and aesthetic expression.

More often than not, virtual insertions do bring along heightened demands for advancing the story. With usual exceptions, virtuality is thus asserted to complicate story traversal [see 15]. On the other hand, virtuality tends to reduce the level of abstraction, which strengthens the diegesis. Increasing the level of virtuality is therefore not simply a question of improving the story but a matter of *virtual balance,* of harmonizing fluent traversal and diegetic volume.

4 Virtuality as a Rhetorical Storytelling Tool

So far the main contribution has been the establishing of Coleridgean aesthetics in the context of modern story forms. This involved accommodating his idea of suspension of disbelief to stories that contain virtual elements and assuming his premise that limitations are not mere deficiencies but also instruments for expression. While the race towards perfected simulation (mimésis) in storytelling that initiated from oral and

literal expression has now reached the stage of virtuality, hardly any narrative forms have become outdated. This is because narrative forms are combinations of limitations—specific sets of expressive avenues—which all require specific skills and knowledge to be read, thereby providing distinct aesthetic experiences.

For videogames, as a narrative form, it is virtuality that stands as the defining element of its expressive distinctiveness, and which sets the specific requirements for its interpretation. This final chapter discusses how the complications that follow virtual story components may be turned into rhetorical tools. The discussion will be carried out through two examples, imaginary concepts and character behavior; respective story components that are both found in numerous narrative forms.

4.1 Imaginary Concepts

William Gibson's cyberpunk novel *Neuromancer* (1984) offers a futuristic vision. A major part of the story is set in cyberspace, where hackers, including the protagonist Henry Case, attempt to steal confidential information from virtual reality databases that are protected with security programs referred to as "ice." While a modern reader may find her or himself comfortable in the setting, it may still be hard to assimilate the imaginary concept of "icebreaking:"

> Ice patterns formed and reformed on the screen as he probed for gaps, skirted the most obvious traps, and mapped the route he'd take through Sense/Net's ice … He jacked in and triggered his program. "Mainline," breathed the link man, his voice the only sound as Case plunged through the glowing strata of Sense/Net ice. Good. Check Molly. He hit the simstim and flipped into her sensorium. [20]

The citation is only a part of Gibson's description of the event. The details of the full description are essential to the mode of expression through which the literary work invites the reader to imagine the peculiarities of icebreaking. Because there are neither audiovisual nor virtual elements, readers construct the concept in their mind with the sole stimuli of the text.

As early as 1982, Chris Crawford argued that the "fundamental motivation for all game-playing is to learn" [10]. While Crawford's observation has been later discussed in game studies as "proceduralism" [e.g. 4, 30, 35], the fact is that the defining rhetoric of videogames is still that of natural learning. The learning rhetoric is also the mode of expression through which *Neuromancer* (1988, Interplay) invites the player to understand the concept of icebreaking.

Advancing the game and its story involves searching for clues that guide the player to locate and break into databases that conceal information. Among other things, the procedure requires the player to internalize icebreaking mechanics that are necessary for successful break-ins. Here icebreaking is manifested as a complex combination of skills, viruses, cracking utensils and jamming devices that take time to master but are indispensible for traversal. It is through this learning process that the concept of icebreaking becomes expressed and assimilated.

The central modal difference between the textual and the virtual expression is found in their reception. By letting readers construct their conception on descriptions

that include numerous unexplained gaps, Gibson presents icebreaking as a vague process open for a variety of interpretation. It is the reader's responsibility to conceive a reading in which her or his conception of the concept coheres with the description of the event. The videogame, in turn, makes the player assimilate icebreaking through the performance of game mechanics. This results in a compressed interpretive bandwidth, for there is no external framework into which fit the conception. The player's own performance is the sole reference of her or his understanding of the process.

The filling of unexplained gaps is visibly relevant, if not a direct counterpart, to the act of suspending disbelief. Recognizing a gap entails evaluating whether it can be cogently filled or not, after which comes along the choosing between conceived alternatives. Leaving more extensive taxonomy for future research, a coherent filling of story gaps can be considered a distinctive type of suspending disbelief. It is an act of critical interpretation that cannot be separated from the act of constructing a reading.

In effect, whereas constructing narrative coherence of a story that contains virtual elements calls for the additional suspension of virtual disbelief, assimilating an idea that is expressed through virtual means may not need suspension of disbelief at all. To recall the Coleridgean premise, one does not have to suspend disbelief in front of what is real. When the player breaks ice, icebreaking is real. In expressing (one cannot talk about simulating) an imaginary concept via the virtual rhetoric of performance the interpretive bandwidth is entirely vanished. This is due to the concept's imaginary nature: it is a signifier signifying itself; or one could even say, a signifier with no signified. The potency of the virtual rhetoric lies in the fact that there is no interpretation of subjective performance—and with no interpretation there is no confrontation. Playing is alone an act of understanding, for which expressing concepts that have no mundane world (or other) reference through explorable and configurable user functions always results in seamless understanding.

4.2 Character Behavior

In Brenda Laurel's (1991) opinion, the most interesting potential of computers lay in their "capacity to represent action in which humans could participate" [27]. Next to Crawford's remark, Laurel's likewise matured notion is still timely when it comes to the rhetorics of digital storytelling. The rhetoric is no longer in showing, but in providing understanding through vicarious control of behavior. While not all videogame characters are virtual [cf. 39], the ones that are may be used for persuading the player to construct narrative coherence.

Quantic Dream's *Heavy Rain* (2010) provides an example of employing virtuality to help players assimilate an act that appears outwardly inapprehensible. In the following scene the player controls the focalized character by choosing actions from alternatives that are presented as icons on the screen at the moment of selection. The focalized character, Norman Jayden, is interrogating a suspect with his partner detective until the unexpected event happens:

> Things quickly get out of hand and the suspect draws a gun on the detective who in turn yells at Norman to shoot the suspect. Almost immediately, multiple icons appear and begin rapidly circling Norman's head. All of them, except for the one labeled R1 (with no accompanying text) flit in and out of view. This last one simply wobbles next to Jayden's head. It is hard to read what the icons that circle around Jayden's head say. While this happens, the detective continues yell and insist that Jayden shoot the suspect. [40]

As José Zagal's close reading of the game reveals, under the pressure of the given situation and controls it is easy for the player to simply choose the hasty action behind R1 instead of other alternatives. Pressing R1 results in Jayden firing his weapon and instantly killing the suspect. Zagal describes his feelings after being driven to make the fatal choice:

> It is obviously the wrong choice, but it's understandable, perhaps even forgivable, given the dramatic tension of the moment. I was surprised when I shot the suspect. It wasn't something I wanted to do. It wasn't something I intended to do. It just, happened. [40]

The case demonstrates the rhetoric through which virtuality can make players understand actions. Unbalancing the distinguishability of alternatives for a limited time period simulates the confused emotional state of the character. Being able to identify with the character's emotional state makes the tragic event understandable with no need to fill his motivational gaps. In other words, players need not suspend their disbelief at Jayden's motives.

A more common virtualization of action in videogames is the simulation of physical effort. In *Jurassic Park: The Game* (Telltale Games, 2011) chase scenes provide the player with the possibility to affect the protagonist's runaway performance. From the perspective of narrative coherence, if the dinosaurs catch the protagonist the incident is consistent since the player is familiar with the factors of the event through her or his vicarious performance.[4] This simulation of behavior differs markedly from the rhetoric of the film *Jurassic Park* (Steven Spielberg, 1993), which invites viewers to construct a coherent reading of its events by means of audiovisual clues. Whereas the film persuades the audience to suspend disbelief at shown events, the videogame persuades players to suspend disbelief at simulated behavior.

Conclusions

The paper's contribution can be summed up in four points.

(i) Varying usages of suspension of disbelief were distinguished. The concept was defined as a skill required for constructing *narrative coherence* by means of overlooking improbabilities. This skill differs between narrative forms, as each form has its specific limitations and conventions that result in specific improbabilities.

(ii) Virtuality was defined in terms of explorative-configurative *user functionality* and *behavioral functionality* that occur in diegetic contexts. Constructing coherent readings of videogame stories was proposed to require the specific skill of suspending *virtual disbelief*, the overlooking of improbable *story components* that derive from virtuality.

[4] See Nick Fortugno's [17] comprehensive discussion of how ineffective player contribution can be used to express futility.

(iii) While virtuality was shown to set increased demands on constructing narrative coherence as well as on story traversal, it was also noted to possess the potential for strengthening diegesis. The tendency between these diverging functions was termed *virtual balance*.
(iv) Following Coleridgean aesthetics, the complications virtuality brings to storytelling were finally argued to function as rhetorical tools.

One more point must be made. The dichotomy between *narrative* and *discoursive* story components (potential improbabilities) presented in the third chapter entail further categorization, as already mentioned in passing. The introduced premise was that narrative components refer to story events in a sense that they are transferable from one narrative form to another, whereas discoursive components are specific (yet rarely unique) to the narrative form itself. But, as narratologists frequently remind us, described events are never entirely distinct from the techniques of the form and the (extranarrative) medium. A more comprehensive analysis of story components, especially one concerning the technological aspects of discoursive components, seems to be in call for.

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Four Quantitative Metrics Describing Narrative Conflict

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Abstract. Conflict is an essential element of interesting stories. In previous work, we proposed a formal model of narrative conflict along with 4 quantitative dimensions which can be used to distinguish one conflict from another based on context: *balance*, *directness*, *intensity*, and *resolution*. This paper presents the results of an experiment designed to measure how well these metrics predict the responses of human readers when asked to measure these same values in a set of four stories. We conclude that our metrics are able to rank stories similarly to human readers for each of these four dimensions.

Keywords: conflict, narrative, metrics, planning.

1 Introduction

Narratologists, screen writers, game designers, and other researchers in computer narrative agree that conflict is an essential element of interesting stories [15,5,11,2,1]. Conflict provides an impetus for the plot to begin [6], and it keeps the audience engaged as the story unfolds, even if they already know the ending [9]. Conflict also structures the discourse of a story into meaningful units that together make up a coherent whole [6,1].

Our previous work [17,18] defined a formal computational model of narrative conflict that was inspired by research in narratology, based on AI planning, and designed for story generation. In short, conflict occurs when a goal seeking agent's plan is thwarted by another agent, the environment, or its own plans to achieve other goals. This definition is intentionally broad to cover the entire spectrum of conflict.

In order to provide greater control over story content, we identified seven dimensions from various narratological sources that can be used to distinguish one conflict from another. The first three—*participants, subject,* and *duration*—have discrete values which can be directly observed in the structure of the planning model and have already been experimentally validated [19]. The other four—*balance*, *directness*, *intensity*, and *resolution*—are quantitative, continuous values which require more contextual information. No consensus exists on how to measure these dimensions.

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We provide four simple formulas intended to measure each of these dimensions and describe an experiment to test whether the observations of human readers correspond to the values predicted by our formulas. This paper presents the findings of that experiment along with an analysis and discussion of the results. We conclude that our formulas for *balance*, *directness*, and *resolution* rank stories in the same order as human readers, and that our formula for *intensity*, while less accurate, still ranks stories similarly to human readers.

This work is an attempt to operationalize a few of the tacit story metrics used by human readers into formulas which can be used by machines to evaluate the content of stories. Even if the formulas do not operate like a human mind, they can enable more human-like story analysis by modeling specific features of narrative structure. Many narrative-oriented virtual environments like role playing games, training simulations, and intelligent tutoring systems need to adapt their content in response to user actions. By capturing a model of how humans evaluate stories, we can guide story generation systems to produce content that is better suited to meet the expectations of the audience by leveraging the benefits provided by well-structured conflicts.

2 Related Work

Much previous work exists on modeling human perception with quantitative metrics. Yannakakis [20] provides a survey of research that measures concepts like *fun* and *flow* in the context of video games. Less work has been done specifically in narrative. Peinado and Gervs [13] collected four metrics from human readers evaluating the quality of stories produced by their ProtoPropp system: *linguistic quality*, *coherence*, *interest*, and *originality*.

Our approach differs from these because we measure properties of stories apart from their effects on the reader. The dimensions of conflict answer *who? what? when?* and *how?*; they are designed so that readers can agree on their values even when they disagree on how fun or interesting a given conflict is.

At least three story generation systems have attempted to reason about conflict quantitatively. IDtension [16] assigns a "conflict value" to each action in a story for the degree to which a character is forced to act against its moral principles. MEXICA [14] estimates the tension a reader perceives in the story at each world state and crafts a pattern of rising and falling action. The AI Director of the zombie survival game series *Left 4 Dead* [4] moderates the intensity of its conflicts by controlling the number and frequency of enemies, distribution of power-ups, and geography of levels. It monitors metrics such as the player's health and accuracy to measure stress, and uses this information to create a series of peaks and valleys in the story's intensity.

Because conflict is such a diverse phenomenon, we have chosen to measure many individual dimensions rather than attempt to quantify conflict as a single value. This higher level of detail will allow story generating systems to produce content with more specific constraints. We also hope to provide a model which can generalize to many domains.

3 Dimensions of Conflict

Complete formal descriptions for each dimension are given by Ware and Young [18]. Some essential notation is reproduced here.

We assume that a conflict exists between character c_1, who intends to carry out a sequence of actions f_1, and character c_2, who intends to carry out a sequence of actions f_2. Some action in f_1 conflicts with an action in f_2—that is, some action in f_1 prevents c_2 from executing one of the actions in f_2. Let E be the set of actions which actually occur in the story. E may contain some actions from both f_1 and f_2, but cannot contain all the actions from both (because the two character plans are incompatible).

Dimensions are measured from some character's point of view. In general, a dimension is expressed as $name(c)$ where *name* is the name of the dimension and c is the character from whose point of view the dimension is being measured. We also employ two additional functions in the range $[0, 1]$:

- $\pi(f)$ measures how likely some sequence of actions f is to succeed.
- $\text{utility}(c, f)$ measures how satisfied character c is with the state of the world after the sequence of actions f occurs. $\text{utility}(c, \emptyset)$ is the character's utility before the conflict begins.

Examples from the *Star Wars* films are provided to illustrate each dimension.

3.1 Balance

Balance measures the relative likelihood of each side in the conflict to succeed, regardless of the actual outcome:

$$\text{balance}(c_1) = \frac{\pi(f_1)}{\pi(f_1) + \pi(f_2)}$$

The range of *balance* is $[0, 1]$. If c_1 is likely to prevail—that is, $\pi(f_1)$ is close to 1, then balance is high for c_1. If the opposing participant, c_2, is is more likely to prevail, then balance is low for c_1.

When Obi Wan Kenobi challenges Darth Vader to a duel in *Star Wars: A New Hope*, he knows that he cannot win. Vader's skill is at its peak while Kenobi's skill is waning with age. In this conflict, the balance for Kenobi is low while the balance for Vader is high.

3.2 Directness

Directness measures how close the participants are to one another at the moment of the conflict:

$$\text{directness}(c_1) = \frac{\sum_{i=1}^{n} \text{closeness}_i(c_1, c_2)}{n}$$

We chose to measure 3 types of *closeness* in this experiment: familial, emotional, and interpersonal. The range of *directness* and each *closeness* is $[0, 1]$.

During the climax of *Star Wars: Return of the Jedi*, Luke Skywalker and Darth Vader are face to face and emotionally close because of their family ties. Interpersonal closeness is non-zero when one agent participates in the conflict via other agents. There is interpersonal distance between the Emperor and Luke because the Emperor participants in the conflict via his subordinate, Vader.

3.3 Intensity

Intensity is the difference between how high a participant's utility will be if she prevails and how low it will be if she fails (which can be estimated as how bad things will be if her opponent succeeds):

$$\text{intensity}(c_1) = |\text{utility}(c_1, f_1) - \text{utility}(c_1, f_2)|$$

The range of *intensity* is $[0, 1]$. Two factors influence this formula: how much can be gained and how much can be lost. Situations which are high risk or high reward have medium intensity, while situations which are both high risk and high reward have high intensity. Like balance, intensity is measured regardless of the actual outcome of the story.

The Rebel Alliance's plan to destroy the Death Star in *A New Hope* is very intense. If they succeed they will cripple the Empire, but if they fail their rebellion will be crushed. This is a high risk, high reward conflict.

3.4 Resolution

Resolution measures the change in utility a participant experiences after a conflict ends. Recall that E is the events from f_1 and f_2 that actually occur:

$$\text{resolution}(c_1) = \text{utility}(c_1, E) - \text{utility}(c_1, \emptyset)$$

The range of resolution is $[-1, 1]$. Luke and the Rebel Alliance overcome the Empire at the end of *Return of the Jedi*. Their resolution is high, while the resolutions for Darth Vader and the Emperor are low.

4 Experiment Design

The task of predicting the exact value a reader will report for some dimension is difficult considering how sensitive these concepts are to subtleties of interpretation. Simply predicting high or low is easier, but would provide less support for the strength of our model. As a middle ground, we tested whether our formulas could rank four stories in the same order as human readers. If readers agree on an ordering, and if that ordering agrees with our predictions, we assume that our formulas can approximate these dimensions of conflict.

Each participant was shown the four stories given in Figure 1 (initially in a random order) and asked to sort them from lowest to highest for each dimension.

Introduction
This story takes place in a magical kingdom ruled by a wealthy king. The king has a young son, the prince. You are just a poor farmer, but you are friends with the prince. One day, an evil sorcerer kidnaps the prince! The king offers you a reward if you can get the prince home safely.

Story A
You travel to the city.
You ask a knight to kill the sorcerer.
The knight buys a sharp sword at the market.
The knight travels to the tower.
The knight challenges the sorcerer to a fight to the death.
The sorcerer reveals that he is your father.
The knight defeats the sorcerer.
The prince travels to the city.
The king gives you a bag of gold.
The king makes you a knight.

Story B
You travel to the city.
You ask a knight to kill the sorcerer.
The knight buys a sharp sword at the market.
The knight buys a suit of armor at the market.
The knight travels to the tower.
The knight challenges the sorcerer to a fight to the death.
The sorcerer threatens to kill the prince.
The knight defeats the sorcerer.
The prince travels to the city.
The king gives you a bag of gold.

Story C
You travel to the tower.
You challenge the sorcerer to a fight to the death.
The sorcerer reveals that he is your father.
The sorcerer threatens to kill the prince.
You defeat the sorcerer.
The prince travels to the city.
You travel to the city.

Story D
You travel to the city.
You buy a sharp sword at the market.
You travel to the tower.
You challenge the sorcerer to a fight to the death.
The sorcerer reveals that he is your father.
The sorcerer and you become friends.
The sorcerer defeats you.

Fig. 1. The four stories used in the experiment. Each story has the same beginning, but a different middle and end. These stories can be generated by a narrative planner such as CPOCL [17] and translated into natural language using simple templates.

Liklihood You Will Win the Conflict
Rate the stories based on how likely you and your allies are to win out over the sorcerer. If you expect your team to win, rate the story high. If you expect your team to lose, rate it low. Do not consider whether or not you actually win. Only rate the stories based on what you expected to happen before someone gets defeated.

Fig. 2. Example dimension description given to participants for *balance*

Dimensions were presented in a random order. All four stories had the same beginning, but different middles and ends. All stories were written in the second person such that the reader was the protagonist in conflict with an evil sorcerer. The text of the stories was composed of simple actions which can be formally expressed as STRIPS-style planning operators [7]. In other words, the stories were such that they could be produced by an automated planning system like the CPOCL algorithm [17].

The content of the stories was structured so that, given our orderings for each dimension, no two stories would appear at the same index for the same dimension (i.e. the story with highest intensity was not highest for any other dimension). Readers were not told of this constraint. To avoid confusion from vocabulary, the dimensions were not given names in the study. Participants were simply given a description of the concept and asked to sort the stories. An example description for balance is given in Figure 2.

4.1 Hypotheses

In this paper, we explore two hypotheses:

1. For each dimension, participants will rank stories similarly to one another.
2. For each dimension, participants will rank stories similarly to our metrics.

Our formulas predicted the following orderings:

Balance: $\{C\ D\ A\ B\}$ The protagonist (or the knight fighting for the protagonist) is more likely to succeed when wielding a sword, and even more so when wearing armor. The knight is more likely to win a fight than the protagonist (a poor farmer).

Directness: $\{B\ A\ C\ D\}$ Familial distance is low when the sorcerer is the protagonist's father, high otherwise. Emotional distance is low when the sorcerer and protagonist are friends, high otherwise. Interpersonal distance is low when the protagonist fights, high if he gets the knight to fight for him.

Intensity: $\{A\ B\ D\ C\}$ The protagonist's life is at stake when he fights the sorcerer himself. The prince's life is at stake when the sorcerer threatens to kill the prince. When neither life is at stake, intensity is low; when both are at stake, intensity is high. Participants were told to value their own lives higher than those of others, so D is more intense than B.

Resolution: $\{D\ C\ B\ A\}$ When the protagonist dies, resolution is lowest. Participants were asked to value riches over poverty, so some reward is better than nothing and 2 rewards is best of all.

This experiment does not require a commitment to specific formulas for $\pi(f)$ and utility(c, f) as long as those formulas produce the predicted orderings given above. For example, we assume that the knight is more likely to succeed when he has a sword and armor than when he has just a sword and no armor. It is not necessary to measure the exact difference in π between the two stories.

4.2 Notes on Analysis

The data collected from each participant was an ordering of four stories for each dimension. The task of choosing an ordering is similar to classification, but it is important to note that two orderings can still be substantially similar even if they are not exactly identical. Capturing this degree of similarity is important, which precludes certain standard statistical tests.

For example, Cohen's or Fleiss's κ coefficient is often used to measure inter-rater reliability, but κ assumes that the raters are choosing one of several discrete categories. The orderings {A B C D} and {A B D C} would be considered two different categories even though 5 of the 6 pairwise orderings are the same in both; in other words, A comes before B in both; A comes before C in both; etc. The various edit distance metrics, such as Hamming distance [10], suffer from similar problems. The Hamming distance between {A B C D} and {D A B C} is 4, the maximum possible.

Kendall's Tau Distance. To account for similarity between responses, we used Kendall's τ distance [12] to compare orderings. τ counts the number of pairwise differences between two lists. Formally, let $\text{index}(x, S) = 1$ just when x is the first element in ordered set S, $\text{index}(x, S) = 2$ just when x is the second element in ordered set S, etc. Given two ordered sets M and N, an *inversion* is an ordered pair of elements (x, y) such that $\text{index}(x, M) < \text{index}(y, M)$ and $\text{index}(x, N) > \text{index}(y, N)$. This means that x is ordered before y in M, but x is ordered after y in N. The τ distance between two ordered sets can be expressed as $\tau(M, N)$ and is equal to the number of inversions that exist between M and N. Kendall's τ distance is symmetric, meaning $\tau(M, N) = \tau(N, M)$.

When comparing two orderings of length 4, the minimum τ distance is 0, when both orderings are the same. The maximum τ distance is 6, when one ordering is the reverse of the other. The τ distance between {A, B, C, D} and {D, C, B, A} is 6 because the pairs {A, B}, {A, C}, {A, D}, {B, C}, {B, D}, and {C, D} are inverted. If we fix M and choose N at random, assuming that all 24 permutations of the 4 stories are equally likely, then on average there will be a τ distance of 3 between M and N.

5 Results

30 people participated in the study—19 males and 11 females with 26 to 35 being the most common age group. Participants were recruited via e-mail and social networking websites. No compensation was offered.

5.1 Most Popular Orderings

In order to evaluate our formulas, we need to determine the most popular ordering for each dimension based on the data submitted by human readers. To account for similarity between answers, we chose the ordering with the lowest average τ distance from each participant's ordering.

For a given dimension of conflict, let $\{p_1, p_2, ..., p_n\}$ be the orderings chosen by the n participants for that dimension (here, $n = 30$). Let M be all 24 possible orderings of the 4 stories. For each of the 24 possible orderings, m, we calculated its average τ distance as:

$$\forall m \in M : \quad \tau_{\text{avg}}(m) = \frac{\sum_{i=1}^{n} \tau(m, p_i)}{n}$$

As an example, consider m ={A B C D}, the first of the 24 permutations in M. To calculate τ_{avg} for m for the dimension of *balance*, we calculate $\tau(\{\text{A B C D}\}, p_i)$ for all 30 orderings p_i that were reported by the participants for *balance*; then we average those 30 values. An ordering's τ_{avg} can be thought of as its average distance from each person's answer.

When an ordering's τ_{avg} is low, that ordering is more popular—it agrees more with the orderings reported by participants. If all 30 participants had reported the same ordering, that ordering's τ_{avg} would be 0 and the reverse ordering

would have the max τ_{avg} of 6. The most popular orderings for each dimension are given in the first row of Table 2, in Section 5.3, where we discuss how our formulas agree with readers.

5.2 Participant Agreement

Before demonstrating to what extent our formulas agree with human readers, we must first demonstrate that readers agree amongst themselves. In other words, we wish to know how strongly the participants agree that the most popular ordering is correct.

As discussed above, there is no clear way to calculate Fleiss's κ coefficient to measure inter-rater agreement for this data. However, it is possible to express agreement by comparing our data, shown in Figure 4, to distributions representing agreement and disagreement, shown in Figure 3:

- **Perfect Agreement:** If users agreed completely with one another, they would all report the exact same ordering for a dimension.
- **Relative Agreement:** Given the subjective nature of how people perceive stories, it may be impossible to achieve perfect agreement. It is more realistic to compare against a distribution which indicates high (but not perfect) agreement. One such distribution is given in Figure 3. This distribution assumes that $\frac{2}{3}$ of the participants will choose the most popular ordering, and then the function will decay exponentially by 3 from there.
- **Disagreement:** If there is complete disagreement, we would expect answers to appear as if they were given at random. This would result in a uniform distribution across the 24 possible permutations for the 4 stories. That uniform distribution, when plotted as τ distance from the most popular ordering, is a roughly normal distribution (as seen in Figure 3).

As a null hypothesis, we assume our observed distributions for each dimension will fit the *disagreement* distribution. To evaluate this, we used Fisher's exact test, which is similar to the χ^2 test but performs better for distributions with

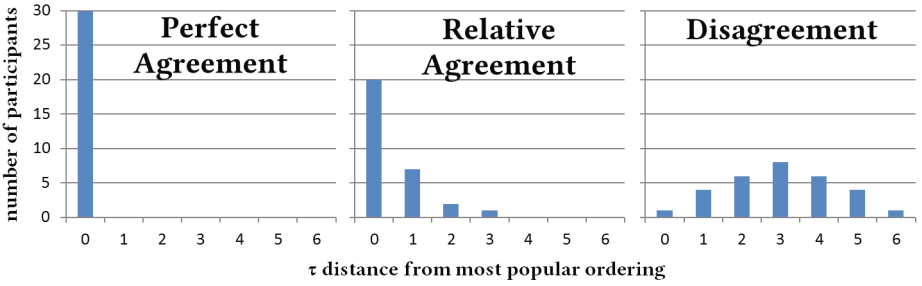

Fig. 3. The three distributions against which we compared our data. These histograms show how many participants (y axis) chose an ordering that was some τ distance (x axis) away from the most popular ordering for each dimension.

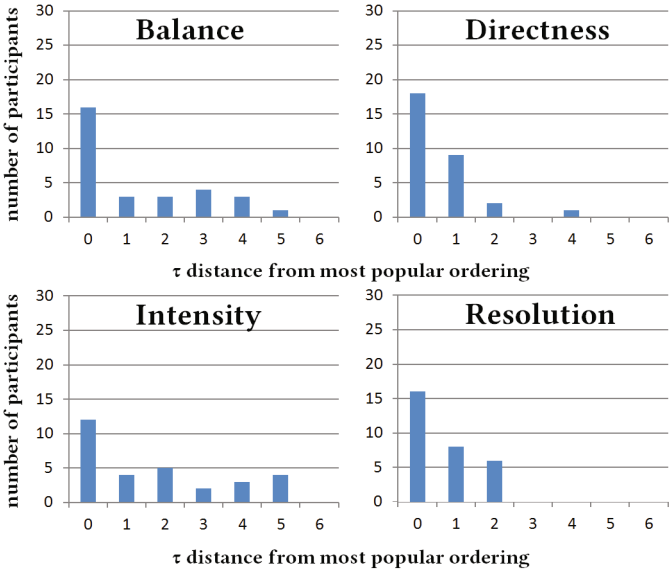

Fig. 4. The observed distributions for each dimension. These histograms show how many participants (y axis) chose an ordering that was some τ distance (x axis) away from the most popular ordering for each dimension.

Table 1. The formula for Bhattacharyya distance, D_B, and the Bhattacharyya distances between the observed distributions for each dimension and the *Perfect Agreement* (Perfect), *Relative Agreement* (Agree), and *Disagreement* (Disagree) distributions. The lowest distance is highlighted in gray for each dimension.

Given two discrete probability distributions p and q over domain X,

$$\mathrm{D}_B = -\ln\left(\sum_{x\in X}\sqrt{p(x)q(x)}\right)$$

Dimension	Perfect	Agree	Disagree
Balance	0.314	0.108	0.240
Directness	0.255	0.037	0.619
Intensity	0.465	0.168	0.175
Resolution	0.314	0.040	0.650

small expected values [8]. For all four dimensions, there was a statistically significant difference between our data and the *disagreement* distribution (for *balance* $p = 0.003$, for *directness* $p = 0.000$, for *intensity* $p = 0.028$, and for *resolution* $p = 0.000$). The null hypothesis is rejected—that is, participants do not disagree.

Now we can evaluate the alternative hypothesis—that users agree on the most popular ordering. For this, we employ a metric for measuring the similarity of two distributions called Bhattacharyya distance [3]. Bhattacharyya distance is 0 when two distributions are the same, and approaches 1 as the distributions become less similar. For each dimension, we want to know if the distribution defined by readers is most similar to the *agreement*, *relative agreement*, or *disagreement* distribution. Table 1 demonstrates that the dimensions of *directness*

Table 2. The top 6 orderings and the bottom ordering for each dimension based the on average τ distance. The orderings predicted by our formulas are in gray.

Balance		**Directness**		**Intensity**		**Resolution**	
Order	τ_{avg}	**Order**	τ_{avg}	**Order**	τ_{avg}	**Order**	τ_{avg}
CDAB	1.26667	BACD	0.56667	BACD	1.73333	DCBA	0.66667
CDBA	1.66667	BADC	0.96667	BADC	1.93333	DCAB	1.20000
DCAB	1.73333	ABCD	1.36667	ABCD	2.13333	CDBA	1.40000
CADB	2.00000	BCAD	1.36667	BCAD	2.26667	DBCA	1.40000
DCBA	2.13333	ABDC	1.76667	ABDC	2.33333	CDAB	1.93333
CBDA	2.26667	BDAC	1.90000	BDAC	2.33333	DACB	1.93333
...17...	...17...	...17...	...17...	...17...	...17...	...17...	...17...
BADC	4.73333	DCAB	5.43333	DCAB	4.26667	ABCD	5.33333

and *resolution* are more similar to the *perfect agreement* distribution than they are to the *disagreement* distribution; however, the dimensions of *balance* and *intensity* are more similar to *disagreement* than to *perfect agreement*. However, all four dimensions are most similar to the *relative agreement* distribution. These results support our hypothesis that users agree amongst themselves on a correct ordering for the four dimensions, especially for *directness* and *resolution*.

5.3 Accuracy of Our Formulas

For each dimension of conflict, Table 2 presents the 6 orderings with the lowest τ_{avg} (the top 6 best orderings for that dimension according to the participants). The orderings predicted by our formulas are highlighted in gray. For the dimensions of *balance*, *directness*, and *resolution*, the ordering predicted by our formula has the lowest τ_{avg}. For the dimension of *intensity*, the ordering predicated by our formula has the 5^{th} lowest τ_{avg}. These results support our hypothesis that participants will rank stories in the same order as our metrics. Our formula for *intensity* may need to be improved based on these results to better agree with human perceptions.

6 Discussion

These initial results are promising, especially for *balance*, *directness*, and *resolution*. Several factors may have contributed to the disagreement we observed.

Clarity of Descriptions. Participants may have misunderstood the descriptions of one or more dimensions, which were intentionally brief and targeted at a high school reading level. We attempted to address this by running a small pilot study before the experiment, which provided valuable feedback on how to clarify the definitions. *Intensity* was the most widely misunderstood dimension during the pilot. It is also possible that participants misunderstood the events of the story.

At least one participant indicated a misunderstanding of the outcome of story D. To make the stories more G-rated, we used the text "X defeats Y," which does not make it explicit that Y is killed. Our predicted ordering for intensity is based on which characters' lives are at stake, so this may have caused confusion.

Dimension Synergy. We assumed that each dimension could be measured independently of the others, but it is possible that participants perceived synergies between them. For example, if much was at stake (high *intensity*) but there was little chance that the sorcerer would prevail (low *balance*), participants might have given the story a low ranking for *intensity*. This may explain why story C is ordered before story D in the most popular ordering for intensity. We hope to investigate how dimensions influence one another in future work.

Knowledge of the Ending. The two dimensions that showed the least participant agreement—*balance* and *intensity*—require the reader to measure them independently of the actual outcome of the story. If the protagonist appears likely to prevail, balance should be high regardless of whether or not he or she actually prevails. At least two participants reported difficulty ignoring their knowledge of the outcome. In future versions of this study, rather than ask participants to ignore the ending, we intend to leave the ending out. This may help to avoid the bias introduced by foreknowledge.

7 Conclusions and Future Work

Previous work focused on developing a formal model of conflict that encompasses the entire phenomenon [17]. This experiment was designed to validate four metrics for measuring specific dimensions of conflict which can be used to evaluate the content of individual stories. Based on our results, we draw three conclusions:

- The dimensions of *balance*, *directness*, *intensity*, and *resolution* are recognizable qualities of conflict.
- Readers demonstrate agreement on how to rank stories based on *balance*, *directness*, *intensity*, and *resolution*. We suspect that improvements to this experiment will yield higher agreement for *balance* and *intensity*.
- The orderings predicted by our formulas for *balance*, *directness*, *resolution*, and to a lesser extent *intensity*, corresponded with those chosen by readers.

The higher goal of this research is to identify what measurable qualities of stories readers perceive and how they evaluate different stories based on those criteria. We believe that this research represents progress toward that goal because it identifies quantitative metrics for evaluating conflict.

In the future, we hope to improve our formulas based on this data and guide the CPOCL algorithm's production of stories with constraints on the values of these dimensions. Constraints on each dimension will be based on observed patterns in various genres. For example, in most computer role playing games, the

protagonist's conflicts with the antagonist become increasingly balanced and direct. Combined with the three discrete structural dimensions of conflict—*participants*, *subject*, and *duration*—we hope to gain considerable control over the content and quality of the stories we produce.

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The Expressive Space of IDS-as-Art

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Abstract. Much of the research and development effort in the IDS community is guided by a design approach, according to which user desires, expectations and agency are central. This approach may place unnecessary limitations on the design space. I argue for the validity and significance of an alternative, expressive approach, which may be more appealing to artists, and offer some formal parameters of IDS-as-Art. These open up for authors the ability to explore the creation of vastly complex and dynamic storyworlds that highlight contingency and probability; and the possibility of manipulating agency as subject matter to implicate users, through userly performance, in the storyworld's meaning. IDS can thus offer users an opportunity to reflect upon various aspects of their performance, including un- and subintentional aspects.

Keywords: art theory and criticism, interactive digital storytelling, interface studies, agency.

1 Introduction: Why IDS?

In [1], Joshua Tanenbaum proposes a framework for the exploration of a wider design space for Interactive Digital Storytelling (IDS). His proposed framework's purpose is to invite everyone in the community to look at IDS from a greater distance and to identify some key 'what' questions that need to be asked about each system, such as: what model of narrative does it assume? What model of interactor does it wish to address? And what sort of system is required to realise the two first models?

'What' questions are indeed fundamental and Tanenbaum is right to observe that they are too often missing from the design process of IDS systems. But to these, one should add another class of questions - 'why' questions. At the first ICIDS conference, Andrew Stern expressed his aspiration that IDS become a premier art form for the 21st century [2]. It is an aspiration I share [3], but it is difficult to remain optimistic considering the fact that, as Michael Mateas observed during his ICIDS 2010 keynote [4], there are more authoring tools in IDS than there are authors. Why, then, are there too few artists in IDS?

'Why' questions are likely to be asked by those artists for whom (but usually without whom) authoring tools are being designed and developed. It is these sort of questions I ask when I examine my own expressive motivations as an author of interactive storytelling systems and experiences. The 'what' question I regularly ask myself is,

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what is the added value of telling stories interactively? A shorter formulation for the same question would be: why IDS?

In my opinion, a good answer to this question would need to show that interactivity can offer ways of creating meaningful experiences that are not possible in another medium. Such a medium-specific answer would therefore have to elaborate on the particular ways in which meaning and experience may be expressed and produced through the forms of the medium of IDS.

Considering IDS as an art form is not just an aspiration but also a valuable analytic exercise that compels one to reconsider many basic assumptions, or intellectual commitments - to borrow another formulation from Tanenbaum's framework. However, I am not sure that this framework is quite wide enough to accommodate the full expressive range required of IDS-as-Art. I specifically beg to differ with some of the intellectual commitments that underlie Tanenbaum's discussion of the interactor model. One of these commitments is expressed in his claim that the challenge faced by IDS is to "support meaningful reader choices". I find the focus on choices and intentional player actions in general to be a limitation on the expressive space of IDS-as-Art, as I will discuss at length in section 4.2 below. Another intellectual commitment I find troubling is the adoption of Krippendorf's design guideline, according to which makers ought "to anticipate and design for the desires of a user and to structure their designs to accommodate these desires". I find this approach analogous to what Bolter and Gromala (see section 2.3 below) have termed Transparency, one of two possible aesthetic strategies to employ when approaching the design of digital artefacts. Besides my preference for the other strategy they mention, Reflectivity, it is a limitation on the design space to focus on just one of (at least) two relevant aesthetic approaches. Or, perhaps, we can imagine that there are two parallel formal spaces for IDS makers – one for designers, which Tanenbaum calls a Design Space, and another one for artists, which I shall call an Expressive Space, where artists roam freely, without unduly concerning themselves with the need to satisfy desires, and where userly performance is meaningful even when it is un- or sub-intentional.

The purpose of this paper is to start exploring the parameters of the expressive space of IDS. Such an exploration should serve to expand tool designers' awareness of the expressive potentials of IDS systems, especially in an art context. I cannot speak for all artists, so in the rest of this paper I will place IDS within broader discussions in the philosophy of art, film studies, and new media art theory, to flesh out some intellectual commitments, which guide my own theory and practice and underlie my motivations to employ IDS in an expressive artistic practice. I sketch a formalistic aesthetics of IDS as an art form in order to identify aspects of this form that, in my view, offer authors what other media can't offer: the ability to create vastly complex and dynamic storyworlds, highlighting contingency and probability; and the ability to implicate the user in the storyworld's meaning through userly performance, offering players an opportunity to reflect upon various aspects of their userly performance.

An often discussed feature of userly performance is the user's ability to experience agency. I have previously raised some doubts about the suitability of the concept of (true) agency to be considered a design goal (for IDS-as-Art) [3]. I will revisit this concept, to develop further, against the background of art theory, the suggestion that

rather than design goal, the experience of agency can be (and has been from the very beginning of the medium) a prime subject matter for interactive art, IDS included.

2 IDS as Interactive Art: A Medium-Specific Perspective

2.1 A Definition of Art (as Distinct from Games) for IDS

It is outside the scope of this paper to discuss the definition of art. It is sufficient to point to an existing definition and to justify its usefulness. One such definition was put forward by Ernst Cassirer, a post-Kantian philosopher most famous for his philosophy of culture known as the Philosophy of Symbolic Forms. Cassirer's definition is nested inside the following analogy: "The child plays with things, the artist plays with forms" ([5] p. 164). I regard this definition to be particularly useful because it connects art and play but sharpens the experiential distinction between the two: in art (even when it is as interactive as play), both artists and their audience pay special attention to formal aspects of the experience. This distinction is relevant to our discussion because it helps us distinguish between the design goals of works that are intended for entertainment and the expressive goals of works of art.

In practice, this is not a dichotomy. Some indie and critical games are very aware of, and challenge their form. In addition, formal innovations that emerge from the explorations of artists - and which initially draw attention to the form - are eventually picked up by others, gain currency and lose their reflective potency. But the analytical distinction is important for our treatment of other key issues.

The formal aspects to which works of art draw attention depend on what medium the work is realised in. Adopting Cassirer's definition thus leads us to the next question: what are those formal aspects which we can say characterise the medium of IDS? In which ways is IDS formally distinct from other media?

2.2 The Form of the Expressive Space of IDS

The systems we build in IDS are always *userly texts*, which, from the user's perspective, consist of an *encoded storyworld* and an *interaction model*.

Userly texts are authorial, expressive systems, whose recipients are users. Users/players remain recipients, but their experiential mode of reception is interactive (this can perhaps be easier to understand using an analogy from computer supported collaborative learning: learners using computers are interacting with the material they learn, but they remain learners rather than teachers or educational designers).

The encoded storyworld includes all the diegetic story elements, as well as all the possible discursive strategies. By discursive strategies I mean the forms according to which story elements could be organised in runtime. I follow Bordwell and Thompson's taxonomy of formal systems in cinema [6], which includes narrative form, as well as associative, rhetorical and other forms (in [7] I suggested a mechanism of dynamic discourse switching by an interactive storyteller character). Other forms of organisation from other media may also be remediated in IDS.

Finally, the interaction model includes the physical (hardware) and symbolic (software) interfaces, and the procedures defined by the work for *userly performance* - the totality of physical, embodied user actions and behaviours during a session, as intended by the user and/or as interpreted by the system (independent of user intention). This performance enacts a specific discourse and a specific plot in each session.

These constructs, severally and together, allow artists to play with their forms to deal with challenges that older forms find it difficult to deal with. In the next section I discuss some of the possible expressive potentials of these forms.

2.3 Expressive Potentials for IDS-as-Art

The Encoded Storyworld: Complexity, Contingency and Implication.

One possible motivation for an artist to engage with IDS as a medium would be that it has something to offer to storytelling that existing forms of storytelling are somehow less appropriate for. The dominant form of storytelling throughout most of the 20th century has been the cinema, where in recent years, more and more complex forms of storytelling have appeared. Film historian Thomas Elsaesser [8] has recently suggested that certain types of film, which he names 'mind-game films', use ever more complex structures of temporal and causal relations, such as forking paths, database or modular narratives, with an aim to disorient or mislead spectators. This, he suggests, is indicative of a 'crisis' in the relation between the film and its spectator. The cinematic and dramatic techniques that have been shaping spectatorship (the film spectator's equivalent of "user experience") are considered insufficient, inappropriate, out of tune with the times, not challenging enough, not compelling enough. It is no longer sufficient to address the spectator as "observer", "voyeur", "witness" – classical film-theoretical conceptualisations of the spectator's position in relation to the film's world that seem to have lost their potency. Even 'suspension of disbelief' itself, according to Elsaesser's account, falls victim to this crisis. Is this because film-makers are indeed looking for a way out, for a way to complicate their storytelling?

Elsaesser's explanation for this shift is different. The agents of this change are not those who tell stories – film-makers or scriptwriters - but rather the business logic of Hollywood, which demands a type of film that is DVD-enabled, capable of having a long afterlife beyond its theatrical release. Elsaesser may be right in pointing out a correlation between the business logic of Hollywood and the structure of complex cinematic narratives, but this does not imply a necessary causality.

Jan Simons [9], reviewing Elsaesser's position, is not content with this explanation. His account of complex narrative structures in cinema begins far from Hollywood and further back in time than the DVD. Following David Bordwell's earlier account [10], Simons' earliest example is Krzysztof Kieslowski's 1981 film "Blind Chance", which, with its three outcomes of the same story, heralded a new kind of cinema and influenced later works by Kieslowski himself as well as more popular forking paths films such as Sliding Doors (Peter Howitt, UK/USA 1998) or Lola Rennt (Tom Tykwer, Germany 1998). Simons' conclusion is that films with complex narratives remind us that there is a whole range of possibilities and probabilities, of chance and

contingency, between deterministic causality and chaotic randomness. Complex narratives try to cope with increasingly complex social and cultural environments by foregrounding the contingent, the possible and the probable ([9] p. 123). If Simons is correct, then one of the things that IDS can offer artists, by virtue of the computer's ability to support complex structures of information and dynamic relations between their structures, are new ways to deal with complexity, contingency, possibility and probability.

To that we should add another strong offering by IDS, in response to the other crisis Elsaesser has identified, the insufficiency of traditional ('passive') spectator/subject positions. IDS allows artists to implicate a performing subject as a meaningful agent in the story and/or the discourse layers of the encoded storyworld, by manipulating agency as subject matter (see further in section 4.1 below).

The Interaction Model: Reflectivity Rather Than Transparency

The implication of users discussed above is structured by the interaction model. In my opinion, therefore, the design of an IDS work's interaction model is as significant as the design of the encoded storyworld's diegesis and discourse layers, and has to be seen in the context of artistic approaches to interaction or interface design that can differ radically from common HCI approaches. If in cinema the distinction has been between pre-interactive and interactive forms, when it comes to the interaction model, the distinction is between two opposing views on interactivity.

Bolter and Gromala ([11], p. 371) distinguish between two aesthetic approaches to interface design: Transparency and Reflectivity. Transparency is the approach associated with creating interfaces for applications, interfaces that function as a window on the information relevant to the task at hand. But when artists approach the design of an interface, they are likely to opt for a radical approach that can "examine how digital technology presents itself to the user in its purest form, because the user comes to a work of art with only a few preconceptions about how the piece should "function" and without any practical (as opposed to aesthetic) needs the piece is expected to fulfill" ([11] p. 371). This description of an artistic approach to interface design – or in the case of IDS the design of the interaction model (see section 4.1 below for an early example) – is consonant with Cassirer's definition of art mentioned above: it pays special attention to the formal aspects of the design, and rather than try to make the interface disappear or become transparent, it seeks to make the interface more present. This is what Bolter and Gromala, drawing on a significant body of works, term "Reflectivity" – the interface is designed to function as "a mirror in which the viewer is invited to reflect on her or his relationship to the work of art or the process and various physical and cultural contexts of production" ([11], p. 378).

3 Agency and Meaning in IDS

3.1 Agency and Meaning in Interactive Art

Agency is a key concept in IDS aesthetics. However, IDS theory seldom discusses it in a wider context. If we want to make sense of IDS as an art form and understand

how artists might manipulate agency in order to produce reflectivity in the user's experience, it may be useful to look at what art theoreticians and historians might have to say about agency in interactive art. In [12], Kristine Stiles and Edward Shanken suggest some useful points of critique and reflection upon meaningful agency in interactive media art.

Stiles and Shanken's account of agency and meaning in interactive art is not limited to mediated work. Their story begins with the happenings movement as the foundational context for all interactive art. Their first point is to dissociate media technology from a certain hype around interactivity and agency that seems unjustifiably linked to technology. Originally, artists were drawn to emerging technologies as "a means to widen the social base for art, and as an exercise in active interconnection with cultural and political milieus". But interactive media art quickly and increasingly turned into a sophisticated marketing vehicle for hardware producers, as focus shifted from using technology for meaningful artistic purposes and investigating the aesthetic potentials of interactivity to using art to popularise new hardware products. An ideology of interactivity and agency was born, co-opted by commercial concerns, according to which "the augmentation of individual agency – however superficial – offered a veneer of imagined personal control to consumers" ([12] p. 83).

Despite this unfortunate turn, Stiles and Shanken still view agency as a possible goal for interactive art, and suggest specific ways in which interactivity and agency can become meaningful. Interactive media art can first be meaningful in the same way that more traditional forms of art throughout history have been, through their "ability to change (or affirm) the way viewers see, understand, and act upon the world" ([12] p. 86). Works that use interactive media technologies should, then, achieve the same by their particular interactive features, which "become meaningful when they engage and activate complex emotional and decision-making responses, such that interaction itself reinforces the transformative effects of the overall piece and plays a constructive role in creative change and exchange." This is very similar to Murray's definition of agency [13], except that it adds an affective dimension: agency and meaning attach not only to decision making but also to emotion.

Since interactive media works have until now offered only very limited forms of agency, Stiles and Shanken propose a further consideration of the concept of agency in order to imagine different forms of engagement. They first draw upon Douglas Browning to connect agency to morality and individuality: "The concept of the agent is required in order to allow for the possibility of freedom, communication, comprehension, and mystery… culture in general… rests upon…agency" (quoted in [12] p. 87). From Donald Davidson they take the idea that agency is the execution of volition: "Agency involves the freedom to create, change, and influence institutions and events, or to act as a proxy on behalf of someone else. In both cases agency is measured by the ability and the responsibility to have a meaningful effect in a real-world, inter-subjective, social context".

What Stiles and Shanken offer us when they adopt Davidson's definition and call for its application to artistic interactivity is quite different from the offer made by Murray and widely adopted in the IDS community. In their account, agency is not only always about intentionality, it is also always situated in a real-world, inter-subjective,

social context, whereas in most accounts of agency in HCI and IDS, agency is a subjective feeling related to user activity within a simulation or a representation (although one which potentially contains representations or simulations of other actual or virtual, human or digital agents).

Stiles and Shanken also provide a prescription for meaningful interactive art: "rather than earnestly pursuing technological enhancements of agency, artists might instead focus their attention on deconstructing the vast ideological apparatus that enlists individuals in their own subjugation." ([12], p.88). Thus, we find in art-critical/historical discourse this expectation to tune artistic expression towards a critical, reflective treatment of agency. If IDS is to become an art-form, it cannot avoid interrogating these ideological underpinnings and its own possible implication in them. Or, to phrase this more positively, part of the expressive space of IDS should be devoted to the exploration and questioning of mediated agency and its relation to real-world, socially situated agency, through its own special forms.

Real Agency vs. Mediated Agency

Stiles and Shanken's discussion of agency, and especially their invocation of Donald Davidson, underlines an important distinction that is at best implicit in IDS theory: as far as I know, with the exception of [14], there is no discussion of the possible relations between the IDS experience of agency and real-world, socially situated agency. It is worth dwelling on the fact that no matter how much of a subjective sense of agency one experiences while playing something like Façade, the work isn't rigged to have any consequences in the actual and social world, and does not claim to do so. Any intersubjective effect remains circumscribed within the relationship between the playing subject and the AI agents within the simulated story.

However, there's no need to see this as a problem unique to agency. The IDS experience of agency is mediated, and more specifically simulated and dramatic [15]. It isn't an extension of real agency nor a subset of it, but a representation. Unlike representation in non-interactive, non-digital media, it is an interactive representation: procedural, enactable through userly performance. And it can be authored according to either a logic of Transparency (satisfying desires) or, as many artists and art critics would prefer, according to a logic of Reflectivity.

3.2 Agency and Meaning in the Experience of IDS

15 years after it was first published, the most cited definition of agency in IDS is still the one suggested by Janet Murray in Hamlet on the Holodeck, according to which agency is "the satisfying power to take meaningful action and see the results of our decisions and choices" [13]. It was later developed and extended by Michael Mateas and others (e.g. [16],[17],[18]) into a rich Neo-Aristotelian theory of interactive drama, which in turn is also based on Brenda Laurel's Computers as Theatre [19]. Several new distinctions have been introduced that have enriched the concept of agency. Throughout all these developments, however, the belief in the "primacy of agency" (a formulation introduced in [16], which stresses the primacy of intentional userly performance), has not waned.

The fascination with Agency in the IDS community is not accidental, and reflects a wider fascination with agency in discourses surrounding interactive media technologies, as attested to by Stiles and Shanken. However, there are a number of traditions of critical treatments of social agency. Laura M. Ahearn, summarised by Harrell and Zhu in [14], identifies three major trends in the conceptualization of agency: "agency as free will", "equating agency with resistance" and "the absence of agency". They write that "although the prevailing view in the domain of interactive narrative aligns itself with the first trend, the recent years have witnessed increasing number of experiments drawn on the other two accounts", but most of the few examples they provide do not appear to demonstrate a deliberate engagement with these alternative theoretical conceptualisations. The IDS community continues to (at least implicitly) subscribe to the notion of a Primacy of Agency that, even if it isn't crudely understood as free will, certainly doesn't amount to a Foucauldian or other problematisation of real world, socially situated agency, and, as Harrell and Zhu write, "ignores or only gives lip service to the social nature of agency and the pervasive influence of culture on human intentions, beliefs, and actions" [14]. In 4.2 below I will discuss additional influences on real world agency.

3.3 The Non-linear Drama of the Interaction Model

In [20], Tanenbaum introduces the notion of bounded agency. Bounded agency is premised on the notion developed in [21] whereby agency "is a process by which the player commits to specific communicative meanings through action (or inaction)." According to this view of agency as process, interaction is seen "as a language which the interactor and system use to communicate with each other." The interaction model possesses an interactional grammar, and the author recommends that systems should be designed "which reveal their interactional grammar to their interactors and obey the rules of that grammar". Agency, therefore, is the result of a successful process of communication, and this success hinges on userly performance which is "in sync with the designed possibilities of the game."

The Bounded Agency model stresses userly performance, compares it interestingly to the performance by actors of a scripted narrative, and stresses the procedural nature of agency. However, its implied model of userly performance is still confined by an emphasis on intentional performance, namely choices; and while it identifies the meaningfulness of the interaction grammar, it is not very specific with regards to the temporal dimension of this agency-producing process of meaning-making.

I agree with Tanenbaum that the player/user needs to understand the system's grammar of interaction in order to understand the meaning of the story and of the user's own performance within the narrative context. It may easily be overlooked, however, that this understanding of the grammar is itself also procedural. In fact, we have two simultaneous, intertwined but analytically distinct processes of meaning-making: understanding the meta-discursive structure of the work (its interaction model, the way userly performance affects and enacts plot and/or discourse in the encoded storyworld); and understanding the encoded storyworld's plot, its narrative and dramatic structure.

It is widely accepted that the processes of narration and narrative comprehension need not be linear (cf. Godard's famous maxim, that every story needs a beginning, a middle and an end, but not necessarily in this order). As Neo-Aristotelian theory has taught us in its distinction between local and global levels of agency (recently also captured by the concept of Agency Scope [14]), the meaning of the story may be understood (or understood differently) retrospectively, and this affects global agency.

The same should apply also to the process of understanding the logic of the interaction model. The meaning of possible actions may be understood before or while they are taken, but this may not be necessary, and very difficult to achieve when the interaction model is dynamic (cf. Agency Dynamics in [14]). The temporal arrangement of this drama of the interaction model is another class of authorial restrictions on agency, of expressive ways to manipulate agency.

4 Agency and beyond

The relative absence of alternatives to the doctrine of the primacy of agency is consistent with scholarship that is primarily concerned with developing technologies to create and satisfy the desires of players of games. Most games, especially those created in a very competitive commercial environment, are meant to entertain rather than challenge or encourage critical reflection. Under such assumptions, it makes sense to find what it is that entertains players, what it is that they desire and even expect, and then to satisfy these desires and expectations. But this isn't what artists or even some within the game design community (a recent example is [22]) are after.

4.1 Agency as Subject Matter

In [3] I claimed that for IDS-as-Art, agency is not a design goal but subject matter, since artists are within their rights to create "IDS experiences that play on, challenge and frustrate player control rather than offer it as-is to players"; and that "players may in fact find this meaningful".

Authors working in IDS may wish to work either towards a transparent experience, or towards its reflective opposite. Under both assumptions, the specific constraints that the author of the system imposes on the player's agency are a significant, constructive, enabling and meaningful feature rather than a problem for the player. This is because the situation is always one of communication between authors and players [23]. When reflectivity becomes the goal, however, authorial constraints on userly performance and agency become a necessary part of the storyworld and its meaning, part of the rules by which that world operates, and part of what there is to find out while playing it through. Rather than try to get rid of these constraints, artists can play with, manipulate, the multiple possible forms of constrained agency.

Interactive art, IDS included, can thus also be an arena to explore the various dimensions of agency. It is in this sense that for IDS-as-Art, agency becomes subject matter rather than merely form. There is some support for this view in [14]: "as a form of cultural production, interactive narratives are created by human authors to

convey meaning. What is significant sometimes is not what the story is, but rather how the story is told. The use of agency is one of the channels for digital authors to express themselves. An equally expressive use is to limit or even temporarily eliminate user agency to convey a certain message, such as the sense of confinement or helplessness."

Agency as Subject Matter in Kinoautomat

The first interactive movie, Kinoautomat [24], provides an example of Reflectivity, of using restricted choice within an interactive work to reflect and comment upon social – and indeed political – agency. Viewers of this pre-digital interactive movie produced in 1967 were equipped with a button that allowed them to choose between two options. At the end of each sequence of the film, the actor playing the role of the protagonist would come on stage, explain what the choices might mean for him and ask the audience to decide what action his character should take. But the structure of the film's interaction model was such, that no matter which action is taken, by the next decision point the plot would end up pretty much the same. Choices matter very little in this structure – and this was the author's point. This carefully orchestrated constraining of agency is there for a reason, it's there because Činčera, coming from Communist Czechoslovakia, intended his film to be a parody of democracy [25]. No matter how you vote – it'll all end up the same way.

The quality of Kinoautomat as a work of art is in emphasising the limitations of agency and using such limitations expressively to create a meaningful experience, an experience of reflection on the way human agency is structured in the real world, likening democratic agency during the cold war era to a series of ultimately meaningless choices.

4.2 Accounting for Sub-intentional Aspects of Userly Performance

There are procedures of meaning production that arise out of moments in the experience where agency is intentionally frustrated, or from moments where the user's performance is productively sub-intentional, when the system looks precisely for such sub-intentional patterns of userly performance, as current technologies of affective computing are quite capable of doing (for specific examples in IDS see e.g. [7, 26, 27]. Pia Tikka's enactive cinema [28] is another relevant reference).

There is a pleasure also in realising, even if retrospectively, and precisely as a result of interacting with others (including digital, computerised others), through the unintended results of our behaviours, that our performance was not as we intended it. We need counter-agency to help us reflect upon, rather than simply "feel" agency.

Can there be agency without intentionality? Agency arises when the user is (1) aware of the interaction model (or at least experiences such understanding, possibly falsely) and (2) able to act upon this knowledge intentionally. But userly performance, just like human performance and indeed human existence, is not all about intentionality. Humans are only aware of a fraction of their relevant environment, and are only able to intentionally control a limited amount of their communicative performance.

Much of what we communicate to the world is involuntary, unplanned. More importantly, we regularly remain oblivious to most of the real world material, environmental, cultural, social and interpersonal consequences of our behaviours - even those that involve the intentional performance of actions in the form of decisions and choices. Our psychological reality is, of course, no different: we are often unaware of what goes on in our own minds, what drives our own performance and what the consequences of these are to our own situation.

The real criterion of a truly meaningful sense of mediated, dramatised agency is in understanding – even retrospectively, even if only after playing and replaying it all through - one's own userly performance. The unintentional, subconscious, fine details of this performance cannot be exorcised from this experience.

IDS experience should thus be about allowing users to see the results of the entire spectrum of their performance – and this includes intentional aspects of human performance such as the "choices and decisions" of Murray's definition of agency, but emphatically also sub- and unintentional aspects. In an increasingly complex and interconnected world, encouraging people to reflect upon the increasingly complex interactions between behaviour and its consequences, within and beyond their immediate control, is a very strong affordance of an artistic medium of IDS.

Artists know that humans are not acting with unrestricted agency in either the real world or within their own minds. Narrative as well as non-narrative forms of storytelling have been able to probe those issues, using their specific forms, which emanated from the technologies and techniques at their disposal at the time. IDS can do the same, and because it is capable of modelling vaster complexities and of implicating users in them through (physical, embodied) userly performance, it can probably do better. This will be achieved, as in any medium before, by exploring the medium's own forms, and thus not by maximising agency as if it were merely a form to be perfected but by using interactive technologies to create story experiences that help users experience agency and lack of agency, by drawing the user's attention to the richness of userly performance, and to its intended, as well as un- and sub-intended aspects and consequences.

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Aporia – Exploring Continuation Desire in a Game Focused on Environmental Storytelling

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Abstract. This paper is a reflective description of the development and the evaluation of the experimental game 'Aporia'. The project demonstrates an exploration of interactive environmental storytelling and an evaluation of engagement as measured by continuation desire in a non-violent first-person computer game. The test method involves the interruption of the player during gameplay at specific points and assessing their desire to continue. The objective of the interactive experience in the game is to convey a pre-written story through environmental storytelling by the use of pictorial cues in an immersive, atmospheric and aesthetic environment. The findings suggest that Aporia appears as a non-linear emergent narrative experience with a high level of engagement facilitating a desire to continue playing the game.

Keywords: Continuation Desire, Engagement, Motivation, Interactive Narrative, Environmental storytelling, CryEngine3 SDK.

1 Introduction

In order to conduct an experiment within the genre of narrative adventure games, this project was conceived in order to explore the potential of environmental storytelling. With the game Aporia, we wanted to revive a sense of mystery that seems forgotten or overlooked in today's games, where action and quick rewards take precedence over mystery and thought. This mystery was intentionally merged with the spectacular visuals of contemporary game-engines to create a world "begging" for exploration and discovery – creating an atmospheric and potentially engaging and immersive experience that is intended to differ from the more traditional storytelling used in many of today's triple-A titles. It is not believed that environmental storytelling is more effective than traditional storytelling, but by experimenting with the focus on conveying a story solely through the environment without characters, text, dialogue, narrator or actions results in a different, and interesting way of conveying the story, because of the needed degree of interpretation.

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'Aporia' is a Greek expression for 'mystery and bewilderment' and the word itself has acted as a catalyst throughout the development of the game while creating the experience and its expressions. The project is thus about context, and not content. Little focus has been given to the individual 3D models and minute details of the game - instead, the meaning and implications of these things took center focus - creating atmospheres instead of models, and conveying narrative elements instead of manufacturing game mechanics. During development it was not about "how" to do something - instead the core of the project turned out to be much more about "why?", "what does that signify?" and "how to achieve that?" This was also why Aporia was developed in CryEngine3 [1], because this development kit provides resources and predefined mechanics that could be utilized in creating the contextual aspects of Aporia. The game is played in first person perspective and the following description illustrates how the beginning of Aporia might be experienced by a player and how the first minutes are designed to raise questions and interest.

You wake up off the coast of an island. Where are you? Who are you? How did you get here? It's cold, dark and raining; – you start swimming towards the coast. In the distance you see a lighthouse perched upon a high cliff at the waterfront, the island might be inhabited!

As you come ashore and enter the nearby forest, you find a small wooden building. Inside it you discover what appears to be abandoned, but extensive research into things – strange things – on this very island. Everything looks a mess, and it appears that it has been quite some time since there was anyone in this house. Paper lies scattered around the house, but not a single word can be found on any. There are many drawings and indications to different places, and the lighthouse seems to be center of it all. But why? And how? What are all these strange drawings? Maybe there's a way off the island? You feel compelled to investigate. It feels important!

Aporia is thus an interactive narrative, which is founded on a detailed virtual environment (Fig. 1) and a narrative mediated through environmental storytelling. It is designed to let the player explore a concealed and partially predefined narrative in order to let the player construct different interpretations from the many narrative elements. The story of Aporia is specifically tailored to facilitate the player uncovering it in a non-linear manner and with the use of an elaborated mise-en-scene and overall level-design forces the player to form independent narrative connections between areas and objects. Pictorial clues were used to support the narrative and were divided in three categories; drawings, photos and cave paintings – each category revealing a successively more abstract or concealed layers of the narrative.

To ensure that the player explores the whole environment, a gathering system was implemented which forces the player to traverse each area of the island. The player needs to collect five different orbs each of which has the ability to unlock hidden areas with the pictorial clues in their respective locations, thus giving the player stronger hints to the story and at the same time rewarding explorative play within the game. The game ends when the player reaches a lighthouse where the player will be exposed to one of the two different endings depending on their exploration and actions throughout the game.

Fig. 1. In-game screenshots of Aporia

2 The Concept of Aporia

Aporia was developed over a period of two months with the intentions of creating a game that focused on conveying a narrative without text or dialogue. The concept of environmental storytelling according to Jenkins [2] was used to mediate the narrative through the environment. The story of Aporia is mainly considered to be an embedded narrative, in which the player discovers the story in a "memory palace" of areas (The story is represented with places and staging of objects in the game world) [2]. However, the narrative in Aporia also holds aspects from both emergent narratives (enabling the players to construct their own narrative within the game world) and evoked narratives (enhancing the existing narrative through spatial design) – in fact, the story can be considered as a careful combination of these two on a foundation of an embedded narrative. The overall narrative is designed to be both predefined and open to interpretation, but with planned consideration as to what is predefined and what is open to interpretation i.e. what are the evoked and the emergent narrative elements. Environmental storytelling facilitates this flexibility across narrative elements given that the perception of the environment is open to interpretation. It is possible to design an environment that tends to have one specific interpretation, but also many others if desired, which has been the main motivation for this particular aim of the project.

Besides the focus on narrative, another objective was to make the player feel immersed in the game universe and to make the players experience at least engagement and engrossment, which Brown and Cairns describe as the first two levels of immersion [3]. One barrier of engrossment is "construction", which refers to the setup and context in the game and also to the game's capability to make the players have high emotional investment [3]. This investment also makes the player want to keep playing the game, thus supporting the experience of continuation desire [4].

To increase the level of immersion and to overcome the barrier of construction, it is important to obtain congruency between the objects, environments, atmosphere and narrative in Aporia. Therefore every single object in Aporia has a specific purpose

and is used to support the narrative. The island of Aporia can be closely related to the virtual island worlds of 'Dear Esther' [5] and 'Myst'. However, these interactive experiences may be considered as having a more passive play style because of the limited degree of interaction. While Dear Esther is a linear metaphorical memory palace with only movement controls as interaction, Aporia is a game where the player has to interact directly with the game itself and objects within it, all of which takes place in an open world where the player is free to choose his or her path. In the Myst series, the player is confined to animated panorama pictures and the story is told with real acting, text and narration together with some environmental storytelling. Conversely, in Aporia, the player has complete freedom of movement, leaving every exploratory decision to the player and potentially enhancing immersion while making the player feel "in-control" - all of which is used exclusively together with environmental storytelling and pictorial cues that tells the story. The story elements in Myst are told directly to the player, whereas the story in Aporia has to be discovered, interpreted and constructed while playing.

3 Test Method, Procedure and Feedback

To achieve a rich and immersive experience for the player and to eliminate external influential factors to the experience, the test of Aporia was conducted in two small rooms where the players only were interrupted as part of the intrusive test procedure [4]. The test took place at Aalborg University, Copenhagen, Denmark and the game was played with mouse and keyboard on two powerful desktop computers with large closed-form headphones to eliminate sound and noise around the participants.

Aporia was tested with 20 participants (18 male, 2 female). The participants played through the game in its entirety (or as long as they wished), reaching one of the two endings, which on average took around one hour. During play, the participants were interrupted at three specific locations in the game, where they should report their current level of their desire to continue playing the game. These answers could then be combined with the reported answers from before and after the play session, creating an overview of each player's continuation desire (Fig. 2), in concordance with the intrusion approach and the Engagement Sampling Questionnaire introduced by Schoenau-Fog [4].

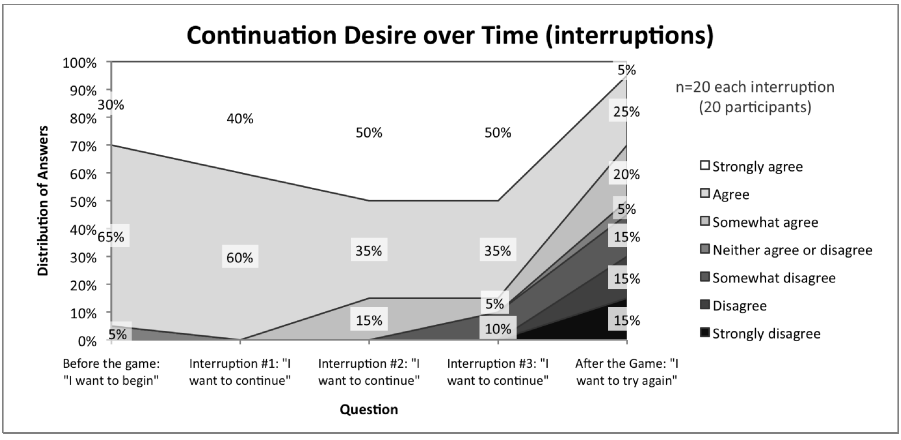

Fig. 2. Continuation Desire over Time

The use of continuation desire as an indicator of engagement is an essential aspect of the evaluation of interactive storytelling applications like Aporia because players will have very different experiences due to the emergent narrative nature of such experiences. However, focusing on the simple, yet fundamental concept of continuation desire will indicate that the player is engaged in the game and will also suggest that the player may have achieved a certain level of immersion and interest in the game. One might tend to believe that the intrusive approach of evaluation would deteriorate the engagement and engrossment aspects of immersion and the general experience, but if there is a desire to continue, this desire should remain throughout the interruption and it is presumed that the participant quickly becomes engaged or engrossed again after the interruption.

The majority of participants wanted to continue the experience of Aporia throughout the interruptions. Before and during the test 85% or more either agreed or strongly agreed that they wanted to continue the experience (Fig. 2). After the game, most people felt that they had completed Aporia which explains why many did not feel like playing the game again.

Continuation desire was furthermore compared across the four player types established by Bartle [6]. Each test participant were thus explained the concepts of the explorer, the achiever, the killer and the socializer player types, and were asked to choose which type described them most accurately.

Almost all types of players had a very high level of continuation desire during the experience. We were hoping to see a difference in continuation desire at the explorer player type (Fig. 3); however it seemed that almost all participants had a general high desire to continue and with only 20 participants, an eventual significance analysis would be too vague to draw any conclusions. An interesting finding however is the indication that killers report lower engagement at interruption 3 and that achievers and explorers are following each other in level of continuation desire, throughout the game. This could be because Aporia had no possibilities to eliminate opponents, and equal amounts of exploration and collecting items.

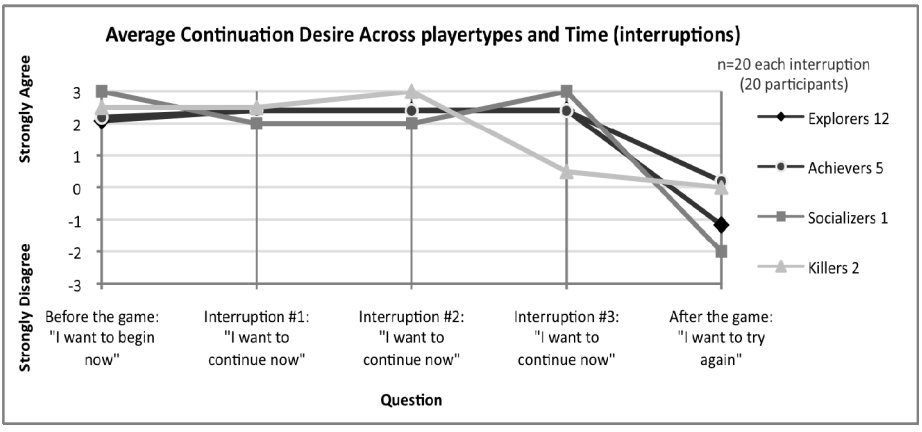

Fig. 3. Average continuation desire across player types and time

The aesthetics, sound, music and overall atmosphere seemed to be functioning very well and many people commented on the music and its high influence on the atmosphere.

In summary, this study suggests that Aporia succeeded in keeping a majority of players engaged throughout the experience due to their reported levels of continuation desire. The tests also indicate that most player types had a high level of continuation desire, and as such Aporia demonstrates that environmental storytelling can indeed facilitate continuation desire when merged with an interactive narrative in an explorative computer game. However, due to the limited number of test participants this still needs to be confirmed in future investigations with a higher number of respondents.

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Digital Interactive Narrative Tools for Facilitating Communication with Children during Counseling: A Case for Audiology

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Abstract. In this article we explore the means by which state-of-the-art knowledge on children counseling techniques can be combined with digital interactive narrative tools to facilitate communication with children during counseling sessions. The field of "narrative play therapy" could profit from the reconciliation between free-play and narratives afforded by interactive digital tools in order to promote children's engagement. We present a digital interactive narrative application integrated with a "step-by-step" guide to the counselor, which could be adapted to many different situations and contexts where an adult professional counselor (or therapists) needs to establish a trustful and efficient communication with children. Furthermore, the tool was specifically customized to pediatric audiology counseling. Our evaluation shows that the tool maintains the centrality of the child's perspective thanks to the emergent interactive storytelling process. At the same time the counselor is given the means for obtaining valuable information for guiding and structuring the therapeutic process.

Keywords: Digital Interactive Storytelling, Interactive Narratives, Emergent Narratives, Narrative Play Therapy, Children's Counseling, Pediatric Audiology Counseling, Digital Tools in Counseling.

1 Introduction

As today's youth can be increasingly characterized as "digital natives", for whom digital media has become perhaps the preferred form of communication, interaction and expression [4], there is a growing recognition by health care professionals and educators that digital technology can make their subject matters more engaging for children [5]. However, while some work has been done in such fields as edutainment, physiotherapy, occupational therapy, or pain management [6], current literature suggests a paucity of empirical research investigating the therapeutic opportunities afforded by this widespread engaging media in the realms of counseling and therapy, resulting in a lack of specifically tailored digital tools to aid children's expression in scenarios that are concerned with communicating therapeutically relevant themes.

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As the need for scientific accountability has become dominant, narrative approaches to counseling tend to be overshadowed by the "evidence-based perspective", and are often displaced by "instrumentalist" diagnoses, prescriptions and treatments, based on the statistics of populations, rather than on the specific individual stories of patients [7]. As human understanding of verbal language is not fully developed until later years of adolescence [1], the exclusive recourse to such "instrumentalist" and anonymous approaches becomes especially problematic when counseling young clients, resulting in an often prevailing communication gap between children and counselors [2], children's lack of engagement and their frequent withdrawal from counseling sessions [5]. Furthermore, as children are natural-born storytellers [8], the underestimation of their voices in the healing process could also lead to deleterious consequences such as introversion, depression, or even an erroneous diagnosis [9], posing a critical need for reconceptualization of the traditional counseling approaches to tailor the developmental, cognitive, emotional and psychological uniqueness of children.

The study reported in this article thereby explores the means by which state-of-the-art knowledge on children counseling techniques can be combined with digital interactive narrative tools to facilitate communication with children during counseling, and describes our attempt to develop one such tool. We base our work on the theoretical foundations of the fields of narrative and play therapies and consider the latest trends in pediatric counseling approaches. The intention is to bridge these fields to contemporary research on interactive storytelling, suggesting that emergent narratives can be beneficial for supporting children's expression and self-exploration, while maintaining their engagement and motivation during communication with their counselors.

With this in mind, we set out to design an integrated tool by implementing a digital interactive narrative in a three-dimensional multi-touch application for Android tablets and developing a "step-by-step" guide to the counselor, which could be adapted to many different situations and contexts where an adult professional counselor (or therapists) needs to establish a frank, trustful and relaxed communication with children. In particular we have designed a case in the field of audiology counseling in order to evaluate its effectiveness and applicability in a context-specific scenario. The study concludes with a demonstrative evaluation, illustrating how the tool can be used in a real counseling session, with the hope of contributing to the on-going re-conceptualization of pediatric counseling in contemporary society, but acknowledging that more systematic evaluation is needed for further development.

The case study reported in this article has benefited from the generous collaboration of the Ida Institute (a non-profit hearing care organization), which provided us with inspiration through their tool "My World", a non-digital board-game for open-ended dialogue between children and therapists. Additionally they facilitated our contact with various audiologists and speech-language pathologists within the field of pediatric audiology counseling that gave us valuable input through focus interviews and during the evaluation.

2 Digital Interactive Narrative Play Therapy

Although current literature evidences a lack of research investigating the potential benefits of digital interactive narratives to aid communication with children during counseling, numerous scholars such as [10], [3], [1] suggest a need for adapting therapeutic practices to accommodate the needs of children in order to fulfill the counseling goals. Sharry [1] proposes that in order to assist children of all ages most efficiently, therapists and counselors could make their practices more sensitive to the developmental level of children by including stories and play, centered on a therapeutic theme, thereby adapting to children's most fundamental means of communication. While there are numerous counseling approaches, we consider that the fields of "narrative therapy" and "play therapy" show the greatest sensibility in this regard and are the most suited for supporting and affording a digital interactive narrative tool to facilitate communication between a child and a counselor.

2.1 Narrative Therapy

Narratives are often regarded as an implicit element of human communication [12], providing us with the most natural and fundamental means to understand and organize our experiences [8], express our inner selves and construct our identities [13]. Narrative therapy as a field evolves from such understanding and draws inspiration from various critical thinkers and philosophers like Vygotsky, Gergen, Bruner, Foucault and Bateson, emphasizing the importance of language and meaning in those social activities that construct and define a person, and can thereby be used as powerful tools for therapists to elicit the client's notions of "self" and identify the way one constructs meaning and experiences the world [14], [15].

In the context of this approach it is believed that people encounter problems in their lives at times when the stories that they, or other people around them, ascribe to their lives can no longer effectively represent their lived experiences [15]. Narrative therapy proposes that not all feelings and lived experiences are encompassed by the dominant problem-saturated story of a person, emphasizing that it is the experiences outside one's dominant story that serve as the primary means to unfolding the alternative stories of one's life [14]. In this realm, therapy thereby becomes a practice that promotes conversations through narratives in order to engage in a process of storying and restorying one's life and lived experiences, gradually moving away from problem-saturated stories and towards therapeutic change [15].With this view, the narrative approach considers a person and the problem as two separate units, rather than one indistinguishable entity, where problems "*appear to have a life of their own*" and could be separated from a person's dominant story through "externalization of problems" – perhaps the most central and important contribution of narrative therapy [15]. Inspired by Vygotsky, externalization of problems becomes possible by using a method of scaffolding conversations maps, where through structured curious questioning one can gradually move from the "*known and familiar*" to "*what is not yet known, but possible to know*", achieving increasingly more agency in influencing one's own life and thereby moving away from dominant problem-saturated stories [16].

These key notions pertinent to narrative therapy evidence that when counseling children with this approach it becomes possible to maintain the centrality of the child through narrative conversations that rely on children's individual stories, rather than on the representations dictated by health care professionals, parents, or other adults in a child's life [9]. In other words, narrative therapy privileges the child's developmental level and interpretative framework and, in contrast to most other counseling practices, tends to create a lighter atmosphere for children to deal with problems, using their own unique resources, such as imagination, inventiveness and honesty [3].

2.2 Introducing Play into Narrative Therapy

In [3], it is emphasized that even though many children might be persuaded to externalize problems verbally, even those that are quite comfortable with verbal conversations usually appreciate being offered alternative forms of expression that support interactions in a playful manner. As it is argued that children tend to communicate their stories through play [1-3], it becomes central to the present study to bridge these two, otherwise separate approaches of narrativity and playfulness.

Play therapy can be described as a therapeutic method for counseling children, which capitalizes on many benefits of play, strategically applying them to therapeutic contexts to promote specific therapeutic outcomes [17]. It centers itself around the notion that play is the primary vehicle of expression for children, which allows them to explore, experiment and discover themselves through the process of acting out a wide range of experiences and feelings [2]. Whereas at the same time, it provides the most fundamental means for children to learn about the world [18] and offers perhaps the most developmentally appropriate and powerful medium to build adult relationships, develop cause-and-effect thinking, process experiences and learn social skills [11]. Thereby, when applied to counseling, play can be used as a non-verbal, symbolical and action-oriented tool, providing children with the means of expressing their inner world feelings and outer-world experiences [2].

Even though narrative and play therapies are generally comprehended as two separate approaches, in this study we propose that if applied collaboratively, they could provide effective means of communication with children, in order to help overcome the often prevalent communication gap and offer children more appropriate means of communication. As an addition to play, narratives could be seen as an effective tool for providing meaning and content to an otherwise free, child-led activity, presenting more structure and coherence between separate playful events.

Similar notions of collaboration between narratives and play can also be found in [10] and [19], who posit that both approaches can be practiced in conjunction to each other, forming a new therapeutic counseling approach – "narrative play therapy". However, even though [10] and [19] advocate for such synthesis, their approach lacks consideration of some of the central concepts of narrative therapy, such as scaffolding conversations or externalization of problems. Thereby, even though their comprehension could be said to have some cathartic benefit, it lacks narrative structure for the therapist to gather the required information and can be questionable

in terms of being an effective therapeutic tool for facilitating communication between children and counselors. Curiously, an analogous dichotomy between narrative and play can also be found in the field of interactive narratives, where there is the much debated issue of the trade-off between narrative-closure and interactivity.

Alternatively, our comprehension of narrative play therapy emphasizes the importance of balance between a structured narrative and free-play activity, and suggests scaffolding conversations as the fundamental means for organizing and guiding the counselor in an otherwise free, child-led activity of exploration. In our approach, we thereby propose to incorporate play into the scaffolding conversations map, as an additional and an alternative way of communication with children, thereby preserving the goal and structure of the process of externalization, but complementing verbal language with the more comfortable and developmentally appropriate children's "language of play".

2.3 Narrative Play Therapy and Digital Interactive Storytelling

As digital media has become one of the most central elements of play for the digital natives in contemporary society, it is thereby unsurprising that some practitioners and researchers have started to consider the benefits of digital play, proposing various digital applications and games as suitable for bridging the prevalent gap of communication [20], aiding social skill development, problem-solving ability [21], and motivating and engaging children in therapeutic conversations [6]. Nevertheless, most current research suggests only reframing the notion of a computer from a tool to a toy to be applicable for play therapy [22], [20], evidencing a lack of research of specifically tailored tools to aid children's therapeutic storytelling – a central element for a successful process of problem externalization. In this study we emphasize that thanks to the development in the fields of digital interactive narratives and storytelling, it can be drawn to the attention of practitioners of narrative play therapy that the interactive digital tools can actually reconcile play (freedom of interactivity) and narrative (i.e.: the storying and restorying processes implicit to narrative play therapy), and therefore promote children's active participation, imagination, free-play and free-choice activities necessary for an efficient counseling process to take place.

As in digital interactive narratives most of the narrative articulation greatly depends on the balance between narrativity and navigational freedom of an interacting subject [23], we stress the importance of interactive narrative structures and consider their applicability for meeting the therapeutic objectives raised by narrative play therapy. While numerous propositions to combine narratives and interactivity exist, Ryan categorizes these into several types of interactive narrative structures and distinguishes two types of interactivity to define user's participation within digital interactive narratives – "selective" and "productive" [23]. According to [23], interactive narrative structures implementing selective interactivity mostly depend on a pre-defined storyline, where the users are granted a choice to select among several alternatives, determining their own path of navigation through a database of stories, being involved in what is usually regarded as a nonlinear mode of reading. Structures dependant on productive interactivity, on the other hand, allow the user to fruitfully leave marks on the "textual worlds" by manipulating the environment and "rewriting" the given story, but are usually said to inhibit narrativity [23].

While the type of interactive narrative structure generally depends on the preference of the designer and style or genre of the system, we argue that in the realm of counseling it is crucial that it coincides with the therapeutic goals aimed to be achieved. The type of interactivity deployed in a tool to be used for facilitating communication with children in narrative play therapy, thereby should afford story construction and reconstruction, exploration of real life experiences, and expression of problems and feelings, ensuring that it is not the content of the system, but the child that is determining the uprising stories. As interactive narrative structures implementing selective interactivity often possess a predefined story-path and limited interaction for the user [23], in this study we argue that they are thereby not suitable to live up to such expectations, whereas productive interactivity could be seen as potentially useful for meeting the aspirations posed by the goals of narrative play therapy. However, this brings us back to the apparent clash between narrativity and interactivity of the so called "narrative paradox", where the highly interactive structures tend to lack narrative coherence and continuity, while the highly narrative structures usually infer linearity [24]. According to [25], this problem mainly arises due to the fact that designers of interactive narratives tend to concentrate on the deployment of plot-based structures within their designs, and proposes the "emergent approach" as an alternative to plot-based interactive narrative structures.

Contrary to the plot-based approaches, emergent narratives are based on character-centric perspective and focus on the process view of a narrative rather than on the structure of the given story, where instead of a plot, a dramatic situation based on character interaction is in focus, assuming that almost inevitably something dramaturgically interesting will occur [24]. In that, the emergent approach "*is much closer to simulation of reality*" and "*is much less 'storytelling' as no elaborate dramatic arc is involved*" [25]. Systems supporting emergent narratives are thereby often referred to as simulations, where through highly free interaction, the users are given the ability to project their experiences on semi-autonomous characters, leaving the emergent narrative open-ended [26].

Even though, the dramatic experience can only take place through an active participation of the user, it is the designer of the system that incorporates the means for narrative emergence to occur, providing specific boundaries for the user, within the range of pre-defined actions and events of the specific scenario [24]. In this sense, the user thereby becomes an author on a content-level, whereas the designer can be regarded as the author on a global-level. In the present study, this notion of dual-authorship is argued to be the main factor that makes emergent narratives significantly relevant to the narrative play therapy approach to counseling. In this manner, the centrality of the child is maintained though promotion of free-play activity, whilst providing the structure for therapeutic goals to be reached through given system boundaries - firstly set by the designer of the system, who provides the in-game actions, objects and environments, and secondly readjusted by the counselor through the structure of the scaffolding conversations map. We argue that emergent narratives are suitable to counseling, since contrary to most plot-based structures, they are fully based on productive interactivity, promoting abstract representation and story emergence from the child's play. Furthermore, they do not involve pre-defined rules or goals that could inhibit a successful problem externalization, and thereby encourage full exploration and expression within the boundaries of the system.

3 Case: Pediatric Audiology Counseling

As counseling takes place in a specific practical context, and depends on a particular range of human problems that are tackled in that context, a case study was built in order to identify the explicit boundaries for the design of the interactive narrative tool for facilitating children's communication during counseling. With this in mind, pediatric audiology counseling was chosen as a context-specific case, given the prevalent lack of similar approaches in these realms.

The Ida Institute, a non-profit hearing care organization, kindly opened the doors for us to the audiology community and helped us to establish contact with numerous hearing health care professionals in the realms of pediatric audiology counseling. The institute facilitated us with the prototype of their non-digital board game – "My World" (intended to facilitating communication with children during counseling) together with valuable ethnographic material produced during its development. From a preliminary analysis of these materials it became clear to us that (according to the practitioners) the tool was lacking a sound framework that could provide structure to the counseling session and was not attaining the playful engagement of the child.

Therefore we used the ethnographic materials provided by the Ida Institute (five video recordings of workshops and counseling sessions using "My World") and six additional interviews that we conducted with hearing health care professionals in order to identify what audiologists would consider to be the main goal for such a digital interactive tool in a counseling session. What they would appreciate is to have an understanding of the experiences associated with hearing loss from a child's perspective, and use the gathered information for developing communication strategies to overcome the identified issues. Additionally, several context-specific situations were classified in such way that when embedded in the tool could reflect hearing-related problems, coincide with the main goals of audiology counseling and promote strategy development. These include children's communication in school, at home and other social contexts, whereas the main areas of concern were identified as children's placement in the classroom, their ability to hear teachers/classmates/family members, and hearing difficulties in social situations. From this analysis, it was evident that while Ida Institute's "My World" tool is based on the main goals of audiology counseling and implies the described situations, hearing health care specialists that we interviewed and who have been in contact with the tool suggested a lack of structure, determining some confusion and disorientation, inhibiting child engagement in the process of communication. This input provided the basis for the design and implementation of the digital interactive narrative tool presented here.

4 Design and Implementation

A three-dimensional multi-touch application for Android tablets (but easily extendable to iPads) was developed for use as an interactive narrative tool to facilitate communication with children during audiology counseling sessions. Its main concern is to help audiologists gather information of communication problems from a child's

perspective, through eliciting stories from real life, and support the development of communication strategies to cope with hearing loss. The developed tool is suitable for social, psychological or assistive-technology related concerns and is designed to be used for both initial counseling sessions as a way of identifying unknown problems, and in follow-up sessions as a way of documenting change and effectiveness of prescribed strategies.

The tool is based on storytelling and play and consists of a digital interactive narrative application including four interface modes (see Fig.1.), and a step-by-step guide, where the child is given a central role in the counseling process and the audiologist partakes only as a facilitator of the session, structuring the child's stories. The centrality of the child is maintained by allowing his/her participation in a free-play activity, which is supported by deploying an emergent approach to interactive narratives through in-game exploration, interaction with objects and characters in his/her preferred way, while telling a problem-saturated story of life. The tool is developed to allow a child to choose a character representation for him/herself, choose characters for the significant others in his/her life, select an environment and build it up by placing in relevant objects. After the world has been built, the tool invites the child to explore and play out situations that appear in his life by interacting with chosen characters and selected objects. The implemented interactions allow the child to freely walk around the environment, talk to the chosen characters, and move around objects. The child can also choose among several emoticons (happy, indifferent, sad, and angry) to represent a specific feeling relevant for an emergent situation by assigning a chosen emoticon to an object or a character in that specific situation. Additionally, the characters were endorsed with different emotional states, implemented in the animations.

Fig. 1. Digital interactive narrative tool application screen captures, depicting four different interface modes: Introduction mode, Environment Selection mode, Edit mode, and Story mode

In order to facilitate the emergence of a narrative and construct a narrative structure relevant for audiology goals, specific pre-defined boundaries were established by the game design and the step-by-step guide. The game design boundaries were set by three pre-defined environments of home, playground and classroom (only the latter one is implemented in the current prototype), a unique set of game elements and interactions specifically tailored to fit each environment, and hearing-loss specific items (e.g. FM systems, hearing aids), all derived from the situations identified from the case study interviews with hearing health care professionals, and aimed at encouraging problem-saturated stories, centered on a hearing-impairment theme, to emerge.

The narrative structure is furthermore facilitated by the step-by-step guide, which is aimed to be used by the audiologist while conducting the session. This guide is an adaptation of the scaffolding conversations map from [16], where specific modifications relevant for audiology counseling were made, however maintaining the philosophy of the original structure. The developed step-by-step guide provides six steps, namely *1) identify the problem, 2) model the world, 3) explore the problem, 4) reflect on the problem, 5) explore strategies,* and *6) form strategies*, which help the counselor to move through the problem externalization process both structuring the conversations with the child and leading the child's use of the application. The guide is based on curious questioning, centered on an audiology counseling theme, providing examples for the audiologist to reflect upon for advancing with the conversation. As in the original version of the map, counselor's modifications to the questioning sequence are welcome, and are especially suitable for the follow-up sessions when using the tool again, as some stages might already be known, and only the unknown has to be explored.

In order to document the process of change and validate the effectiveness of prescribed strategies between the initial and follow-up sessions, the tool is developed to incorporate the functionality of saving and loading, whereby the child's last creation can be saved and returned to at later stages for reflection and continuation. Documenting change is also greatly supported by the use of emoticons, as these are visualized at all times after being assigned to a character or an object, whereby providing a visual map for reflection of problems that the child was experiencing and the things that worked well in the preceding sessions. Moreover, the tool provides functionality for entering information relevant for identifying a particular patient, such as name, age and the problem area, which would aid the audiologist to distinguish between sessions of different patients and maintain records organized.

5 Evaluation and Findings

Given the specificity of the case proposed in this study, and its context implying an ethically sensible domain (i.e. children's counseling), at this stage of development we were only able to conduct a small-scale context-specific qualitative evaluation involving a speech-language pathologist with solid background in audiology counseling and a nine-year-old hearing impaired child for whose participation we obtained proper consent. For this purpose we conducted an ethnographic study,

involving direct non-intrusive observation, pre- and post-session interviews and video analysis to observe the feasibility of the tool in its natural settings. Prior to the procedure, the counselor was introduced to the use of the application and the step-by-step guide, and was instructed to carry out the upcoming session in a form of a routine audiology counseling practice. Issues addressed throughout the evaluation were twofold: 1) to evaluate if the tool meets the goals of a real world counseling session and, 2) to assert if it facilitates a conversation with a child patient.

Regarding the first of these two issues, the counselor's interview and the observational data evidenced that throughout the evaluated session a problem-saturated story of a child's school life emerged, focusing on the communicative issues associated with hearing loss from the child's perspective. The results further propose that the tool helped both the child and the counselor to explore problems, form strategies and create solutions for overcoming those problems, illustrating an efficient problem externalization process. The applicability of the tool is additionally supported by the fact that the counselor did not have any problems in following the structure provided by the step-by-step guide, and adapted it naturally to her means of communication.

Regarding the second issue, according to the counselor's interview the child was more open to conversation and appeared less shy when explaining complex situations in comparison to their previous sessions. As expressed by the counselor "the tool facilitated that the child could experience his role in the classroom", therefore aiding the identification of sensible issues such as "group and teacher pressure". Moreover, it was possible to observe that through the use of the step-by-step guide the counselor never imposed her expertise on the child, allowing him to search and explore the problems in his own way. This, together with the interactive narrative, thereby afforded a more relaxed situation for problems to be externalized helping to identify communicational strategies. Furthermore, given the fact that the child's play sometimes even guided the questioning sequence of the counselor, implies that the tool can potentially provide efficient means to maintain the centrality of the child and promote counselor-child relationship. It was evident that the child was engaged while interacting with the application and it did help him to better illustrate his explanations. The child's engagement was especially evident in the second part of the session, as he became more relaxed, and had learned the "logic" of the tool, and started to extensively use it for supporting his verbal expressions even without encouragement from the counselor. This fact is especially important in our study, as it provides a good indication of how this tool aids children in taking initiative during a counseling session. Also, unlike in the session observed when using the Ida Institute's non-digital "My World" tool, in the present scenario the child was at all times interacting with the application in accordance to the therapeutic conversation, instead of just randomly placing and exploring objects. This might be due to certain constrains designed within the system and the scaffolding conversations map, as neither the child's emergent narrative nor the free-play activity stepped out of the boundaries of the hearing impairment theme.

6 Conclusion and Future Work

The digital interactive narrative tool developed in the present study illustrates how the combination of state-of-the-art approaches to counseling and advances in digital interactive storytelling can be used to facilitate communication with children during counseling, suggesting a potential value of these tools. The findings presented here indicate that given a specifically designed emergent narrative system, structured around specific counseling goals and supported by a context-specific adaptation of scaffolding conversations maps, digital interactive narrative tools can be potentially useful in engaging and facilitating communication with children during counseling and/or therapy sessions. On the other hand, given the particularity and historicity of the participants and of every counseling session, further evaluation is necessary, considering both: a series of sessions with the same counselor-child couple, in order to analyze the developmental aspects of the relationship and therapeutic change (in relation to the tool), and also the analysis of sessions with different participants (children and counselors), in order to comprehend possible idiosyncratic differences. Furthermore, in order to expand the potentiality of the concept presented here to other areas of communication and counseling, it would be interesting to see how such tool could be adapted to different counseling contexts, covering more diverse problem domains.

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Who Poisoned Hugh? - The STAR Framework: Integrating Learning Objectives with Storytelling

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Abstract. Little research in Interactive Digital Storytelling (IDS) has been given to writing stories that convey a set of Learning Objectives (LOs). This is particularly important for educational IDS games. In this paper we propose the STAR framework for formalizing the design of IDS stories for educational interventions. The story is designed as a set of red-herrings and clue puzzle in which the LOs are integrated. We present one of the three IDSes we designed based on this framework; we use one as a case study and present its evaluation. A study was undertaken to evaluate the game effectiveness in conveying the educational message. This study performed with 145 players shows that the players' knowledge improved as a result of playing the game and that the change was statistically significant.

Keywords: interactive digital storytelling, serious games design, narratives, game design, game based learning.

1 Introduction

Interactive Digital Storytelling (IDS) games have shown positive results when used for educational purposes [1]. However, there is little available out there "on how to design and facilitate games for learning" [2]. This research proposes to add to work on educational games design by focusing on storytelling within games [3], when they are used for educational interventions. Although in this arena, there is some research on how to design the stories for entertainment purposes [4-7] little attention has been given to stories designed specifically for educational interventions. This research contributes to the work in this arena, by showing how the Learning Objectives (LOs) could be conveyed through an engaging plot. Our aim is to propose a framework for designing an interactive story so that the essential LOs are covered. Each story is designed as a set of puzzles and each puzzle contains different LOs. We use the framework to design three different IDSes and evaluate them.

We present as a case study the Global Handwashing Day (GHD) game. The way we constructed the puzzles and we integrated the LOs in the puzzle are also presented.

The rest of this paper organized as follows. Section 2 presents the existing work in the area. Section 3 presents our proposed framework STorytelling for educAtional

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inteRventions (STAR). Section 4 introduces the three games we created using the proposed framework and presents in detail the Global Handwashing Day (GHD) Game design. Section 5 presents the evaluation and the future work. Section 6 ends the paper with our conclusions.

2 Background and Related Work

Research studies on IDS have focused on different aspects of the design. Among them, [4] proposes a pattern library for role playing games "to better understand the relationship between level and quest design". [5] proposes to use techniques from cinema, literature and gaming world to generate IDS. [6] proposes to design interactive narratives around the idea of roles and functions. [7] designs the game using the following theories: narrative-centered learning, activity theory and cognitive load theory. [8] performs a preliminary study to assess the user experience when the game is text based or delivered through the graphical interface. The result of the study shows the advantages and disadvantages of each of the version, with graphical version being more appealing and easier to navigate, while the text based stimulating the imagination more than the graphical one. Our approach differentiates from the previous approaches mainly by focusing on IDSes aimed at educational interventions.

In this area there is little guidance for game designers to design educational games, and little research to assess what is effective in educational games [2]. Among the few researchers looking at this problem, [9] looks at whether or not adding narratives to adventure computer games improve the academic learning content and learner enjoyment. They find that the addition of narratives does not significantly enhance the learning of educational content. Concerning the learner enjoyment, participants who played the game enhanced with the narratives enjoyed the game slightly more, but this difference was not statistically significant.

Our approach differentiates from the current approach by taking a slightly different path. First we focus mostly on story generation, for narrative educational games. We show how we designed the story such that we obtain a statistically significant improvement in student knowledge. Although the research of [9] shows that narratives do not add value to games, our approach is differentiated from theirs by the fact that we include the educational content in the narrative, whereas the [9] approach added the narratives just as a support to the game, and the educational content was not integrated into the story. This approach has been shown not suitable for educational games, as the players pay more attention to the story and ignore the educational content that is being taught [10].

3 Educating by Storytelling: The STAR Framework

The requirements for STorytelling for educAtional inteRventions (STAR) framework are:

1. Engaging story plot
2. Convey a given set of LOs (with the options of varying educational importance)
3. Reinforce important LOs
4. Flexibility in adding or removing LOs as required
5. Interactivity by allowing the user to influence the story

The STAR framework is composed from four main components: *Introduction*, *Puzzles*, *Resolution*, and *Debriefing* (Fig. 1). It should be noted that this framework was designed to be suitable especially for storytelling within games, in which the story is similar to a detective story. The reason behind this is the enduring popularity of investigative-style games (CSI/ Phoenix Wright / Heavy Rain) coupled with the natural opportunities such games offer for puzzle structures. From a pedagogical view we follow Problem Based Learning (PBL) [11]. Although there is no consensus on how pedagogical approaches are to be used in educational games, PBL has been successfully used in several games [12-13].

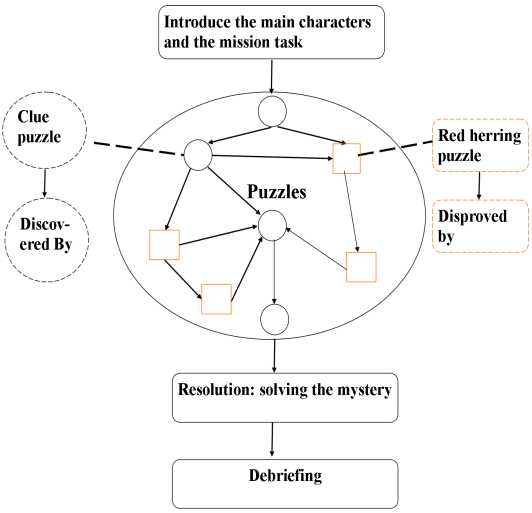


Fig. 1. Story structure

In PBL the user is introduced to the problem before the learning occurs and the process through which the problem is understood and solved drives learning [14]. Learners generate hypotheses as to how they may solve the problem, and through self-directed research evaluate their hypothesis on the basis of evidence. The problem is then solved or, if their hypothesis is disproven, a new hypothesis is generated. This process maps well to quest structures found in story-based games [15]. When referring to the problem to be solved we will use from here on the term *mission task* as this term incorporates the idea of integrating the "problem" with the story's "mission".

The player will visit various locations during their investigation to solve the mission task. Each location has a number of items that the player can find by clicking

on them. Each item (excluding those put in as false clues) either corroborates or contradicts a statement that has been or will be made by characters the player meets.

Each location also has one or more characters present. By talking to these characters, the player finds out background information on the puzzle at hand. Some characters will suggest theories as to the cause or source of the problem. The player will find items (or other evidence such as quotes from other characters) that corroborate or contradict these statements. By presenting the appropriate evidence at the correct time, the player furthers the dialogue and receives further information about the problem. The player must pay attention to what characters are saying, understand their point of view and find evidence relevant to their statements.

3.1 Introduction

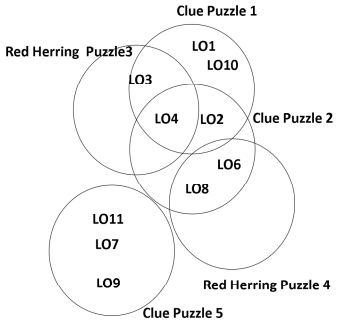
The first part of each story introduces the main characters, and the mission task. The characters used in the storytelling are designed to resonate with the target group for which the story is intended.

3.2 Puzzles

The second component of our framework is composing the LOs as a set of puzzles that have to be untangled to solve the mystery presented in the Introduction. This part of the game allows the player to explore the environment. According to [16] the environments in which the students can actively explore lead to better learning. Moreover, this part of the story teaches the educational element of the games, the Learning Objectives (LOs). It is important to have the educational content integrated in the story, as otherwise the learner ignores factual content [10].

The puzzles require the player to read and understand the statements made by characters and then find evidence that corroborates or contradict these statements. The player must understand the content in order to be able to identify the current clue to prove or disprove each statement. If the puzzle to be solved lead to approving the statement we will call it from here on a *clue puzzle*, whereas if the puzzle lead the player to disprove a statement we call it a *red herring puzzle*. The puzzles are usually relevant to solving the mystery. Not all the puzzles are mandatory for solving the mystery and the player can explore different paths in the game.

The LOs are integrated in the puzzles, with each of the puzzle having one or more LOs (Fig. 2-a). Due to the non-linearity of the story, and because the player can choose different paths, the same LO could occur in different puzzles. Another reason to repeat one LO in multiple puzzles is that it affords reinforcement of important LOs. In this framework *clue puzzles* are puzzles that are mandatory for the player to solve, while *red herring puzzle* can be mandatory or not, leading to the interactivity of the story. It is important that each path the player can take through the game has to cover the mandatory LOs for which the story was designed, therefore puzzles can be designed to act as ‘gates‘ where the player must complete that puzzle before continuing to a further part of the mission. It is the designer’s responsibility to ensure that the all the LO are covered by the mandatory puzzles, one way to do it is by using a table similar to the one presented in Fig. 2 which will cover all the *clue puzzles* and the mandatory *red herring puzzles*.



a)

	P 1	P 2	...	P m	LO Covered
LO 1	x	x			√
LO 2	x				√
LO 3		x			√
...					√
LO n				x	√

b)

Fig. 2. a) LO b) LO Covered by the Mandatory Puzzles

3.3 Resolution

This is the part of the story where the player reaches to a resolution regarding the mystery: who was the guilty party, what the problem was etc. It basically represents the point where the player solved the "mission task" defined in the introduction section.

3.4 Debriefing

In the debriefing phase the player explains the steps they took to solve the mystery. The player re-presents the solution to the mission task and explains the steps required to reach the solution (based on the puzzle visited). From an educational point of view this section acts as a summative assessment of the collection of educational content hence reinforcing the LOs taught and allowing measurement of the player's knowledge.

4 Case Study

Considering that we start with the following list of LO:

LO 1: Microbes can be found on our food and can transfer to humans
LO 2: Cooking food properly can kill harmful microbes
LO 3: Sometimes microbes can make us sick
LO 4: Infection can be spread through unclean hands
LO 5: Hand washing can prevent the spread of infection
LO 6: When to wash your hands
LO 7: Why to wash your hands
LO 8: Microbes can pass between different food products
LO 9: Separate utensils should be used for meat and vegetable products
LO 10: Wash your hands after using the toilet, even after 'just' a pee
LO 11: Don't spread your bad microbes to others

Starting with these LOs we created the story of the Bad Bacteria at BBQ/GHD (Global Handwashing Day) Game which we will use for exemplification purposes. The game was designed using the STAR framework. The game is an adventure game, where the player adopts the role of an investigator that travels to countries across the world to investigate and solve microbial problems.

4.1 Introduction

During the introduction the player finds that they are a junior detective working for an investigation agency. Moreover, the main characters: Big C and Alyx are introduced here, whereas the rest of characters are introduced as the story unfolds (Fig. 3). Alyx is a young scientist who is assigned to be your partner at the beginning of the first mission. She accompanies you wherever you go and is used in the game to further narrative where required. Alyx is also the character we use to give hints or prompt the player when we think s/he is stuck. We also use Alyx to carry out tests in the portable lab if needed.

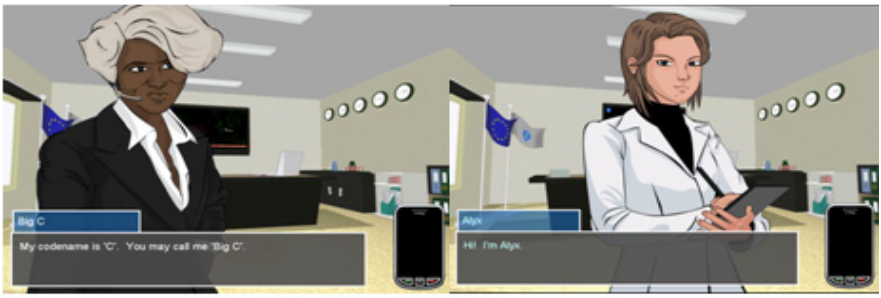


Fig. 3. Big C and Alyx

Big C is the head of the investigation agency. Most of the characters in the game were designed to appeal to the age group of the children and be a "cool" character they easily associate with (based on our focus groups) while Big C who is the boss and is older, represents authority and senior expertise – her role is to assign the mission task in the *Introduction* and debrief the player in the *Debriefing* session. After the scene is set, Big C introduces the mission task, Hugh Gaego, a famous actor who earlier this evening won the Best Male Actor award at the International Film Awards, has been taken ill and a possible poisoning has to be investigated by the player.

4.2 Puzzles

There are currently six puzzles integrated in the game. We worked with a group of experts in the area to determine which specific LO to include based on the European curriculum [17]. Although the same LO appears multiple times, it is presented each time in a different context so that the story will not be boring for players, moreover all the LO are covered by at least one mandatory puzzle (Fig. 2).

There are four locations in which the puzzles take place: the barbeque, the bathroom, the kitchen, and the laboratory. Additionally the agency headquarters are introduced at the beginning. The barbeque is happening at Hugh's mansion and has been thrown to celebrate his success. It is the last place where Hugh eats before he gets sick. The player will meet Hugh in the bathroom due to the fact that he is continuously ill. For meeting the chef (the initial suspect in this case) the player would have to travel to the kitchen. The laboratory is the place where the data analysis takes place.

The barbeque, the toilet and the kitchen contain various items which the player can collect by clicking on them. For example the following items and the associated evidence can be found and collected at the barbeque:

1. Punchbowl
    a. No unusual microbe activity.
2. Hugh's plate of leftovers
    a. Shows microbe activity on the salad and not so much on the cooked chicken
    b. When tested in the laboratory e-coli bacteria and the vomiting virus are found
    c. This is unusual for salad.
3. Salad bowl
    a. Shows some signs of unusual microbe activity.
4. Hand sample from bodyguard
    a. As collected on an agar plate
    b. Shows high level of microbe activity.

Below we present the puzzle existent in the game.

Food Poisoning from Chicken – Red Herring Puzzle

Learning Objectives: LO 1, LO2, and LO3.
Puzzle Setup:

1. Hugh's bodyguard suggests that the kitchen is unhygienic
2. Player finds a raw-meat chopping board in the kitchen that is covered in microbes.

Disproved by:

1. Player will find plate the Hugh has been eating from containing the chicken and salad and take it to the lab to test it
2. Chicken is cooked correctly
3. Microbial levels in chicken are normal
4. The security guard mentions that the other guests who also ate chicken are fine

Food Poisoning from Salad – Clue Puzzle

Learning Objectives: LO 1, LO2, and LO3.
Puzzle Setup:

1. Player has disproven the hypothesis that the cooked chicken was the source of bacterial transfer (see above)
2. The other item of food on Hugh's plate was salad.

Discovered by:

1. Player collects salad and take it to the lab to test it
2. Salad returns positive for e-coli and vomiting virus
3. This is unusual as you would not expect to find these on salad.

Contamination via Chopping Board - Red Herring Puzzle

Learning Objectives: LO 1, LO 9, and LO 10.
Puzzle Setup:

1. Hugh's bodyguard has suggested that poor kitchen hygiene could be the source of Hugh's illness
2. Player has found a raw-meat chopping board that has a high concentration of bacteria
3. The player cannot see a vegetable chopping board. Thus, if the same chopping board were used for salad as raw meat, bacteria could transfer.

Disproved by:

1. Player tests chopping board which has been used to prepare chicken but only has expected campylobacter which is usually contained in uncooked meat but the microbe that has infected Hugh is not found
2. The cooked chicken from Hugh's plate does not have the campylobacter - suggesting that it has been cooked correctly
3. Chef insists the veggie board is in dishwasher.

Bad Kitchen Hand Washing – Red Herring Puzzle

Learning Objectives: LO 4, LO5, LO 6, and LO 7.
Puzzle Setup:

1. The player has identified that there are unexpected bacteria and vomiting viruses in the salad that Hugh ate (see above)
2. The player has ruled out contamination from chopping boards (see above)
3. The player is trying to find out how the microbes were transferred to the salad and since the Chef handles the raw meat, he could be the source.

Disproved by:

1. Player taking a swab of Chef's hands and take it to the lab to test it
2. Chef's hands have mostly normal good microbes
3. Only very small (inconsequential) quantity of e-coli implying that he does wash his hands but may have come in contact with a source.

Contamination Poor Post-loo Hand Hygiene by Chef- Red Herring Puzzle

Learning Objectives: LO 4.
Puzzle Setup:

1. Since the bacteria that was found on the salad was not found on the raw-meat chopping board, it is possible that the chef transferred other bacteria obtained through poor bathroom hygiene to Hugh's food.

Disproved by:

1. Chef's handprint in agar is tested in the laboratory and shows too few microbes for the Chef to be source.

Contamination Poor Post-loo Hand hygiene by Hugh's Bodyguard – Clue Puzzle

Learning Objectives: LO 4, LO 5, LO 6, LO 7, LO 10, and LO 11.

Puzzle Setup:

1. Having ruled out bad kitchen hygiene and also ruled out the Chef as a likely source of 'fecal-oral' bacterial contamination via salad, the player seeks alternative sources.

Discovered by:

1. A handprint on the bathroom door shows the same bacteria as was found on Hugh's salad
2. The bodyguard's fingerprint in agar is tested and matches the handprint found on the bathroom door.

4.3 Resolution

At this point the player solved the mission task. In this case, the bodyguard poor bathroom hygiene, penchant for salad (he is a vegan) and lack of food hygiene habits (he used his fingers to nibble on the party salad) – all lead to him accidentally poison Hugh. The player returns to Hugh to tell him the results of the investigation (Fig. 4).

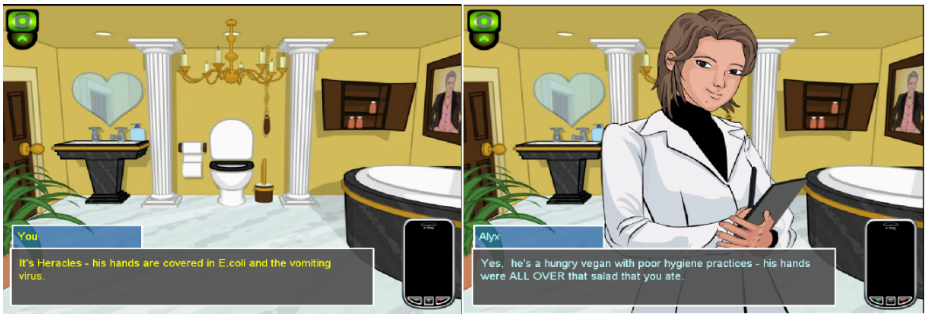


Fig. 4. The guilty person is found

4.4 Debriefing

After the investigation is over, the player returns to Big C for debriefing. Through dialogue, Big C asks questions of the player that provide the opportunity for the player to expand upon the puzzles they followed and describe what was discovered. While explaining the findings of the investigation the player repeats some of the LOs covered in the story.

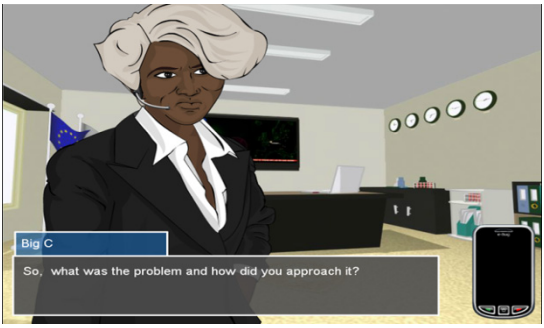


Fig. 5. Debriefing

5 Evaluation, Lesson Learnt and Future Work

Three games were created using the STAR framework, with the aim of teaching health and hygiene related issues:

1. Bad Bacteria at BBQ/GHD Game: focuses on hand and food-preparation hygiene
2. When Bugs go Wild: focuses on responsible antibiotic use
3. Gambling Never Pays: also focuses on responsible antibiotic use but following slightly different learning objectives

A small sample study was initially performed to assess the games effectives in conveying the LOs [18]. For GHD Game a second study has been done with 145 participants and the results of the evaluation show statistically significant knowledge gain as a result of playing the game.

The players enjoyed the games but they took too long to play and some players quit the game before finishing [18]. Although it is not something unusual, and has been reported in previous other studies [19-20], the games have been shortened. For example the GHD Game, presented here, had originally ten puzzles. Due to the non-linearity of the story it was possible to simplify the game without having to rethink the narrative and plot. This shows the flexibility of the STAR framework. In future work we will explore different techniques to keep players engaged, such as to improve the competition element, explore multiplayer options and to introduce a social aspect.

We also noticed that players participating in the study do not enjoy taking the pen and paper pre and especially post tests after playing the games. Following this observation, we are currently working to have the evaluation of the LOs seamlessly integrated in the game, with the aim of reducing the inconvenience of the pre and post test pen and paper evaluations.

We are also planning to add an adaptive dimension to the story, in which the game changes not only based on the player actions but also on his knowledge level. It would be also interesting to explore if there is any difference in term of conveying the educational message between the red herring puzzles and clue puzzles.

6 Conclusions

This research presented a novel framework, STorytelling for educAtional inteRventions (STAR), for designing stories for games intended for educational interventions. The framework integrates a given set of LOs tightly with narrative and puzzle design to teach through the story. The framework has four main components: *Introduction*, *Puzzles*, *Resolution*, and *Debriefing*. This framework has been successfully used in creation of three games aimed to teach important concepts related to health, one of which was illustrated in this paper as case study. The results of the games evaluation show that the games are both enjoyable and efficient in conveying the educational message. Although this paper presents the story design rather than the implementation, it should be noted that the story success depends on different factors such as the implementation of the game, the artwork used, and pedagogy etc.

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Structural Writing, a Design Principle for Interactive Drama

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Abstract. Computer-based highly interactive drama involves different authoring approaches, compared to linear media. Underlying design principles needs to be understood in order to guide the authoring process, to teach authors and to design better systems. This paper identifies a fundamental design principle termed Structural Writing that underlies some of the most generative approaches in interactive drama. A theoretical description of this principle is proposed, which leads to a general architecture for interactive drama that may help authors and researchers to design systems that better exploit the principle of structural writing.

Keywords: interactive storytelling, interactive drama, authoring, creation process, design principle, structural writing, structuralism.

1 Introduction

A computer-based highly interactive drama (hereafter "interactive drama") is a system enabling an end-user to act within a narrative world as if he or she were the main character in a story. Being a character means more than executing a few choices within a story. It implies that the character has the same degree of freedom as other story characters [24]. The necessity for the system to take into account the end-user's action for modifying the story is one of the major challenges in the field.

The automatic generation of narrative events has the potential to provide a solution to this challenge. Several algorithmic tracks have been explored, such as autonomous agents simulations [1], narrative planing [26], narrative modeling [18, 22], and case-based reasoning [7]. However, these approaches have rarely gone beyond the stage of the "technical prototype" and have not produced many convincing playable stories [15]. The authoring issue may explain this situation [21]. Authoring such systems is quite difficult, not only because of a lack of user-friendly authoring tools, but also and more importantly because of inherent conceptual difficulties in handling the computational data needed to produce an interactive drama. The abstract nature of these data makes the authoring task particularly difficult [20, 23].

Tackling the authoring issue can take several routes. Our approach is based on the two following assumptions:

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- Instead of considering the authoring issue a constraint that guides the implementation of components that are added to an existing system, authoring should be taken into account from the outset and be at the heart of system design.
- Therefore, it is essential to identify as precisely as possible what makes authoring difficult, more precisely to identify which principles explicitly or implicitly lie behind the generative algorithms used by various systems.

The aim of this paper is to present a principle that appears relevant to interactive drama that we term Structural Writing. This principle is not new. It can be put into practice within existing systems but has not been explicitly presented to date. By clearly presenting the concept, we hope that existing systems may be either improved or used more appropriately, and that new systems may be implemented.

The paper is structured as follows: First, we present the notion of Authoring/Design Principle, a concept that helps understanding the authoring issue (Section 2). Then, we describe Structural Writing in reference to existing systems and approaches (Section 3). Section 4 explores algorithmic consequences of Structural Writing, to propose a general architecture for interactive drama, which in turn enables a refinement of the central concept of narrative structures (Section 5). Section 6 concludes the paper.

2 Authoring Principles

2.1 What Is an Authoring Principle?

In [20], it is claimed that what fundamentally distinguishes Interactive Storytelling from linear and multilinear (branching-based) forms of storytelling is the principle of conditional actions. For an author, writing a story with Interactive Storytelling systems such as Storytron, IDtension, Mimesis or Façade, requires understanding that a given event will happen only if some conditions are met. In several systems, such a condition is attached to an action by the author and is called a pre-condition. Post-conditions are conditions that are added whenever the action or event is executed and that can themselves serve as pre-conditions for other actions or events. These elementary Artificial Intelligence concepts constitute a major gap in terms of authoring.

The principle of conditional action does not suffice in supporting all authoring activity involved when writing an interactive drama. We claim that other principles exist in current interactive drama systems and we aim at identifying them. Beforehand, it is useful to characterize these authoring principles in general, with respect to the concept of abstraction

2.2 Abstractions

Abstraction has been identified as a key issue in authoring [20, 21, 23]. Although some forms of linear writing (such as screenwriting) involves a kind of abstract thinking, what characterizes generative writing is the fact that authors need to directly enter abstract data into the system. Abstraction is seen as a burden for authors, but from a computing point of view, abstraction is what makes the technology "powerful". Abstraction is correlated with the degree of generativeness. The more

abstract the data, the more generative the algorithm that uses these data, that is, the more story variations are possible with the same amount of information. This is schematically illustrated in Fig. 1.

To reach the goal defined in the introduction, it is necessary (but not sufficient) for an interactive drama technology to be able to generate such a high quantity of story variations. Hence the necessity of abstraction.

Abstraction is not an authoring principles as such but it characterizes all authoring principles for interactive drama, to start with the principle of conditional actions. With conditional actions, authors do not know when an action will occur but rely on conditions on fictional states, which is remote from the concreteness of writing a drama as a mere chronology of actions.

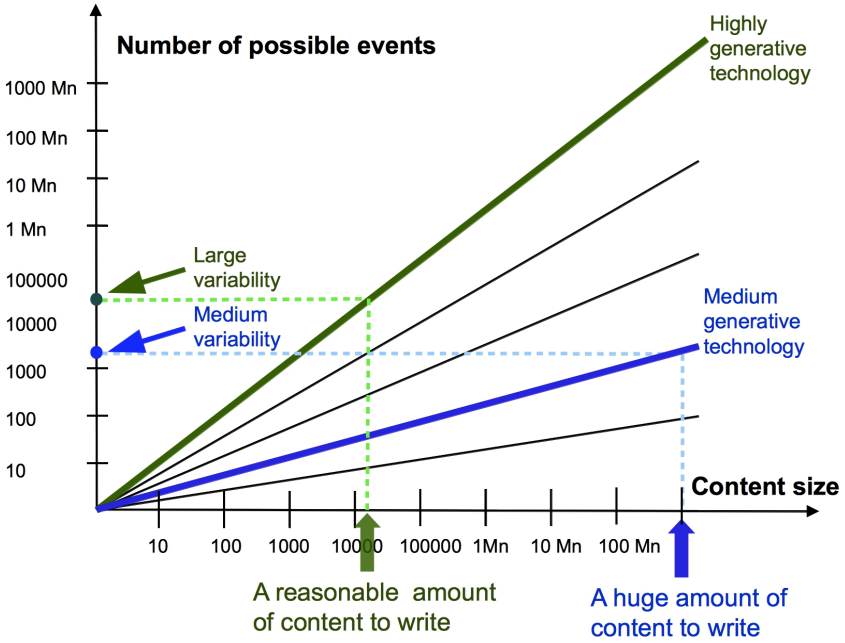

Fig. 1. The lines, drawn in an algorithmic scale, illustrate the exponential growth of the number of possible stories relative to the amount of data entered by an author. Each line corresponds to a system or approach, with the most generative ones represented by the steepest lines. This graph illustrates that with a given quantity of content, a more generative and abstract approach will lead to more variation (more possible events). Because human writing is limited highest levels of variation cannot be produced by less generative approaches.

Additional authoring principles involve a higher degree of abstraction, compared to the principle of conditional actions. As such, they add another degree of authoring difficulty to systems that only rely on conditional actions. The ability for an author to master these principles is crucial to the success of a system itself, hence the need to clearly identify them.

2.3 The Second Authoring Principle: Genericity

We can only present briefly a second authoring principle here. It will not be detailed in this paper, contrary to the third one that constitutes the core of our contribution (next Section).

Genericity is the principle that consists in including variables within actions (or other narrative elements). Such actions are called generic actions, in contrast to specific actions in which all variables are instantiated. A generic action is powerful in terms of quantity of possible generated instantiated actions. For example, the simple action of giving an object to someone can be represented as *give(?giver, ?object, ?receiver)*. With 6 characters and 5 objects, the number of possible giving actions is 150.

The principle of genericity is independent from the principle of conditional actions. For example, there exist AI-based systems for interactive drama that are conditional but not generic, as they represent actions and states as simple *propositions*.

The elementary programming concept of variables is fundamentally new as far as authoring is concerned. This raises several issues:

- First, authors themselves are rarely programmers, and they may need time to fully grasp the concept of generic actions.
- Second, it is difficult to anticipate all cases that may occur whenever an action's variable is instantiated. A typical case we encountered frequently in our authoring activities concerns "obvious" exclusions. For example, consider an author writing the action of giving an object that includes three variables: the giver, the object, and the receiver, which can be represented as *give(?giver, ?object, ?receiver)*. When writing rules and conditions to trigger such an action, the author will, at times, obtain the action *give(John, box, John)*, which is absurd. The author omitted to specify that the receiver cannot be the giver. In more complex situations, such errors can be very difficult to detect.
- Third, generic actions need to be not only instantiated but also rendered, visually and textually, which constitutes one dimension of abstraction [20]. Text generation becomes harder to master if deep structures contains variables. For example, textual surface forms need to vary according to the gender and spelling of the value that instantiates a variable.

These difficulties are examples of how abstraction makes authoring interactive drama particularly difficult.

3 The Principle of Structural Description

3.1 Structures and Structures

The term "structure" needs to be clarified, because it can refer to two almost opposite concepts. On the one hand, "structure" refers to the set of main actions and events that give a story its core. For example, a well-known model to describe drama is the three-act structure [8]. In that case, a structure is a story's *skeleton*. On the other hand, a structure in structuralist narratology denotes a set of deep narrative elements that are related to each other and represent the meaning of the story. A common example of

such a structure is the tabular description of myths proposed by Cl. Levi-Strauss [11]. In that sense, one also uses the term "deep structure".

While these two meanings of structure refer to two different narrative theories, there is no simple match between structure type and underlying theory. For example, when the V. Propp theory [16], which originated in Structuralism, introduces its well-known succession of 31 elements, what it proposes is a skeleton. But when the same theory introduces the notions of roles and functions, it describes a deep or underlying structure. It is that second meaning of structure to which we refer here.

3.2 Structures in Drama

It is easy to spot (deep) structures in classical drama, as they correspond to dramatic situations. For example, a love triangle is a structure in which two persons are rivals intended on conquering the same third person. Several practical catalogs exist of such situations, such as Polti's "36 dramatic situations". At a deeper level, all these situations express a conflict, i.e. an opposition between two potential actions. A situation without conflict would be a situation that leads to an obvious resolution, which by definition is not interesting from a dramatic point of view, especially in a love triangle.

Beyond the above mentioned ad-hoc catalogs, a more scientific investigation was conducted by E. Souriau in 1950 [19]. By analyzing a number of theater plays, Souriau isolated six fundamental roles that, when assigned to various characters in the play, can generate a situation[1]. Specifically, he describes a dramatic situation as a system of forces that are always "in tension" during the play. This mechanical analogy is interesting because it shows that structures cannot be reduced to actions. Structures are by nature *potential* (analogous to the notion of potential energy in mechanics). They can produce a dramatic movement (analog to the kinetic energy) but they are not themselves the movement.

Also, the potentiality of narrative structures makes them relevant by themselves, even if they do not generate any concrete action in the story. For example, the fact that two characters are rival might make them plan to hurt each other, hope that a "terrible accident" might occur, etc., even if none of these events actually occur. In other terms, narrative structures generate cognitive acts that contribute to the story quality. In the theory of Possible Worlds, these acts create possible world of various kinds (obligative, optative, conditional, hypothetical, pretend worlds, etc.) [17] in which the narrative structure generates different actions.

Finally, narrative structures play a fundamental role in the reader's activity. A good narrative structure stimulates many "inferential walks" [5], that is many anticipations of possible future events in the reader's mind.

3.3 Structures in Interactive Drama

Why are narrative structures interesting for Interactive Drama, and why now, after more than a decade of research in this area? The relevance of structuralist theory for interactive drama was highlighted more than a decade ago [25]. Since then, authors of

[1] The model was later reformulated by A. J. Greimas, as the actant model [9].

this paper have had the chance to proof test the validity and usefulness of the structuralist hypothesis for interactive drama, which sheds some new light on the issue.

The main argument for structural models for interactive drama is that a unique structure can unfold in a multitude of temporal paths. The author does not write those paths but the structure that can generate them. Recently, J. Murray reformulated this hypothesis by claiming that "to make a compelling narrative, we have to look for the underlying causal structure that motivates those actions" and by giving examples of story patterns that correspond to these structures [13].

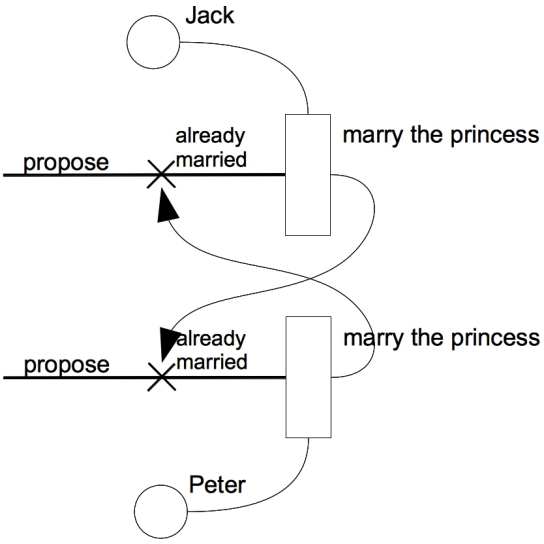

Fig. 2. Representation of a love triangle dramatic situation with goal-task structures. Two knights, Jack and Peter, have the same goal, to marry the princess (rectangles). To reach that goal they have to propose (tasks, horizontal lines) but their task is hindered by an obstacle (crosses) "already married", which is triggered whenever one of the knights reaches his goal, "marry the princess".

The transformation from an author-defined atemporal structure to a variety of computer-generated temporal paths appears to be an elegant solution to the core issue of the field: how to provide an end-user with a large number of stories (depending of his or her choices) without writing all of them. From a computational viewpoint, such a transformation echoes the principle of generative systems. There already exist computational approaches that enable the generation of a series of actions, but the concept of narrative structure adds the constraint of narrativity to these algorithms.

At this stage, the argument remains theoretical. Let us examine two examples. First, the love triangle. In Fig. 2, this structure is represented with the help of IDtension [22] formalism: two characters (knights), have the same goal, marry the princess. If the first character reaches his goal, the second character cannot, and vice-versa. This is represented as an obstacle in our formalism. The same dramatic situation can be represented in various systems and formalisms, goal-tasks structures being chosen as an illustration. A hypothetical system using this structure would

trigger a number of actions and events for exhibiting the structure, so as to "make the structure play". For example, each of knights will at some point adopt his goal, discover the other character's goal, try to reach his goal, influence the other to make him change his mind, ask advice from other characters, imagine/dream that he has gained the princess's love, etc. The order of these actions does not have to be defined in advance, as the system calculates these actions and their occurrence, based on the authored structures. As for conditional authoring (Section 2.1) there exist conditions for triggering one action rather than another. But these conditions are not written explicitly by story author. They are set dynamically by the engine, according to more general rules, that describe structures at a general level. For example, a (simplified) rule states that whenever a character has a goal, he or she will attempt to reach it. This is only defined once for all situations in which any character has a goal.

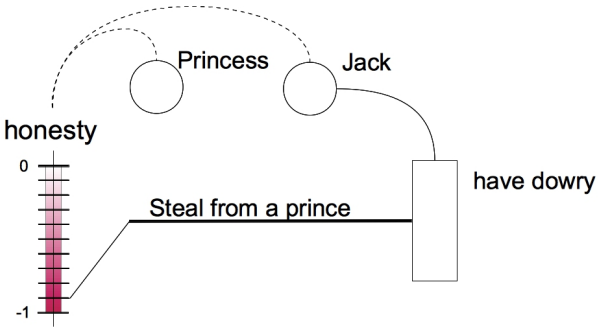

Fig. 3. Representation of an ethical conflict situation, with goal-task structures (see text). The gauge on the left represents the value of "honesty", to which both Jack and the princess are attached. The task "steal from a prince" is negatively scored according to this value.

Another example is the ethical conflict. In this case, the character wants to reach his goal of marrying the princess. But all attempts to propose her will fail unless he possesses a large dowry. One of the ways of overcoming this obstacle might be to rob a rich prince. However, this runs counter to the main character's, as well as the princess', values (see Fig. 3). Several characters can intervene in the story, to encourage or dissuade the knight to choose a course of action.

Following these examples, it is possible to provide a definition of a narrative structure for the purpose of interactive drama. A narrative structure is an author-readable and narratively meaningful set of fictional data (data from the fictional world), interconnected by relations, that do not directly describe events in the story but that are used by a derivation algorithm to indirectly calculate and generate a large amount of story events. This definition is author-oriented, as it includes the structures' readability as a fundamental criterion.

4 Algorithmic Considerations

The derivation algorithm that was mentioned above is a key component in a system based on structures. It comprises two distinct parts:

- First, the algorithm needs to be able to derive which narrative actions are possible at a given time, based on the narrative structure and the current state. These narrative actions encompass both the performative actions that can be directly derived from the structures, and other more complex types of actions: influences, transmissions of information, help/hindrance, or more specifically jealousy, revenge, self-destruction, etc. In terms of classical logical representation, rules and action descriptions often need to be of higher order. To take an extreme example from classical drama, in Marivaux' "Les Fausses Confidences" (1737), we encounter the following situation between the two lovers A (the man) and D (the woman): "He knows that she believes he does not know that she knows that he loves her", with "believing" meaning "having a wrong knowledge" while "knowing" meaning "having the correct knowledge". If, to simplify matters, everything is coded as beliefs, one represents this knowledge as follows: *believes(D,believes(A,not believes(D,believes(A,loves(D,A)))))*
- Second, the algorithm needs to be able to produce one action after the other so that these actions chain in a way that builds an interesting *Interactive Narrative Experience* for the end-user. Planning algorithms for example, ensure that narrative actions follow each other until a specific goal is reached, either a character's goal [3][1] or a more global goal [26][4]. Qualifying essential qualities of an Interactive Narrative Experience is a very difficult task. Not only should the story move forward, but pacing, plot clarity, end-user's emotions, connotative aspects, etc. are qualities that cannot be ignored.

We refer to the first part of the algorithm as the *Action Generator*, and to the second part as the *Narrative Sequencer*. If one applies these algorithms to the structure depicted in Figure 3, one observes that the story remains too basic to be interesting because there are only a few concrete actions that can happen in the storyworld. The obvious solution is to make the structure more complex, by adding specific narrative elements. For example, in the above-mentioned example (love triangle, Fig. 2 & 3), one could invent actions that will hinder the other suitor, such as spreading rumors about him, making him miss an encounter with the princess, fail to rob the prince, etc. However, this would result in a complex structure in which the fundamental elements that need to be expressed are lost within less important elements. Furthermore, the algorithms for calculating actions are not the same for "core" structural elements and for additional ones. Therefore, we introduce a fundamental distinction between two kinds of elements, those that create the core narrative structure from which one or more narrative paths are calculated and those that enrich each path. We call the former *core elements* and the later *support elements*. This distinction is analogous to the distinction made by Roland Barthes in 1966 between "nuclear functions" and "catalysts" [2], the nuclear functions covering the key events in a story, the catalyses covering actions which complete these key events[2]. The difference is that Barthes' nuclear functions are story events while our core elements are structural atemporal elements and their relations.

[2] More precisely, the above-defined support elements correspond to Barthes' catalysts, indices and informants combined.

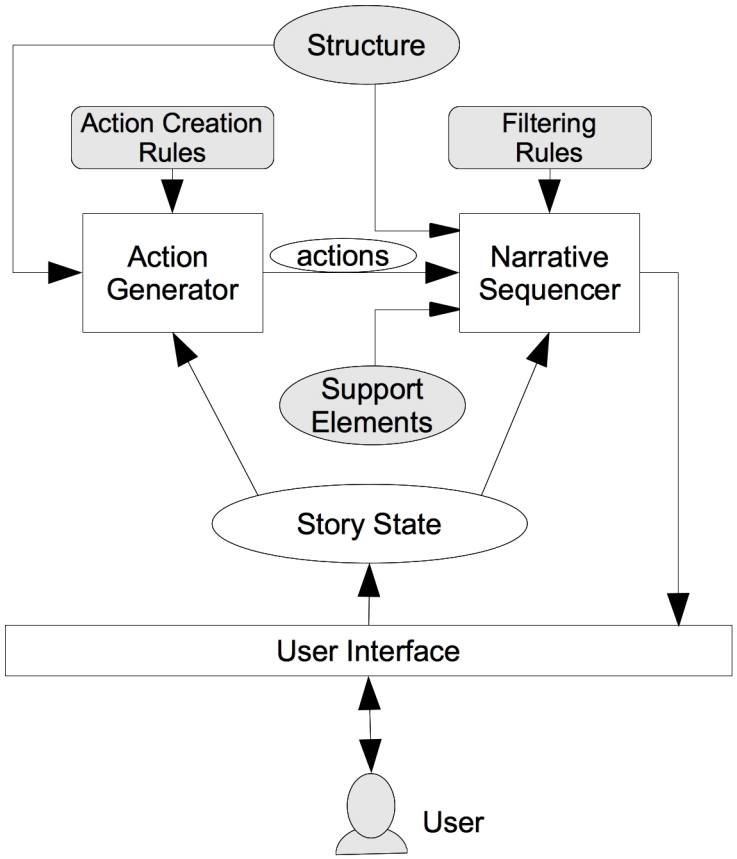

Fig. 4. An general architecture that supports Structural Writing. Authored elements are in grey.

From the above considerations, a tentative architecture based on structural writing has been sketched in Figure 4. This architecture is not a system description – Its various components are not enough specified for that purpose. Rather, our motivation is (1) to extend as much as possible theoretical considerations about structural writing to the algorithmic side and (2) to illustrate the algorithmic components visually so that they become more explicit. The architecture visualizes the fact that narrative structures contains abstract data that need to be processed, by the Action Generator (see above), based on *Action Creation Rules*, to yield to possible actions to be displayed to the user. These possible actions are then processed by the Narrative Sequencer (see above), based on another set of rules, the *Filtering Rules*. The Narrative Sequencer sends to the *User Interface* either NPC actions or a set of actions possibly played by the end-user. The User Interface is responsible of visualizing the executed actions and capturing the end-user's intervention in the story.

These components are not totally new in the field of interactive narrative. For example, the Action Generator corresponds to the *narrative logic* in IDtension, while the Action Creation Rules correspond to the respective *rules* [22]. In a different type

of system, the *double appraisal* mechanism [12] corresponds to a part of the narrative sequencer, the filtering rule being: select the action that maximizes the emotional impact on other characters. The content of each component is voluntary left open, the above architecture being more an illustration of our theoretical considerations rather than a system description.

Fig. 4 also depicts the levels at which authoring should occur: Narrative Structures, Support Elements, Action Creation Rules, and Filtering Rules. Asking the author to write at the level of these two sets of rules is problematic, as it requires a level of procedural literacy that many authors do not have. From our authoring experience with IDtension, in which this level is typically hidden from the author [22], we observed that the author needs to have control over these rules, in order to be able to write structures that fully exploit the engine possibilities. A solution consists in pre-writing these two sets of rules so that the author only has to configure/tune the rules. Such pre-writing is possible because these rules are relatively stable from one scenario to the other.

5 Refining the Concept of Structure

We observed that connecting structural elements together does not, in many cases, produce the expected large amount of possible events. For example, instead of having two competing goals, as illustrated in Figure 2, we can arrange goals in a sequence so that one goal is triggered once the previous one has been reached. The derived story events would naturally create a rather linear story. Therefore, there is a need to further qualify structures in terms of potentiality to produce large amounts of events.

Structuralist narratology has largely developed the concept of structure, but often in an abstract manner that is difficult to use for our purpose. Souriau's approach, however, is certainly useful, with the mechanical analogy mentioned above. Dramatic situations are seen as “a system of forces in internal tension” ([19] p.42 our translation), which evokes a psycho-social system in which various motivations to act (or acts) go in opposite directions, which corresponds to the concepts of conflicts [6, 8, 10], obstacles [10], dilemma, paradox [14], etc. Such a tension corresponds to cycles in the topology of interconnection between narrative elements. For example, Figure 3 represents such a cycle, with a character who wants to reach a goal, which is reachable by a task, which is (negatively) attached to a value, which is attached to the same character. The “degree of circularity” that occurs within such a structure can be formalized in the future, with a formalism that depends on the language used for representing narrative structures. Such a formalization would provide indicators on the quality of the structures and help authors to write interesting structures.

6 Conclusion

We introduced the concept of Structural Writing, a fundamental and independent design principle that can be at work in computer-based interactive drama. This principle, as other authoring principles, is independent of a particular system. It is

shared, for example, by both character-based interactive drama and centralized drama managers. With its high degree of abstraction, Structural Writing is believed to provide a powerful solution for interactive drama, although by no mean it is the one and only design principle.

The identification of the design principle of Structural Writing enables us to better understand existing systems, and improve future implemented systems. In particular, the resulting architecture (Fig. 4) is a tool for both analyzing some existing systems and designing new systems for interactive drama.

An important feature that has been largely overlooked in the field is the a priori assessment of dramatic structures, based on their topology. Existing approaches rely on authors to design "good" structures. However, "bad" structures can simply ruin the particular advantage of structural writing, by merely implementing the principle of conditionality. An ideal system should not only allow authors to express their creativity with the available narrative elements, but also prevent them from writing structures that do not have suitable structural generative properties.

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Genres, Structures and Strategies in Interactive Digital Narratives – Analyzing a Body of Works Created in ASAPS

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Abstract. The Advanced Stories Authoring and Presentation System (ASAPS) has been used to build 60 interactive digital narratives (IDN) so far. The paper briefly discusses several salient aspects of the system, including the bottom-up approach of the project and observations from using the tool for teaching in an academic setting, as well as related work. Next, we describe several outstanding examples of ASAPS narratives before analyzing visual styles, narrative genres, and structural aspects, as well as identifying additional narrative strategies.

Keywords: Interactive Storytelling Authoring System, Interactive Digital Narrative, Content Analysis, Narrative Design, Narrative Genres, Narrative Strategies, Teaching Interactive Narrative.

1 Introduction

In continuous development since 2007, the Advanced Stories and Presentation System (ASAPS) [1] is a specialized software suite for creating and presenting interactive digital narratives (IDN)[1]. ASAPS is built with three broader goals in mind – ease of use for authors, extensibility, and interoperability. Additionally, the platform serves as the practical complement to an evolving theoretical framework for IDN [2][3]. ASAPS is built on top of ASML, a markup language created to describe interactive narratives; furthermore the system includes a cross-platform authoring tool and a cross-platform playback engine. ASAPS offers authors familiar narrative elements like characters, props and scene backdrops and adds branching structures and procedural elements to the mix for the creation of compelling interactive experiences. ASAPS in its current form can also be described as a lightweight specialized 2D game engine with support for several common graphics formats, z-layering, animations, video, and three-channel sound support.

So far, ASAPS has not been released to the broader public but is available by request from the project's homepage [4] and has been used in university settings in

[1] We prefer "narrative" to "storytelling" since the later implies an act of storytelling by a storyteller which foregrounds the "telling." In contrast we are interested primarily in narrative experiences that are not "told" in a traditional way.

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teaching IDN and to create 60 interactive digital narratives so far. This body of works is available for a comparative analysis, with the distinct advantage of having all elements exposed and well known.

We briefly describe specific aspects of authoring and teaching with ASPAS, before we present an overview of narratives created with the system. Then, we analyze visual styles, genres, structural similarities, and narrative strategies.

2 Aspects of ASAPS

ASAPS foregrounds a bottom-up approach, based on the idea of giving non-expert authors access to "building blocks", and letting them combine them into IDN works. The design of the system is meant to impose as little pre-determined structure as possible and let creativity run free. The users' suggestions along with an analysis of their works then form the basis for the next expansion of the system. In this way, much additional functionality like new beat types and sound support has been added to ASAPS. The overall goal is to iteratively build a more powerful system in this way, one that reflects the needs and wishes of a community of authors. More advanced computational functions are planned to be integrated by means of standards-based interfaces, for example via TCP/IP communication.

2.1 Authoring in ASAPS

An important motivation in the design of ASAPS is to ease the transition from traditional to interactive storytelling and to make the procedural power of digital media accessible to non-experts. The authoring tool is targeted at individuals who are interested in IDN, but often have only limited knowledge of this subject. Consequently, the application utilizes terminology familiar to this group (*story* for the overall product, *settings*, *characters*, and *props*) and only introduces IDN concepts in the "narrative design" section. Here, authors combine narrative building blocks, or *beats* to form the overall narrative structure. The 14 different beat types include static elements like a title screen, as well as flexible elements, which contain an author-determined number of choices in a conversation, for navigation, or for adding items to an inventory. Finally, procedural beats allow authors to manipulate counters, global variables, inventory items, and timers. Any of these dynamic conditions can be checked at later points in a narrative and used to track character or narrative development or to steer the narrative in a particular direction.

2.2 Procedural Branching

With its arsenal of static, flexible, and procedural beats, ASAPS combines static branching with procedurally determined narrative progress. In more concrete terms this means that while branches have to be pre-determined by an author, the concrete decision on which branch to take can be determined at runtime depending on the state of a particular counter, the inventory system, or a variable. These procedural elements

can be changed as the result of actions taken by an interactor; for example each choice in a conversation can change a counter representing a character trait such as *aggressive*, *timid*, and *reasonable*. Once the conversation has finished, a combination of condition-checking beats can be used to determine which trait has been the most prominent and the narrative can branch accordingly.

This combination of branching with procedural aspects also results in a dramatic reduction of the need for branch and beat production. In this example (Figure 1), the optimized narrative structure applies the inventory system, local variables, and counters to record interactors' choices in picking an item and selecting a direction path. In this way, the system keeps track of the development of the narratives main character. Applying these techniques allows ASAPS authors to be more productive by reducing the time needed to produce an interactive digital narrative. In addition each work becomes more manageable by reducing visual and logical complexity. In this way, the system takes into account issues raised by Andrew Stern in his warning about the unmanageable nature ("linearity hell") of large linear branching systems. [5]

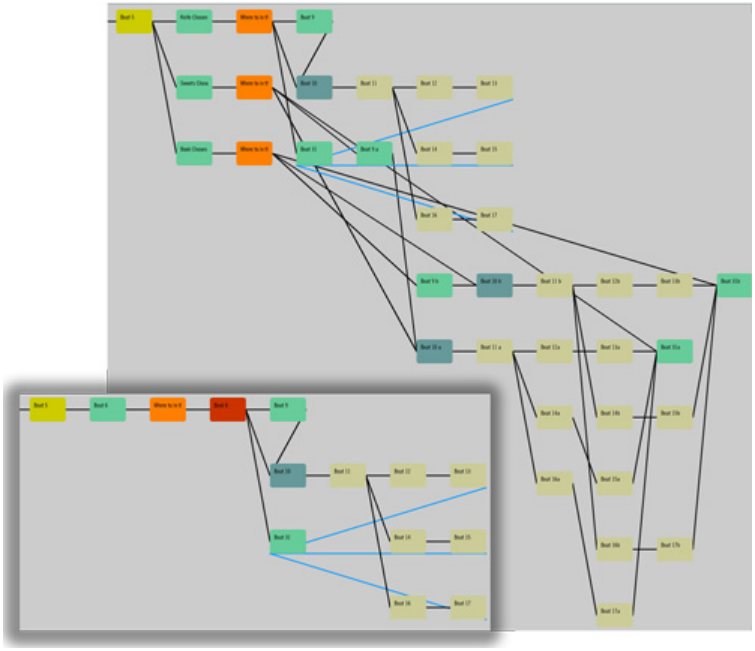


Fig. 1. The same content as a linear branching structure (large graphic) and by applying ASAPS's procedural functions (insert)

2.3 Teaching IDN with ASAPS

ASAPS has been used in teaching interactive narrative for several years now. The authoring tool was generally well received by students, whose biggest complains have

been early issues with stability. Beyond that, this group of users has suggested new features, many of which – such as z-layering support or a way to group beats together - have been implemented in subsequent versions.

A particular difficulty in teaching ASAPS – and by implication IDN in general – is in getting students to understand and make use of the procedural features in the system. We have observed a tendency to initially build a purely branching story with no procedural elements, a behavior, which we intuitively understand as influenced by the hyperlinked structure of the WWW and the structure of children's build-your-own-adventure books. In our experience, extra emphasis in the class schedule needs to be devoted to this topic along with specific examples like the one displayed above to illustrate the advantages and possibilities of using procedural elements.

2.4 Related Work

While many IDN authoring systems exist – such as Art-E-Fact [6], the authoring part of the IS engine [7], DraMachina [8], and Scenejo [9] (for a more extensive list, see [1]), many do not encompass all aspects of interactive narrative authoring - as Magerko and Medler have also argued [10] - and for example specialize on dialogue creation. We position ASAPS as a general authoring tool that – giving its growing body of works – aspires to be compared to systems like the IF authoring tool Inform [11] and the Japanese NSCRIPTER [12] system for the creation of virtual novels. What sets ASAPS apart from these two systems is a significantly lower requirement for expertise in programming on the side of its users, as both require learning a specialized scripting language, while ASAPS does not. Finally, we see the bottom-up approach and the related commitment of not imposing specific forms (like textual IF in Inform) as another differentiating factor of the platform.

3 Analyzing ASAPS Narratives

With the number of IDN works created in ASAPS having reached 60, it is warranted to speak of a body of works, which provides an initial basis for analyzing and understanding commonalities like visual styles, genres, narrative structures, and strategies. Furthermore, the shared underlying architecture provides two key advantages for narrative analysis:

- all elements are known, nothing is hidden
- the structural view of narratives can be compared across all narratives, since it is created automatically by the same algorithm

These advantages stand out even more if we take into account that the exact structure and internal workings of many commercial IDN examples, especially contemporary narrative computer games like Heavy Rain [13] or LA Noire [14] are considered trade

secrets and are not directly available for analysis, which force researchers into gleaning the internal structure from observations, promotional material, and developer interviews (for example [15] [16][17]).

We conducted a preliminary content analysis in order to identify commonalities in the existing ASAPS narratives. In this analysis we are looking at visual aspects (section 3.2), genres (3.3), structural aspects (3.4), and additional narrative strategies (3.5). The sample consisted of the 60 narratives created by students and fellow researchers. In order to give an impression of the analyzed narratives we start by describing several outstanding examples.

3.1 Outstanding Examples

At this stage of the development, works created in ASAPS cannot be expected to measure up to IDN milestones like *Façade* [18], *Madame Bovary* [19], or *The Prom* [20]. This is due in a large part to the emphasis on a bottom-up approach, which entails a preference of ease of use and extensibility over computational sophistication. However, where these works reach high, and stand out as singular examples, ASAPS reaches wide and in this way has enabled the creation of many intriguing narratives. In particular, several works with more than 100 beats are exemplary for their narrative complexity expressed in many choices, and in longer narratives to explore.

The Ship, a work by Charlie Stafford with 367 beats, is the current record holder in beat count. In this extensive narrative, which combines motives from Greek mythology with elements from strategy games, the protagonist wakes up on a ship with no memory about getting there. By exploring the space and talking to the other passengers, the interactor slowly uncovers what kind of special ship she is on, what forces are at play and if there is a way to escape. In the office life parable *Breaking Points* by Digdem and Tonguc Sezen, (257 beats) the interactor puts the desolate protagonist on a path that might change her life by making seemingly incongruous decisions like what dress to wear or what task in the office to do first. *Imprisoned* by Andrew Chappell (157 beats) leads us from a start in striking black and white with the sounds of a hospital room onto an exploration of a maze-like prison that can lead to freedom or death and also reveal the protagonist's mysterious identity during the journey. Finally, Thomas Bauer's *Day in the Life* (115 beats) takes the interactor on an extensive exploration of a real-life cityscape in search for clues of last night's memories, combined with a maddening soundtrack that perfectly complements the frantic action.

Many smaller works have their strong points, too. For example, Crista Harrington's *A Superhero Story* lets the interactor explore the result of questionable moral choices in the familiar look of super hero comic books. And Jacob Harkey's *The Heist* lets an interactor experience the stress of a bank heist by putting her under time pressure to act quickly or go to jail.

Fig. 2. A selection of visual styles in ASAPS narratives

3.2 Visual Style and Perspective

IDN works created in ASAPS encompass a wide spectrum of visual designs (Figure 2). The authors have applied photo-realistic presentations, hand-drawn imagery, comic-style graphics, and pseudo 3D presentations. More specifically, the visual presentations have been influenced by established styles such as black and white film-noire, high contrast music videos, super hero comic books, and children's picture books. Aside from these influences from more traditional narrative media forms such as books, movies and videos, many narratives are also influenced by computer games, especially the appearance of adventure-like games. While 3D presentation is a goal for a future version of ASAPS, it is interesting to note that only a handful of authors have asked for 3D capabilities, whereas most were content with the 2.5D[2] capabilities available in ASAPS.

Video and animation are used in 14 of the works, or about 23% of the total sample. Given the additional complexity of creating animations and shooting video, this number seems fairly high and documents an interest in integrating these forms in IDN works.

[2] A 2D presentation style, which has z-layering support and often also features visual depth-cues like shadows or perspective.

In terms of perspective, a 3rd person view with a visible avatar representing the interactor is the most prevalent form, encountered in exactly 70% of the narratives. 1st person view is present in 15% of the sample. In the remaining 15%, the perspective changes between 1st and 3rd person throughout the narrative. Intuitively, we link the clear dominance of 3rd person perspective to the influence of the dominant visual presentation form in TV drama and computer games.

3.3 Narrative Genres

Since IDN is still an emerging form of narrative expression, any discussion of genres is preliminary to a degree, especially if compared to the established disciplines of literature studies and film studies. However, we feel our sample of 60 narratives is big enough to recognize similarities with existing forms as well as provide a tentative identification of new genres.

There are eight types of narrative genres in the sample: adventure game/hero quest, detective story/mystery, role-playing game, alternate history scenario, amnesia/escape room, situational challenge, character development, and complex topic scenario. The first four categories (adventure game, detective story genre, role playing game, alternate history) show many similarities with existing genres in computer games and older forms of narrative; the remainders are genres specific to IDN. In several cases, a particular narrative combines aspects of different genres. Here, we have identified the dominant type and categorized the narrative accordingly. 88% in the sample are original works, while the remaining 12% extend existing stories in the manner described by Jenkings [21] for transmedia narratives. They share the underlying narrative world with TV series such as *Star Trek*, or *Seinfeld*, or *Community*.

Adventure – in this type of narrative, the interactor is on a quest to solve a specific problem, or find a particular item. 17% in the sample are narratives of this kind. The narrative here is focused on unfolding events, while the interactor is engaged in completing a quest.

Detective Story/Mystery – here, the interactor is in the role of a detective charged with solving a crime. In the sample, 8% are narratives of this kind. The narrative of the crime is uncovered by the interactor through spatial exploration, collecting cues, and interviewing suspects. Although similar to the adventure category in regards to interaction, the focus on events that have already happened in the past and are being uncovered warrant a separate category.

Role Playing Game - this kind of narrative has the interactor build up a character through challenges and decisions to gain more power and abilities. A single narrative is in this genre, however several more use some of the role-playing mechanics, especially an initial selection from a range of items to determine the traits of a character.

Alternate History – Two of the narratives in the sample fall in this category. One presents a character in an unfavorable state, which the interactor is asked to change by reversing decisions in the past. The second example allows the interactor to change a part of ancient Greek history.

Amnesia/Escape Rom – in this type of narrative, which is found in 13% of the sample, the interactor starts with little or no knowledge of the narrative context and is most commonly (over half of the narratives in this category) placed in some sort of a prison/escape room situation. In these cases, the interaction is engaged in a dual activity of finding a way out and uncovering the prior narrative that lead to this situation.

Situational Challenge- This category is the most popular, with 30% of the sample. In this genre, the interactor hast to master a challenging situation, from finding the way to school, to overcoming the lure of distractions in the course of academic success, to navigating the pitfalls of dating or surviving as an intern in a business environment. This category has similarities with simulation games, but trades the large-scale world of games like *The Sims* or *Civilization* with a smaller episodic situation and a focus on narrative development and dramatic situations. A particular narrative focus in this genre is on the eventual consequences of a number of decisions.

Character Development – 25% of the sample task the interactor with developing a character through choices in the narrative. The common starting point in this category is a blank character that turns good or bad, flirtatious or timid.

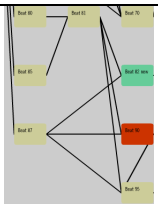
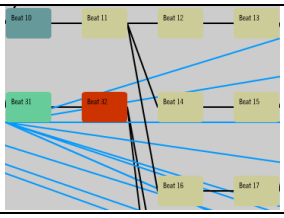
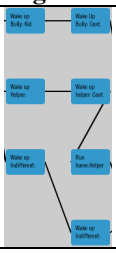
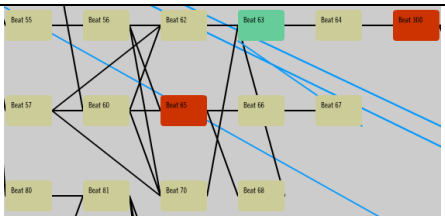
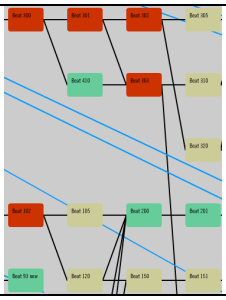
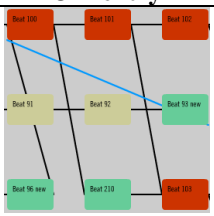
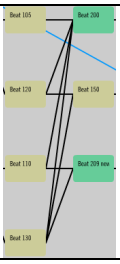
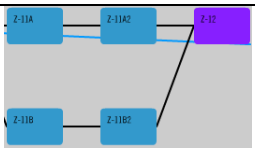
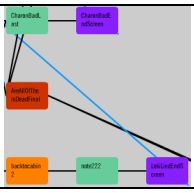
Complex Topic/ Multi Perspective – in this kind of the narrative – featured in 5% of the sample - the interactor encounters multiple divergent perspectives towards a single topic, either in the form of different characters to follow, or in a presentation of alternative opinions. In choosing a path amongst the perspectives, the interactor gains a deeper understanding of a topic. One example in this category is an IDN, which presents perspectives on the Occupy Wall Street movement.

3.4 Structural Aspects

At the beginning, the graph view of each ASAPS narrative, which is the visualization of the narrative structure, was screen printed and was defined as the unit of analysis. Since existing research on narrative structures in IDN, like Bernstein's observations regarding hyperfiction [22], did not provide a good fit for the content analysis for the ASAPS narratives, the coding scheme was constructed by emergent coding, namely, all the graph views were scanned to identify common traits. In this manner, ten dichotomous coding categories were constructed and divided according to structural similarities and narrative strategies. The results of this content analysis (N=60) are shown in Table 2 and 3 in percentages of the categories.

The analyzed structural similarities are: (1) branching structure (tree-like vs. web-like), (2) topic orientation (thematic vs. fragmental), (3) cluster distribution (uni-clustered vs. multi-clustered), (4) node entry (uni-entry vs. multi-entries), and (5) ending type (uni-end vs. multi-ends) (Table 1). We define nodes that are connected in sequence without backward links as tree-like branching while web-like branching contains links for returning to previous nodes. Narratives with an overarching thematic topic show a horizontal structure whereas fragmental topics tend to be vertical in the graphic view. The remaining categories of cluster distribution, node entry, and ending type, vary with the complexity and overall length of the narratives.

Table 1. Examples of structural categories

Tree-like	Web-like
	
Thematic	**Fragmental**
	
Uni-clustered	**Multi-clustered**
	
Uni-entry	**Multi-entries**
	
Uni-end	**Multi-ends**
	

The content analysis of our sample show that there are more stories with tree-like branching than stories with web-like branching, signifying that the flow of narratives tends to process from one node to another and that there are few options for going backward. The majority of these nodes have only one link originating from the antecedent nodes. In the sample, there are about the same number of narratives with one thematic topic and several fragmental topics. Narratives are either composed of a clear main topic or of several sub-topics. We also observed that narratives with multiple clusters and multiple endings outweigh those with a unique cluster and a single ending. This means that even though stories have an equal chance to be thematic or fragmental in topic orientation, they are more likely to be narrated in complex ways.

Table 2. Frequency of Structural Similarities

	Category	Frequency	Percent
Branching Structure	Tree-like	40	66.7
	Web-like	20	33.3
Topic Orientation	Thematic	32	53.3
	Fragmental	28	46.7
Cluster Distribution	Uni-clustered	15	25.0
	Multi-clustered	45	75.0
Node Entry	Uni-entry	39	65.0
	Multi-entries	21	35.0
Ending Type	Uni-end	18	30.0
	Multi-ends	42	70.0

3.5 Other Narrative Strategies

We also analyzed the following narrative strategies: (1) method of introduction (explorative vs. consecutive), (2) narrative world (parallel vs. interwoven), (3) narrative path (fixed-path vs. conditional-path), (4) narrative presentation (text-based vs. graphic-based), and (5) point of view (uni-character vs. multi-characters).

Explorative introduction means that the narrative starts with a character trapped in a mystery or that interactors encounter a narrative situation without any explanation, whereas consecutive introduction provide specific directions to lead interactors into the narrative world. In a parallel world type, several sub-narratives exist while in an interwoven world type an overarching narrative exists. Fixed path means that consequences of choices are entirely pre-determined by the author rather than influence by interactor's decision made through the story. Narrative presentation concerns the choice between text and graphics, while point of view indicates whether the interactor plays more than one role in the narrative.

In our sample, narratives more frequently employ consecutive introductions that give specific directions at the very beginning. There is smaller percentage of narratives with parallel worlds than with a singular interwoven world. In the sample, narrative paths are conditional more often than fixed by a wide margin. However, the fact that more than a third of the narratives are fixed path emphasize the difficulty in getting authors to understand the advantages of using procedural elements. As far as

Table 3. Frequency of Narrative Strategies

	Category	Frequency	Percent
Introduction	Explorative	23	38.3
	Consecutive	37	61.7
Narrative world	Parallel	27	45.0
	Interwoven	33	55.0
Narrative path	Fixed-path	22	36.7
	Conditional-path	38	63.3
Narrative presentation	Text-based	19	31.7
	Graphic-based	41	68.3
Point of view	Uni-character	36	60.0
	Multi-characters	24	40.0

text vs. graphics is concerned, a majority of stories use a graphic-based narrative presentation, which foregrounds the visual presentation of stories with the aim to be more direct and user-friendly than text-based narratives. Finally, a majority of the narratives allow the interactor to play only one character in the narratives rather than multiple characters.

4 Conclusion

Our content analysis of 60 ASAPS narratives yields interesting results in several areas and provides starting points for further research. We have tentatively identified four IDN specific narrative genres – *amnesia/escape room, character development, situational challenge,* and *complex topic/multi perspective*. Our analysis of structural elements show a tendency towards an overall consecutive and directed flow of narrative, while the complexity - as signified by clustering and multiple endings - is high. In regards to other narrative strategies, a majority of authors prefer to introduce interactors first to a narrative, and then have them explore a complex and dynamic but consistent narrative world. The results of the content analysis also back our experience in regards to the difficulty of teaching authors to use procedural elements.

We will use these results in extending the ASAPS system and as a basis for a better theoretical understanding of IDN works. More concretely, we have finished a first version of ASAPS for a mobile platform (iOS) and we plan to include sensor support (accelerometer, GPS, etc.) in new beat types. It will be interesting to see how such "physical" narratives will compare to the present analysis. On the theoretical side, we plan to follow up on this overview with an analysis through the lens of protostory and narrative design [2]. Finally, we intend to make the ASPAS narratives available on the project website [4].

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Project Aporia – An Exploration of Narrative Understanding of Environmental Storytelling in an Open World Scenario

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Abstract. The genre of interactive narratives in computer games has been researched extensively in the past. However, it still seems that there is a potential for investigating how a narrative can be conveyed solely through environmental storytelling. This paper reports an experimental study which examines the understanding of a pre-written story which is mediated without the use of characters, dialogue, or words and only through the environment in the prototypical game 'Aporia'. The evaluation of the story construction in Aporia analyses and quantifies written open-ended answers and compares them to the pre-defined elements of the story. The findings indicate that Aporia mediates a narrative potential, which generates emergent narratives among users rather than mediating an embedded and evoked narrative.

Keywords: Environmental Storytelling, Interactive Narrative, Embedded, Evoked, Emergent, P.I.N.G. Model, Understanding of Interactive Narratives.

1 Introduction

This paper describes an exploration of the understanding of a narrative mediated through environmental storytelling. Our experimental and prototypical game Aporia conveys a story by using only environments and pictorial clues – an approach which resembles an embedded and evoked narrative [1]. With the design of 'Aporia', we attempt to expand and explore the narrative possibilities within the genre of interactive narratives in computer games by adding interactivity to the narrative through game mechanics. We see great potential in interactive narratives specifically if combined with elements from the adventure game genre – creating a synthesis of exploration and discovery of the story, in contrast to presenting the narrative directly to the player.

To convey a pre-written narrative solely using the environment, this paper will thus first investigate the concept of environmental storytelling as well as introducing a classification model (the P.I.N.G. Model) with focus on narrative and computer games to clarify the goals of the project within these areas as well as the participants' classification of their experience of Aporia.

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 96–101, 2012.

2 Environmental Storytelling, Narratives and Games

Jenkins [1] introduces the concept of environmental storytelling and elaborates on four terms in particular: Evoked narratives have the ability to enhance an already existing narrative through the level of detail in the spatial design. Enacted narratives provide narrative elements which is build up around characters. In Embedded narratives the game world is a "memory palace" where the object and the staging within the game contain clues which enables one to reconstruct the plot, whereas Emergent narratives set up a universe where the player can construct their own narrative based on encountered events. Evoked and embedded narratives holds great potential in conveying a story without text or dialogue, since features like the mise-en-scene [2] and spatial design does not need any textual or audible expression. Each object and especially the setting in the game can be carefully constructed to be open for interpretation. Therefore the narrative and spatial design in Aporia is created based on the evoked and embedded narrative types.

Inspiration for Aporia is drawn from a range of commercial games. 'Dear Esther' served as inspiration for the narrative focus, while the atmospheric and interactive aspects of 'Amnesia – The Dark Decent' have been emulated to obtain a similar effect in Aporia. Another inspirational source was the pictorial storytelling used in 'Journey' where the player gradually uncovers the story that involves no text or narration. So Aporia draws inspiration from the atmosphere and style of all three games, and allows the players not only to reach the game's objectives but also to set up their own goals and experience the non-linear story in various ways.

The narrative is designed to be a static setting and a place in time with no particular chronological development in the narrative, and it is categorized in three levels of narrative understanding ranging from the immediate, obvious and apparent story, which is derived from the things that the player encounters and have no deeper or inferential implications to the concealed story (narrative level 1). The next level requires the player to interpret drawings and clues in order to understand and construct the fundamental story (narrative level 2). Finally, the last level then spans out to the metaphorical and ultimate meaning of the story (narrative level 3). Discovering parts of the narrative on level 2 and 3 will alter the players' perception of the game and the players will perceive the ending very differently. The concealed objects and drawings relevant for the story are physically hidden in the game world in secret places, but clues will help direct the player to where they are and how to get there. Some of these clues will appear only when the player has performed a certain task. If the player reaches understanding of the story within level 2 and 3, it might become apparent that the story is metaphorically describing a mind trying to deconstruct its own dream; trying to wake up from a coma and that it is this subconscious state that guides the player through the game.

In order to place Aporia in context with other contemporary games with narratives, the P.I.N.G. model (Passive-Interactive Narrative-Game model) has been developed.

The model compares games across two axes – the first being an expression of whether the game's focus rests on narrative elements, or on more challenge-based game elements. The second axis refers to the interactivity of the game. This axis spans a range from no interaction to a variety of interaction possibilities (Fig. 2.). As

can be seen in the figure 'Dear Esther' is passive towards the narrative since there is not much interaction within the narrative. The P.I.N.G. model is created to establish a specific area between existing games and interactive storytelling applications, and their foci seen from the developers' perspective. With the P.I.N.G. Model it is possible to decide a focus for an interactive application and to compare this focus to the focus perceived by the audience.

The model is developed based on discussions about related games and other game genres and makes it possible to illustrate a visual overview of how the narrative and interactivity should be prioritized in Aporia in order to create a greater potential of understanding the story conveyed through the environment.

Based on a comparison of various games plotted in the model, it was decided for Aporia to aim for an area with large focus on narrative elements and with some focus on interaction with elements within the game. This area has been marked with a circle in the P.I.N.G. model in Fig. 2.

3 Evaluation Method and Procedure

The evaluation approach comprised of an analysis of answers acquired through three in-game interruptions and a questionnaire with open-ended qualitative questions and closed-ended quantitative questions. Table 1 summarizes the questions, which were the foundation for the analysis of the understanding of the narrative aspects. A set of demographic data was also collected in the questionnaire in order to increase the validity of the results, by taking any deviating patterns into consideration when investigating the final results, as well as when determining if the participants indeed were a representative sample of the target audience [3].

Table 1. Narrative questionnaire (extracted from the original questionnaire)

Part One: Before the experience: Demographics (gender, age, frequency and amount of playing, favourite game(s))
Part Two: During the experience (3 interruptions): Q1. How would you retell the story based on the experience you've had since the last interruption? Q2. What do you think is the meaning of the story so far?
Part Three: After the experience: Q3. How would you retell the story based on the whole experience? Q4. The player is asked to categorize Aporia on the P.I.N.G. Model.

The success criteria for the understanding of the narrative was held up against level 2 (understanding the concealed story) and level 3 (metaphorical understanding) which can be seen in Fig. 1. On basis of these criteria, it was decided that in order to have a successful understanding of the story, the players should understand three out of five narrative elements in level 2, since this level holds the most important parts for understanding the narrative.

To make the qualitative answers concerning the explanation of the story comparable to the intended narrative in Fig. 1., all responses were analyzed and categorized. The framework and quantification of the results was achieved by evaluating each explanation of the story and checking if any keywords (for example words such as brain, coma, dna etc.) matched the elements from the pre-written story. If that was the case, that specific explanation was analyzed further. It should be noted that this method makes otherwise non-comparable responses comparable.

Verifying if the players felt that they understood the narrative or if their interpretation of it was pure conjecture or nonsense was also necessary (answers from Q1). The correct formulation for these questions was important towards the answers and should, as far as possible, be understood in one way [3]. It was decided that when finishing the experience, the participants should retell the entire story as clear as possible (Q3). To get a better understanding of the respondents' connection of the narrative we also questioned what they thought the purpose of the story was (Q2).

Finally, the categorization of Aporia in the P.I.N.G. model (see Fig. 2) furthermore describes how the respondents reported whether the focus of the game relies on narrative elements, or on more challenge-based game elements (Q4).

The evaluation was conducted with 20 participants (2 females and 18 males) who each had an educational background in Medialogy or Engineering. Four participants did not finish the game, due to bugs, but all four experienced two thirds of the game and are therefore considered as valid respondents.

4 Findings, Discussion and Conclusion

As depicted in Fig. 1, 30% of test participant understood that other people had been washed ashore on the island and understood that the main character was in a coma (35%). 10% understood the train accident on level 2 and 10% understood the fact that the entire island is in fact the players own mind on the metaphorical level 3.

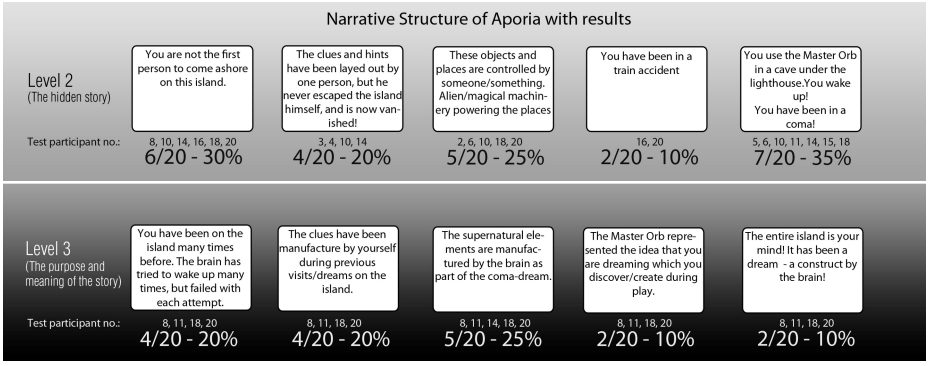

Fig. 1. Narrative Structure of Aporia with results

However if we focus on the success criteria for the narrative, being that the test participants should understand 60% (3 out of 5) of the narrative fragments, only 4 understood the narrative in each level (equivalent to 20%).

The following quote is a clear example of a participant who has reached level 3 of the narrative: "I am a person who fell into a coma state. The world I'm in is a metaphor for my brain and the parts of the world are parts of the brain […]" (Participant #20). In general too few (20%) participants understood the story in Aporia. The interaction with key objects seemed to steal the focus from the narrative and took most of the participants' focus, also when describing the narrative. This suggests that the interactivity and narrative should have been combined and facilitated each other, instead of being two separate elements in the game.

Despite the fact that only 20% of the test participants understood the pre-written narrative, many had great imagination and level of detail when describing the narrative and many formed their own emergent narrative, e.g.: "A lost civilization from another universe/dimension tries to communicate with our world by leaving these signs and buildings on this island.[...]." (Participant #4).

The greatest disadvantage of the categorization method is the fact that it is not possible to know why the participants answered as they did and the formulation on paper might not be the same as their actual perception. Furthermore, the researcher might also be biased when analyzing the answers.

The participants' classification on the P.I.N.G. model from Q4 (marked with a large grey square in Fig. 2), is not far from the desired focus of Aporia, but still lacks intensity in both the narrative and interactive element (Fig. 1.). 15 out of 20 (75%) found Aporia to have a higher focus on the narrative than the game elements, which almost approached the desired focus on the narrative. On the other axis 11 out of 20 (55%) defined the game as more interactive than passive.

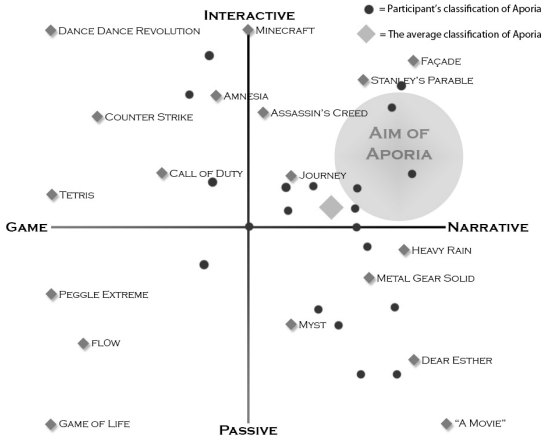

Fig. 2. The P.I.N.G. Model with results

When investigating the participants' classification of their understanding of the concept of Aporia, the majority thus seem to correspond very well to the initial aim.

However, since Aporia is not fully developed the desired classification of Aporia might have been slightly too ambitious. Furthermore, the results have their limitation because of the quantitative methods and would probably be more applicable and valid if qualitative methods were used. Nevertheless, the findings indicate that Aporia is a proof of concept that supports the initial idea that the environment in games has a high amount of narrative potential, but in order to convey a pre-written narrative in order to make it understandable, not only less ambiguous objects and more linearity should be considered, and also the goals of the player and each object's connection and significance with the narrative, should have been stronger.

In the context of another model which describes user roles across a spectrum of interactivity [4] where a two-dimensional spectrum between degree of interactivity and narrative types has been suggested, Aporia could be classified as having a freely participating character which narrative form is defined as emergent, opposed to a branching narrative structure, where the player is forced to choose between multiple choices.

5 Conclusion

In conclusion, Aporia conveys its narrative with embedded and evoked narrative elements instead of using in-game characters, dialogue, or words in general. Through these experimental guidelines, Aporia was meant to give the player an understanding of a pre-written story. The game was not completely able to convey a story through embedded and evoked narrative, but it had a lot of narrative potential, because the objects and environment yielded different interpretations in each test participants' experience. Overall it can be concluded that Aporia appears as a non-linear collection of narrative potential elements, which generates emergent narratives rather than telling an embedded and evoked narrative. It can be considered a difficult task to convey a pre-written story based solely on embedded and evoked environmental storytelling and make a game non-linear at the same time. However, the field of environmental storytelling within interactive narratives and games is now open for further exploration.

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Coffee Tables and Cryo Chambers: A Comparison of User Experience and Diegetic Time between Traditional and Virtual Environment-Based Roleplaying Game Scenarios

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Abstract. This paper explores how the user experience and diegetic time changes when a specific roleplaying scenario is played via a virtual environment and headsets, compared to a traditional playthrough. A case-study roleplaying scenario is developed to investigate the change in user experience qualitatively, and a virtual environment matching this scenario is created. The players using the virtual environment version spent the entire time communicating within the story, and the diegetic time equated real time for the entire playthrough, compared to approximately 4/5 of the time in the traditional playthrough. Additionally, there are indications that this adherence to the diegesis resulted in a higher suspense. The results show that the virtual environment version can deliver an engaging story experience, and might therefore potentially inspire for a solution to the narrative paradox.

Keywords: Interactive Narratives, Roleplaying Games, Scenario-driven Narratives, RPG scenario, Narrative Paradox, Virtual environment, Character-driven narratives, Storytelling, Engagement, Emergent Narratives, Game Master, Continuation Desire.

1 Introduction

Roleplaying games have come a long way since the beginning in the early seventies, where they evolved from tabletop fantasy war-games into a self-contained game category of its own [1, 2]. By now, one can play traditional roleplaying games to explore fantastic worlds, defeat magnificent beasts and overcome villainous plots. Additionally, subgenres within roleplaying have emerged, which deal more with interrelationships between characters, a joint exploration of emergent stories, and the dramas normally associated with great literature. But some of the core elements of all roleplaying games have been the shared experience, the social commune, and the collective intellectual and creative explorations of a shared story and setting.

Even if these core aspects of roleplaying games can be claimed to have been successfully translated to different formats than the original, tabletop pen & paper

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 102–113, 2012.

variety, it has seemingly so far only been migrated into computer roleplaying multiplayer games (CRPG) with relatively simplistic plots and mechanics, ones that tend to focus on the combat elements of the roleplaying experience rather than the shared story exploration and social interaction. Furthermore, mostly due to technical and production time limitations, the plot and setting has been defined rigidly through the game designer, with very little, usually no influence from the players. This is not necessarily a problem in itself, as the current computer roleplaying game market seems to thrive just fine as it is (20,3 % of total computer games sold in 2010 [3, p. 8]), but reversely, one cannot help but think that maybe something got lost in the translation from original form and onto the computer game medium.

So instead of focusing on how to enhance a computer game by integrating roleplaying game elements into the gameplay, it could be quite intriguing to investigate what would occur if one were to attempt a direct translation of a traditional roleplaying game scenario into an interactive narrative media experience, where these main elements of the roleplaying game are to be kept intact. While previous work [4, 5, 6, 7, 8] has been done in this direction, none of these publications seem to primarily investigate the storytelling aspects of roleplaying game scenarios, with a direct comparison to a translated interactive narrative media experience. Such a comparison might reveal which types of narratives are particularly suitable for this translation, and which aspects of the user experience change through a translation.

Furthermore, if the translation is successful, it could provide a medium for emergent interactive narratives that are less resource-demanding to implement yet engaging and effective, compared to pre-branched or algorithm-based solutions.

It should be noted that the textbased Multi-User Dungeons (MUDS) of the early 90s did offer the opportunity to focus on the collaborative storytelling, but MUDs were not 3D Virtual Environments (VE). They certainly could not provide a realistic looking virtual environment to explore, one which mimicked the storyworld. In essence, they were specialized chat programs, developed with the intent of playing traditional roleplaying games remotely. Reversely, the proposed solution augments the traditional scenario with a matching VE, in order to both enhance engagement/immersion, and to help the Game Master by lessening the required amount of descriptive and synchronizing utterings (speech).

2 Background

This paper will focus on a pilot test concerned with a one-off roleplaying game scenario developed specifically for the purposes of testing. A method for evaluating the change in user experience between the traditional and transferred scenario playthroughs will furthermore be described.

To lay the groundwork for such an endeavour, it is necessary to first establish the change in user experience when transferring a roleplaying game scenario to a virtual environment, so as to determine the effects of such a transfer if a future solution is to be developed through which to provide an interactive narrative solely via predefined player characters and a story setting. This interactive narrative may then be evaluated against the narrative paradox.

2.1 The Narrative Paradox

The common definition of the narrative paradox is "the clash between the pre-scripted character of much narrative and the freedom afforded by a Virtual Environment." [9, p. 1]. The current study is seeking to address the narrative paradox through the field of roleplaying games, by providing the players with a diegetic framework within which they have a wide variety of interaction possibilities, constricted only by the diegesis itself instead of technical limitations. Thus, the way in which the player characters are constructed, combined with a carefully selected setting which narratively restricts the viable player interaction choices, should provide the basis for a highly engaging emergent narrative with vast interaction options (especially with regards to social interactions), just like story-centric roleplaying game scenarios.

2.2 Characteristics of Roleplaying Games

Roleplaying games (RPG) can conjointly be said to be a form of interactive, collaborative storytelling [4, p.1], where one or several players each take the role of one or several fictitious characters [5, p. 2], and explain this or these characters' actions and utterings in a fictitious setting to another person [1], generally known as the Game Master (GM). This GM acts as an arbiter of both the outcomes of the player characters' actions, the responses to the utterings, as well as describing the general setting and taking the role of primary storyteller [10]. Often, the players act out parts of the roleplaying, especially dialogue, with the GM taking the part of the encountered Non-Player Characters (NPCs) and usually, the collaborative storytelling is the main purpose of the play, rather than a competitive experience as one would find in most social board game situations.

This paper will focus on the social, storytelling aspects and dynamics of roleplaying games, as these seem to function as a hyper-creative environment where innovative and different stories are created at the moment they are experienced. Not many narrative media yield collaboratively created emergent narratives that can be so effective, inspirational and thought-provoking that they e.g. cause users to go home and rethink their marriage based on personal insights gained through the emergent narrative [11]. Furthermore, the collaborative social storytelling sub-genre arguably holds a potential for providing a solution to the narrative paradox [12], as the methods used to create these interactive collaborative narratives seem to be able to provide the players with both a diversity of interaction possibilities and a range of possible story-constructions which may result in a variety of engaging emergent narratives.

2.3 The Player Action and Utterance Typology Framework

In order to aid the analysis of the roleplaying sessions, a roleplaying game player action and utterance typology (PAUT) framework has been conceptualized, dividing player utterances and actions into two categories, each with two subcategories, as shown below:

Table 1. Roleplaying game Player Action and Utterance Typology framework (PAUT)

Category	Subcategory	Description
Inside Diegesis	In-Character	Player actions and utterances performed as though the player was the character, e.g. acting out the character with dialogue and/or body movements.
	Out-of-Character	Player utterances and occasionally actions describing character actions and utterances.
Outside Diegesis	In-Game	Player utterances and occasionally actions pertaining to the roleplaying game (scenario) and its inherent systems, e.g. rule clarifications or discussions regarding optimal story progression.
	Off-Game	Player actions and utterances completely unrelated to the game, e.g. discussions concerning a recent sports event, social chatter or joke telling.

This player action and utterance categorization was constructed through an amalgamation of [8, 13], as well as ethnographic studies of roleplaying sessions in most sub-genres.

In order to determine the change in user experience, a four player one-off roleplaying game scenario was developed specifically for test purposes, with elements designed to appeal to all three main player types, as determined by the prevalent player typology within the Nordic roleplaying community, being *Dramaticists*, *Immersionists* and *Gamists* [14], focused on optimal story creation, player character immersion and acting, as well as game structure, balance and victory, respectively.

2.4 Real and Diegetic Time

It is necessary to specify the difference between real and diegetic time with regards to roleplaying game sessions. Usually, the session will skip and jump in diegetic time, as the narrative is paused while the GM e.g. describes a new room, or fast-forwarded during e.g. travel or recuperation periods. This can sometimes negatively affect the player engagement, as the diegetic time often cannot be sufficiently tightly controlled.

2.5 Engagement

Within the context of this paper, engagement is defined as the degree of continuation desire at a given moment in time [15]. This definition, along with the PAUT framework and a specified differentiation between real and diegetic time, allows for a combined methodology covering the aspects of the user experience sought investigated in this paper.

Having defined the various frameworks, it became possible to construct a testbed scenario, which will be described in the following section.

2.6 Case Study: Project Restless Sleep

In order to create a testbed suitable for both this study and future works, a traditional roleplaying scenario was developed specifically with the intention of being adaptable to a VE solution. The "Project Restless Sleep" scenario takes place in a hard[1] science fiction future, on board a derelict space freighter with four cryogenically preserved crew members, who can each guide an avatar robot around the spaceship in order to perform menial or repair tasks while en route. A freak accident occurs, and the player characters must then not only discover what happened, but also make repairs to the cryogenic cooling system preserving their bodies. At some point they discover that the system can only preserve three of the four crew members for the rest of the journey, and the ship's systems require that three crew members authorize a cryopod shutdown. It is now up to the players to discover the origin of the mysterious black fluid which has infected the cryocooling system, complete the repairs, and simultaneously decide who must perish, forming and breaking alliances doing so.

The hard science spacefreighter setting ensures a relatively limited set of interaction options for the players, compared to a normal setting, since the player characters are forced by the hostile environment to stay where they are, with the limited resources available to them at the specific location. Furthermore, the safety measures on the ship's systems, as well as the player characters only navigating the ship via their avatar robots, prevents most undesired player actions, so that the scenario is not over after 5 minutes because a player character murders someone else. However, these restrictions should seem realistic and acceptable to the players, compared to technical or artificial limitations, since they are part of the diegesis and setting.

The setting of this traditional roleplaying scenario was then adapted to a computer-mediated version. The scenario was designed and constructed as a virtual environment, and implemented with interaction possibilities in the Unreal Development Kit [16]. A software solution (Ventrilo) [17] was set up so that the players could communicate via headsets, either through a main channel, privately with either a single other player, or directly to the Game Master. Four player characters were developed, the personalities and motivations of which were designed to create conflict, in order to provide an optimal framework for interplayer intrigues and disputes. This setup, combined with a carefully balanced set of privileges divided between the characters, and a plot instigator leading to a critical ethic and moral dilemma, sought to ensure the interest of all three player types whilst simultaneously providing for an engaging and dramatic emerging narrative.

[1] Counterpoint to science fantasy. Setting where there should be a scientific explanation to all present technology and setting/world details. Usually combined with a dark or dystopian theme [13].

Fig. 1. The Virtual Environment in "Project Restless Sleep"

3 Test Method

In the pilot-test two scenario playthroughs were conducted: one in the traditional roleplaying manner, and one with the virtual environment version, in order to determine the changes in user experience between a traditional playthrough and a playthrough which incorporated the virtual environment and sequestered test participants communicating via headsets. Both tests used the same Game Master.

The traditional playthrough was audio-recorded with a dictaphone, and filmed via a video camera. The VE version was set up so that each test participant was recorded through a webcam, their screens were recorded via screen capture software, and the audio transmitted on all six communication channels were recorded, all for later analysis.

After each act in the scenario playthrough, the test participants were asked to rate their desire to continue on a Likert scale of 1-10.

Immediately after completing the scenario playthrough, the test participants completed a questionnaire asking the test participants to evaluate various aspects of the experience and asked to elaborate on the reasons. These questions were based on Roth, Vorderer & Klimmt's framework for evaluating user experience in interactive narratives, dividing such an experience into the following five categories: Curiosity, Suspense, Aesthetic Pleasantness, Self-Enhancement and Optical Task Management (Flow) [18].

Additionally, the questions were intended to provide findings for an evaluation of the comparability of the playthroughs, and for determining whether the developed scenario was a viable testbed sample of similar scenarios in the field. The engagement ratings obtained after each act, were used as references to interview the test participants regarding their reasons for the rating, expanding upon the experienced continuation desire by discussing various memorable events within the narrative, and inquiring about continuation desire connected with each.

The results were corroborated by test administrator observations during the test, as well as subsequent analysis of audio and video recordings of the tests, with specific focus on the categorization of player utterances as well as indications of engagement. Furthermore, a semi-structured focus group interview was held immediately after the completion of the questionnaires, with the purpose of obtaining further elaborations on the user experience, particularly with regards to the aforementioned components of the user experience evaluation method, as well as noteworthy events in the scenario playthrough.

4 Results and Findings

The test results include data on player actions, player utterances and engagement.

Four test participants tested the traditional version, while four respondents took part in the test of the VE version. Both test groups featured 3 males and a female, with age spans from 24-35. The test participants were all experienced roleplayers, and knew each other beforehand. The player preference towards the hard sci-fi setting was equally mixed in both groups, ranging from indifferent to preferred.

The traditional scenario playthrough took 4 hours and 20 minutes to complete, compared to the VE version's 2 hours and 20 minutes.

The various recordings were analysed to determine the PAUT distribution, and to determine the degree of correlation between the real and diegetic time.

The distribution of player actions and utterances within the categorization framework portray significantly different user experiences between the two versions, as seen in table 2. Given the small sample size, it is however not possible to generalize the results and state with absolute certainty that the difference is as significant as is portrayed here, but the observations and subsequent interview results corroborate a marked difference in time and event distribution between the various subcategories of player actions and utterances.

Table 2. Player Action and Utterance Typology distribution, in percent of total utterances

Utterance Category	Traditional version	VE Version
In-Character	65	93
Out-of-Character	15	7
In-Game	13	0
Off-Game	7	0

The results in Table 2 show that there is an indication of a noteworthy difference between the traditional and VE versions when it came to the difference between diegetic and real time, meaning whether the scenario was played in real time or had slowdowns or pauses. Players in the traditional scenario playthrough spent a lot of the play-time on conversations outside the diegesis, as well as diegetic flashforwards, action descriptions and plain offgame comments and jokes, whereas the playthrough of the developed VE version stuck to the diegetic timeline, seemingly resulting in a much more concentrated experience with regards to focus and intensity.

With regards to the experienced engagement, the qualitative data pointed towards a higher engagement in the VE playthrough, corroborated by both questionnaire replies, interview responses and observations during the test.

5 Discussion

Generally, the findings contribute with several discoveries, most important of which is that the narrative paradox may potentially be solved by providing the players with an interactive narrative in which multiple players create the main portion of the emergent story through the interplay between their roleplayed characters, and where the most troublesome interaction possibilities are restricted through the story and setting rather than through technical limitations.

Possibly, depending largely upon the narrative sought implemented, interactive narrative applications could be developed where the interaction restrictions are all integrated within the application itself, along with any information the players might otherwise need from a GM, thus providing an application which in essence is a self-contained interactive narrative based solely on player interactions. Such an application could potentially work as both a solution to the narrative paradox and as a re-playable and easily distributable interactive narrative, especially if randomized events and additional/alternative player characters were also integrated.

Additionally, the developed solution shows the potential for developing what could arguably become a new platform for roleplaying games, a hybrid between traditional and computer roleplaying games, but with the potential to transcend both in certain aspects.

5.1 Player Actions and Utterance Typology Distribution

One of the most interesting indications observed between the two scenario play-throughs, was the time distribution between the various player action and utterance categories. The fact that virtually no time was spent on actions or utterances outside the diegesis in the VE version test, compared to roughly 20% in the traditional scenario test, is an interesting indication with regards to determining a tendency for change in user experience between the traditional scenario play-through and that of the developed solution.

This might at first glance seem a rather obvious finding, since players situated around a coffee table on a comfortable sofa should be more prone to momentary lapses in diegetic focus. However, there are several reasons why this finding seems beneficial for the academic subfield, the first of which is that many traditional scenarios can be (and are) played entirely within the diegesis, depending mostly on players, mood, the GM and obviously the scenario. Thus, traditional roleplaying scenario playthroughs can, and often do, adhere to the diegesis, and so the finding can be taken as an indication that the VE version potentially heightens the diegetic adherence among the players.

Secondly, the test results appear to indicate that the developed scenario may not necessarily be of a format which fosters a natural diegetic adherence during a traditional playthrough, but that the VE version of the same scenario may have augmented or possibly forced the players to adhere much more stringently to the diegesis. Thirdly, the findings can be taken as corroborating the aforementioned expectations that players may be more prone to diegetic and game disengagement if the surroundings or situation warrant this compared to a VE environment, a finding which in itself may be significant for developing future solutions and tests for these.

5.2 Engagement

The general engagement, i.e. overall desire to continue the experience, seemed to differ considerably from the traditional scenario playthrough to the test of the developed solution, as corroborated by the various observations, interview responses, and questionnaire elaborations. It definitely appeared as though the test participants in the playthrough of the VE version experienced a considerably higher level of engagement. This seemed to stem largely from the correlation between diegetic and real time, with the players never leaving neither the storyworld nor story-timeline, effectively maintaining a second-by-second adherence to, and creation of, the story as it happens. Likewise, the experienced engagement appears to have been notably heightened by the adherence to the most pervasive diegetic player immersion stages, these being the In-character and Out-of-character utterance categories. However, the effect of the scenario, setting, amount of time played, and possibly also communication method and virtual environment cannot entirely be dismissed, nor can the augmentation distribution be determined at this time with the current data-set.

5.3 Communication Method

One could argue that the communication method may have had a significant effect on both engagement and diegetic time adherence, in that the communication method encouraged the players to stay in-game for the duration of the scenario, and likewise strengthened the unspoken interplayer agreement that the voice channels were not to be used for idle chatter or off-game remarks. While traditional roleplaying games can obviously also encourage and enforce such unspoken rules, and likewise strengthen an adherence to the diegetic time, in this particular playthrough of the traditional scenario version, neither the players, session nor scenario seemed to do so.

While not in any way conclusively proven, there are indications that especially the communication method attributed to a much stronger cohesion between the diegetic and real time, and through this, a much higher adhesion to the most immersed stage of the roleplaying communication types. Scene 2 and 3 in the playthrough of the developed solution were almost completely In-Character, with only brief and infrequent lapses into the Out-of-Character utterance category when player character actions needed to be declared to either the other players, or most frequently, to the GM.

Whether this can be mostly attributed to the difference in roleplayer type and experience of the two test groups, or is in fact largely caused by the change in communication method, is impossible to declare with any significant certainty. But it is an important tendency, which should definitely be investigated further, most easily by running more test iterations with less independent variables. Likewise, the impact on the user experience is undeterminable, but since the paper intended to investigate the changes to the user experience, rather than the causes for these changes, it is still an interesting finding, partly because it helps focus future research into this subfield. Most likely, the user experience will have been heightened in the areas which relate to time lapse, like suspense and dramatic engagement, and further research might be able to determine the nature, validity and distribution of these effects.

5.4 Limitations and Future Work

The small sample size does not allow for generalizations in this study and in order to generalize the indications discovered here, future work could address the comparison quantitatively with a higher number of respondents and a representative sample group. Furthermore the following three elements could be combined in order to acquire quantitative data sets:

1) Roth, Vorderer & Klimmt establish a framework for evaluating user experience in interactive narratives, consisting of five separate elements, these being *Curiosity*, *Suspense*, *Aesthetic Pleasantness*, *Self-Enhancement* and *Optical Task Engagement (Flow)* [18]. The framework appears appropriate because all the characteristics seem clearly applicable to roleplaying game playthrough experiences, and furthermore provides a basic method for comparing the two sets of user experiences, albeit without a concrete test methodology established through the framework description.

2) Additionally, the core characteristics of roleplaying games should be defined through an investigation of previous work in the field [13], yielding the following five characteristics: *Emergent*, *Interactive*, *Collaborative*, *Storytelling*, and *Game*. These characteristics can then be investigated individually as part of a quantitative test session, in order to more clearly understand the components of the user experience.

3) Lastly, Schoenau-Fog [15] provides an investigation of the triggers and components of engagement, combined with a general description of engagement and the determination of same. In [15], engagement is explained as a process where players want to keep playing while they engage in a pursuit of objectives and thereby perform a range of activities in order to accomplish objectives and feel affect. Of particular interest for this study are the activities of experiencing the story and characters, and future work could develop evaluation methods intended to yield more detailed information regarding the intensity of the user experience specifically with regards to continuation desire and engagement.

These three frameworks could then be combined with an expanded version of the developed platform with incorporated test features to measure continuation desire and flow, and the currently utilized questionnaire and interview could be expanded with questions relevant for the frameworks.

6 Conclusion

The test participants in the VE version spent all of the play session engaged in the diegesis, with the diegetic time equating the real time throughout the scenario playthrough. This is possibly related to the apparent increase in perceived engagement reported by the test participants in the playthrough of the VE version. Reversely, the apparent increase in engagement could instead be caused by the altered communication method.

It is thus suggested that the developed solution can serve as a platform for collaborative emergent narratives, which are both engaging and highly interactive within the given diegetic setting restrictions. It thus seems plausible that the narrative paradox can be solved or at least circumvented if players are provided with a carefully designed setting and player characters, both of which are honed to make the players create their own emergent narrative within the provided framework.

Aside from these changes in user experience, many unproven tendencies were found, and further testing and research is necessary to explore the change in user experience when a roleplaying scenario is transferred to a different media platform.

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Achieving the Illusion of Agency

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Abstract. Games with a strong notion of story are increasingly popular. With the increased amount of story content associated with games where player decisions significantly change the course of the game (branching games), comes an increase in the effort required to author those games. Despite the increased popularity of these kinds of games, it is unclear if a typical player is able to appreciate the rich content of these games, since any given player typically only experiences a small amount of that content. We create a non-branching game that simulates branching choices by providing players with choices followed by immediate textual feedback. We hypothesize that this game, where player decisions do not significantly change the course of the game, will maintain the player's sense of agency. Experimentation showed that in a text-based story with forced-choice points there were in most cases no significant difference in players' reported feelings of agency when they experience a branching story vs. a linear story with explicit acknowledgement of their choices.

1 Introduction

One important way video games, especially role-playing video games, are appraised is on how much control the player has over the story content. Fallout: New Vegas [12], for example, allows the player to sculpt his or her story experience using the decisions the player makes over the course of the game; however, creating these customizable story experiences requires authoring exponentially more content [2]. Dialogue, voice acting, and testing has to be done for all of the story paths, many of which the typical player will never encounter. It could be desirable, therefore, to provide the illusion of control players experience from truly branching stories without creating all combinations of game content.

L.A. Noire [5] is a successful game that simulated a strong sense of player control, but actually has a fairly linear story. L.A. Noire gave dialogue feedback to the players that acknowledged their choices, but ultimately the choices didn't affect the outcome of the game. We believe that this immediate textual feedback can evoke a similar sense of control as an actual long term effect of an action in the story. *We hypothesize that a non-branching story with explicit feedback on players' decision will evoke a similar sense of agency to a truly branching story.*

In this paper, we use a branching story, and two non-branching variants of it to study the effects of players' choices on their sense of agency. The branching

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story represents a heavily-authored game like Fallout: New Vegas. The two non-branching stories were created from the most visited path of the branching story. The first non-branching story acknowledges the user's choices with immediate textual feedback, but the choices do not actually affect the path through the story. This represents a successful non-branching game like L.A. Noire. Finally, as a baseline, we created a non-branching story that gives little to no feedback and does not acknowledge the user's choices. This was created to demonstrate that it is the feedback text that is important for preserving players' sense of agency. The three variants of the story were made available online as part of a human subjects experiment. Before the participants began, they took a demographic survey, and after completion of one of the stories, they took a survey measuring their sense of agency at a story level and at a per-decision level.

The results of the study showed that there was no significant difference between the branching story and the non-branching story with feedback for four out of five pair-wise comparisons between questions measuruing components of agency. This result is encouraging because it implies that game designers can preserve players' senses of agency while reducing the burden of authoring.

2 Defining Agency

Previous work that dealt with the concept of agency is varied; each research effort that has addressed agency commits to a particular definition to operationalize. Despite the particular choice of definition, all of these approaches have examined agency as a phenomenon which lies in between game control and player control, and the approaches vary in terms of where to situate agency along that spectrum.

Wardrip-Fruin *et al.* [18] reviewed definitions of agency in an attempt to characterize it as a phenomenon involving both game and player, one that occurs when actions players desire are among those they can take as supported by an underlying computational model. Mateas characterized agency as a structural property of games [10]. Mateas built upon Laurel's Aristotelian characterization of interactive experiences [7], defining agency as a phenomenon which a game player experiences when there is a balance between material and formal affordances [10]: material affordances are opportunities for action that are available to the player, and formal affordances are motivations the game presents to pursue particular courses of action. Murray's characterization, on the other hand, presents agency as a phenomenon in the player: she posits that agency is the satisfying power to take meaningful action and see the results of our decisions and choices [11]. This definition is advantageous because it does not depend on identifying the player's desire (as Wardrip-Fruin *et al.* posit), nor does it rely on intuition for how to strike a balance between providing actions the player can take and providing motivation for player actions (as Mateas posits). Our work is based on an operationalization of Murray's perspective, and we posit that the feedback presented to the player shows the results of her decisions and choices.

As Harrell and Zhu [6] indicate, there are multiple levels of interaction (and consequently, multiple levels of agency) that game designers could be interested

in. We are less interested in interactions that don't relate to plot (such as those that deal with avatar customization or interactions with the environment). Our primary focus is on a player's perceived sense of agency as it pertains to determining the outcome of a story's development.

3 Related Work

Our work is different from most work within the interactive narrative community, which focuses on maximizing agency by creating systems capable of authoring a vast amount of story content in a variety of different ways [1,17]; our approach aims to elicit a sense of vast story content with a minimal amount of authoring effort. Our approach is also different from emergent-narrative approaches [3,13], since the story arcs we are interested in using remain, for the most part, fixed. Given our emphasis on the perceptual nature of agency, we leverage a concept developed in experimental psychology relating to one class of meaningful actions: choice. Thompson et al. developed, what they term, the "Control Heuristic," a way to estimate a person's perceived degree of control in a situation which requires that person's input [14]. The heuristic predicts a person's perception of control based on four factors: the *foreseeability* of a choice's outcome, the *ability* to make the choice (make the outcome occur), the *desirability* of the outcome that resulted from the choice, and the *connection* perceived between the actor's choice and the observed outcome. Within the Interactive Narrative community, there has been work developed to address two of the four factors. The *PaSSAGE* [15,16] system modifies the plot fragments that players experience in a video game, based on their measure of how *desirable* a particular plot fragment will be for a player. Recent work by Young and Cardona-Rivera [20] has begun to address the notion of *foreseeability* through the use of narrative affordances; subsequences of narrative content that a player *foresees* as completions to her current game experience. Our work here begins to address a third factor: *connection*. Our approach involves providing feedback to the player, which explicitly provides information regarding the connection between a player's choice and the resultant outcome. Instead of spending time creating a diverse and branching story with multiple paths and then modifying which plot fragments to present, we propose that constructing and modifying textual feedback that a player experiences after she makes a decision is enough to create a comparable sense of agency.

4 Experimental Design

We created a branching, text-based, choose-your-own adventure story where the participants played the role of "Stump Junkman", a monster slayer who searches for the king's lost "Crown of Power". The story involved the participants making six decisions at fixed points, each with two choices. Of the six decision points, two were true branch points in the story where the players' inputs would result in substantively different story content. The remaining four decision points were non-branching, where the players would receive an acknowledgement of their

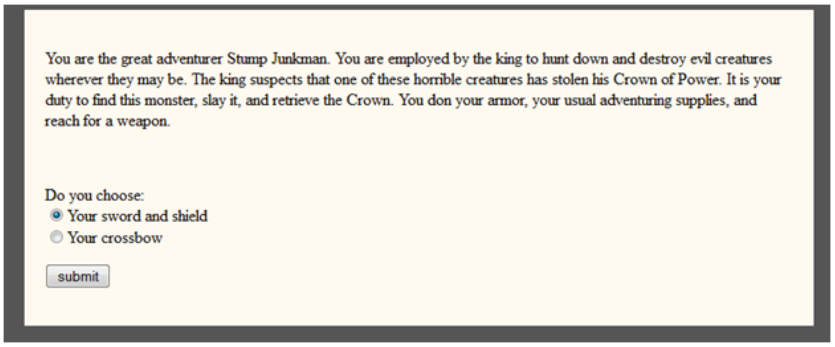

Fig. 1. A screenshot of the story interface during a story event. The top text contains the story content for the event, and the bottom text contains the choices the player has available. The radio buttons allow players to select their input, and the submit button confirms the input and presents the player with a subsequent story event.

decisions (to varying degrees depending on the version of the story they played) before the plot would move forward linearly. This story was created to simulate a typical, heavily-authored game which has branching story content.

This story was written in HTML with JavaScript to help handle the participant input. We recruited participants using snowball sampling, with direct recruiting messages sent via email, message boards, in person, and on social networking sites. We encouraged the participants who had taken the study to recruit others. The participants were given a link that directed them to a consent form. If they clicked accept, they were directed to a multiple choice demographic survey that asked for their gender, age, how long they had been playing video games, genres of video games they prefer, and how familiar they are with text-based video games (like the one they will be taking in the study). In this survey, and in a subsequent exit survey administered after completing the story, the participants were allowed to leave any question unanswered. After the demographic survey, they were redirected to a page that trained them on how to use radio buttons, since radio buttons were how they were to enter their choice in the story. Finally, they were redirected to the actual story. The participants read the text, and made their choice using a radio button (See Figure 1).

After the story was finished, the participants completed a survey with questions designed to measure their sense of agency at a story-wide level and at a question-by-question level. The questions were created to measure different components of Murray's definition of agency:

> Agency is the satisfying power to take meaningful action and see the results of our decisions and choices [11].

They were measured on a five point Likert scale [8]. The first five questions were asked to measure participants' overall sense of agency and can be found in Figure 2. Next, players were asked if they would play the story again. Finally, participants

Exit Survey Story-level

1. I felt that the actions I took were meaningful within the context of the story.
2. I felt that my actions were important to the progression of the story.
3. I was able to see the results of my actions.
4. I felt that the story would have been different if I had selected different choices.
5. I felt like I had control over aspects of the story that I wanted control over.
6. If given the choice, I would play the game again.

Fig. 2. The questions measuring the player's sense of agency for the story as a whole. Question 6 did not measure agency but was still asked at this point.

Exit Survey Question-level

1. I felt that this action was meaningful within the context of the story.
2. I felt that this action was important to the progression of the story.
3. I was able to see the results of this action.
4. I felt that the story would have been different if I had selected different choice.

Fig. 3. The questions measuring the player's sense of agency for each story choice

were shown each decision point in the story, the choices they had selected, and asked four questions regarding their sense of agency for each decision. Those four questions are listed in Figure 3.

Figure 4 shows the composition of the downselected branching story. The circles indicate decision points presented to the participants. The boxes represent text feedback that the participant receives after making a choice. For example, the "choice of a weapon" decision point in the branching story is:

> You are the great adventurer Stump Junkman. You are employed by the king to hunt down and destroy evil creatures wherever they may be. The king suspects that one of these horrible creatures has stolen his Crown of Power. It is your duty to find this monster, slay it, and retrieve the Crown. You don your armor, your usual adventuring supplies, and reach for a weapon. Do you choose: Your sword and shield or Your crossbow.

If they choose the sword and shield, they receive the text:

> You arm yourself with your sword and shield. Your sword was crafted by the king's blacksmith and your shield has saved your life many times.

If they choose the crossbow, they see:

> You arm yourself with your trusty crossbow. You add a dozen crossbow bolts to your quiver and oil the gears to your crossbow.

Either way, they move on to the "choice of location to visit decision" point. Therefore, the "choose a weapon" decision point is a non-branching choice. An example of a branching decision point would be the "choice of location to visit" decision point. The text for this decision point is:

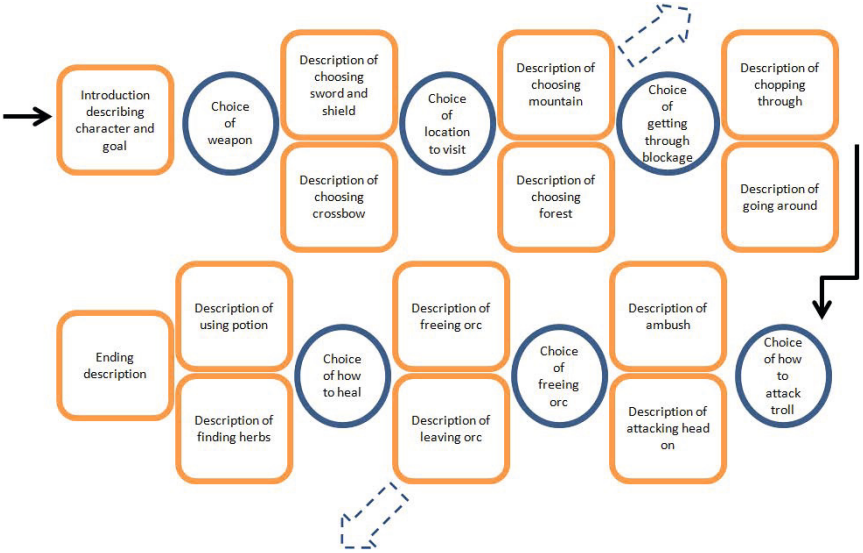

Fig. 4. A map of the downselected branching story. The circles indicate decision points presented to the participants. The boxes represent text feedback acknowledging the decisions that participants make. The dashed arrows represent elements that were removed in the non-branching versions.

> You leave your house and travel to the outskirts of the city. There are two possible locations to explore. Do you choose: The forest to the north of town or the mountains to the east of town?

If the participant selects the forest, she will receive this feedback text:

> You trek through the dense forest to the north of town. It is menacingly quiet. After several hours of hiking, you come to a place in the forest where it is completely overgrown and impassible.

and the story will proceed along the left branch (as depicted in Figure 4); however, if she selects the second choice, she will receive this feedback text:

> You trek through the mountains to the east of town. You take the narrow, windy path that crosses through the mountains. Eventually you come across a huge ravine. The bridge that normally leads across the ravine has collapsed. You need to get to the other side.

and the story will proceed along the right branch (as depicted in Figure 4).

Additionally, the choices participants' make early in the story are referenced again later in the story. This process is similar to "variable binding" found in some interactive story systems *e.g.*, ([9,4]). Continuing this example, choosing to travel to either the forest or the mountains is a branching choice. If the participant goes to the forest and takes a particular path in that branch, she

later reads "You journey back from the forest and present the king with the Crown of Power," referring back to her decision to go to the forest; however, for non-branching decisions, participants' choices are not referred to again. For example, because the choice of sword and shield or crossbow is not a branching choice, it is not referred to again in the story. This long-term variable reference for branching decision points was used to emphasize the branching nature of that decision. In addition to seeing the short-term effect of their actions, participants were reminded of their actions when they were referenced again later in the story.

The experiment was conducted in three phases. In phase one, all participants played the full branching story. After a week of data collection, we determined which branch of the story received the greatest number of playthroughs by players. We then took that branch and created the two non-branching versions of the story: one with immediate textual feedback acknowledging player choices and one with little to no textual feedback. This proceedure enabled us to control for the effects of story content on players' perceptions of agency. The non-branching stories are highlighted in Figure 4. In phase two, participants were randomly assigned to one of the three stories. After data collection, we ran a Chi-Square analysis on the demographic distributions and found that women participants disproportionately selected one particular branch of the story in the branching version. In order to account for this bias, in phase three we reopened the experiment and collected more data to enable a sensitivity analysis. In total, there were 42 men and 37 women during phase one, 60 men and 24 women during phase two, and 79 men and 28 women during phase three.

The first non-branching story is shown in the bold part of Figure 4. The dashed parts were story elements that were not included in this non-branching version. In this version of the story, the participants were still presented with both choices at each decision point and given the feedback choice that corresponds to their choice; however, at each decision point, regardless of their choice, the participant experienced the same subsequent story event. Thus, at the "choice of location to visit" decision point, if the participant chose the forest, they received this feedback text:

> You trek through the dense forest to the north of town. It is menacingly quiet. After several hours of hiking, you come to a place along your path where it is completely blocked and impassible.

and then moved on to the "choice of how to get through blockage" decision point; however, if the participant chose the mountains, they received this feedback text:

> You trek through the mountains to the east of town. You take the narrow, windy path that crosses through the mountains. After several hours of hiking, you come to a place along your path where it is completely blocked and impassible.

and still moved on to the "choice of how to get through blockage" decision point. This story gave participants immediate feedback based on their choices, but their decisions did not affect outcome of the story. Additionally, after the immediate feedback, their choices at the decision points were never mentioned again.

We were interested in determining if this non-branching story with immediate textual feedback could be used an an easier-to-author substitute for a fully branching story that still preserved the player's sense of agency. We had two hypotheses we designed the study to test.

Hypothesis 1: Story one, a branching story with immediate and long term decision feedback, and story two, a non-branching story with only immediate decision feedback, will result in participants reporting similar senses of agency.

If hypothesis one is true, then it may be the case that simpler non-branching stories that provide players with immediate feedback on their interactions can yield a similar sense of agency as more authorially intensive branching stories.

We wanted to show that it was the immediate decision feedback that afforded the players the same sense of agency as the true branching story. Therefore, as a baseline, we created another non-branching story that does not have any immediate or long-term feedback. Our theory was that this story would evoke a weaker sense of agency than the story with the feedback. This story was similar to the first non-branching story, using the same story content. The difference was the lack of immediate or long-term feedback that the players received. Instead of a descriptive paragraph describing their choice, the users received the same, minimal, non-descriptive feedback regardless of their choice. For example, when the users were presented with the "choice of weapon" decision point, either decision resulted in the feedback:

> You grab your weapon and head out.

Their choices were not referenced later in the story. Our second hypothesis was:

Hypothesis 2: Story three, a non-branching story with no immediate or long-term feedback, will result in participants reporting a weaker sense of agency when compared to the reports of participants in a non-branching story with immediate decision feedback.

If both hypotheses are true, then we know that a non-branching story is not sufficient to preserve agency, but rather the inclusion of immediate feedback specific to players' decisions that is responsible for their reported sense of agency.

5 Results

In total, we had 79 participants read through the branching story. To control for the effects of story content on player responses, in this evaluation we only consider the 52 participants who explored the story path that we used to create the non-branching stories. There were 54 participants who played through the non-branching story with feedback, and 44 people who played through the non-branching story with no feedback. A summary of participant demographics can be found in Table 1. Because participants were not required to answer all questions on the exit survey, not all questions have the same number of responses.

Table 1. Gender and age information for participants in all three version of the story. The "Downselected Branching Story" line indicates the gender of participants who chose the branch of the story we ultimately used for the non-branching versions in phase two of the study (which is highlighted in Figure 4).

	Male	Female	Mean Age +- St. Dev.
Branching Story	42	37	27.2 +- 9.2
Downselected Branching Story (Story 1)	20	32	27.0 +- 7.1
Non-Branching Feedback (Story 2)	47	7	27.9 +- 8.5
Non-Branching Minimal Feedback (Story 3)	33	11	25.1 +- 6.1

To evaluate our hypotheses, we examined the ratings provided by participants in exit survey. For each question on the survey, we used the Wilcoxon Sum Rank test for unpaired samples [19] to see if there is a statistical difference in the responses that participants gave across all three stories. Since you can only compare two populations at a time using this test, stories were paired such that all combinations of stories were tested: Story 1 vs. Story 2, Story 1 vs. Story 3, and Story 2 vs. Story 3. The survey was created to characterize agency as it relates to story through player choice. We examined participants' responses to questions at each of these levels separately. Because we controlled for story content by creating the non-branching stories using one of the branches from the branching story, we are able to make direct comparisons between story-level participant responses as well as choice-level participant responses.

A complete summary of all story-level comparisons of player responses is found in Table 2. A significant result is that participants felt a higher sense of agency in the branching story (Story 1) in every question when compared to the non-branching story (Story 3) with minimal feedback ($p = 0.05$). This implies that reduction from a branching story to a non-branching story without feedback about the player choices does not preserve the player's agency.

The results also moderately support our first hypothesis, that players will feel a similar sense of agency in a branching story as a non-branching story with immediate textual feedback acknowledging their choices (Story 2). However,

Table 2. P-values and W-values for survey responses on story-level questions from Figure 2. Marginally significant ($p <= 0.1$) entries are bolded. Statistically significant ($p <= 0.05$) entries are bolded and marked with an X.

	Story 1 vs. Story 2		Story 1 vs. Story 3		Story 2 vs. Story 3	
	P-Value	W-Value	P-Value	W-Value	P-Value	W-Value
Question 1	0.141	1161.5	**0.015 X**	**1053.5 X**	0.160	1268.5
Question 2	0.223	1124.5	**0.009 X**	**1082.5 X**	**0.039 X**	**1368.5 X**
Question 3	0.123	1167.5	**0.011 X**	**1068.5 X**	0.108	1297.5
Question 4	**0.030 X**	**1233.5 X**	**0.003 X**	**1100.0 X**	0.153	1267.0
Question 5	**0.084**	**1203.0**	**0.032 X**	**1033.5 X**	0.254	1227.0
Question 6	0.302	1096.5	**0.025 X**	**1043.5 X**	**0.060**	**1344.0**

participants did feel a greater sense of agency in Story 1 when compared with Story 2 when asked the question, "I felt that the story would have been different if I had selected different choices," significant to the $p = 0.05$ level. They also felt a marginally greater sense of agency in Story 1 compared to Story 2 in the question, "I felt like I had control over aspects of the story I wanted control over," significant to the $p = 0.1$ level.

We failed to prove the second hypothesis, that players would feel a greater sense of agency in Story 2 compared to Story 3. In only one question, "I felt that my actions were important to the progression of the story," did participants feel a greater sense of agency in Story 2, significant to the $p = 0.05$ level.

6 Discussion

Three of the story decision points seemed to yield a higher sense of agency than the other three, regardless of treatment. The three higher agency questions were: the location to visit, how to attack the troll, and whether or not to free the orc. The lower agency questions were: the choice of weapon, how to get through the blockage, and how to heal. We hypothesize that the decisions in the higher agency group seemed like the consequences of failure were more severe or that they offered two seemingly distinct story paths, while the lower agency group decisions has less severe consequences or were two different means to the same end. For example, whether or not to free the orc had implications for the character's safety and might have been a moral choice, where as what kind of weapon the character chose did not seem as important. We do not have sufficient data to make decisive claims about these two categories of choices, however, so this is a potential topic for future work.

Also of interest was that a disproportionately large number (32/37, or 86%) of the women went to the forest as opposed to the mountain in the branching story before any downselection occured. Only 20/42, or 48% of the men made the same choice. This choice was the first branching decision in the story. We ran a Fischer's exact test on these values and found that the women preferred the forest branch ($p = 0.0003$). We also ran Fischer's exact test for the other branching decision, whether or not to free the orc, but found no significant difference between men and women ($p = 0.529$). A bias may have been introduced into the story that influenced the women to choose the forest over the mountain.

Hypothesis 1 being moderately demonstrated implies that players felt a similar sense of agency in a branching story and a non-branching story with immediate textual feedback. However, participants of the branching story responded to one question measuring a component of agency significantly higher. These results are still encouraging, though. Authors can achieve much of the same sense of agency with less story content. Individual designers may decide if the increased effort to author a branching story is worth the increase to player agency.

7 Future Work

We found that women preferred visiting the forest over the mountains in our branching story. It would be interesting to examine why they preferred the one path over the other, and also to explore if men and women make other story-related decisions differently.

There are several assumptions that we made that can be explored in depth.

One assumption that we made was the that choices had to be substantively different from each other. Choices included choosing a sword and shield OR a crossbow, swinging across a ravine OR climbing down, *etc.* If the choices were to choose a bow OR a crossbow, it is likely that the player would feel that these choices were essentially the same and experience a lower sense of agency.

Also, we presented the study as a choose-your-own-adventure. The nature of the genre is that your decisions affect the outcome of the story. This is an example of "psychological priming." It is likely that the participants inferred that their choices affected the outcome of the story, regardless of whether or not their choices actually did. Another way to control the study would be to present the study in this way, and also to simply have the participants take the study without calling it a choose-your-own-adventure. This would eliminate the psychological priming bias. Future work would consider these and other possible assumptions that have to be made to reduce a branching story to a non-branching story.

8 Conclusion

There is a significant authorial burden in creating branching games [2]. The typical player is not able to appreciate this rich content, since only a small amount of that content is explored; however, a few successful games, such as L.A. Noire, acknowledge the player's choice but do not have the choice affect the story. We have shown that an approach where players' actions are acknowledged but don't influence gameplay has the potential to preserve the player's sense of agency while reducing the amount of content authors must create. We hypothesized that a branching story can be reduced to a non-branching story with immediate textual feedback of the player's choice. We have shown that this reduction is possible, and that most of the player's sense of agency is preserved in this reduction. This result is promising because it offers a first step in reducing the authorial burden of games. Going forward, it will be possible to consider other factors in the story reduction from branching to non-branching such as narrative influence on the choices, qualities of the individual choices, and player expectations.

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Designing an Interdisciplinary User Evaluation for the *Riu* Computational Narrative System

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Abstract. Evaluation is one of the major open problems in Interactive Digital Storytelling (IDS) research. As narrative systems grow in their capacities, the community needs a set of well-designed evaluation methods and criteria that can bring insights on the systems as well as the stories they provide. In this short paper, we examine existing evaluation methods in the area of generative narrative system, and identify several important properties of stories and reading that have so far been overlooked in empirical studies. We present our preliminary work of developing a more interdisciplinary evaluation approach that takes into account both the system and cultural aspects of the computational narrative system *Riu*.

1 Introduction

Evaluation is one of the major open problems in IDS research. A set of well-designed evaluation methods not only is instrumental in informing the development of better computational narrative systems, but also helps to articulate overarching research directions for the field over all. However, it is tremendously difficult to evaluate computational narrative systems in terms of both the system performance and the narrative experience they provide. As Gervás observes in the context of computational narrative, "[b]ecause the issue of what should be valued in a story is unclear, research implementations tend to sidestep it, generally omitting systematic evaluation in favor of the presentation of hand-picked star examples of system output as means of system validation [2]."

This is not an isolated phenomenon, but occurs across many computational research areas that intersect with cultural and creative domains such as music and the visual arts. A recent survey of 75 creative systems shows that, only slightly above half of the related publications give details on evaluation; among those, the main aim and evaluation criteria are quite different [4].

We argue that the difficulty of establishing evaluation methodology in computational narrative, research reflects the cultural clash between the scientific and the arts/humanities practices. Aligned with Snow's notion of the two cultures, many researchers active in the intersection of both communities have observed their different and sometimes opposing value systems and axiomatic assumptions [6, 16, 19]. For example, Simon Penny [12] argues, in the context of digital media art, that sciences insistence upon alphanumeric abstraction, logical rationality,

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 126–131, 2012.

and desire for generalizability are fundamentally at odds with the affective power of artwork, which is based on specificity and complexity. In the context of evaluation, this conflict takes the form of the clash between the productivity-and-value-based methodology adopted by both AI and HCI communities, and the general resistance to empirical studies in the arts and humanities.

In this short paper, we present our preliminary work of developing a more interdisciplinary evaluation approach that takes into account both the system and cultural aspects of computational narrative systems. We built on our initial work [18] and present our user study design. Our work is not intended to replace the function of literary criticism and close reading with simple empirical studies and statistical analysis. We also believe that evaluation is a critical process to inform the development of narrative systems and to deepen the understanding of how to provide new forms of narrative experiences. In the rest of paper, we first examine existing evaluation methods in computational narrative, focusing on story generation systems, and identify several important properties of stories and reading that have so far been overlooked in existing evaluations. Drawn upon methods from empirical literary studies, we then present our preliminary work on designing user evaluation studies on our computational narrative system, *Riu*.

2 Existing Framework on Narrative Evaluation

This section provides an overview of existing evaluation methods in story generation systems. Some of our observations can also be applied to interactive digital storytelling systems in general. Recent examples of evaluating the latter type can be found in [17, 15]. Based on our survey of major text-based story generation systems, existing evaluation methods can be grouped into three categories.

2.1 System Output Samples

As Gervás pointed out above, providing sample generated stories is one of the most common approaches for validating the system as well as the stories it generates. This approach started from the first story generation system *Tale-Spin* [7], where sample stories (translated from the logical facts generated by the system into natural language by the system author) are provided to demonstrate the system's capabilities as well as its limitations. In addition to successful examples, Meehan also picked different types of "failure" stories to illustrate the algorithmic limitation of the system for future improvement. Similarly, many later computational narrative systems such as *BRUTUS* [1] use selected system output for validation. One reason for the wide use of this approach is its alignment with traditional literary and art practice, where the final artifact should stand on its own without formal evaluation beforehand. However, simply showing the "successful" output without stating the system author's criteria for selection can be potentially problematic. Some more recent work in this approach has attempted to make this selection process more transparent. For example, using the WordNet knowledge base, the authors of the *Riu* system developed a measure of semantic distance to evaluate the quality of the analogy generated by their system [10].

2.2 Evaluating System Process

The second approach is to evaluate the system primarily based on its underlying algorithmic process. For instance, the *Universe* system [5] provides fragments of the system's reasoning trace, along with the corresponding story output, in order to show how the underlying process leads to the particular output. This category often contains systems that use narrative to illustrate/model underlying cognitive processes. For example, the author shows an example of how *Universe* learn new "plot fragments" by generalizing from given example stories. The bigger research goal is to illustrate the system's capability to expand its plot-fragments library automatically, and hence the learning process is a necessary condition to creativity.

2.3 User Studies

Minstrel is evaluated by a series of user studies in order to determine the quality of the stories it generates. In the first user study, 10 users were asked to read the generated stories, without being told that they were generated by a computer, and to answer questions regarding their impression of the author and the story. In the second study, 10 users repeated the above test, except the generated stories were rewritten by a human writer for better presentation with improved grammar and more polished sentences. In the third study, the same questions were asked about another story written by a 12-year-old as a benchmark.

A larger number of users were involved in the evaluation of the *MEXICA* system [13]. An Internet survey about the generated stories was sent out and 50 users submitted their answers. The users rated 7 stories by answering a set of 5-point Likert scale questions over five factors (i.e., coherence, narrative structure, content, suspense, and overall experience). Among these 7 stories, 4 were generated by *MEXICA* using 4 different system configurations (with or without certain modules). Two stories were generated by other computational narrative systems (*GESTER* and *MINSTREL*). In the *Fabulist* system [14], the system author conducted two quantitative evaluations. The first one is to evaluate plot coherence: a story is shown to different users; each of them then rate the importance of each sentence in the story, based on the assumption that unimportant sentences decrease plot coherence. Second, character believability in the stories is evaluated by asking users to rate the difference in characters' motivation in stories generated by two configurations of the system.

3 User Study Design

There are three aspects, among other things, that we need to address in a more culturally driven user study of computational narrative systems. First, the user study needs to acknowledge different audiences and different modes of reading. For example, an ordinary user will be more likely to adopt story-driven reading, which focuses more on the immersiveness of the stories. They contemplate what

characters are doing, experience the stylistic qualities of the writing, and reflect on the feelings that the story has evoked [9]. An expert reader, on the other hand, will more readily adopt the point-driven orientation. They perform informed close reading — a complex act of interpretation at the linguistic, semantic, structural, and cultural levels — in order to understand the "point" of plot, setting, dialogue, etc. These qualitative expert-novice differences have long been acknowledged in the literary empirical studies of linear text, and should be incorporated into evaluations of computational narrative.

Second, evaluations of the narrative experience provided by computational systems need to be measured against system and content authors' intention. In many of the evaluations we surveyed above, system output is evaluated based on either a set of cross-system criteria, such as character believability and plot logical coherence, or on how much readers enjoy the stories. Although these criteria provide useful milestones for the research community, it is important not to forget the assumptions built in these criteria, that is, they embody the quality of the narrative that the system authors *intend* to create. Storytelling is, after all, a form of communication between the author and the reader. In some cases, the authors may intend to focus more on the emotional atmosphere created by the system, rather than plot coherence. In other cases, a user's report of unpleasantness may be positive or even desirable, if the system author intends to use her stories to challenge the reader's belief system, in ways similar to Duchamp's Urinal. In other words, evaluation criteria of specific narrative systems should take into account the particular expressive goals of their authors.

Third, as a whole field, we will benefit from more mixed approach that use both quantitative and qualitative methods. A large percentage of the evaluations we surveyed gravitate towards quantitative methods with qualitative methods as a supplement, if at all. Through surveys and experiments, numerical data is collected, then analyzed statistically to provide an average user response. Although these methods have the clear advantage of being relatively easy to collect and analyze, they filter out the specificity and contextualization that is crucial to cultural artifacts. More details of the discussion can be found in [18].

3.1 Study Design Guidelines

The computational narrative system we plan to evaluate is the *Riu* system [11]. It uses computational analogy to generate a text-based interactive narrative experience about a character's internal activities such as memories and daydreams. Through analogical retrieval and analogical projection, these internal activities are used to enrich and influence the "physical" world of the character. For instance, while encountering an object in the "physical" world, the character may retrieve memories of similar objects, which will in return change his disposition towards it and hence possible actions.

We are primarily interested in the narrative effect of adopting the parallel structure between the character's "physical" world and inner world brought forth by computational analogy. In other words, as our first step, we intend to understand whether and to what extent the internal activities of the characters

affect an ordinary reader's (hence story-driven reading orientation) emotional connection with the main character. As system authors, our intention is to create a new kind of interactive narrative experience that focuses on association (i.e., similarities between objects and events) rather than cause-and-effect (as in many planning-based computational narrative systems). It is more important, to us, if our system creates memorable narrative moments and evokes deep emotions than providing logical and coherent plots. As a result, we will not evaluate our system based on "plot coherence" or "character believability." Instead, our study will center around readers' connection with the character and their general emotional response to the stories. For the kind of rich exchange of meanings that *Riu* intends to evoke, quantitative data captured by Likert scale questionnaire alone is not sufficient to capture the rich interpretive process people engage in reading. Our study seeks to supplement quantitative data with qualitative open-ended interviews. As a result, the study is geared less towards statistical significance of the users we include, but rather the depth of the response of each user. Overall, the users will be randomly assigned into two groups. One of them will interact with the system with the analogy-driven internal activities and the other group without. Their interaction with the system will be video recorded and the participant will be interviewed with retrospective protocol for their experience. This general methodology has been used in Façade [8] and art-oriented digital systems [3].

More specifically, in order to gain insights into how memorable the interactive narrative experience is to each user, we will adopt a recall test. Each user, after completing their interaction with the system, will be asked to perform comprehension and recall tasks. For instance, the user will be asked to recall as many phrases and story elements they read as possible. Although both tasks are well-developed methods in understanding reader response, often used in empirical literary studies, to the best of our knowledge they have not been substantially used in the evaluation of computational narrative systems. By asking users to answer specific questions and recall phrases from the story, we hope to gather more reliable data about how engaged the users are in the story than simply asking them to rate the experience. It will also allow us to compare the effect of incorporating character's internal activities between the two groups.

4 Conclusion

In this short paper, we discussed the challenge of designing evaluation methods for interactive narrative systems. Based on our survey of existing approaches, we identified three main aspects we hope to address in order to better understand interactive stories as expressive cultural artifacts. Drawing upon methods in empirical literary studies, we presented our preliminary design for the user evaluation of our analogy-based computational narrative system that is geared towards the above three main aspects.

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Distributed Drama Management: Beyond Double Appraisal in Emergent Narrative

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Abstract. In this technical paper, we describe an implementation of Distributed Drama Management (DDM). DDM is a concept which involves synthetic actor agents in an Emergent Narrative scenario acting on both an in-character level, which reflects the concerns of the characters, and an out-of-character level, which reflects the concerns of a storyteller. By selecting the most "dramatically appropriate" action from a set of autonomously proposed actions, Distributed Drama Management aims to retain the benefits of Emergent Narrative such as believability and agility of response to user actions, but attempts to provide a structurally and emotionally consistent experience.

1 Introduction

1.1 Overview

This is a technical paper describing the implementation of a concept known as Distributed Drama Management (DDM). At the core of DDM is the idea that in an interactive digital story facilitated by autonomous agents, those agents must be aware on one level of the story from the perspective of the characters they represent, but also on another level from the perspective of a storyteller.

In traditional, non-interactive stories, characters in and of themselves are unaware of several narrative considerations the author must take into account. For example, characters have no concern for the plot of the story in which they are participants. It is the concern of the author to select her characters' actions such that they serve the plot without appearing unbelievable. However, incorporating such a degree of authorial control into an interactive story is, as described by the Narrative Paradox [1], antithetical to significant breadth of freedom in user interaction. Our approach to resolving this – DDM – is inspired by the role-playing game (RPG) practice of distinguishing between considerations that are *in-character* (IC, which is to say, looking at situations from the perspective of the character the role-player is playing), and considerations that are *out-of-character* (OOC, which is to say looking at situations not from the perspective of the character, but from the perspective of the role-player herself). Therefore, it is appropriate to think of DDM agents more as virtual role-players than as virtual characters.

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 132–143, 2012.

For the remainder of this section, we will describe DDM at a high level. In the next section, we will examine the related work in the field. In section 3, we will explain the concepts of DDM in more detail, and in section 4 we will describe our current implementation of DDM and provide an example of how it works.

1.2 Distributed Drama Management

There are, broadly speaking, two approaches to Interactive Digital Storytelling. One approach is the plot-centric (also called top-down, plot-centric, or author-centric) approach, while the other is the emergent (also called bottom-up, or character-centric) approach. The relative advantages of these two approaches are well-established, e.g. in [2]. The top-down approach has benefits in structure, pace, and authorial expression, while the bottom up approach is advantageous for narrative coherence and consistency (which contribute to believability) and agility of response to user interaction.

Much study has been made into approaches to bridging this gap. DDM is one such approach. A selection of other approaches will be examined in the next section.

At a high level, the DDM system comprises five components. Characters are represented by virtual actors which actually account for two of the components: the **Character Layer**, which is responsible for simulating the character according to its own beliefs, desires, intentions and emotional state, and the **Actor Layer**, which is responsible for mediating the possible actions generated by the Character Layer in terms of their dramatic appropriateness. Dramatic appropriateness, in DDM, is contingent on how the action will affect the character the user is role-playing, which is represented in DDM by a special agent called the **Virtual User**, which does not act in itself, but represents the beliefs, desires and emotional state of the user's character. The Actor Layer sends proposed actions, along with their simulated emotional impact, to a **Drama Manager**, which, unlike traditional managers, does not exert directorial control over the agents, but merely compares all proposed actions from all actors against the target emotional trajectory, and then selects and authorises the one with the best fit. The target emotional trajectory is specified by the final component, the **Story Specification**, which is an authorially-produced document describing the story at a high level of abstraction as a sequence of 'episodes', each with its own emotional target.

The process of DDM begins with the Character Layers generating a set of all actions it can perform that are consistent with both its goals and current emotional state. Actions are defined as either steps taken by the character in pursuit of a goal (deliberative actions) or reactions to an event (reactive actions). The Actor layer then *simulates* the effect of each of these actions on the Virtual User – no actions are executed in the world at this time – and proposes those actions that are closest to the emotional target to the other agents, which then simulate the action they would subsequently perform. This creates a sequence of two actions, representing not only the proposed action, but also what can immediately follow. The Actor Layer then simulates the emotional impact of this sequence on the Virtual User and notifies the Drama Manager of the sequence and its predicted emotional impacts. Once the Drama

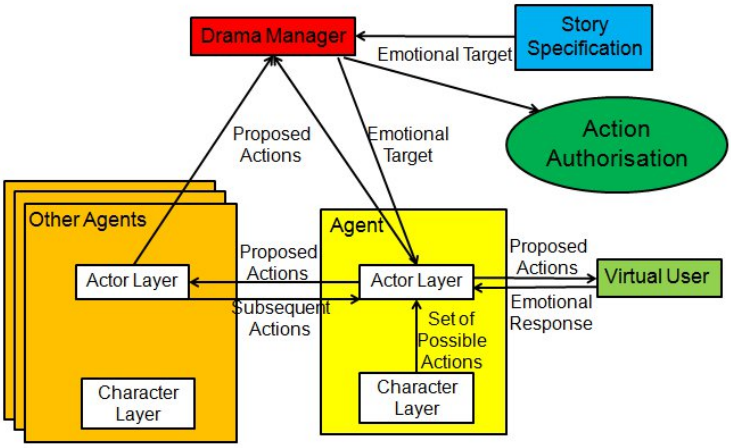

Fig. 1. A high level diagram showing the different components of DDM and the relationships between them

Manager has received all sequences from all agents, it compares all of the emotional impact sequences to the emotional target provided by the Story Specification, and selects the one with the closest match. The initiating action of that sequence is then authorised for execution in the story world, and the agent, upon receiving that authorisation, executes that action.

2 Related Work

DDM makes use of FAtiMA (Fearnot AffecTIve Mind Architecture) agents, and so *FearNot!* [3] is significant related work. *FearNot!* is a character-based system relying on the properties of Emergent Narrative to allow a user to participate in a story in which a child is being bullied. *FearNot!* is notable for its affectively-driven agent architecture incorporating continuous planning and Ortony, Clore and Collins' (OCC) emotion taxonomy [4], resulting in sophisticated autonomous agents. It is our belief, as discussed in section 3.1, that FAtiMA agents address one component of character, but there are other components of character that are not addressed, and it is into this gap that DDM fits.

The Virtual Storyteller [5] represents Swartjes' work on using improvisational theatre as a model for Emergent Narrative. Swartjes notes that, like improvisational actors, Emergent Narrative agents should be aware of and act on both in-character and out-of-character concerns. This is our reasoning behind the use of a Character Layer and an Actor Layer in DDM.

On the theme of improvisational theatre, Magerko and Baumer's *Digital Improv Project* [6] aims to create improvisational agents on the basis of "offers and responses". Agents can make 'offers' to attempt to advance the story, which other agents can subsequently either accept and augment, accept in a qualified way, or

block, while presenting an alternative. DDM is similar to the "accept and augment" response, but agents do not accept the proposal themselves; rather, their augmentation is more hypothetical – the Actor Layer says what the agent would do if the proposed event occurs (*i.e.* is selected by the Drama Manager).

Riedl and Young's *Fabulist* [7] is a narrative generation engine that creates a plan (which is to say, a sequence of character actions) to achieve goals specified by the author, and then reasons about whether or not those actions appear believable based on the intentions of the acting characters, back-tracking and replanning if any of the actions appear unbelievable. In principle, DDM is the inverse of this – it begins with believable actions, and then selects the action that best matches the story needs.

Szilas' *IDTension* [8] represents an attempt to simulate "the laws of narrative". It uses narrative logic to calculate all the possible actions in the story world at a given time, and then a narrative sequencer to estimate the impact each potential action would have on a 'user model', to determine which action would be most valuable.

Persu, described by Figueiredo and Paiva in [9] is an architecture for systematically deploying persuasive content in order to encourage a user of an IDS system to adopt goals and perform actions that serve authorial goals for the story. While DDM is not concerned with the user performing actions that serve authorial goals, we believe there is scope for adapting *Persu*'s methods to persuade the user to adopt goals that are appealing to the playable character, thus reinforcing the relationship between user and character. This, however, remains potential future work for DDM.

Finally, it is necessary to compare the Drama Manager of DDM with search-based drama management such as declarative optimization-based drama management discussed by Nelson and Mateas in [10]. Search-based drama management is directive and interventionist: it searches for actions that fulfil authorial goals. DDM's Drama Manager, by contrast, is opportunistic: it authorises and denies emergent actions depending on their suitability to the authorial goals.

3 Approach

3.1 The Character/Actor Distinction

Firstly, we believe that the weaknesses of Emergent Narrative can be largely attributed to the fact that EN agents are focused on providing a high degree of simulative fidelity, which is to say that they are "virtual people". With reference to Scholes, Kellogg and Phelan [11], characters in a narrative are (to varying relative degrees depending on cultural norms and on individual stories): *aesthetic* in that they serve the plot of the narrative, *illustrative* in that they represent or symbolise certain ideas or themes, and *mimetic* in that they simulate human beings. Characters are self-aware only insofar as they are aware of their mimetic components; their aesthetic and illustrative components exist outside of the fictional world, such that only the author and reader may be aware of them.

Due to the focus on simulative fidelity, the current state of EN agents emphasises the mimetic component of character, and as such, these agents are unaware of their

narrative responsibilities. EN agents will act believably, but it is not guaranteed that these agents will perform dramatically interesting actions, much less that they will perform a sequence of dramatically interesting actions, and less still that all agents will do so in a form structurally recognisable as a story. One attempt to address this weakness was Double Appraisal [12] and DDM is an extension of this work. In the Double Appraisal approach, characters did not themselves select actions to perform, but generated a set of possible actions to perform. Because this set of actions was generated by the character agent, all actions in the set were guaranteed to be believable, retaining the benefit of emergence. The emotional impact of each action in the set on other agents was simulated before committing the action to the story. On the basis that emotional impact is a surrogate for drama, the action with the largest emotional impact on the other characters (and, therefore, the "most dramatic" action) was selected.

The weaknesses of Double Appraisal were twofold. Firstly, Double Appraisal selected the action with the largest emotional impact, but did not consider which emotion was being impacted. Under Double Appraisal, an action that made a character very distressed and an action that made a character very happy might be considered of equal dramatic value. Secondly, with reference to Aristotelian structure [13], such as rising action, climax and falling action, the "most dramatic" actions should occur only at the climax, and not at every point in the story. It should be noted that the weaknesses we identify with Double Appraisal here are related to how it was applied, and not with the premise of using Theory of Mind to project the emotional impact of an action, and use that in action-selection. Indeed, we are using this premise in DDM.

It is for these reasons that DDM agents use a two-layered approach, comprising a Character Layer, which is, essentially, the current state of EN agents, and is responsible for the mimetic component, and an Actor Layer, which is responsible for handling narrative concerns of which the characters are themselves unaware, which is to say the aesthetic and illustrative components. In the implementation described in this paper, we are concerned only with the aesthetic component, but the illustrative component remains a promising avenue for future research. An analogy can be made here with the role-playing game (RPG) practice of distinguishing between in-character (IC) thoughts, speech and actions, and out-of-character (OOC) thoughts, speech and actions, the significance of which to interactive digital storytelling was highlighted by Swartjes in [5].

3.2 The Virtual User

We believe that an interactive Emergent Narrative approach should necessarily consider the role of the user. Pursuant to this, DDM incorporates a Virtual User, which is a special class of agent that does not, in itself, act, but is responsible for modelling the emotional state of the playable character (PC). In this, we are influenced by both the effect of a protagonist's emotional state on a reader in a non-interactive story (*e.g.* work by Komeda and Kusumi [14]) and by the relationship between user and playable character in an interactive work such as a digital game

(*e.g.* the work of Keogh [15]). It is necessary to consider the relationship between user and protagonist from both an interactive and non-interactive perspective because it is well-established [16] that a user of an interactive digital story embodies two roles: that of a spectator (or audience), and that of a participant (or actor).

The Virtual User is the 'target' for action selection, which is to say that while Double Appraisal selected actions based on the emotional impact they had on any character, in DDM, actions are selected based on the emotional impact they will have specifically on the Virtual User. Because a change in emotional state of the playable character affects the user's experience, we believe that manipulating how the Virtual User is affected affords some control over the user experience.

Furthermore, actions are simulated one step ahead, which is to say that as well as simulating the emotional impact of the proposed action, we also simulate the emotional impact of a hypothetical subsequent action by any other agent. This allows us to evaluate the emotional appropriateness of the action not only in terms of the action in itself, but also in terms of any immediate consequences.

In this implementation of DDM, the Virtual User represents a playable character as written by the author. Toby Gard [17] makes a distinction between 'avatar' and 'actor' type playable characters, where 'avatars' possess no individual personality beyond that projected onto them by the user, and 'actors' possess a fully-realised individual personality created by the author. The DDM Virtual User currently represents what Gard would describe as an 'actor', and necessarily so, because a character needs a personality before the emotional impact of an action on that character can be simulated. However, while the nature of DDM creates difficulties for experiences that allow user-defined characters, we do anticipate future work involving making the Virtual User adaptive to the user, using a pre-authored character only as a baseline.

3.3 Authorial Considerations

Experience has shown that authorship of Emergent Narratives is difficult. With reference to the Narrative Paradox described in [1], authoring Emergent Narrative necessarily involves relinquishing some authorial control as compared to plot-centric approaches [3]. We, however, believe that previous approaches to Emergent Narrative have required the author to relinquish too much control; that there are certain elements the author can control without interfering with the emergent properties of the scenario.

To this end, Distributed Drama Management incorporates a Story Specification, which describes the story at a high level of abstraction, as defined by the author. This comprises a sequence of episodes, which are analogous to the 'functions' of Vladimir Propp [18]. These episodes are defined at a high enough level of abstraction that they do not interfere with emergence, and provide a starting point for a narrative structure. In this implementation, each episode specifies an *emotional target* for the Virtual User, which is to say a given emotion or set of emotions that the Virtual User should experience, as well as a target level for those emotions. It is against this emotional target that "emotional appropriateness" of an action described above with reference to the Virtual User is evaluated.

3.4 The Drama Manager

Finally, DDM does make use of a Drama Manager. Unlike traditional drama managers, DDM's Drama Manager does not direct the agents to perform any action directly. Instead, it receives all the proposed actions from the agents and makes an executive decision as to which one most closely suits the needs of the story. No agent can act without the authorisation of the Drama Manager, but any actions the Drama Manager authorises will be an action the acting agent proposed, and therefore will retain the properties of emergence.

4 Implementation

4.1 Architecture

The DDM system is built on top of the FAtiMA agent architecture [3]. The Character Layer is, itself, a lightly modified version of a FAtiMA agent, the major difference being that it does not select actions, but generates sets of actions the character can perform. These actions are generated by the reactive and deliberative components of the agent and sent to the Actor Layer. The Actor Layer is responsible for simulating the emotional impact of an action on the Virtual User, for communicating with the Actor Layers of other agents to learn subsequent actions, and for proposing sequences

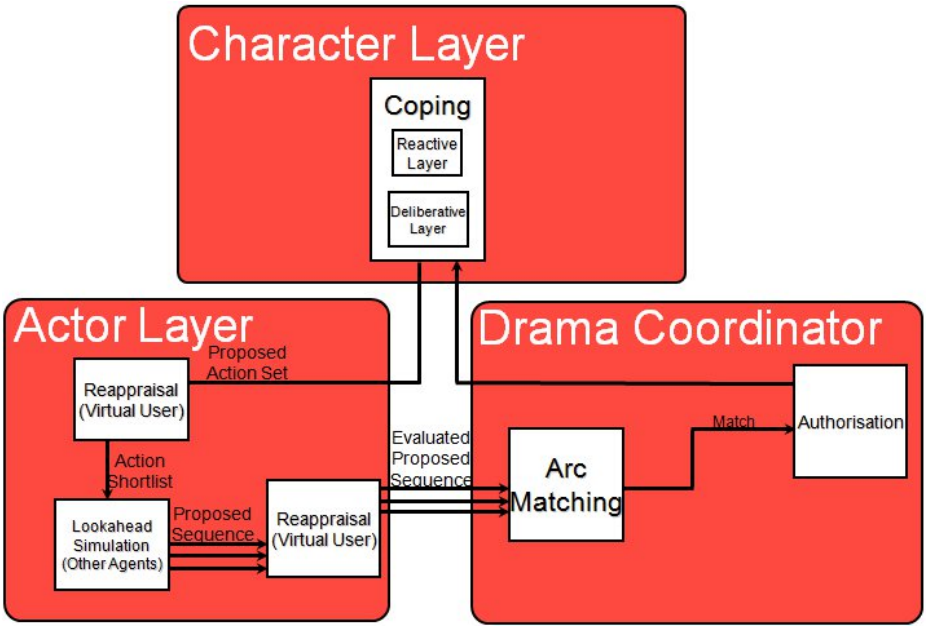

Fig. 2. Diagram of the DDM architecture

of actions to the Drama Manager. The Drama Manager is then responsible for determining which sequence is the best fit for the author-specified emotional target, and authorising the action that initiates that sequence. This authorisation is sent back to the appropriate agent, which then executes it. All communication occurs via the world simulator in the form of command-messages, which are invisible to the user, but can be perceived by agents and handled by the Actor Layer.

4.2 Example

To illustrate the DDM process, we have prepared a small example. It is to be noted that this example exists purely for illustrative purposes: It is non-interactive, and while it is necessary to use a simple example to illustrate how DDM works, this makes it too simple to illustrate why DDM is useful.

Our scenario comprises three characters: Batman, Superman and The Game Master. The Game Master is superhumanly good at videogames. He is bored of playing games, because none of them can offer him a worthwhile challenge, and wants to use his special abilities as a superhero. The scenario involves Batman and Superman conducting a job interview to determine if The Game Master is a suitable candidate to be a superhero.

In this scenario, Batman and Superman are represented by DDM agents, and The Game Master is represented by a regular FAtiMA agent, in the stead of the user. The Game Master's agent takes on Virtual User responsibilities, such that the DDM system is trying to affect the emotional state of The Game Master's agent.In the following subsection, wherein we describe the decision-making process of the DDM system, we will illustrate each step by describing what happens in this scenario.

4.3 Decision-Making Process

The first step in the Distributed Drama Management action-selection process is, necessarily, to create a set of actions from which to select. Because merely selecting from the agent's action repertoire would negate the benefits of using autonomous agents, firstly the agent must, on the Character Layer, decide which actions are appropriate in the current context from both a situational perspective and in terms of the agent's internal emotional state.

Actions can come from two components of a FAtiMA agent: The reactive layer is responsible for reactions that are a direct response to an event, while the deliberative layer is responsible for ultimately selecting actions that an agent undertakes in pursuit of its goals. To generate the set of potential actions for DDM action selection, we must first collate the potential actions from these two sources.

We have considered that reactive and deliberative actions should be handled differently by Distributed Drama Management. Absent concrete conclusions, however, this difference is not covered in this implementation and is a subject for future work.

Generating a set of actions from the reactive layer involves examining the agent's *action tendencies* – which is to say, what the agent will do under certain circumstances – and to identify which of those circumstances are currently true, and

thus, which action tendencies are active. However, it does not suffice to merely generate a set of actions from the deliberative layer, as this would only include actions associated with the currently active *intention*, regardless of if the character may have other intentions. As such, on the deliberative layer we do not generate a set of actions, but a set of intentions: Our set of potential actions from the deliberative layer is the union of the sets of potential actions for all potential intentions. Having generated our two sets of potential actions, reactive and deliberative, these are passed up to the Actor Layer of the agent.

Example: Superman has no reactive actions to perform, as there is not yet anything to react to. For active pursuit goals, Superman's goal is to make a decision on whether or not to hire The Game Master, which requires asking questions in four categories. Superman can choose to ask a hard question or an easy question in each category. This provides eight possible actions Superman can perform at this time.

The Actor Layer receives from the Drama Manager the target emotional change for the action. This target comes from the episode specification, and comprises the emotions being targeted, and whether the actions affecting those emotions should be low, medium or high impact.

Example: We have decided that we want The Game Master to experience a mildly stressful interview, so our scenario specification reflects that we want actions to evoke an emotion of Distress with an intensity of 3.0 (emotional intensities in FAtiMA existing on a scale between 0.0 and 10.0). This is the emotion that the Drama Manager and the Actor Layers of all agents are trying to match.

The Actor Layer then performs Double Appraisal to discover the emotional impact that each action in its set of potential actions would have on the Virtual User. It selects a number of these (defined by a constant in the code) to propose. The selection is done by calculating the 'distance' between the action's emotional impact on the virtual user and the emotional target, and selecting those with the lowest 'distance'.

Example: The Game Master has varying attitudes about the questions he can be asked. This is reflected in the desirability of these actions for The Game Master, which creates distress (or joy) in FAtiMA. By simulating the potential actions on the Virtual User, Superman's Actor Layer discovers that the three actions that will come closest to evoking a distress of 3.0 are a hard question about attitude, an easy question about teamwork, and an easy question about background, as seen in Table 1. These become Superman's actions for proposal.

Table 1. Superman's potential actions

Action	Emotion
question_powers_easy	Joy 6.0
question_powers_hard	Joy 3.0
question_attitude_easy	Joy 3.0
question_attitude_hard	**Distress 3.0**
question_teamwork_easy	**Distress 3.0**
question_teamwork_hard	Distress 6.0
question_background_easy	**Distress 3.0**
question_background_hard	Distress 6.0

Having evaluated all actions in the set of potential actions in this way, the agent sends a signal into the world about each action that it is proposing. This signal specifies the ID of the proposal, subject (*i.e.* the agent itself), the action, and the target (*i.e.* on whom the action will be performed).

Other agents then simulate what they would do if the proposing agent performed that action. While this involves action selection, using Distributed Drama Management action selection at this point would lead to infinite recursion, so these agents use FAtiMA's default action-selection mechanism.

Having decided what they would do after the proposed action, agents use Double Appraisal to simulate what effect their second action would have on the Virtual User if the proposed action had already been performed. Having simulated this emotional response, the agents send a signal out into the world specifying the ID of the proposed action and the emotion type and intensity of the active emotion elicited in the Virtual User by their follow-up action.

Example: Batman's Actor Layer receives Superman's three actions for proposal, and simulates what Batman would do next (without considering impact on the user). At this point, in this simple scenario, there are only two actions Batman can perform that would make sense: to soften the question or to harden the question (which evoke mild joy and mild distress respectively in The Game Master). The simulation, by FAtiMA's existing action-selection method, shows that Batman would soften a hard question about attitude (evoking joy at 3.0), harden an easy question about teamwork (evoking distress at 3.0), and soften an easy question about background (evoking joy at 3.0).

When an agent perceives a response to one of its own proposals, the agent creates a sequence of emotional impacts on the Virtual User, beginning with the emotional impact of the appropriate proposed action and subsequently the emotional impact reported by the other agent. The agent sends this sequence out into the world. If the Actor Layer has received follow-up emotional impacts from all other agents, it removes the proposed action from the list of actions for proposal. Once that list is empty, the agent sends a message into the world signifying that its proposals have been exhausted.

Upon receiving a proposal, the Drama Manager's first action is to classify the emotions being proposed. This may be necessary if the author has specified that the emotional target is on one of a number of emotions rather than on a specific emotion, *e.g.* if the author has specified emotions of negative valence as the target. Our example, however, is targeting one specific emotion.

Once the Drama Manager perceives signals from all agents that their proposals have been exhausted, it can begin to compare them. This involves ranking the proposed sequences according to how well they fit the emotional target given by the episode specification.

We have developed two ways of evaluating this fit: attempting to reach a target level of emotion over the course of the episode, or attempting to maintain a target rate of change. The former involves estimating how many actions will occur in the episode and dividing the target level by that number: this gives the target change for any given action. The latter involves comparing the angle between the action's

emotional impact and the horizontal with the angle between the emotional target and the horizontal (where the horizontal axis represents time and the vertical axis represents intensity).

Example: Table 2 shows the emotional trajectories of the sequences initiated by Superman's shortlisted actions. The easy question about teamwork is ranked highest, because it most closely matches the target trajectory. It also ranks higher than any of the arcs Batman's Actor Layer proposed in the meantime, and so is the action that becomes selected.

Table 2. The proposed action sequences

Superman Action	Emotion	Batman Action	Emotion
question_background_hard	Distress 3.0	soften_question	Joy 3.0
question_teamwork_easy	**Distress 3.0**	**harden_question**	**Distress 3.0**
question_background_easy	Distress 3.0	soften_question	Joy 3.0

Having ranked all the proposed sequences according to their fit to the emotional target, the Drama Manager selects the best one, and sends a signal into the world authorising the initiating action of the sequence by ID.

Upon perceiving an authorisation notification, each agent checks whether the authorised ID belongs to it. If it does, the Actor Layer retrieves the action associated with that ID and sends it for execution in the world. Then all agents clear their proposed action maps in preparation for the next round.

5 Conclusion

The current implementation of DDM concentrates on bringing pace, structure and a coherent emotional tone to Emergent Narrative by selecting the most "dramatically appropriate" action from the set of potential believable actions at any given time.

There is still potential for future development of the DDM concept. Such work may include: adaptivity of the Virtual User to a user's specific interpretations of the character and preferences; authoring tools to assist the author in scenario development, and allowing the drama manager to trigger non-character events (i.e. what Chatman [19] calls 'happenings') if no character actions are suitable.

In the near future, however, we intend to evaluate DDM on two evaluative tracks: user evaluation and author evaluation. For user evaluation, we are interested in whether participating in a narrative experience using DDM has any effect on engagement with the story, using models of engagement such as that described by Busselle and Bilandzic [20]. For author evaluation, we are interested in whether, by providing some very high-level control over the course of the story, it is easier to define a scenario for DDM than for Double Appraisal.

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Backstory Authoring for Affective Agents

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Abstract. The authoring and configuration of affective characters for interactive narratives presents a significant problem for the viability of interactive digital storytelling. Motivated by work on exploring the author's perspective on character creation, we present an outline of how a selection of action sequences as backstory experiences can be used to derive configuration parameters for an affective agent architecture. Potential planning paths that include the action sequences provide the foundation for setting concrete values for the importance of goals, standards, and tastes of the character as well as for determining the availability of implicated plans during runtime.

Keywords: interactive narrative, affective agent architectures, appraisal theories, backstory, design.

1 Introduction

Autonomous characters in interactive storytelling are often implemented using affective agent architectures [11]. The configuration method for most current tools for controlling affective agents, however, is largely implementation-specific and engineering-centric rather than being tailored to the needs and ways of authors. In [15,16], the authors examine this disparity from the point of view of authors with IDS experience. One promising avenue towards more accessible ways of assembling affective characters consists in relying on the importance of characters' backstories, i.e. events that happened before or outside the main plot but that impact how and why a character behaves in a certain way.

In this paper, we present an outline of how this idea can be realised for one particular affective agent architecture, ActAffAct [14], enabling the configuration of characters by a selection of short action sequences as backstory events. After relating this effort to other research, we show how the notion of backstories allows the use of event sequences presented to an author to derive configuration values for an affective agent architecture.

2 Related Work

A significant part of research towards Interactive Digital Storytelling (IDS) has focused on creating interactive storyworlds [3,14,22,9], i.e. virtual worlds inhabited by synthetic characters. While not the sole relevant element for creating

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interactive narratives [18], we limit our perspective to approaches that focus on autonomous affective characters [10]. A key dimension for agent control architectures endowing such synthetic characters with personalities and social relationships is affective competence as described by theories in disciplines including psychology, cognitive science, and behavioral sciences [13,11]. Adding to the substantial technical challenges of assembling autonomous affective characters [7], the development of creation tools usable from an authoring perspective is required [2]. Current agent architectures do not cater to the needs of authors as their capabilities and configuration interfaces do not allow for focused creative work. This issue also applies to the agent architecture used for the present work [14], as well as to other systems inspired by cognitive theories of emotion: e.g. systems based on the EMA model [6,12] or the FAtiMA architecture [4,9].

The goal of current work is to obviate the requirement for authors to pinpoint storyworld states at authoring time. In a similar way, the VirtualStoryteller framework [23], employs *late commitment* for the autonomous characters to determine the actual values of some internal parameters and to determine the state of the storyworld during the users' interaction rather than at authoring time. Such delayed decision are informed by assessing the benefits of the available alternatives for story development.

The Thespian system [21,20] also provides similar authorial control: Next to beliefs, goals, and recursive beliefs-of-others as main parameters that drive the behaviour of individual characters, characters can be configured by specifying multiple story-paths that are used to deduce their goals at runtime.

3 Backstories

In traditional stories, characters are carefully crafted to reflect a backstory, i.e., individual and joint histories that motivate their behaviour; that are exploited directly and implicitly (e.g. through deliberate omissions and openings) by the author. In IDS, different approaches have been proposed to capture such backstories and the related personalities of characters. In [15], backstories were identified as a potential framing device for the presentation of configuration options, based on an author case study and a questionnaire evaluation of authors' views collected during a summer-school on IDS authoring.

Character-centred drama models, see e.g. [8], support the idea of the affective constitution of a character as the central element for narrative. Motivations and aversions of a character are subordinate to a single main desire, and fears derived from that desire. Desire, fears, and the related motivations and aversions are rooted in the backstory of the character. A direct and incremental manipulation of elements of a backstory while developing a character would more directly support processes of engagement and reflection as proposed to model creativity in writing [19,5]. Figure 1 illustrates the process of deriving an agent's parameterisation in terms of trait values and cognitions from events of the character's backstory. Of course this does not consider all the potentially complex connections between a character's backstory and the events in a story, but it provides

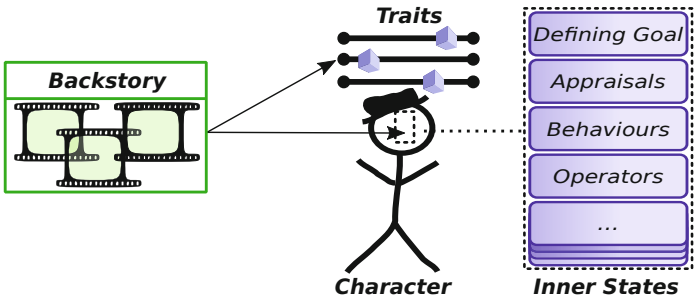

Fig. 1. The configuration of characters by backstory events

a starting point for the configuration of a character in order to be able to reflect that backstory without the intervention of the author at runtime.

A library of backstory fragments can thus serve as a means to shape a character's reactions across a range of occurring situations: Entries can represent actual past experiences of a character as well as its imagined history or future. Such a set of experiences can be regarded as episodic memories of the character; together with a character's defining goal, it can serve to direct a character's emotional behaviour.

4 Agent Configuration

ActAffAct [14,17] is a proof-of-concept system that relies solely on the affective competences of individual characters and their configuration in terms of *beliefs* and *desires* to generate interesting but very simple plots within an interactive storyworld setting comprising a hero; a villain; a victim; and a mentor, as well as simple props such as a sword; a rope; and a bouquet of flowers. As a system rooted in belief-desire-intention (BDI) agent models and with a practical reasoning system at its core [1], the modification of *inner states* is the natively supported direct way of exploring character designs: Beliefs representing what an agent holds to be true, desires (and goals) what an agent tries to fulfill, and a plan library what the agent may ever be *intending* to do. The main influences on agent behaviour that all such architectures share are the relative importances of different desires (i.e. their *utilities*) and the set of capabilities available to a specific agent. ActAffAct adds an operationalization of *affective* subjective appraisal of perceived events. This addition results in further parameters for configuring an individual agent: the relative importances of standards, i.e. the *normative* evaluation of different types of behaviour; the initial relative importances of the actors and objects in the storyworld, i.e. the *preferences* and *attitudes* towards these entities; and the *creation thresholds* and *decay rates* for the *different types of emotions* considered. Further, the architecture has been extended to consider *mood* as a *meta-level effect*, i.e. as an aggregate of experienced emotions. The use of a mood system also supports the modeling of *traits* that influence the

character as a whole, as factors of different emotion types affecting aggregated mood and of the dynamics of the mood state around its nominal setpoint value.

The implementation of the subjective appraisal process includes the selection of coping styles [13] and the relative weighting of different types of emotions. These two elements lend themselves to being configured by a selection from automatically generated episodes, where each episode shows reactions of the character in the possible combinations of encounters with other characters and objects in the storyworld.

5 From Action Sequences to Plans

ActAffAct uses a hierarchy of procedural plans that is instrumental for the implementation of its variant of appraisal. At the lowest level, plans implement reactive action sequences, which can be used to present options for backstory events to authors: A concrete execution instance of such a plan constitutes an event involving one character and potentially other target characters.

Examples of such action sequences that can be selected by authors are giving an object to another agent (`giveObjectTo $OBJECT $AGENT`); stealing an object from another agent (`stealObjectFrom $OBJECT $AGENT`); or fleeing from an agent (`fleeFrom $AGENT`), where the variables for agents and objects are replaced with concrete instances. These actions can further be combined with showing an expression (i.e. one out of a finite set of emotion expression instances) with a specific intensity. Due to the hierarchical organisation of plans, the system is then able to determine which set of higher-level plans can potentially trigger a given particular action sequence as part of its plan body; finally, this set and the combination with an emotional expression allows deriving parameter values.

Consider the example: `stealObjectFrom Sword Hero`. This induces a set of possible plan-decompositions containing this action: Stealing a sword is a component step in plans concerned with preventing another actor from either freeing or threatening someone; a potential realisation of dealing with anger about someone receiving a present (if the attitude towards the donee is suitably low); and a way of acquiring an object if an agent's moral attitude towards stealing (the corresponding standard) is positive, above a certain threshold.

6 From Plans to Parameters

Most actions can be triggered by many different plan-decompositions. As part of the present proof-of-concept implementation, the derivation of configuration parameters only considers a limited number of higher-level plans.

The example backstory element of stealing a sword from the hero, potentially followed by an expression of pride, leads to the following configuration parameters for the agent in question: The plans matched during the search for higher-level plans are added to the available runtime set for that agent. This includes top-level plans for deterring an actor, as these can trigger the plans to preclude that actor from achieving intentions to free or threaten someone.

These identified plans in turn relate to a top-level *concern* to be mean to an actor towards which the agent has a negative *attitude*, so that this concern is set to *active* and the preference for the hero is set to a negative constant (defined as basic parameter for the agent). Also when considering the realisation variant of coping with anger about an undeserved present, the same preference value is again set to a negative value, but in addition the standard for evaluating the present-giving action *is* set to a negative value, too, to allow for anger to arise in that situation. Finally, the moral attitude towards stealing is set appropriately.

7 Conclusions

In this paper, we demonstrated a concept for character creation that directly employs the notion of a character's backstory. We have shown how the different levels of configuration that affective agent architectures used in interactive digital storytelling systems provide can be driven by a selection of backstory events when the affective model for character behaviour allows to infer suitable parameters from runtime events.

To relate our preliminary results more solidly to general authorial practice, extension of this work is planned by more comprehensive testing of the character configuration system with authors. A key aim of this effort is to point out new ways towards more accessible use of affective agent architectures in interactive storytelling without requiring advanced programming competence of authors. At the same time, configuration rooted in theoretical and practical considerations in agent architectures and computational modeling of psychological theories could itself also prove a rich source of inspiration for authors.

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Emotional Appraisal of Moral Dilemma in Characters

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Abstract. In the narrative realm, emotions in general, and moral emotions in particular, play an important role in conveying moral values to the audience. A paradigmatic case is given by the occurrence of moral dilemmas in stories, where the character must trade off options that cannot be reconciled, each related with a certain moral value. In this paper, we propose a model of the appraisal of moral emotions, and describe an agent architecture that reacts to the occurrence of a moral dilemma with the appropriate emotions.

Keywords: Virtual characters, Emotions, Moral values.

1 Introduction

Moral values have been acknowledged by drama theorists and psychologists as having a primary role in drama. According to Bruner, "stories achieve their meanings by explicating deviations from the ordinary in a comprehensible form" [6], contributing to enforce the canonicity of a culture's values. In scriptwriting, the moral nature of the narrative premise, pointed out since the pioneering work of [12,22], becomes explicit in the work by [28]. Moral dilemmas take to the stage the representation of diverging moral commitments within the same character, bringing them to life with the help of the appropriate emotional range. In moral dilemma, a character is faced with options that cannot be reconciled: the choice of one option determines the impossibility of bringing about the others, and each corresponds to a different moral value, so that the character is faced with a choice between different values. This deadlock makes contrasting emotions arise in the character, deeply interwoven with rational considerations. Finally, an option (and a value) prevails, but the emergence of canonicity does not retain the character from experiencing strong and conflicting emotional states along the process.

In this paper, we propose a character model in which moral emotions become part of the deliberation process of the character. Moral emotions, like pride and shame, arise as a consequence of moral values; their intensity depends on the importance of the values they are related with and is increased if these values are shared with other agents. The aim is to create artificial characters who display the emotional range triggered by the occurrence of a moral dilemma, defined

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as mutually exclusive options that put different values at stake. In the struggle among conflicting values, the choice of an option by the character is driven by the intensity of the moral emotions she experiences; a special role is played by the values shared with the community, which increase the intensity of shame and pride. Remorse is also part of the game, when the character, after deliberating and acting, is left alone with her conscience.

This paper is structured as follows. After surveying the related work (Section 2), in Section 3 we describe the relationship between moral emotions and values and the agent model. Section 4 illustrate the agent architecture where moral emotions are embedded. Section 5 shows the model at work on a literary example (the story of "Iphigenia in Aulis", written by Euripides). Conclusions and future work end the paper.

2 Related Work

The construction of a model of character who reacts to moral dilemma in the same way as literary characters requires the integration of a rational and an emotional component. Both components should embed some notion of moral value, to let the character reason about the compliance with values at the behavioral level and feel moral emotions when her values are put at stake.

Intelligent agents offer an operational way to design and implement characters in interactive storytelling, as shown by a number of successful application [20,23]. The Belief-Desire-Intention (BDI) model of agent [5] has proven to be an effective basis for the implementation of artificial characters, thanks to the availability of programmable agent frameworks [21,4]. In contemporary aesthetics, the adequacy of this model to the paradigm of identification postulated by [8] has been put forth by the work of Feagin [15].

Many works tried to integrate computational models of emotions in a cognitive architecture for intelligent agents [24,14,18]. Although different theories of emotions have been proposed (including physiological and dimensional models), most computational models are based on appraisal theory, in which cognitive processes are involved in the generation of emotions [19,17,25]. According to appraisal theories, cognitive processes have the function of building a mental representation of the situation in which a person is involved. This representation (*person-environment relation*) is not limited to the external environment, but includes also the internal disposition of a person as goals, desires, intentions, norms, moral rules. Emotions arise from appraisal of the person-environment relation according to appraisal dimensions that are defined in the theory (i.e. desirability of an event). Many models don't take into account the link between moral emotions, values and goals [16,18,14,3], with the relevant exception of FLAME [13]. In FLAME, moral rules are acquired by learning user's actions and a fuzzy logic approach is used to calculate the intensity of emotions; however, the appraisal process is not encoded in the system.

In the OCC theory [19], the person-environment relation is represented by goals, standards and attitudes; appraisal dimensions are represented by *desirability* (or *undesirability*) of an event, *praiseworthiness* (or *blameworthiness*) of

an action, *liking* (or *disliking*) of an object. According to this model, the agent's "standards" (i.e. the agent's "beliefs in term of which moral and other kinds of judgmental evaluations are made") affect the evaluation of self and others' actions. Actions that meet the agent's standards are deemed praiseworthy, and their execution triggers emotions like pride and admiration. Conversely, blameworthy actions trigger emotions like shame and reproach. So, in our work, we assume the OCC model, and rely on previous work by [7] to establish an explicit link between moral values and moral emotions.

In the story generation systems by [2], a finite set of dilemmas are defined, each characterised by a set of preconditions that the system has the task to achieve. Generated dilemmas are presented to the user in order to engage her in the drama with the choice of the next course of action. Differently from [2], we present a model of character in which a moral conflict arises from the conflict of values and from the emotional appraisal of one's own actions. Inspired by work on moral dilemma [2] and the notion of value [11,26], we propose a model of how a character reacts in front of a moral dilemma and how moral emotions can affect her behavior. Different individuals acknowledge different values, arranged into subjective scales [26]. So, different characters react differently to values at stake, as a consequence of the values they care for and the importance they attribute to them.

3 Dilemma-Compliant Agent Model

In previous work [10], value–sensitive agents are modeled as BDI agents, augmented with the notion of value. An agent features a set of values, arranged into a subjective 'scale of values' [26]. Each value is associated with a set of conditions: when one or more conditions hold in the state of the world, the value is put at stake. The value–sensitive agent monitors the state of the world for values at stake: when the agent realizes that some value is at stake, it modifies its commitment accordingly, by forming a goal (value–dependent goal) that contributes to re-establishing the value (or the values) at stake. Notice that, according to this model, the monitoring of values is carried out not only on what the agent believes to be the current state of the world but also on the agent's expectations about the outcomes of the events and of the other agent's actions.

Following the model described in [7], we map the notion of agent's "standards" on the notion of "values" and we define the *praiseworthiness* or *blameworthiness* of an action on the basis of the agent's values. The agent considers her own action as praiseworthy only if she has formed the intention to execute it to bring a value at stake back to balance. Conversely, if an action puts at stake a value of the appraising agent, it is considered blameworthy. The role of values is relevant not only for the appraisal of an agent's own actions, but also for the appraisal of other agents' behavior. In our model, different emotions can arise in the agent, and an action can be appraised as blameworthy and praiseworthy at the same time. Also, we distinguish when a value is put at stake by an action but can be reestablished subsequently and when a value is put at stake with no possibility of

being reestablished. Based on this, in the following section, we introduce moral dilemmas.

We model a character as a BDI agent augmented with the notion of values and emotions. So, a character is a 5-tuple $\{B, D, I, V, E\}$ where B is the set of beliefs of the character, D is the set of desires (or high-level goals), I is the set of intentions, V is the set of values, E is the set of emotions. For the aim of this work, we consider the emotions of pride and shame, classified in OCC model as Attribution emotions concerning the self. The beliefs base includes not only the state of the world but also expectations about how it may evolve, information about interpersonal relationships with others agent and their mental state (clearly, in a real implementation a theory of mind about others agents and expectations have to be restricted to a certain number of nesting).

Goals arise as a consequence of the character's values. Inspired by [27], a goal g is defined by a tuple $g(c, e, s, \pi, t)$ where:

- c is the satisfying condition. When c is true in the state of the world the goal is achieved and dropped;
- e is the failure condition. When e is true in the current state of the world, the goal is dropped;
- s is the state of the goal. A goal can be adopted, suspended, activated or dropped. Following [27], desires $\in$ D are adopted goals. Adopted goals remain suspended until they are ready for execution (i.e., they are in active state), then possibly suspended again if a more important goal is adopted. Goals can eventually be dropped if certain conditions hold, namely, when the rationality constraints stated by [9] are met;
- π is the plan formed by the planning component to achieve the goal;
- t is the goal type. In this work, we consider only achievement goals and perform goals. When dealing with values, an achievement goal is the goal to achieve a certain state of affairs in which the value is not at stake anymore, while a perform goal is the goal to execute actions (i.e. plans) to re-establish the value at stake.

A value v is defined by a set of constructs of the form $v(c, r, l)$ where:

- c is a ground formula. When c holds in the state of the world or in the character's expectation the value is put at stake;
- r (a real number) is the priority of the value. Values are organized in a scale of values [26];
- l represents the probability of reestablishing a value through the execution of a plan (this implies that the value is at stake and that the agent has an active value-dependent goal with a formed plan).

With respect to [27], [11], we introduce for plans a structure that contains information about the values at stake, in order to let the agent reason about dilemmas. A plan structure $\pi \in I$ contains a sequence of actions, devised by the planning component. We assume that actions are in STRIPS-like style with preconditions and effects. A plan π is described by a tuple (P, V^T, V^B, g, u) where:

- P is the set of facts that the plan π makes true in the state of the world (if completely executed with success). Every condition $p_i \in P$ is a condition c of a value at stake $v_i \in V^T$ that may hold in the current state or in the future, according to agent's prospect reasoning (or expectations);
- V^T is the set of values v_i put at stake by the plan π;
- V^B is the set of values v_i reestablished by the plan π;
- g is the value-dependent goal achieved by the plan. Goal g arises from the motivation of bringing values in V^B back to balance;
- u is the associate utility (a real number). Agents choose which plans to execute with respect to their utility, calculated by taking into consideration the moral emotions that arise from reestablishing or putting at stake a value and the probability of success of plan.

Emotions are defined by (t, i, v, π) where:

- t is the emotion type, according to OCC model;
- i is the intensity of emotion (a real number); it is involved in the calculation of plan utility;
- v is the emotion valence that indicates if emotions is a positive ('+') or negative ('-') emotion. For example, a positive emotions, like 'pride', contributes in positive way to utility and expected utility of a plan.
- π is the plan from which emotion rises.

Further, in the belief base, we also define the following data structures:

- $V_{atStake}$: the set of values $v_i \in$ V put at stake in the current state of the world or in character's expectations;
- V_{Shared}: the set of values shared with others agents, augmented with information about the relationship of the agent with them. A shared value $sv_i \in V_{Shared}$ is described by $(ag, v_i, rel(ag))$ where ag is the agent that shares the value, v_i is the shared value and $rel(ag)$ is the believed intensity of the relationship with that agent.

4 Character's Architecture

In order to cast the model described in the previous section into an agent architecture, we define the following agent loop:

Monitoring: the agent perceives the world and updates its beliefs ($update(B)$). In particular, the agent supervises the failure condition on his/her goals to drop them and the conditions of her values at stake to control if a value at stake is re-established ($checkConditions(D, V_{atStake})$).

Goal Adoption: the agent updates its value at stake. $\forall\ v_i \in V$ if the condition c of the value v_i holds in the state of the world, the value is at stake and is added to $V_{atStake}$ ($update(V_{atStake})$). The agent forms and adopts a value-dependent

Algorithm 1. Moral dilemma reappraisal

while *true* **do**
  $B \leftarrow update(B)$
  $checkConditions(D, V_{atStake})$
  $V_{atStake} \leftarrow update(V_{atStake})$
  $formGoal(D, V_{atStake})$
  $generatePlans(D, I)$
  $prospectReasoning(I, D, V)$
  $checkConflict(I)$
  $selfAppraisal(E, I, D, V_{atStake})$
  $socialAppraisal(E, I, D, V_{atStake}, V_{Shared})$
  $\pi \leftarrow chooseBestPlan(I)$
  $execute(\pi)$
  $generateEmotions(\pi)$
end while

goal to restore the values at stake ($formGoals(D, V_{atStake})$). For each new generated plans, the possibility of success is calculated to bring the value back to balance.

Option Generation: the agent performs means-end reasoning to generate new plans for the adopted goals ($generatePlans(D, I)$). Then, she performs anticipatory reasoning to detect if the new plans put at stake some other value in V ($prospectReasoning(I, D, V)$). $\forall\, \pi_i \in I$, the agent checks if an effect of an action puts another value $v_i \in V$ at stake. Although expensive, focused anticipatory reasoning is an essential element of social frameworks, such as [18,1]. If so, the condition of the value at stake is added to the plan set of precondition P and the value at stake is added to the character set $V_{atStake}$ and the plan set V^T. Also, the agent forms a value-dependent goal to re-establish the new values at stake and generates new plans for new adopted goals. For every new plan, the probability of success is calculated to set the probability to re-establishing the value (the field l in value construct). The agent performs a check on the updated set I to detects conflicts between plans ($checkConflict(I)$). Plans are in conflict when a chiasmus is established between them. A chiasmus (Fig. 1) between two plans π_i and π_j exists when the intersections $V_i^T \cap V_j^B$ and $V_j^T \cap V_i^B \neq \emptyset$.

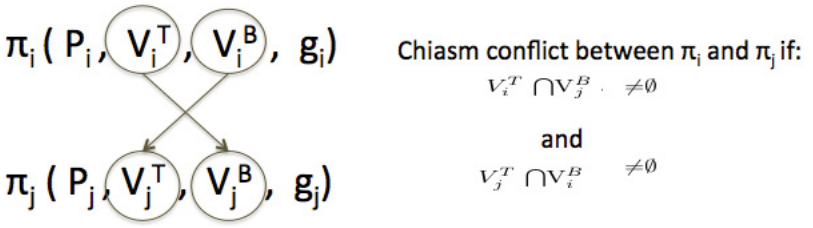

Fig. 1. Definition of chiasmus between options

A conflict between a plan π_i and a plan π_j means that, when successfully executed π_j, the probability of success of plan π_i is equal to zero, and vice versa. So, the probability l of a value is set to the conditional probability of success of the related plan and not to the probability of success of the plan (as described above).

Making this assumption, we model the fact that there is no possibility of reestablishing the value in the future. So a moral dilemma is detected, the agent's decision is not about what value to bring in a positive state before, but which value must be put aside.

Appraisal-Based Deliberation: in this phase, the agent decides what goal becomes activated. The appraisal takes into consideration moral emotions to choose the value-dependent goal to activate and forms the value-dependent perform goal to execute the related plan. The deliberation is done in two phases: one is the self-appraisal ($selfAppraisal(E, I, D, V_{atStake})$) and the other is the social appraisal ($socialAppraisal(E, I, D, V_{atStake}, V_{Shared})$) of plans. In the self-appraisal phase the character considers only his own goals, while, in the social-appraisal phase, the values shared with the society are taken into account in the decision process.

In *self-appraisal*, the intensity of emotions that arise from a certain plan are calculated and the expected utility of the plan is computed:

1. $Pride_I = \sum_{v_i \in V^B} r_i$ * step(π_i) * probOfSucc(π_i)
2. $Shame_I = \sum_{v_i \in V^T} r_i * (1 - l_i)$ * step(π_i) * probOfSucc(π_i)
3. expected-utility(π_i) = $Pride_I$- $Shame_I$

After the self-appraisal, the agent executes *social-appraisal*, in which she takes into account her beliefs about shared values and social relations to calculate the intensity of emotions and the expected utility of plans. So, in this phase, a plan is appraised as praiseworthy or blameworthy by taking into consideration the shared values. The priority of the shared value is obtained from the weighted sum between the priority of the shared value and the intensity of the relation with the agent with who shares that value. The new priorities of the values $\in V^T$ or $\in V^B$ are re-calculated as the sum of original priority with the priority of the shared value (for example, given $v_i \in V^B$ and v_{i1}, $v_{i2} \in V_{Shared}$ the new priority is equal to $r_i \in V^B + \sum_{v_{ij} \in VShared} r_{ij}$). The intensity of emotions are then calculated by taking into consideration the new priority of the values, according to the formulas:

1. shared-priority(v_i) = $\sum_{v_i \in V_{Shared}} r_i * rel(ag)$ given a value $v_i \in V^T$ or V^B;
2. $Pride_I = (\sum_{v_i^b \in V^B} r_i$+ shared-priority($v_i$)) * step($\pi_i$) * probOfSucc($\pi_i$)
3. $Shame_I = (\sum_{v_i^t \in V^T} r_i * (1 - l_i)$ + shared-priority(v_i)) * step(π_i) * probOfSucc(π_i)
4. expected-utility(π_i) = $Pride_I$ - $Shame_I$

The agent chooses the best plan ($chooseBestPlan(I)$) and forms a perform goal to execute the plan. The goal related to the chosen plans become activated, the others goals remain suspended.

Execution. The agent executes the next action of activated plan – the first action when the plan is activated for the first time (*execution*(π), *generate Emotions*(π)).

5 Example

The example, taken from the greek tragedy "Iphigenia in Aulis" by Euripides, revolves around Agamemnon, the leader of the Greek fleet during the Trojan War, and his decision to sacrifice his daughter, Iphigenia. We model the moment in which the Greek fleet is waiting at Aulis (Boeotia), but is unable to set sail due to a lack of wind. After consulting the seer Calchas, Agamemnon comes to know that the goddess Artemis causes the lack of wind because he offended her. To appease the goddess, he has to sacrifice her daughter Iphigenia. So, in the moment before the profecy, Agamemnon is committed to the achievement goal $ag_{setSail}$, motivated by the value of loving his country $v_{Country}$, and to the perform goal $pg_{setSail}$ for the plan $\pi_{setSail}$, which consists in the departure from Aulis to Troy (Table 1).

Table 1. Agamemnon's state before learning Calchas's profecy

Beliefs	*wind-intensity(low)* *failed*($\pi_{setSail}$) *inAulis(ships)* *wind-intensity(high)* $\iff$ *sailing(fleet)*
Desires	$ag_{setSail}$(sailing(fleet)), wind-intensity(low), activated, $\pi_{setSail}$, AG) $pg_{setSail}$(succeeded($\pi_{setSail}$), failed($\pi_{setSail}$), activated,$\pi_{setSail}$, PG)
Plans	$\pi_{setSail}$(-, -, $v_{Country}$, $ag_{setSail}$)
$V_{atStake}$	$v_{Country}$(inAulis(ships), 0.8, 0.5)

In the Monitoring phase (Table 2) Agamemnon updates his beliefs. According to the profecy, the ground formula *not(alive(Iphigenia))* $\iff$ *wind-intensity(high)* is added to the beliefs. The goals $pg_{setSail}$ and $ag_{setSail}$ are dropped because their failure condition (*wind-intensity(low)* and *failed*($\pi_{setSail}$)) hold in the state of the world, while the set of values at stake $V_{atStake}$ remains unaltered. So, the initial plan $\pi_{setSail}$ is abandoned. In the Goal Adoption phase (Table 2), Agamemnon forms the achievement goal $ag_{Country}$ to restore the value still at stake. In the Option Generation phase (Table 2) Agamemnon forms a new plan $\pi_{Country}$ to restore the value $v_{Country}$ and satisfy the goal $ag_{Country}$ according to his new beliefs. Agamemnon performs the anticipatory reasoning for new plans generated and he detects that the plan $\pi_{Country}$ contains an action with an effects (i.e. 'sacrifice Iphigenia') that threatens a condition of value $v_{Iphigenia}$ (preserving the life of her daughter Iphigenia). He forms a new value-dependent achievement goals $ag_{Iphigenia}$ to re-establish $v_{Iphigenia}$ in V and derives a new plan, $\pi_{Iphigenia}$ (saving Iphigenia's life) to achieve the new goal. Agamemnon performs a check to

Table 2. Monitor - Goal Adoption - Option generation Phase 1

Beliefs	*wind-intensity(low)* *inAulis(ships)* *wind-intensity(high)* $\iff$ *sailing(fleet)* *not(alive(Iphigenia))* $\iff$ *wind-intensity(high)*
Desires	$ag_{Country}$(sailing(fleet)), low-intensity(low), suspended, -, AG) $ag_{Iphigenia}$(alive(Iphigenia), not(alive(Iphigenia)), suspended, -, AG)
Plans	$\pi_{Country}(v_{Iphigenia}, v_{Country}, ag_{Country})$ $\pi_{Iphigenia}(v_{Country}, v_{Iphigenia}, ag_{Iphigenia})$
$V_{atStake}$	$v_{Country}$(-, inAulis(ships), 0.8, 0) $v_{Iphigenia}$(-, not(alive(Iphigenia)), 0.9, 0)
V_{Shared}	(Menelaus, $v_{Country}$, 1) with priority (0.8 * 1) = 0.8 (Ulysses, $v_{Country}$, 0.5) with priority (0.8 *0.5) = 0.4 (fleet, $v_{Country}$, 0.3) with priority (0.8 * 0.3) = 0.24

Table 3. Appraisal-based Deliberation phase

	Self-appraisal $\pi_{Country}$	Self-appraisal $\pi_{Iphigenia}$
$Pride_{int}$	0.8 * 2 * 0.5 = 0.8	0.9 * 2 * 0.5 = 0.9
$Shame_{int}$	(0.9 * (1-0)) * 2 * 0.5 = 0.9	(0.8 * (1-0)) * 2 * 0.5 = 0.8
utility	0.8 - 0.9 = -0.1	0.9 - 0.8 = 0.1
	Social-appraisal $\pi_{Country}$	Social-appraisal $\pi_{Iphigenia}$
$Pride_{int}$	2.24 * 2 * 0.5 = 2.24	0.9 * 2 * 0.5 = 0.9
$Shame_{int}$	(0.9 * (1-0)) * 2 * 0.5 = 0.9	2.24 * (1-0)) * 2 * 0.5 = 0.8
utility	2.24 - 0.9 = 1.24	0.9 - 2.24= -1.34

validate if and which plans are in conflict. At this point, a chiasmus is detected between plans $\pi_{Country}$ and $\pi_{Iphigenia}$.

In the Appraisal-based Deliberation phase (Table 3), due to the detected conflict, Agamemnon reasons about moral valence of plans and calculates the expected utility of plans according to the rules described in Section 3. We suppose that both plans contains two actions and a success probability of 0.5. So, for example, in the case of plan $\pi_{Country}$ the pride emotion intensity is $\sum_{v_{country}} r * step(\pi_i) * probOfSucc(\pi_i)$; the shame emotion intensity is $\sum_{v_{Iphigenia}} r * (1-l) * step(\pi_i) * probOfSucc(\pi_i)$ and the expected utility is equal to the difference between pride intensity and shame intensity. After the self-appraisal, Agamemnon takes into consideration the shared values to perform social appraisal (Table 3). The only value at stake shared with others agents is the value $v_{Country}$. The new priority for the shared value is calculated as the sum of the shared-priority (Table 2) with the original priority of the value (0.8). So the new priority for the value at stake $v_{Country}$ is equal to (0.8 + 0.8 + 0.4 + 0.24) = 2.24. After the social appraisal, the highest expected utility is the expected utility of the plan $\pi_{Country}$. The achievement goal $ag_{Country}$ becomes 'activated' and a perform goal $pg_{Country}$ is formed to start executing the chosen plan. In the execution phase, Agamemnon executes the first action of the plan: he writes a letter to Iphigenia to tell her that she must join him.

Table 4. Monitoring - Goal adoption - Option Generation - Deliberation Phase 2

Beliefs	*wind-intensity(low)* *inAulis(ships)* *wind-intensity(high)* $\Longleftrightarrow$ *sailing(fleet)* *not(alive(Iphigenia))* $\Longleftrightarrow$ *wind-intensity(high)* *coming(Iphigenia)*
Desires	$ag_{Country}$(sailing(fleet)), low-intensity(low), activated, -, AG) $pg_{Country}$(succeeded($\pi_{Country}$), failed($\pi_{Country}$), activated,$\pi_{Country}$, PG) $ag_{Iphigenia}$(alive(Iphigenia), not(alive(Iphigenia)), suspended, -, AG)
Plans	$\pi_{Country}$(-, $v_{Iphigenia}$, $v_{Country}$, $ag_{Country}$) $\pi_{Iphigenia}$(-, $v_{Country}$, $v_{Iphigenia}$, $ag_{Iphigenia}$)
$V_{atStake}$	$v_{Country}$(inAulis(ships), 0.8, 0) $v_{Iphigenia}$(not(alive(Iphigenia)), 0.9, 0)
$\pi_{Country}$	Self-appraisal
$Pride_{int}$	0.8 * 2 * 0.9 = 1.44
$Shame_{int}$	(0.9 * (1-0)) * 2 * 0.9 = 1.62
utility($\pi_{Country}$)	1.44 - 1.62 = -0.18
$\pi_{Iphigenia}$	Self-appraisal
$Pride_{int}$	0.9 * 2 * 0.5 = 0.9
$Shame_{int}$	(0.8 * (1-0)) * 2 * 0.5 = 0.8
utility($\pi_{Iphigenia}$)	0.9 - 0.8 = 0.1

In the subsequent cycle, Agamennon monitors the world again and the appraisal restarts. For the sake of brevity, we focus on the Appraisal-based Deliberation phase. Agamemnon's mental state is depicted in Table 4. Following the story line, after Agamennon has written the letter to his daughter, the shared values are removed from his belief base. In the goal adoption phase Agamemnon is still committed to the goals $ag_{Country}$ and $pg_{Country}$, while the goal $ag_{Iphigenia}$ is still suspended. In the option generation phase there is no new value at stake, only the plan $\pi_{Iphigenia}$ may contain a different course of action to re-establish the value still at stake, because of the new beliefs (Table 4). In the Appraisal-based Deliberation phase, Agamemnon re-calculates the utility of plans. This time, the success probability of the plan $\pi_{Country}$ is equal to 0.9 (he has written the letter and Iphigenia is bound to arrive). We don't report the social appraisal re-calculation because no values are shared with the society at this time (Table 4). Agamemnon chooses the best plan $\pi_{Iphigenia}$. Consequently, the achievement goal $ag_{Country}$ becomes suspended, the perform goal $pg_{Country}$ and the plan $\pi_{Country}$ are dropped, while $ag_{Iphigenia}$ is activated and a new perform goal is formed to execute the new plan. Then, in the Execution phase, Agamemnon starts to execute the plan $\pi_{Iphigenia}$. According to the story line, he feels remorse for what he has done, and writes a new letter to his daughter saying her not to come to Aulis. [1]

[1] It is interesting to note that the story says that Menelaus prevents Agamennon from sending his letter. When Iphigenia arrives to Aulis, she faces exactly the same dilemma as her father. But in this case, since personal values are different, the conclusion is also different: she decides to sacrifice herself for the sake of her country.

6 Conclusion and Future Work

In this paper, we proposed an agent model that accounts for the emotional range triggered by the occurrence of a moral dilemma in stories. We introduced the notion of values to define the moral appraisal of actions and illustrated the model on a literary example of moral dilemma. The aim is to create artificial characters whose emotional appraisal is affected by moral values, and shared values in particular. Being an operational model, it lends itself to implementation with agent frameworks and languages, that we are currently conducting.

We want to extend our model to consider not only value-dependent goals but also standard goals, in order to investigate the interplay of value-dependent goal formation and standard deliberation, and generate a wider range of emotional states, that account for the social component in a more accurate way. Last, we want to test the emotional states generated by the model on the involvement of the user and her perception of the character's behavior, by testing if the moral values of the user have an impact in the mechanism of sympathy and empathy.

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Laugh To Me! Implementing Emotional Escalation on Autonomous Agents for Creating a Comic Sketch

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Abstract. The growing interest for Interactive Storytelling has lead the research into the exploration of this new media in classical story genres. In our research, we develop autonomous agents that act in a storytelling context with a comic purpose. We present a comic sketch model for autonomous agents with affective reasoning. The agents that use this model prepare the timing of the comic punchline by reasoning about emotional states in a process called Emotional Escalation. The punchline used for our test scenario, as well as the personality of the comic characters is based on the humour theory of incongruity-resolution.

Keywords: Autonomous Agents, Humour, Emotional Escalation.

1 Introduction

Comedy is one of the most difficults, but yet one of the most entertaining forms of storytelling. As such, there are several examples of the pursuit to adapt the comedy genre in Interactive Storytelling [4,3,20,15]. The common ground between most of the approaches is that they rely on planning formalisms that allow a character to fail. The comic situations arise from the character failing to achieve their goals. The comic effect of a failed plan is explained by the Schultz's incongruity-resolution theory [14]. Following Shultz the punchline(ending) of a joke creates an incongruity that contrasts with what was suggested by the set-up of a joke. One must go back and search for an ambiguity, in the set-up and interpret it in a different way in order to get the joke. This is called an incongruity-resolution theory because first we are surprised by the incongruence and then that incongruence finds an explanation (is resolved) in the final part of the joke.

In our research we define the generation of incongruence as the build-up of an inconsistence or gap, which can be exploited for comic purposes. Our goal is to create a comic reality, which is a a caricature of real reality, a distorted vision in which some features are emphasized, downplayed, or contrasted with

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their opposite. We do this not just by relying on action failure, but also considering other forms of incongruence such as emotional incongruence and context incongruence.

In this paper, we present the fundaments that support the implementation and evaluation of a comic sketch model for autonomous agents based on incongruence-resolution theory. In our test scenario we rely on our agents ability of creating emotional incongruence to achieve a comic effect. The agents build up the incongruent emotional context through a process called Emotional Escalation, by which they tend to set the scene passing and punchline timing.

2 Related Work

Computational Humour (the subfield of Artificial Intelligence concerned with the production of humour) has been mostly connected with works in Natural Language, since Lessard and Levison's 1992 Tom Swifties (a specific type of pun) generator[9], which used the VINCI Natural Language generator, and a subsequent work related with riddles [10].

A more ambitious approach was JAPE, developed by Binsted and Ritchie [2],[1], later used to develop STANDUP [13], a system aimed at helping children with cerebral palsy develop better language skills [22]. Another important work in computational humour was Stock and Strapparava's HAHAcronym, a simple prototype that sought to produce ironic acronyms [19]. HAHAcronym extends the lexicon with hierarchic domain information about the terms, in order to explore the incongruity between groups of concepts, for example, Sex vs. Religion.

In Interactive Storytelling the most common approach to comedy has been based on planning formalisms that allow the character to fail. The comic situations arise from the character failing to meet their goal. One prototype by Cavazza et al. at the University of Teeside [4] was based on the sitcom Friends. The prototype resulted in some funny situations, which emerged from the failure of a character's plans. Cavazza reckons that the situation of two characters that have different conflicting goals is "likely to result in a series of comic situations and *quiproquos*." A similar work with a different planning mechanism was based on the Pink Panther cartoon [3]. Another implementation was that of Thawonmas et al. [20], who further noted that there should be some control how the plan failure occurs.

Another important work by David Olsen and Michael Matheas further developed the plan failure method in ACME, a prototype system set in the world of the Coyote and Road-Runner cartoons [15]. The conflicting goals here are the Coyote's aim of catching the Road Runner and Road Runner's goal of escaping. The system itself has the story goal of frustrating Coyote's plan through the occurrence of some gag, such as an anvil falling over Coyote. The occurrence of these gags take in account a level of anticipation, that grows with the number of steps the Coyote has gone through in his plan to catch the Road-Runner. This level of anticipation sets the probability of a gag occurring that causes the Coyote to fail his goal.

But, comedy is associated with the presence and actions of characters in a scene, and in particular, their emotions. There have been many works in Interactive Storytelling concerned about the agent's emotions. One of this works, Clark Eliott's Affective Reasoner [8] is an appraisal system that relates emotions with story variability. Appraisal is the process by which the agent attributes emotions to his perceptions of the world. The premise of the Affective Reasoner is that two stories that are, for the most, identical, in terms of the events, are perceived as different because the appraisal of actions done by the characters is different. Elliott suggested the use of his Affective Reasoner paradigm in the context of Computational Humour, exemplifying with a very specific type of humorous situation [7], described via the emotions the characters felt.

Other works show how agents can choose actions deliberate to alter the emotional content of a story. One work suggested that agents using FAtiMA – the agent architecture used in this work – could support a double appraisal mechanism, in which the agent reappraises a selected action according to the emotional impact in others [12]. This could make agents behave more like actors and less like characters, who evaluate the dramatic interest of an action. Indeed double appraisal mechanisms have been shown to create more interesting narratives [11]. Another extension of FAtiMA that has been proposed and is currently being implemented aims at making emotional intelligent agents [6].

A work by Pizzi et al. based on Gustave Flaubert's novel Madame Bovary [18], showed how a narrative could be described in terms of the agents feelings. The contribution of each action to achieve the character desired emotional state is given by an heuristic function, in which a low value means that the character is closer to a desired emotional state and a high value means it is more distant. The character can thus be aware of how its situation evolves: for example, an initial decrease of the heuristic, which gives a character hope, followed by a prolonged increase. This can, according to Pizzi et al. "correspond (...) to the narrative notion of 'shattered hopes' " [18].

3 Background on Humor

Out of the several humour theories that were discussed across centuries, the one that is more closely related to our model is the incongruity-resolution theory. Following Thomas Shultz ([14], pg. 64) the ending of a joke creates an incongruity that contrasts with what was suggested by its set-up. One must go back and search for an ambiguity in the set-up and interpret it in a different way in order to get the joke. This is called an incongruity-resolution theory because first we are surprised by the incongruence and then we resolve it, by finding an explanation (is resolved) that makes the ending follow from the premise. According to this theory, failing to see an incongruence would lead to no surprise and being unable to resolve it would make the spectator puzzled, resulting in no laughter in either case.

Perret [17] and Vorhaus [21], comedians who wrote about comedy writing, both agree on the importance of incongruity. We consider two main uses of

incongruities in comedy writing: as *comic premises* and as *punchlines*. Comic premises are the initial idea behind a comic scene or a joke, such as a man interviewing a dictator about his love of botanic. The punchline is the ending part of a joke or a scene, that resolves the incongruity and provides the humour. John Vorhaus, whose perspective on comedy writing is strongly character-centric, introduces the concept of *strong comic perspective* in relation to comic characters ([21], pg. 42). A strong comic perspective is a point of view by a character that is very unique and related to specific traits of his or her personality. This point of view is unlike that of a normal person.

An important factor in comedy is building up the *tension* (set-up) before delivering the joke (pay-off). Sketches are short, isolated scenes that develop a certain comic premise (a comic premise is the incongruity that composes the initial idea of a comic story). Perret refers to an analogy of jokes as the building blocks of comedy. He remarks a sketch is not just a collection of jokes, much like a house is not just a collection of bricks. Perret considers a good sketch must have "a premise; some complications; an ending, or in other words a beginning, a middle and an end" ([17], pg. 154). In his account of what a sketch should be, Vorhaus stresses the need to create and develop a conflict between characters ([21], pp. 154-161).

4 Implementation

Fig. 1. Screenshot of the prototype, when the Client shows anger

4.1 FAtiMA and OCC Model

To implement our agents we used the FAtiMA framework [5] based on the OCC (Ortony, Clore and Collins [16]) theory as the underlying model of appraisal. OCC encompasses in total 22 valenced emotion types. Valenced means that these emotions always have a negative or a positive charge: for example Joy has a positive valence while Distress has a negative valence. OCC proposes a set of appraisal variables as well, such as *Praiseworthiness*, *Desirability*, and *Desirability for other*. The OCC model proposes a hierarchy of the different

emotions according to these variables and according to the subject of the action, whether is the same one who is doing the appraisal or not.

When appraised OCC emotions have a given potential, which is represented in FAtiMA as a numeric value from 1 to 10. The intensity with which each emotion is felt equals the potential minus the threshold the agent has for that specific emotion. OCC emotion has a potential, a threshold, an intensity and a decay rate. The potential is the sheer value of the emotion after appraising. The threshold is the minimum limit beyond which we do not feel a certain emotion. The intensity is the value with which the emotion is actually felt, and is given by the difference between the potential and the threshold. Finally the decay rate defines how fast emotions fade with time.

In the FAtiMA architecture the personality of an agent is defined by rules derived from the OCC model. These set the values of their thresholds and decay rates for each emotion (using value between 1 and 10), and how each event is appraised in terms of appraisal variables (using value between -10 and 10). There are also a number of Action Tendencies: reactive actions activated when an emotion reaches a certain intensity.

4.2 Agents, Sketches and Incongruence

Conceptually, we divide incongruence in three types, depending on the way they relate to the agent: Context, Action and Emotional. Context refers to the environment in which the agents act, and whether or not it conflicts with their behaviour. An Action incongruence happens when the actions of the character are inconsistent, for example, with the agents goals. We consider most of the past works in Interactive Comedy described belong to this category. An Emotional incongruence arises from the personality of the agent itself, how differently an agent appraises the world considering what would normally be expected of him.

The authoring of a FAtiMA personality helps define Emotional incongruences. A character that acts or reacts in an incongruent manner is consistent with our idea of a comic character, while a character that acts in an acceptable way is a regular character.

As discussed, sketches present a specific structure. As such the actions available to the character depend on the moment of the sketch: the beginning, where the conflict is established, the middle where the action is developed, and the ending, which may be a punchline. Our implementations uses a scripted (in the sense of a predefined sequence of actions) beginning and punchline. The timing in which to activate the punchline, however, is defined by a set of preconditions.

4.3 Emotional Goals and Guidelines

To further explore the incongruence that results from the authoring of the character, we define Emotional Goals and Guidelines. This allows the agent to be active in how he will elicit certain emotions that not only explore this incongruence, but also buildup towards the punchline. As such the agents are not mere characters but active actors as well, that influence how the scene develops.

Emotional Guidelines are a function of the emotion over story time. In our implementation we define this story time as the actions of the agent itself, while the value of the emotion is given by the potential, as defined in FAtiMA's implementation of OCC. Thus each Emotional Guideline defines a desired potential for a given emotion at a point in time. The agent actively tries to select an action that evokes the emotions set by the Emotional Guidelines. The agent is capable of simulating an action and comparing its emotional output to that value.

The absolute difference between the values of the simulated and desired emotion potential is taken in account in the heuristic used by the agent to select an action. The agent tries to minimize this difference. In mixing each guideline it also prioritizes the Guidelines that present the higher desired values, given the point in time the heuristic function is being run in.

Emotional Goals group Emotional Guidelines with a set of preconditions. When these preconditions check, the Guidelines are considered activated. The agent will then actively consider these Guidelines in the action selection, according to the heuristic described above.

5 Scenario

We required for our scenario: two characters, at least one of whom should be a comic character; an object of conflict between these two characters; and a reason to keep the characters together throughout the sketch. We set our sketch in a pastry shop, involving one Client and one Seller. The Client is a regular character, while the Seller is the comic character who refuses to sell the cake (thus the cake is the object of conflict and their client/seller relationship what bounds them together). The Client is obese, and the attitude of the Seller ranges from being plain insulting to stress the fact he is overweight as a reason not to sell the cake.

The punchline would be the Seller trying to sell something else. We defined the Seller would want to make the Client angry, and as such it seemed fitting to make him trying to sell anti-depressants when the Client reached that state. After the Client refuses to buy the pills, the Seller, failing to see the inconsistence of his own actions, blames the crisis for the fact he did not sell the other product.

6 Authoring

Authoring in FAtiMA is done by defining a set of actions and goals available to the agent and its personality, meaning the emotional reaction rules and thresholds, as well as their reactive behaviour. Our scenario comprises two agents, and the comicality of their behaviour depends on this authoring as well: how their personality relates to what we would expect of a regular character, and what their Emotional Goal for the scene is.

The actions have a precondition, `sketchMoment`, that filters the actions available in the beginning, middle and end of the sketch. The goals define several aspects: their generic goal of interacting with each other, their Emotional Goals

that promote the Emotional Escalation, and the goal of activating a punchline. The preconditions of these punchline are what define when the moment is right to trigger it - the timing. Following from our scenario, this moment is defined as when the Client achieves a high value for anger, through its reactive behaviour.

6.1 The "Seller"

Since the Seller is a comic character, its personality, following from our model, should be incongruent with that of a regular character. Our Seller appraises actions such as `Insult` as desirable, even though they conflict with the goal of a normal salesman, of pleasing and making business with the client.

The goal of the Seller as a comic character is to annoy the Client. As such two emotions that the Seller will likely want to arouse are arousing Distress in the Client and Gloating in himself. Note Distress is the result of a negative desirability, while Gloating is caused by appraising an event as desirable, but not desirable for others. In our prototype we tested two Emotional Goals. However, here, for simplicity reasons, we consider only the Emotional Goal without Gloating. This Emotional Goal, `DispleaseClient-A`, consists of an initial sigmoid curve of the Client's Distress that is followed by an exponential growth (defined by another guideline). This makes for a change of pace in the sketch, that starts slow, but escalates fast afterwards.

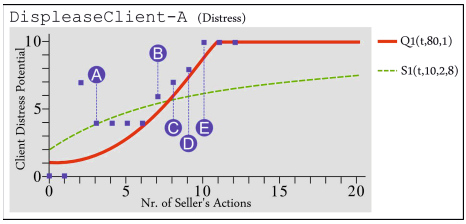

Fig. 2. Emotional Goal DispleaseClient-A. Letters represent actions: A-RaiseMoralIssues, B-Reason, C-WarnHinderAppetite, D-MakeSarcasticRemark, E-MakeFatPeopleJoke, F-FormallyComplain

The output resulting of this Seller's Emotional Goal can be seen in figure 2. We can see both Distress Emotional Guidelines that are part of this Emotional Goal, a Sigmoid, we dub S_1 and a Quadratic we call Q_1. Before explaining how each action was selected, recall Distress is the result of negative Desirability, according to the OCC theory. Note also that, since the desired effect is to distress the Client, the emotional output shown in figure 2 refers to the model of other the Seller has of the Client. The actions (represented by order in the x-axis) are of the Seller.

At the beginning, the most influent guideline (remember the higher the emotional potential defined by the guideline, the more importance it is given by the heuristic) is the Sigmoid, S_1. This Sigmoid has a slow growth rate, and this is

why the initial action chosen – `RaiseMoralIssues` repeats several times, as the Quadratic guideline grows to catch it.

The sketch only proceeds when the Quadratic guideline's value is bigger than that of the Distress potential of action `RaiseMoralIssues`, choosing a more undesirable action, which is `Reason`. From here on, the exponential guideline gains preponderance, making the sketch evolve at a faster pace. The Seller selects the action `WarnHinderAppetite`, followed by `MakeSarcasticRemark` and finally `MakeFatPeopleJoke`. These actions are more and more undesirable, leading to a growing Distress of the Client. The `MakeFatPeopleJoke` is appraised by the Client as especially undesirable (and also as undesirable for the target of the action), which angers the Client in such a way that it triggers the punchline.

Note how the shape of the guidelines helps set the pacing of the sketch. In a second prototype that defined a more complex Emotional Goal for the Seller that included a Gloating Emotional Guideline, we also reduced the growth rates of the several guidelines. This resulted in a longer sketch, in which the Seller repeated some actions, such as `MakeSarcasticRemark`. By adding the Gloating guideline some actions also were not chosen for the sketch.

6.2 The "Client"

The Client is a regular character. As such his reactions are more in line with what should be expected of someone in that situation, appraising events such as `Insult` as highly undesirable. Since its behaviour is not incongruent, the Client could perhaps be authored without emotional goals, as its actions are mainly reactions to the Seller's inappropriate behaviour. However we defined his behaviour through an Emotional Goal. The initial goal of the Client is to accomplish his goal of getting the cake; we define this as a Joy emotional guideline. However, as the Client is provoked, he will need to react by making actions that recover his hindered pride. As such the Client also has two Pride emotional guidelines.

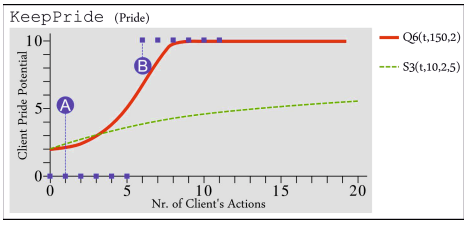

Fig. 3. Emotional Goal KeepPride. Pride guidelines only, Joy guideline not shown. Letters represent actions: A-AskCakeOrCandy, B-FormallyComplain.

We can see the representation of the Client's emotional goal in image 3. The simplicity of the Emotional Goal attributed to the Client reflects in his simple behaviour, selecting only two different actions, `AskCakeOrCandy` and `FormallyComplain`. In the beginning the most relevant guideline of the Client is

the sigmoid Joy. Though this guideline is not shown in figure 3, the `AskCakeOrCandy` action generates a level of Joy that is just below the guideline value. It also produces Pride, though the potential of the emotion that results of this action is below the threshold level of the Client, which means the Client himself does not feel that emotion as a result of `AskCakeOrCandy`.

The second action, `FormallyComplain`, is chosen because of the rapid growth of the Pride guideline. There are several other actions the Client could do that are praiseworthy, for example `Reason` and `DemandRespect`. However the Client appraises reasoning as undesirable, while `DemandRespect` has an emotional precondition that requires the subject of the action to feel Reproach towards the target.

7 Evaluation

To test if the prototype complied with our model and analyze its potential we devised an online questionnaire presenting a video of the sketch. Two versions were evaluated, but here we only discuss the one that used the Seller's emotional goal without Gloating (`DispleaseClient-A`). This questionnaire registered 75 responses out of which 37 were males and 38 were females. The multiple response questions discussed here are summarized in table 1.

The participants clearly identified Happiness as the initial feeling of the Seller (60% of the answers to Q1) while a significative number did not identify the feeling as any present in the list ($25,3\%$). The middle section of the sketch (Q2) presents less clear results, and Worry gathers only 36% of the responses and 28% are unable to find in the choice list a word that could express the Seller's feelings. As for the ending part of the sketch (Q3) opinions are divided between answers associated with Sadness ($49,3\%$) and Disappointment ($42,7\%$).The perceived emotions are thus consistent with both the actions and expressions of the Seller character. Initially the Seller feels glad for seeing the Client, thus Happiness seems the most appropriate answer. As the sketch proceeds, the Seller's smile fades to a neutral smile. Participants had some doubts on how to interpret this, but decided the Seller was worried. In the ending part the Seller fails to sell the antidepressant pills and, as a result, he sports an extremely sad smile. Participants recognized his sadness, and inferred, from the actions and subsequent reactions, the Seller got disappointed for not selling the antidepressants.

The Client's emotional escalation was even more straightforward than the Seller's. Being the regular character, most of the emotional escalation of the sketch was perceivable through him. The initial perception of the Client's feelings is similar to the Seller's, with Happiness being the mode answer to Q7 (57%). The evolution of the Client's feelings is then perceived as a growth of Anger ($61,3\%$ thought the Client was angry throughout the middle section – Q8 – of the sketch, and $70,7\%$ – Q9 – in the ending part).

The majority of the participants (76%) totally disagree the Seller character behaved according to expectations (Q4). We can thus say the Seller was recognized as the *incongruent* character. In contrast, participants agree the Client behaved as expected.

Table 1. Questions stated on the online questionnaire

Question no.	Question
Q1	How did the Seller feel in the beginning of the sketch?
Q2	How did the Seller feel in the middle of the sketch?
Q3	How did the Seller feel in the end of the sketch?
Q4	[Do you agree] The Seller behaved as expected, given the situation.
Q7,Q8,Q9,Q10	Same as 1-4, but in respect to the Client
Q13	[Do you agree] The sketch was too long.
Q15	[Do you agree] The sketch had a good ending.
Q16	[Do you agree] The ending should be better explained.
Q18	[Do you agree] The sketch was funny

The answers on whether the viewers thought the sketch was funny (Q18) was not conclusive with 3 as the median value selected. Some correlations with other questions may provide a better insight on *why* the participants deemed the sketch funny or unfunny.

A Spearman correlation test indicates an inverse relation between perceived length (Q13) and funniness, with a correlation factor (rho) of $-0,366$ significant at the $0,01$ level. This helps make the case that pacing is indeed an important subject in Interactive Comedy. Spearman-rho correlation tests also indicate funniness of the sketch relates directly with the quality of the ending (Q15, rho of $0,597$, significant at the $0,01$ level) as well as inversely with the need of a better explanation for the ending (Q16, rho of $-0,356$ significant at the $0,01$ level). This relation stresses the importance of the punchline of the sketch, and the way it derives from the buildup. Our model accounts for the link between buildup and punchline through the preconditions that are needed to trigger a certain punchline. However, the buildup could probably be bettered by adding a bit more context to the actions each character selects. Taking in account how the perception of the sketch's length contributes to humour, we can also consider that more jokes are needed to be triggered in the intermediate part of the sketch to enrich the buildup.

8 Conclusions

Our proposed model divides a sketch structurally into three parts, in which a conflict is introduced, developed and finished. The development of the action in the sketch is based on the concept of Emotional Escalation. We propose agents behave not only as characters but also as actors that play characters. As such they guide their actions in relation to an Emotional Guideline, that maps the scene time into the emotional output. The pacing of the sketch can be controlled by the shape of these guidelines, and how fast or slow they contribute to the Emotional Escalation. An Emotional Escalation is the evolution of emotions towards an emotional peak in which the sketch is resolved. Also, the preliminary

results of our study indicate that this is a promising start, since the viewers identified this process and the evolution of emotions in the agents.

We have implemented this model as a prototype built upon the FAtiMA agent architecture, and tied it to an animation system that is capable of expressing the agents emotions and thus portraying the emotional escalation. The assessment of the comedic value of the resulting sketch is encouraging albeit non-conclusive. The relation between the perceived length of the sketch and its funniness suggests pacing should be a topic of interest in Interactive Comedy.

This work contributes to how Interactive Storytelling may mingle with the comedy genre, and how that can be tied to autonomous affective agents. Our model relies heavily on authoring, both for the characters personalities and on the Emotional Guidelines. With further understanding of how the evolution of emotions of characters takes place in comedy, the agent itself could use this knowledge, reducing the authoring and improving the ability of the agent to change its behaviour according to his appraisal of the world and of his interaction with other agents. Our evaluation suggests as well that the actions selected during the sketch should be more coherent and provided better context. Also, since humour is so connected to our social interactions, integrating the possibility of interacting with comic agents could probably also improve its comic value.

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3D Simulated Interactive Drama for Teenagers Coping with a Traumatic Brain Injury in a Parent

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Abstract. This paper describes the current state of a pedagogical immersive 3D story TBI-SIM and the changes that have been made to it. The system is a narrative simulation in a fully immersive 3D world in which the user controls a character that can interact with non-player characters (NPCs). The users achieve goals and make decisions that have an impact on the course of the story.

Keywords: Interactive Drama, Interactive Narrative, Pedagogical Interactive Drama, Pedagogical Narrative Simulations, Educational Games, IDtension, Traumatic Brain Injury.

1 Context

1.1 Traumatic Brain Injury

Children and adolescents undergo a dramatic change in their family life if one of their parents has a traumatic brain injury (TBI). Interactions among family members change rapidly and, often, for the worse; and new responsibilities are thrust upon the child or adolescent, who may be overwhelmed by feelings of guilt, anger or helplessness [2,6].

Our research project aims to develop and deliver educational material to youths faced with TBI of a family member. Based on testimonials we obtained through focus groups and interviews with families, we developed scenarios of everyday situations in an imaginary family in which members have to cope with the father's TBI.

1.2 Techno-pedagogical Environment

The *IDtension* interactive drama engine has been used to implement the scenarios [9]. They are then displayed on the *Unity* game engine [12]. By playing a virtual character involved in short pedagogical stories (with a few goals to achieve), users experience different kinds of behavior. The experience of both usual and unusual situations in a safe simulation environment can be a good basis for further exchange in a real or a

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virtual focus group, or for therapeutic sessions with a psychologist. The 3D simulation that we developed provides an immersive interactive environment that readily engage users [3,4]. Engagement is reinforced by the narrative nature of the user experience, which focuses on relevant and striking situations, instead of simulating scientifically social relationships within a family.

IDtension [9] is the underlying drama engine used to generate narrative actions, which does not rely on any branching or conditional branching mechanism, but generates appropriate actions on the fly, based on narrative rules and algorithms (see [9] for a full description of the engine). As a result, the engine enables a large number of choices, which differentiates the current demonstration from most pedagogical narrative simulations (e.g. Heart Sense [7], Carmen's Bright Ideas [5], FearNot [1] or Scenejo [8]). This larger number of choice aims at providing a greater engagement to the user.

The system described in this paper is an improvement over an earlier demonstrated version [10]. Changes covered in this paper are about the scenario, the text-to-speech integration and the end-user interface.

1.3 The Scenario

This demonstration presents the third version of the scenario. The user plays the role of Frank, a 16-year old teenager living with his parents, his younger sister, and his grandmother. His father Paul had an accident some years ago and now suffers from frequent mood changes, memory problems and socially inadequate reactions. At the beginning of the scenario, Frank is at home with his father, his sister Lili and his grandmother Olivia. His mother Martina is still at work. She asked him to prepare the dinner. But Paul has forgotten to buy what he was supposed to buy earlier at the supermarket. Frank has to find a solution. During the scenario some other events like the visit of a friend, a phone call from Martina, Paul's mood changes, etc. modify the flow of the story and hinder Frank's efforts to reach his main goal: prepare dinner. These events can lead to new goals to achieve like giving his medicine to Paul.

In this version of the scenario, events pop during the experience to disturb users. In the previous version of the scenario, there was only one main goal to achieve, that is, to welcome Frank's school friend Julia and give her book back, which started always at the beginning of the game. While trying to do that we had to stop Paul from drinking alcohol, which constituted the only event. Now, with the latest version of the scenario, we have no predefined event at the beginning of the game but one main goal to achieve, to make dinner. Random events will start to run to complexify the simulation while we try to make dinner.

2 Technical Implementation

2.1 Unity and IDtension

The real time 3D engine, *Unity* [12], was chosen to develop this learning game. The 3D environment and the user interface are implemented via scripts written in *C#*.

Unity allows compiling the project on several platforms with the same code. The project is mainly compiled to the web version to allow online access without installation.

IDtension [9] is the drama engine that dynamically generates all dialogs in the game. Narrative components of the scenario are written in XML files and *IDtension* translates them into different situations that make up the user's experience. *IDtension* is *Java*-based and can be deployed on several platforms.

For the Internet-accessible version, The *Unity* scripts are compiled on a *Linux* server where *IDtension* is also hosted. Both programs communicate via sockets. The project is accessible via a web page that launches an execution of *IDtension* for each user.

2.2 Text to Speech

In this prototype, the characters can talk. The use of recorded human speech, as in *Façade*, would have created high quality dialogs, however, it seemed to be not feasible for our project because of the high rate of all possible dialogs. Even techniques for assembling small parts of dialogs together would have required a huge amount of recording that we could not afford within the scope of the project. Therefore, a text-to-speech technology was introduced.

We chose "Natural Voices" technology from AT&T because it was the only one that contained enough voices for all our characters for the sake of the project. Nevertheless, we are open to adopt another text-to-speech technology in the future to include emotional variations and more languages (French in particular).

Text-to-speech technology allows us to use sentences generated by IDtension and to transform them into a sound file on the fly that is loaded by Unity and that is attached to the character who speaks. Since Unity supports 3D-sound, the volume of dialogs changes according to the distance between Frank and the speaking character. The version presented in this demo is fully voiced by "Natural Voices", using male and female voices that speak in American English.

3 User Experience

3.1 Navigation

The scene takes place in a specific part of a house including the kitchen, the living room and the entrance. We replaced each 3D model of *TBI-SIM* (except characters) with a low polygons model to produce better performance and to maximize compatibility with old computers.

Physical navigation can be performed in two different ways. The most common way of physical navigation consists in using arrows on the keyboard and/or mouse to move the character, as is commonly done in many videogames. The second navigation system is more immersive, as it uses a large projection-based screen and a *Wiimote*, with users standing in front of the screen.

3.2 Interaction Mechanisms

When users approach a non-player character (NPC) they can see the character's portrait appear at the top center of the screen to show the current addressee (see figure 1). Then, users can interact by pressing the action key ("Enter" on the keyboard or "A" with the *Wiimote*) or by clicking directly on the addressee's portrait. This two-step interaction avoids a possible long list of choices that may appear each time the player character walks to another character. Alternatively, users can click directly on the character. A transparent window then appears and lists all the actions the user can undertake with this character.

NPCs in the scene have an "idle activity". "Idle activities" are behaviors that characters perform when they receive no action from the narrative engine (like talking to another character for example); they help to give life to the simulation. An "Idle activity" can be someone sitting on the sofa and watching the television. While the user is interacting with a NPC (i.e. when the user is choosing among different options with him), this NPC cannot move anymore and his "idle activity" is disabled as long as the user is interacting with him. If this NPC needs to execute a behavior as part of a narrative action (sent by the narrative engine), it will start this activity, but the user will be able to launch an action with him, since the player character has priority over all behaviors (except the ones he is already involved in). It means that Frank can stop a dialog between two NPCs to start a behavior with one of these NPCs.

In early versions of TBI-SIM, interactions were possible only between two characters (between NPCs or between Frank and a NPC). For example, at the beginning of the scenario, users could talk to Olivia and ask her for a solution to prepare dinner. She might have answered that food was in the fridge for dinner. Then, the user had to interact with Olivia again to be able to open the fridge. Now direct interaction with objects is also supported, in the same way users interact with characters. This integration of interactive objects in the 3D simulation makes it possible to enrich the scenarios, generate higher levels of coherence, and better approximate real-life settings. In the current state of the scenario, the user can interact with a few objects like: the fridge, the television, a chair, Paul's medicine or the broom.

3.3 Action Selection and Execution

To design a user interface (UI) for an interactive drama is challenging. The UI needs to offer many possible choices (e.g. 10-15), while remaining unobtrusive, in order to favor immersion. Furthermore, the user risks being overwhelmed by parallel dialogs intervening between non-player characters.

Fig. 1. The user interface when interacting with a NPC

While usability issues have not been entirely solved, several changes have been made to improve the demonstrations' usability and immersive quality.

First, the portrait of the current addressee, is only shown during direct interactions with another character instead of a blank portrait being displayed when there is no addressee, which reduces visual clutter. At the same time, the number of possible actions is now displayed inside the portrait (see Figure 1) in order not only to highlight the specificity of such a learning game (number of choices) but also to allow users to anticipate the possible length of the list of choices that they might be faced with when clicking a portrait icon.

Second, in the list of choices displayed to the user when interacting with a NPC, the choice have been made easier by changing the order of actions. On the top are displayed actions that the narrative engine considers as more relevant at the time of interaction, leaving less relevant actions at the bottom. Relevance is a criterion that is calculated by the narrative engine to score and rank actions for both NPCs and the player character. It measures the fact that an action is more or less relevant in the context of the previous actions, for example, a question is relevant if it follows the corresponding question (see [9] for details). This type of ordering is based on the ergonomic principles of guidance: we estimated that the user would select preferably the most relevant actions, so we put them at the top . If not satisfied with the top choices, the user can browse other actions and choose another option. Other ordering could be experimented, too. Further research would be needed to assess the pedagogical and ergonomic value of such different ordering options.

Third, the dialogs in which Frank, the main character is involved, are now clearly distinguished from the dialogs between non-player characters (see Figure 2). In the previous version of TBI-SIM, all dialogs were shown in the same way, including those that didn't involve Frank. In the current scenario, it was observed that NPCs dialogs were of lesser importance than Frank's dialogs and they created some confusion in parallel dialogs. Consequently, they were made smaller to be distinguished. By this method, users focus on Frank's dialogs when both occur at the same time. Moreover, when Frank turns his back to NPCs who are talking with each other, their dialogs are hidden (But can still be heard in the voiced version). Dialogs involving Frank take the whole width of the screen and are always displayed at the bottom (Contrary to NPCs dialogs which can be hidden).

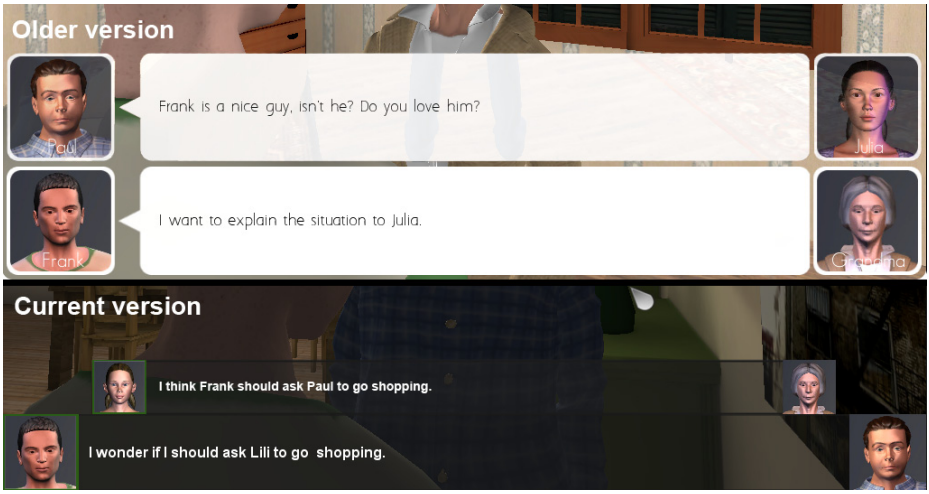

Fig. 2. Comparison between the older and the new dialog system

3.4 Resulting Experience

The interactive drama starts with an introduction to the story and various help screens that the users can consult or skip. Then the users navigate in the room and interact with the present characters to make the story move in one direction or the other, as illustrated in Fig. 3. Playing an entire story lasts about 15-20 minutes.

On a preliminary test with 38 users, on average, 22.6 distinct options were available whenever the user was making a choice. This largely exceeds what the authors could have reasonably written. This was achieved with a scenario containing 35 goals (but note that the number of choices does not solely depend on the mere size of the scenario, but also on its structure).

Fig. 3. Series of screenshots illustrating the user experience. 1) The game introduction explaining the starting situation and the main goal. 2) The user controls Frank with keyboard arrows or clicking on the ground or on a character. 3) Following a click, Frank moves to the desired location. These movements can be cancelled at any time. 4) Paul's portrait appears, Frank can interact with him because he is within distance. 5) By clicking on Paul's portrait, a list of actions appears. 6) A dialog between Frank and Paul has started. At the same time, two NPCs are discussing together, because the engine has launched two actions in parallel.

4 Conclusion and Future Work

The *TBI-SIM* demonstration constitutes an example of a fully implemented interactive drama that can be accessed online. Carried out by a plural-disciplinary team (Artificial Intelligence, computing, graphical design, writing, clinical psychology), the project has produced a succession of prototypes aiming at delivering a novel, engaging and pedagogically relevant experience to the user.

The benefit of the product is currently under investigation. An evaluation of the user experience based on the IRIS evaluation scales [11] will be conducted with approximately 30 users. Furthermore, the participants will fill a specific questionnaire regarding the perceived relevance and usefulness of the experience.

An early version of this demonstration was presented to a general public audience in May 2012 in the 100th anniversary celebration of the faculty of psychology of the University of Geneva. About 40 people played the game in its immersive version without voices. Children and young adults where particularly attracted by the simulation and expressed curiosity and interest.

Beyond evaluation, possibilities of improvements over the current version are numerous. First, we plan to improve the communication from the game engine (Unity) to the narrative engine (IDtension) so that an obstacle (a key narrative element in IDtension [9]) could be triggered by the physical environment. Second, we plan to integrate a behavior engine to facilitate the authoring of characters' behaviors. Third, the dialog engine can be improved. In the current version, generic sentences are used for some narrative action types (e.g. Encourage, Congratulate), which is powerful. However, in some cases, the use of specific formulations would be more appropriate to provide a well-written dialog. Fourth, we plan to add the functionality of *scenes*: A scenario unfolds through several scenes that occur possibly at different locations, with ellipses between them. The challenge is to generate and trigger these scenes dynamically. Fifth, we will investigate multi-party interaction and the computation of the visibility of actions between characters as well (e.g. the computation of what characters learn at the narrative level from what they perceive at the physical level). Sixth, in order to facilitate authoring, we plan to add the possibility to access and modify authoring files on the fly during the execution of a scenario.

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Interactive Video Stories from User Generated Content: A School Concert Use Case

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Abstract. This paper describes a web-based narrative system able to generate video compilations, framed as event stories, from a shared repository of video recordings of the event itself and possibly of related events. For this, it employs narrative techniques informed by TV documentary. The generated stories are dynamically personalised, in that the system is able to adapt them to the choices and preferences expressed by the active viewers during narration. The system has been prototyped for the case of school concerts. User evaluations indicate that experiences founded on story navigation rather than sharing individual media assets is a rewarding one and point to further areas of development in interactive storytelling in the context of user generated content.

Keywords: interactive narrative, interactive storytelling, digital storytelling, computational narrativity, video, user generated content, media share, interactive television, NSL, ShapeShifting media, SMIL.

1 Introduction

Recent advances in non-professional video camera technologies have transformed the way we capture important events and experiences in our lives. Cheaper, easy to carry and operate video cameras now seem to always be available to record moments of the social events in which we partake. The richness of video makes it a very attractive recording medium for what we believe could later become valuable memories.

Nevertheless, the ability to capture video recordings with such ease does not necessarily result in them becoming easily accessible memory objects that generate attractive and rewarding recollection experiences. The actual result is that a large amount of socially significant content is captured only to be shared as fragments of video material. A specific clip may be chosen and uploaded to a public internet channel on YouTube[1] or Vimeo[2]. Alternatively, a user could edit a video with

[1] http://www.youtube.com

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 183–195, 2012.

software such as iMovie[3] or professional products such as Adobe Premiere[4]. Newer web based alternatives such as WeVideo[5] are available as well as mobile applications including VidTrim[6] and Splice[7]. These methods fail to allow for the exploration of all the potential narratives that could emerge when all the available captured content relevant to the events is pooled together. For example, at any typical social event many family members and friends could be filming. The whole collection of clips offer the potential for richer stories to emerge, as different individual clips could complement and contextualise each other and could provide different perspectives and levels of detail. This possibility led us to pose the following research question:

> Could professional video narrative concepts and techniques be employed to the *automatic* generation of personalized video stories from a common repository of user-generated recordings of social events?

We explored this question within the specific case of a high school music concert by developing a prototype system which would enable the uploading, automatic tagging and transcoding of video material from a wide variety of sources into a repository. This repository in turn would need to be accessed by a narrative engine which could interpret the content of the clips and assemble them into meaningful and compelling video narratives. The narrative engine would have to be *instructed* on how to construct such narratives—adopting a declarative knowledge representation approach, this process consisted in constructing narrative structures in a dedicated language, according to story structures informed by existing editing rules and grammars from cinema and television. Finally the system would need to be applied to a specific use case, which in this. This is the story recounted by this paper.

The paper is structured as follows: Section 2 looks at related work. Section 3 outlines the narrative concept that guided the design of the prototype system and Section 4 details its implementation. Section 5 describes findings from user trials which took place at Woodbridge high school in the UK in November 2011 and Section 6 offers conclusions and pointers to future work.

2 Related Work

In our work we consider a narrative-based approach to automatically compile personalized video stories from a shared repository of user-generated recordings of social events. The discussion of related work, therefore, is approached from a number of perspectives including video mash-ups, automatic video-based storytelling, interactive cinema, time-based video navigation and video summarization.

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[2] http://www.vimeo.com
[3] http://www.apple.com/ilife/imovie/
[4] http://www.adobe.com/products/premiere.html
[5] http://www.wevideo.com/
[6] https://play.google.com/store/apps/details?id=com.goseet.VidTrim&hl=en
[7] http://spliceapp.com/

A first perspective is that of video mash-ups and content repurposing. Kennedy and Naaman [1] apply content analysis techniques for UGC on the Web in the domain of live music capture; they describe a system for synchronization and organization of short video clips that are taken at a single live music event by multiple contributors. Using a novel synchronization algorithm, their system is capable of automatically generating a time-line representation of the event which enables overlapping clips to be displayed simultaneously. Shrestha et al. [2] report on an application for the creation of mash-up videos from YouTube recordings of concerts. They present a number of content management mechanisms (e.g., temporal alignment and content quality assessment) that are used for creating a multi-camera mash-up. They suggest that the final videos, produced by their system, are perceived almost as if created by a professional video editor. Shamma et al. [3] propose a system which employs content analysis tools to automatically extract metadata from social media content, integrated with metadata from user interactions, in order to identify key segments in video clips and improve the accuracy of the synchronization between clips relating to the same event. Zsombori et al. [4] report on a system that is capable of automatically generating personalized video narratives, based on a single song, recorded during a school concert by multiple contributors. After the alignment and synchronization of video clips to a single master audio track, a set of higher level cinematic rules are applied to construct an automatic assembly; these rules are expressed in a production-independent language and interpreted by a generic narrative engine.

These approaches, though most of them are framed in more ambitious contexts, share a common trait: a main focus on content analysis, automatic alignment, indexing and synchronization of clips, with the objective of producing an aesthetically pleasing multi-camera coverage of a single song. In our work we try to move beyond the coverage of a single song, by placing individual songs, or key fragments of songs, in a more general story framework, in order to be able to tell more complex narratives, such as the story of the drummer in a concert, or the story of a concert in the context of a school's life.

A second perspective is that of automatic storytelling that takes into account end-user input. In this context various AI approaches have been suggested, and some reviews are presented in Cavazza et al. [5] and Riedl and Young [6]. A main thread of investigation has so far focused on generated content, often involving intelligent animated characters (e.g. Ibanez et al. [7]), leading to less structured and more emergent narratives which are not constrained in story terms by a fixed pool of video recordings.

Cinematic theory is often at the heart of attempts to enhance the presentation of automatically generated narratives [5]. Ronfard [8] explores this in the context of video games but also alludes to their relevance in interactive storytelling and automated movie production. Mancini and Shum [9] has explored links between cinematic practice and the hypertext medium which itself offers parallels with interactive narrativity. In this context, the discourse is made up from a chain of fragments (shots which together make up story elements) made by the author and in hypertext discourse this chain is co-produced by the author and the user. Maintaining story coherence and cinematic expressiveness is one of the key challenges in this context.

Recent work by Gilroy et al. [10] builds on the associations with hypertext and explores the relevance of time-based media navigation in generated 3D interactive narratives. Their work employs a story timeline as a navigation interface, rather than purely relying on AI techniques, which produces action sequences that are based on a pre-authored space of narrative actions. This development is important as it explores the importance of time-based narrativity and how it can enrich story generation systems enabling longer, coherent and more convincing interactive stories.

Davenport and Murtaugh [11] describe an evolving documentary prototype based on a bi-directional mapping between units of content and units of description. The relative weights of these descriptors define a story context. Also, descriptors are exposed to users as interactions, in order to influence the story context which in turn influences the sequencing of content. While our work is similar to this in terms of annotations-based content assembly, it moves beyond the direct correspondence between clips and annotations by allowing annotations attached to higher level story structures, including the timeline.

A recent result is reported by Porteous et al. [12], which describes a video-based storytelling prototype which is able to generate multiple story variants from a baseline video. This is more related to video summarization than to story assembly from a shared pool of video fragments coming from different users.

The potential for integrating story-level interactions with TV has been investigated by Ursu et al. in [13] for three main genres: drama, news and documentary. The study has been carried out taking the Narrative Structure Language (NSL) and the corresponding ShapeShifting Media toolkit [15] as a basis, NSL being a genre-independent machine-understandable language capable of representing interactive narrative story spaces. The focus of the study is on professional content and considers interaction as inherent part of both production and postproduction—i.e. footage is created with interaction in mind and is subsequently authored into interactive narrative spaces using tools such as ShapeShifting Media. The work presented here adopted these ideas and extended them to the context of user generated content (UGC).

Barry [17] describes an approach to automating processes in documentary videography filming and pre-production using a common-sense based approach and a knowledge base aware of the important distinction between *subject sense* and *cinematic sense* i.e. what is shown and how it is shown. This falls more into the category of automatic story *creation*, where narratives *emerge* through the application of AI techniques. *Vox Populi* by Boconi [14] is an example of an approach that focuses more on story *telling*—documentaries are created from a pool of video fragments, based on a higher level description of rhetorical structures. A similar approach is taken in *A Golden Age* [16], an interactive documentary about the renaissance in England, whose interactive narrative structures are represented in NSL [15]. The work presented here keeps the focus on story *telling*, but explores this concept in the context of repositories of UGC. There is still a structured representation of an overall interactive story space, but there is no control over the way the content is captured. The content structures that can be made and exploited are only those emerging from the structure of the covered event itself.

3 Narrative Concept

The core of the narrative concept is the adoption of expert documentary production as a model for automatic video storytelling of events covered in a non-coordinated and non-scripted way by the end users themselves. In particular, we focused on the notion of a *sequence*—a sequence is a unit, populated by audio-visual material, which serves the purpose of a narrative building block and could represent *segments of time, events at a location* or *a developing idea* [18]. The term sequence also refers to the collection of the relevant material available to the editor of the sequence as well as the existing edit of it.

In the context of a school concert, for example, a professional director, in order to cover various story possibilities, might employ the following sequences: interviews with performers beforehand, following the characters of the important relations into the concert venue, material covering what is happening off-stage, relevant highlights of the performance itself and post-concert party footage. Each of these would have a *story function* attached to it, for example, the first set of interviews could be used to *introduce a key character*, the concert venue material would *show the context of the event,* the performance footage would be the *core material* showing the success or less laudable performance of the individual performer and so on. If the story is to be centered around a performer, say Philip, then an edit might look like this:

- Interviews with Philip talking about the event - *introduces the main character*
- Footage showing the location of the school grounds and the hall from the outside - *introduces the place/venue*
- Rehearsal sequences assembling some of the less successful moments– *contextualizes the performance and provides a jeopardy for Philip to face*
- Context sequence showing the venue being prepared and the audience arriving – *locates the event in time and announces its beginning*
- Philip off stage preparing his instrument - *continues the story of Philip's feelings*
- Quick sequence of highlights from musical performances preceding Philip's in the programme – *moves the story of the concert forwards in time and sets a quicker pace.*
- The song in which Philip is a main performer, with a focus on Philip – *the slice of time at the core of the story.*
- Applause and reaction from the audience – *the jeopardy has been overcome*
- The party afterwards and Philip talking of his success – *concludes the narrative arc*

These sequences are flexible. For example, the director and editor might decide that the first section of interviews don't highlight the elements of character they wish to highlight so they might choose different material from the same interviews to populate that sequence. Alternatively, they might feel that the story of a different performer serves the purposes of the story better, so the same set of sequence types could still be used, but with different footage showing a different performer Sequences function as generic model.

This concept of flexible story units underpinned our approach to building narrative structures for automatic storytelling of a school concert, but with two key constraints in mind. Firstly, we acknowledged that it is not possible to model all of the complexities, and match the quality, of a professional director. Secondly, the video representations available to the narrative system are limited by the material provided to the system by the amateur users (friends and family filming the event) as opposed to material shot by professionals. Nevertheless, some, at least semi-professionally shot footage, might also be assumed to be available (e.g. a professional cameraman employed for this task).

With these limitations in mind, our approach was to return to the structure of the school concert event itself and define a set of generic sequence types which would form flexible narrative building blocks. We maintained the assumption that, in the context of a school concert, the stories of most value are, like the story about Philip, about the protagonists. The sequences represented computationally would need to be flexible to allow for stories about different protagonists, with different lengths and highlights to be automatically compiled. The event (concert) as a whole was represented as the following sequences:

- *Concert Context*. Could be made up of material that shows the concert venue, the audience arriving or the piano being tuned. Could apply to material from before the start or after the end of the main concert event.
- *Concert Opening*. At a given point the master of ceremonies introduces the concert to the audience.
- *Songs*. Each concert is made up of individual songs.
- *Concert Conclusion*. The master of ceremonies offers thanks to the attendees and the performers share a few words with each other.
- *Aftermath*. Drinks are given and performers and audience leave.

In turn the *songs* sequence is made of:

- *Song Presentation*. Introduction of the particular song and performer(s).
- *Preparation*. The performer(s) arriving on stage preparing themselves.
- *Song Opening*. Starts on the actual first beat of the performance
- *Song Highlights*. Sections of the song that might best illustrate the qualities of the performers and the protagonists.
- *Song Conclusion*. Ends on the last beat of the performance.
- *Applauses*. Audience reaction to the specific song.

The main linking material between these is provided through events such as:

- Rehearsals
- Interview/Video diaries
- Personal Context material. Footage of the performers or relatives in different contexts to the main concert hall.

In the same manner that professionally produced sequences can be edited in different ways to tell different stories, the automatically edited sequences need to allow for

different video clips to be assembled within them to tell stories of different protagonists, of different lengths, with different highlights, etc. In order for the appropriate clips to be chosen within a sequence, the video clips themselves need to be described, computationally, according to the semantic structure of the event (concert). The narrative system needs to recognize: the *type of shot*, e.g. close-up, medium, wide, cutaway or contextual; *who is in the clip*, i.e. which protagonists are viewable in the clip; *what is in the clip*, e.g. if not showing protagonists, it may be showing instruments, *where the clip is filmed* e.g. in the concert venue or rehearsal studio and *when the clip was filmed*, in other words, the event the clip represents in time, e.g. the second rehearsal which takes places two days before the performance or 30 seconds of the performance itself. Clips also have a *synchronous* or *non-synchronous* relationship with sequences. In the former, video clips need to be chosen in strict time with the relevant section of a master soundtrack; in the latter, the clips can be sequenced together with the length of the sequence defined by the choice of clips themselves. These descriptions, obviously with certain limitations, can be determined automatically. They provide the ability to flexibly combine synchronous with non-synchronous material, and to allow for variation within sequences in terms of both the *subject* and the *cinematic* sense, allowing the computationally expressed narrative structures and therefore the narrative system to cater for stories that draw on all aspects of a concert and its associated footage, rather than simply assembling a straightforward sequence of songs. The system, thus, tells stories of people involved in the event, rather than simply following a sequence of songs, which might not even qualify for the term "story".

With this model, choices can be exposed to the viewers who can therefore interact with the narrative system. Choices and preferences could be expressed at the outset of storytelling, such as the protagonist who becomes the "hero" of the story, but also during storytelling, such as requiring more detail on a particular fragment of the story or changing the protagonist, as the story itself might influence the choices made at the beginning For example, the viewer could express the wish to see more of the finger work on the instrument of the current performer or the wish to see the performance of a different individual. This interactivity is supported through the flexibility of the defined sequences. For example, the former would inform the selection of video clips in the current sequence, i.e. change the cinematic choices, whereas the latter would change the content of the subsequent sequence, i.e. change the subject matter. The interactive aspects, obviously, ought to be authored in the overall narrative space.

4 Implementation

We built a narrative system whose main functionality is the ability to automatically edit personalized interactive video compilations based upon the concept of *sequences*, as described above. The people who participate in a social event, a school concert in our case, only need to upload their video recordings into the system's media repository and then, each time they engage in a viewing session, the narrative system selects appropriate content from the shared repository – by all contributors – and edits it into a documentary-like video compilation.

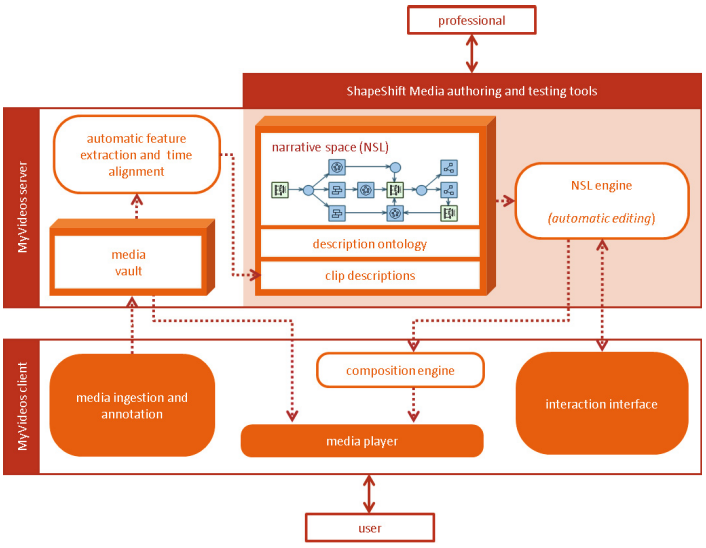

Fig. 1. The high-level architecture of the narrative system

When watching, interaction cues are overlaid on the video that can be interacted with in order to change the story in real-time. The interactions allow for the change of protagonist, change of focus (performer or instrument) and change in the level of detail (duration). Unlike hypertext, the interactions do not cause a sudden change, but as the viewer keeps watching and interacting, the video adapts smoothly and maintains story continuity. The architecture of our narrative system consists of three main components: the media vault, the narrative logic and the user interface. Fig. 1 provides an overview.

The *media vault* contains the video files recorded by the users during, before (e.g. rehearsals, the audience gathering before the concert, etc.) and after the concert (e.g. the audience leaving the hall) on their handheld cameras. In addition, the vault contains a high quality soundtrack of the event that was recorded by the school. It also contains the footage of a master camera that was locked off and recorded continuously. In our trials, this was tripod-mounted, not moved during the performance, and framed to have a view of the entire event.

The content is automatically transcoded to a standard format (H.264) and aligned automatically to a common timeline, based on the audio track [19]. By lowering the cut-off threshold of the alignment tool, a considerable part of the rehearsal footage – recorded outside the concert – can also be aligned automatically to its corresponding performance audio track. A commercially available video editing tool (Final Cut Pro X[8]) is used to automatically detect the shot types of individual clips. This process, in our system had to be triggered manually, but there are encouraging signs that a simple script can automate this process[9]. The result of the shot type detection is a set of

[8] http://www.apple.com/finalcutpro/

[9] http://www.digitalrebellion.com/blog/posts/final_cut_pro_x_from_a_developer.html

mappings, in XML format, that is imported into our system by a simple conversion plugin. The reliability of the shot detection algorithm is very high with 96% of shots detected as close ups being correctly detected. The boundaries between what constitutes a medium shot and a wide shot seem less clear however allowing for some subjectivity the accuracy is of a similar level. Additional shot type information, such as cutaways was added manually. A prototype system that does face clustering and detection fully automatically based on representative photos provided by the users is currently being worked on (this is more a technological than a research issue). This effort is currently conducted manually.

The *narrative space* is described in the Narrative Structure Language (NSL), a declarative representation language for interactive video narratives [15]. This description defines any possible narration, based on the concept of *sequences*, using powerful hierarchical NSL composition constructs. The implementation of the sequences is an extension of the synchronous coverage of audio segments detailed in [4]. The narrative space is decoupled from the actual media; the content is referred to via its *clip descriptions* that result from the annotation process. These descriptions – annotations – are organized in a *description ontology*.

The narrative space is defined by a professional author, who also defines the description ontology and annotates the master audio track to define the event structure, as described in the previous section, using the ShapeShifting Media Authoring Tools [15]. The consequence of the decoupling between the narrative space and the actual media, is that the narrative space becomes a computational format that can be applied to any collection of content, recorded in a school concert, that is described according to the description ontology.

The structures are interpreted by an *NSL engine* that takes into account the interactions, provided by the user at viewing-time, to generate a personalized stream of dynamic playlist fragments. Each viewer has its own dedicated engine instance, running on the narrative server, for the duration of its viewing session.

The user interface consists of the *media ingestion and annotation tool* and the *playout* system. The former aids the users with uploading their content. It also triggers the automatic alignment and annotation process and provides an easy-to-use interface for manual adjustment of the resulting annotations.

An important constituent of the playout system is the composition engine that interprets the playlist fragments compiled by the NSL engine, fetches the appropriate media from the vault and ensures their seamless assembly and playout in the media player. The notation of playlist fragments follows the SMIL standard [21]. In our system we used a modified version of Ambulant Player[10] for composition and media playback, which is also capable of mediating the interactions (render and transmit) between the viewer and the NSL engine.

5 Evaluations

5.1 Approach

For the evaluation of our narrative system, we worked with a high school in Woodbridge (UK), where a concert was recorded in November 2011. The concert

[10] `http://ambulantplayer.org/`

lasted around 1 hour and 20 minutes during which time 18 students performed in 14 songs. A total of 12 cameras were used to capture the concert. Eight cameras were distributed among parents, relatives, and friends of performers. Members of the research team enacting family and friends used other 3, and one stayed in a fixed location (master) and recorded the whole concert. In total about 331 raw video clips were captured, some of which were recorded before or after the event, totaling approximately 14 hours. All the material was provided for analysis, annotation and finally storytelling.

Nine people among performers, parents and other relatives participated in the evaluation of the narrative system between January and February 2012. Five participants were 40+ years old; the other 4 people were teenagers, 3 of which performed in the concert. The participants in the evaluation were instructed to describe their experiences while interacting with the system. The interviewers encouraged the interviewees to detail their experiences and asked additional questions in this regard during each interview.

5.2 Findings

Compilations generated by our narrative system were often well received. One performer commented, '*In itself, it was a fun thing to do. It was [..] a utility software to give you the best impression of the concert, but lets you have some fun as well'*. Users felt they could engage with the material and were keen to try and experiment with the possibilities offered by a narrative based system. A mother of a performer said, "*I was especially keen to use this to create a video of my son playing cello to share with my father who lives in Wales and isn't mobile. I actually don't have any videos of him playing cello as it is often not the done thing to video concerts. I think a tool like this would give an incentive to people to record more, and not only their kids*'. Within this experience users were also able to note the link between television production and the system, one parent stating '*it started to look like a produced version… it was keeping my attention'* and was '*more immersive*' and therefore very different from other ways of viewing user generated content.

It was a positive result that users were both able to recognize an experience they felt was comparable to the TV production paradigm and, as a consequence, imagine the stories they could create as opposed to the media they could explore, i.e. wanting to automatically create a video about a son's cello playing instead of exploring the clips showing her son playing the cello.

However, even if the system showed success in creating a story based experience, the story was not always to users' tastes. One found the opening introductory sections too long. Difficulties were also experienced with the interaction with the narratives. The users who most enjoyed the automatic narrative system enjoyed the fact it took the effort away from them – '*I would prefer to interact less – when I sit to watch I just want to watch*' said a grandfather of a performer and another parent said, '*I didn't want options… I just wanted to let it do it*'.

The users who were more interested in engaging with the interactive features of the narrative system were more ambivalent in their responses. For example, the offering

of interaction choices in an initial introductory section of the compilation came as too late for one user, he wanted to have control immediately over which performer was the focus of the story. For another user the choice of only two performers to choose from was not enough. He wanted access to the whole set of performers. There was an awareness of the potential stories available but if the interaction possibilities available did not allow users the appropriate amount of complexity to explore this space, then it became more of a source of frustration. Equally, the manner with which interactions were exposed was unsatisfactory for some; one user stated they did not appear on screen for long enough. Another was unclear about what a focus on the instruments instead of the performers actually meant in terms of what the video would be like.

Some of these drawbacks could be attributed to the fact that this is a novel approach to media exploration which users are unfamiliar with; one parent of a performer described using the system as '*it was more than just getting into that concert… it was doing something completely different, almost like a different activity*'. However, the question of how to interact with such a narrative system remains to be answered. Whilst the system proved capable of offering a user experience based on navigation of stories, it was a limitation of our implementation that both the method of navigation, and the number of choices available, did not give the users the tools to fully explore the narrative space our approach opened up. Richer interaction mechanisms could be built into the story space, but what is sufficient and at the same time not interfering with the storyline is a question that requires further evaluations.

6 Conclusions and Future Work

We set out to build a narrative system, whose main functionality was the ability to automatically edit personalized video stories from shared repositories of recordings of social events. Our quest was motivated by the number of potential stories that remained unexplored, abandoned on memory cards or files on YouTube, when the access method is video clip based. The research question we asked in this context was: could video narrative concepts and techniques be employed for the automatic generation of personalized video stories from a common repository of user-generated recordings of social events, and thus bring to life the whole footage shot at the event, combined into various storylines?

Focusing the scope of the question onto a specific type of social event – a school concert – and basing our narrative structures on pre-existing methods and grammars from TV documentary production, particularly on the notion of sequence – we found a positive response to this question, with users experiencing and engaging with coherent video stories generated by our system. A multiplicity of potential stories could be generated, from the entire media pool, which would not be accessible otherwise, with existing media sharing tools. The variation in storytelling was substantial and this was achieved by employing the recursive structures of NSL in the representation of the narrative space—i.e. the artifact on the basis of which the narrative system generates the stories. Finally, the effort required a professional to

author the narrative space was reasonable, deeming the paradigm feasible. It is to note, however, that the narrative space is a concise computational representation used in the automatic telling of a significant number of video stories, not their explicit enumeration.

Encouraged by these results we have a number of development plans to explore:

- improving the provisions for end-user interactions
- understanding the response of the end-users to various levels of complexity and sophistication of narrative spaces
- explore different video editing techniques which could be employed to improve the quality and complexity of sequence based narratives and allow for the other potential applications for this paradigm in other areas or scenarios.

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Exploring Body Language as Narrative Interface

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Abstract. The limitations of current technology in the field of user interaction cause a bottleneck in the development of interactive digital storytelling systems. The use of body language has recently arisen as a simple but expressive approach to human-computer interaction, motion capture devices being used in interactive simulations and videogames. This paper discusses the use of these devices for recognition of body movements as key elements for designing interactive stories in virtual environments, presenting our findings in the early stages of development of a serious game that uses Microsoft Kinect for allowing players to interact in a more sensitive and amusing way.

Keywords: Theory of Interactive Storytelling, Narrative Videogames, Edutainment, User Interaction, Nonverbal Communication, Motion Sensing.

1 Introduction

Interactive Digital Storytelling (IDS) is a field characterized by the wide set of problems that it faces. This paper tackles immersion and user interaction, topics that are usually overlooked in practice because most research projects emerge with technical or financial constraints that force the use of simple ad-hoc user interfaces.

When interacting with a computer, we typically use a standard combination of devices: mainly the keyboard and the mouse, maybe the gamepad. These solutions are good enough for conventional software, but things are different in the field of IDS: creating and participating in a story assumes implicit transmission of lots of complex messages to the computer, which is difficult to do using traditional interfaces.

Recently there is a strong trend in the videogame industry to use motion sensing systems. The commercialization of affordable devices is creating a large user base ready for new games and applications based on these interfaces. Considering this phenomenon as an opportunity for IDS, this paper explores how to use this technology for nonverbal communication, identifying the advantages and disadvantages that a designer of interactive stories can encounter. Section 2 reviews the current state of the art of motion sensing technologies. Section 3 explains how body language can be used for designing narrative interfaces. Our ideas are illustrated in the serious game we are developing with Unity and Kinect in Section 4. And finally, Section 5 discusses the implications of this approach to the field of IDS, presenting our conclusions and suggesting next steps in research on this topic.

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2 Motion Capture and its Limitations

While language has a sequential structure that can be easily registered as text, non-verbal communication usually transmits several simultaneous messages overtime, including information that cannot be extracted from the speech only, so it requires a continuous and multimodal method of registering. Currently there is a number of approaches to formalize the body language [6, 9] and identify gesture patterns [2].

Motion capture technology allows us to potentially read every body movement of the user, although advanced equipment is expensive and difficult to use. However, there are proposals in the market that are becoming very affordable. This is the case of Microsoft Kinect [1], Asus Xtion [2] and other devices with public SDKs. Although we have chosen Kinect for this work, our statements are extensible to similar systems.

Kinect RGB-D Sensor incorporates a color camera and a depth sensor designed to provide complete body motion capture and face recognition. Although Microsoft's device serves as a very good "skeleton recognizer", due to its resolution (a maximum of 640x480 pixels) it is not as useful detecting small objects, e.g. fingers, unless they are very close to the sensor (depth range is 1.2m – 3.5m). Kinect can track head pose, hand position, and facial expression, but the depth sensor is not very accurate [14], which means a lot of raw data has to be processed in the application layer.

Recognizing whether a hand is open or closed, or whether the player has turned his head or not, needs special algorithms for processing that data. Intermediate solutions like the OpenNI [3] library allow identifying much more than the basic SDK offered by Microsoft and are used extensively by researchers and developers [1, 3, 10, 13, 14]. There are several examples of recent advances in this field such as the open source framework FUBI [4], the framework Dragonfly [5] that is able to recognize sign language [8], and a finger recognition system that uses depth and image metrics [13].

Kinect has also a maximum number of points of a skeleton that can be recognized at the same time (two simultaneous players with 20 points each one). Depending of the number of these "joints" to be captured it is possible that we cannot detect facial expressions at the same time as body gestures, or that we cannot see whether the hand is open or closed if focusing only on the position of limbs and head. But even considering these limits, there is a clear trend of using this technology for both fun and serious applications, such as training [1, 10], health [3], or ordinary life [12].

3 Designing a Narrative Interface Based on Body Language

When designing an immersive motion sensing interface for participating in an interactive story we do not want to use the body as a mere "handler" for a conventional graphic user interface with buttons, scrolls, etc. We are not looking for another substitute of the combination of keyboard and mouse, but to change the whole control

[1] www.kinectforwindows.org
[2] www.asus.com/Multimedia/Motion_Sensor
[3] http://openni.org
[4] www.informatik.uni-augsburg.de/en/chairs/hcm/projects/fubi
[5] https://bitbucket.org/Slang/dragonfly

paradigm. Depending on the story to be told, we would need to evoke realistic or fantastic movements, pursuing a great level of intuitiveness in every gesture, ideally obtaining something as effective and "natural" as the control of sport games such as Wii Sports Resort and Kinect Sports. Anyway, when the obvious option is to use motion capture to control the "pointer" of a more classical interface, e.g. in game menus, it has been demonstrated that Kinect also shows a great acceptance [5].

Kinect and similar tools have a hard time in capturing facial gestures due to their resolutions, but they are doing well with body gestures, so it seems reasonable to start processing the body language alone, trying to identify the user's intended action.

It can be argued that in most stories the true plot driver is the verbal channel so, without a powerful conversation engine, bodily communication could be of little use for IDS, especially if it is considered as an isolated channel. However, certain studies [7, 11] show that sometimes body language carries messages not communicated by verbal language, using different signals to express different ideas at the same time that, in some situations, could be more important than those explicitly verbalized. For instance, even when we are quiet, just listening to someone, most of the time our gestures are sending useful feedback to him. This is why we think research on bodily communication is relevant for IDS, even not considering a verbal interface yet.

Indeed, nowadays there are many videogames in which verbal interaction is not required; sometimes the main character is "mute" or the interaction with non-player characters (NPCs) is basically physical. Although it seems even more difficult to design a non-verbal IDS system, in our work we try to focus on scenarios that do not involve conversation neither need it, concentrating our efforts in bodily communication only. Our claim is that capturing arms position, hands position, and body leaning should be enough to identify relevant messages of body language that can affect the unfolding story in a new and meaningful way.

4 Example Scenario for the Proposed Interface

To illustrate these ideas on nonverbal user interfaces for IDS, we have devised a serious game that we plan to create on top of a Kinect framework we have already developed. This framework is part of a virtual world application for training medicine students that has been developed in collaboration with the Japanese Institute of Infectious Diseases. The first prototype of our serious game shows a virtual environment created with Unity 3D [6], and uses Kinect as the only interface with the player, who controls a character immersed in a Pathology Exam scenario (Figure 1). The student is doing a test at the Medical School and he have not studied enough so, ignoring the ethical consequences, he decided to ask for the answers to other students (NPCs), communicating with them by gestures, or to copy them, peeping into the test sheets of his fellows. Naturally, in this scenario the goal of player is to pass the exam with the best mark as possible, avoiding being "caught" by the classroom invigilator.

This scenario presents a simple and intuitive situation in which only gestures are allowed, favoring an immersive and narrative interaction: not only your academic reputation is at stake, but also the esteem and feelings of your colleagues towards you.

[6] http://unity3d.com

Fig. 1. A screenshot of the user interface with the "suspicion meter" and the "knowledge bar"

The events during the examination follow a script, as it does the camera, placed behind the semitransparent avatar in a slightly top-down perspective, so the player does not have to worry about character's movement or scene's point of view.

The gestures that have been designed for controlling the main character of the game are categorized in six groups (or game mechanics), as follows:

1. *Doing gestures to other student*. In order to attract the attention of one of his fellows, the player should wave to her when she is looking towards him.
2. *Asking a question to other student*. When the player has the attention of other student, he will be able to ask for the answer to one of the five questions of the test. Showing three fingers of his hand means "tell me the third question" and so on.
3. *Begging or menacing*. If a student refuses to help the player, he can beg for help by joining the hands like in a prayer or menacing her by raising his fist. Obviously, each choice having a very different impact on the feelings of the other student. NPCs also use gestures to respond to the player's messages, and could even warn the invigilator about the player's intentions if they feel strongly disturbed.
4. *Looking to the test sheet of other student*. The player can try to look at the test sheet of one of the students sitting next to him. Leaning his body towards her during five seconds, he will be able to get the answer of one question of the test.
5. *Passing the test sheet.* The player can pass his own test sheet to one of his neighbors, taking it back when the other student has added one answer on it. This is done by making gestures of slowly dragging the sheet with the palm of the hand.

Using these tricks, the player should be able to answer as many questions of the test as possible. His success is represented by a "knowledge bar" which gets filled as he is obtaining the answers, showing marks from F to A, the grade he will obtain if the invigilator do not catch him. When the player is caught doing suspicious movements, the "suspicion meter", initially green, will turn yellow. If the player persists in his attitude it will turn red, causing the student to be expelled from the examination room.

The scenario is designed for ten minutes of gameplay, so if timer runs out and the player has not been caught, the exam finishes and the player receives his mark.

5 Conclusions

We have presented the design of a narrative interface, illustrated by a game scenario in which a motion capture device is used to allow the player to participate in an interactive story, using nonverbal communication as the only communication channel, avoiding replicating the typical control of the keyboard and the mouse combined.

Previous approaches to bodily communication, as choosing a specific gesture from a list or typing a specific command, have been thoroughly used and could be effective in some context but carry a clear lack of immersion. Using conventional approaches every gesture would be repeated exactly the same way in every interaction, so they would lose realism; and it is not possible to simultaneously transmit several gestures. On the contrary, using gesture recognition the main character can mimic the player movements gaining more liveliness and expressiveness. What was difficult before, now it is easy to express in Kinect, e.g. the player "starts" a gesture but suddenly stops and does another one, or maybe do the same one but in a slightly different way.

Even the expression ambiguity is not a drawback but an interesting feature of these interfaces, because it is genuine from bodily communication to not always communicate the desired message. In ordinary life we sometimes transmit unconscious signals or signals that are misinterpreted by the receivers, being the most relevant question not what we want to transmit, but what we effectively transmit [4]. This will allows us to experiment more with the notion of "misunderstanding" in IDS.

Another important quality of the body language is its economy. With just one gesture we can transmit something that would need a lot of words to be expressed. This could be useful as an approach to the player's feelings inside an IDS application.

Unfortunately, there are also disadvantages. Affordable motion capture systems like Kinect have limitations in the degree of detail that it can capture so we are still far of recognizing the smile or the gaze of our players. Even recognizing hand positions is a very laborious task and in practice produces very imprecise results. As we mentioned before, the biggest drawback is the limit in the number of "bones", joints and forms that can be tracked at the same time. Anyway overcoming these limitations is a matter of processing power so we can expect improvements in the near future.

More worrying is the complexity of the process of merging the array of communicative signs captured by these devices in a coherent way. A naive approach associates one gesture to one meaning, maybe accepting certain variation threshold. But we think it could be necessary to develop an emotion metrics system with fuzzy parameters in order to accurately extract feelings from a body gesture, or even creating a knowledge base that matches body gestures with their associated meanings.

We think the field of IDS can benefit significantly from experimentation with these technologies and nonverbal interfaces because a new array of uncharted applications is becoming available. Our current efforts are oriented towards the development of this serious game, integrating it in the virtual world mentioned in Section 4. The idea of extending this bodily communication interface with sentiment analysis is also interesting, trying to extract that valuable information that players intuitive and effortlessly provide to the system, with the simple act of playing using their bodies.

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Reading Again for the First Time: A Model of Rereading in Interactive Stories

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Abstract. When a non-interactive story is reread, the experience may change, even though the text remains the same. But what if the text is potentially different in each reading session, as is the case in an interactive story – how does rereading change in the context of interactive stories? In our earlier empirical studies of rereading we found that, surprisingly, readers of interactive stories reported that they do *not* feel that they are rereading until after they reach an *understanding* of the story, even if the story is unchanged between readings. To explain this, we propose a model of rereading in interactive stories in which readers are initially rereading to reach some form of *closure*. After achieving this goal, readers *do* feel that they are rereading, focusing on their understanding of the story as invariant. We demonstrate this model by using it to explain why inexperienced readers of Mateas and Stern's *Façade* initially reread to explore the story, but quickly shift to "playing with the system", and do not continue to reread for long.

Keywords: interactive storytelling, rereading, theoretical models.

1 Introduction

There are many reasons why people may want to reread or rewatch a story – for example, to recapture the experience, to compare different perspectives, or to reflect on the techniques used. In a non-interactive story, the *text* remains the same between readings. If the experience of reading the text again is different from previous readings, as Galef observes, "[w]hat changes is the reader, not the invariant text" [1, p. 21]. For an interactive story, this is no longer necessarily the case. Choices a reader makes during a reading session may lead to different texts being encountered on each reading. If the text itself is literally different each time it is read, what does it mean to "re-read"? In our empirical studies of rereading in interactive stories [2, 3] we observed that, before they reached an understanding of the story, readers reported they did *not* feel that they were rereading, even if the story did *not* change between readings. It was only when they "got the gist" of the story that they *did* feel that they were rereading, even if the text of the story changed between readings. In this paper, we propose a model of rereading in interactive stories to explain these observations.

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 202–213, 2012.

We use Calinescu's [4] framework of rereading in non-interactive stories as a starting point for our model. Calinescu categorizes rereading in non-interactive stories into *partial*, *simple*, and *reflective* rereading. Partial rereading, or backtracking, takes place in an effort to recall details or understand information which was missed on the first reading. This implies an incomplete first reading. Simple rereading is an attempt to recapture the experience of the first reading. Finally, reflective rereading involves stepping back and looking at the text in a more analytical manner. Note that Calinescu's framework may not apply directly to interactive stories, as the underlying assumption is that the text is fixed, and that the reader's role is to interpret the text. In an interactive story, however, the reader is not just interpreting the text, but is also *making choices* (what Aarseth [5] describes as an *intervention*) which may *change* the text, and consequently the discourse and/or the story. Calinescu's model does not take this into consideration.

According to our model, readers of interactive stories initially read again in an attempt to reach some form of *closure*. This can be seen as analogous to partial rereading in a non-interactive story. After achieving their initial goal, what readers are doing changes. At this point, readers focus on their understanding of the story as invariant, and are engaged in an activity equivalent to simple or reflective rereading. This model suggests new ways of designing to support rereading in interactive stories, and new ways of looking at rereading in general.

This paper is structured as follows. We begin by providing an overview of the related work, and stating our research problem and the scope of our paper. We then summarize our earlier empirical studies, and describe our model of rereading. Next, we use the model to explain why inexperienced readers of *Façade* begin by rereading for the story, but soon shift to "playing with the system", and do not reread for long. We end by discussing implications and future work.

2 Related Work

In this section, we provide an overview of the related work, covering theoretical discussions, implementations of interactive storytelling systems intended to support rereading, and empirical studies of rereading in interactive stories.

There has been some theoretical discussion of rereading in interactive stories. In terms of hypertext fiction, there are differing opinions about the nature of rereading. Some critics focus on the relationship between rereading and variation, whereas others focus on rereading for closure. Focusing on rereading for variation, Bernstein [6–8] sees rereading as opening up the possibility for multiple meanings to emerge as fragments of text are encountered in different contexts on subsequent readings. Similarly, theorists such as Selig [9] and Peacock [10] suggest that the variations, multiple meanings and challenges that readers face in hypertext fiction will encourage rereading. In contrast, researchers such as Harpold [11] and Douglas [12] argue that readers return to hypertext fiction, not to experience variation for its own sake, but rather to seek closure. Harpold feels that it is the promise of eventually finding a conclusion which provides the

motivation for rereading. Douglas suggests that readers are looking for some indication as to when they have reached the end of a text, and that there is some possibility of reaching closure in a hypertext fiction. These close readings suggest a somewhat different model of rereading than the model implied by the theorists who emphasize variation.

Researchers and theorists of AI-based interactive drama have tended to focus on the need for variability and agency for interactive stories to be satisfying, and argue that this requires repeated experiences for readers to be able to see the impact of their choices [13]. For example, Murray [14] has suggested that readers will want to repeatedly experience interactive stories to see different perspectives, and eventually achieve a form of second-order closure when they are able to perceive the larger system underlying the variations. Mitchell [15] suggests several new motivations for rereading of interactive stories, including rereading to find out more, to experiment with different choices, and to figure out how the system works. However, Mitchell and McGee [16] caution that rereading may actually impose limitations on agency and variation.

Most of the research into implementing interactive stories has focused on *single* experiences of an interactive story. There have, however, been some systems explicitly designed to address repeated readings by the same reader [17–19], and some discussion of the trade-off between focusing on single versus repeat experiences [20]. The emphasis tends to be on using variation to encourage and reward rereading by ensuring that a reader has an experience which matches her choices in a given reading, as distinct from choices made in previous readings.

Although there has been much theoretical discussion of the issue of rereading in interactive stories, and some implementation work to explore these issues, there have only been a few empirical studies which directly address the question of rereading. Most of these studies [21–23] have focused on Mateas and Stern's interactive drama *Façade* [17]. Studies of other systems which focus on rereading, such as [24], have evaluated the algorithms rather than readers' responses.

3 Research Problem

Although our discussion of the related work shows that there has been some exploration of rereading in interactive stories, there has not been any work to examine how rereading actually changes in the context of interactive stories. This is the question we address in this paper, by developing a model of rereading in interactive stories. We now define the scope of our paper, explaining why we use the term "reading" for interactive stories, what types of rereading we are addressing, and what forms of interactive stories we are examining.

We use the term *reading* to refer to the process of making choices and perceiving the responses to these choices in an interactive story, regardless of the medium through which the story is conveyed, and of constructing an understanding of the story from these choices and responses. This emphasizes the experience of the *story*, as opposed to other terms, such as "playing" or "interacting", which suggest different types of experience. We consider a *repeat reading*,

or *reading again*, to mean the process of going back and reexperiencing an interactive story. Although this can occur any time after an initial reading, we are focusing specifically on reading again *immediately* after the previous experience has been completed. In addition, we are limiting our focus to repeat readings which involve the reader completing a reading session and then going back to read the work again in a *new* reading session, as opposed to reencountering a section of the work during the same session through looping or repetition.

We focus on interactive stories where the reader makes choices in terms of exploring story fragments or changing parameters which impact the story. We do not consider interactive stories in which the reader contributes new connections or content, or where the reader is restricted to unlocking the next part of a linear story. In addition, we will limit ourselves to situations where a single reader interacts with a computer-based interactive story.

4 Empirical Studies of Rereading in Interactive Stories

To develop our model, we conducted two empirical studies of people rereading interactive stories. In this section, we briefly describe the design of these studies, and summarize our observations[1].

The first study investigated why readers reread interactive stories [2]. The study involved 12 participants who were asked to repeatedly read 2 short hypertext fictions. We conducted a series of semi-structured "clinical interviews" [25], during which we observed and probed readers' reactions, looking specifically at what they were doing as they reread. In this study, we saw that readers were rereading *to arrive at something*. This could involve looking for the "best version", "what really happened", or some other form of closure. Regardless, they tended to be goal-directed, and continued to reread until they either achieved this goal, or they felt that it was not achievable.

We conducted a second study to explore the question of whether readers consider rereading an interactive story to be *rereading* [3]. This study involved 22 readers repeatedly reading a complex hypertext. In this study, we asked participants if they were "rereading", and probed their responses using a "clinical interview" approach. Interestingly, many of the participants in our second study struggled to describe what they were doing as "rereading". Instinctively, based on their experience of non-interactive stories, this seems to *not* be rereading, because the text was different in each reading. After some time, readers tended to report that they had "got the gist" of the story. At this point many of the participants who were initially uncertain as to whether or not they were rereading now changed their minds and said that they *were* rereading, even if the text they encountered was different on each reading. The participants, having reached some form of closure, were now able to focus on their *understanding of the story*, rather than the text, as invariant across readings.

[1] Please see the original publications [2, 3] for complete details of these studies.

5 A Model of Rereading in Interactive Stories

Based on the observations described above, we have developed a model of rereading in interactive stories. We now describe this model:

1. *Reading again to reach closure*
   Readers initially read again to reach some form of *closure*. On each reading, although the text may change, what the reader is doing does not change. This is equivalent to partial rereading in non-interactive stories. Readers do *not* consider this to be rereading, even if the story (as opposed to the surface text) does not change between readings.

2. *Rereading after closure*
   Once a reader has achieved closure, the reader's goals when reading again will change: to either simple rereading to reexperience the interactive story, or to a more analytic, reflective rereading. This requires a change in what the reader is doing while reading the story. Readers *do* consider this to be rereading, and shift their focus to their *understanding of the story*, rather than the text, as invariant across readings.

By *closure* in an interactive story, we mean a feeling of resolution or completion, such as reaching an understanding of the story, reaching the "best ending", or finding the "most interesting" version of the story. This is similar to Carroll's definition of narrative closure in non-interactive stories as "the phenomenological feeling of finality that is generated when all the questions saliently posed by the narrative are answered" [26, p. 1]. In the context of an interactive story, however, this feeling of finality is best regarded as a cluster of related experiences resulting from the process of pursuing specific goals while reading the interactive story, which are felt in relation to the reader's experience of both the *narrative* and the *choices* she is making.

We will now discuss the two stages of our model of rereading in more detail, and explain how the model relates to the observations in our empirical studies.

5.1 Reading Again to Reach Closure

Our model states that readers initially read again to reach some form of closure. This is based on our observations of reader behaviour in our first study [2]. This view of what readers are doing when reading again is supported by some of the related work. For example, in Douglas's extended discussions of reading (and rereading) *afternoon, a story* (Joyce, 1990) [12], she describes her desire to find closure within the work, and how she stopped rereading when she felt that she had got what she wanted from it. Similarly, Murray describes how, even in a "kaleidoscopic" narrative, readers are looking for some form of closure, albeit not the same type of closure that they would get from a traditional narrative [14, p. 180].

Our model also states that, when reading again to reach closure, readers do *not* consider what they are doing to be rereading. Although what the reader is *doing*

stays the same across reading sessions, the *text* which the reader specifically encounters may change. This makes it difficult for readers to consider what they are doing to be rereading.

This can be compared with what readers are doing when rereading a non-interactive story. During partial rereading, it can be argued that the reader is actually still *reading* rather than rereading, given that partial rereading involves looking for things that the reader missed the first time round. In this case, the reader is continuing the process of refining their understanding of the story, and responding emotionally to that understanding. In this case, the reader is actually doing the *same thing* in each reading, i.e. trying to understand the story and work towards closure.

In a non-interactive story, readers are not made aware of the problematic nature of partial rereading (which is more like reading than rereading), since the text is fixed. This makes it easier to call the act of going back over the story "rereading". Even in the case of a complex narrative, which forces the rereader to engage in a certain amount of partial rereading although she has clearly seen everything in the first reading, the rereader can focus on the invariant nature of the text, and call this action "rereading". In an interactive story, however, this is problematized by the fact that the reader is aware that there are literally paths not yet taken, and text not yet seen, even though she has "completed" the initial reading. This makes it unclear whether a repeat reading is actually a rereading, since the reader is uncertain if she has really finished the initial reading.

5.2 Rereading After Closure

One a reader has reached closure, our model states that the reader will change focus from looking for closure to looking for something new, and the reader *will* consider this to be rereading. This raises two questions: what has changed after readers reached closure, and why do they consider this to be rereading?

We can answer these questions by considering what the reader is doing after reaching closure in a non-interactive story. At this point, any rereading will not be partial rereading, but instead will be simple or reflective rereading. During simple rereading, the reader wants to go back over the story to recapture something of the initial experience. The key difference from an initial reading is that the reader has *already* experienced the story. Thus, what the reader is doing is not quite the same as during the initial reading. Although the cognitive process of reading during simple rereading is the same, the difference is that the reader knows (and expects) that the story will be satisfying. The reader also already has a model of the storyworld, characters, and events, although depending on the complexity of the narrative the reader may have forgotten some of the elements of the story. What the reader is doing is *not* quite the same as during the first reading. Instead of trying to reach closure, she is seeking to recapture the previous experience. In the case of reflective rereading, the reader is consciously stepping back and approaching the text in a different manner: to analyze the use of technique, symbolism, intertextuality, and so forth. In this case, the reader is very deliberately *not* doing the same thing as during the initial reading.

This suggests that, paradoxically, for simple and reflective rereading in a non-interactive story, the reader is actually *not* reading again, at least not in the same manner as in the first reading. Simple and reflective rereading actually involve *doing something different*. The key insight here, which we can apply to our investigation of rereading in interactive stories, is that when the reader is rereading, there is *no* invariant in terms of what the reader is doing. Instead, what the reader is doing *changes*.

Recall that in the case of reading again for closure in an interactive story, the reader is still doing the same thing – looking for closure. It is only when she "gets it" that it becomes rereading in the way that she expects: there is now something which can be held invariant (the reader's understanding of the story), and any further rereading would involve doing something different. Although the core mechanic, the action which the reader literally performs moment-to-moment, may stay the same, what the reader is *trying to achieve* has changed: from looking for closure, to looking for something *new*. This is why it is only after reaching an understanding of the story that readers feel that they are rereading.

6 Applying the Model to Explain Reader Behaviour

Having developed our model of rereading, we tested this model by using it to provide insight into why inexperienced readers of *Façade* tend to initially reread to explore the story, but quickly shift to "playing with the system", and do not continue to reread for long. We argue that readers of *Façade* respond this way because the core mechanic does not afford inexperienced readers taking action to pursue narrative goals, which frustrates their initial goal-oriented rereading, and makes it difficult to move on to rereading beyond closure; instead, readers find it easier, and more rewarding, to form non-narrative goals related to, for example, undermining the system.

Façade is an interactive drama which was designed specifically to support repeated experiences [17]. The reader of *Façade* takes on the role of an old college friend visiting the two main characters, Grace and Trip. As the session progresses, it quickly becomes clear that the reader's character is caught in the middle of the breakdown of Grace and Trip's marriage. The reader interacts with *Façade* through two different mechanisms. The reader is able to construct utterances by typing in text, which is converted into a set of discourse acts [17] which in turn trigger reactions from the system. These reactions can consist of local responses from the characters, or involve the transition to a new set of such "beats" within the system's overall model of the story. The reader can also navigate and interact with the 3D simulation of the physical environment.

The session is structured roughly into two parts, during which the reader is taking part in three psychological "head games" [17]. The first, a "hot-button" game, involves triggering off specific hot topics about which Grace and Trip will argue. In the process, the reader will encounter fragments of story which uncover some of the background to the couple's current marital problems. The second, an "affinity" game, involves the reader making statements which determine whose

"side" Grace and Trip think the reader's character is taking. These two games take place simultaneously during the first half of the story. During the second half, the reader is involved in a "therapy" game, in which the reader's discourse acts increase either Grace or Trip's level of self-realization. Eventually, the session moves towards one of several different endings, which involve either one character or the other deciding to leave, or the reader's character being asked to leave.

6.1 Rereading *Façade*

Based on our own repeated readings of the work and observations of students who were asked to experience *Façade* as part of a university course on interactive storytelling, we can describe most readers' reactions as follows. The first session can be satisfying, as the reader can see that her actions are having some impact on what is happening, and, despite the occasional frustrations, can get the feeling that Grace and Trip are actually responding to her statements. Over the course of the session, the reader will gradually uncover some of the backstory, and come to an initial understanding of the situation.

In the second session, as described by Knickmeyer et. al. [22] and supported by our own observations, the reader may try different strategies, and be rewarded with some variation in the progression of the story and the responses of the characters. The use of different interaction strategies suggests that readers are not actually engaging with the story, but are more engaged with the interface and mechanics. Although Knickmeyer does mention readers' enjoyment of story and conversation variations, it is not clear whether they are enjoying this variation as part of the story experience, or more primarily as part of the experience of local agency.

Our experiences suggest that readers are not likely to be motivated to reread more than twice. For those who do reread, subsequent sessions tend to involve "messing" with the system. This often involves pursuing emergent goals such as trying to get kicked out of Grace and Trip's apartment as fast as possible by transgressing social conventions. This is very clearly *not* behaviour which can be described as interacting with the story. Similarly, Milam et al. [23], in their study of readers' responses to *Façade*, reported that participants initially wanted to replay to explore different endings, but were dissatisfied and instead tended to "test the boundaries" of the system.

6.2 Explaining Readers' Responses to *Façade*

As described in our model, the reader is initially goal-directed, and will be reading again to reach closure. There are two possible goals which the reader could focus on: moving the story towards a specific resolution, or uncovering and understanding the backstory.

For the reader who chooses to focus on controlling the outcome of the story, the reader will quickly realize that there are limits as to how much control she can exercise. What becomes obvious is that it is easiest to get reactions which lead to early termination of the story, by acting against social conventions. This

approach quickly degenerates into playing with the system, rather than playing with the story. If, instead, the reader chooses to focus on uncovering the backstory, the inexperienced reader will quickly become frustrated. The core mechanic is oriented on the social games, which only indirectly result in revelation of backstory. In principle, a persistent reader should be able explore the underlying story. It is possible, through repeated readings, to learn which topics will trigger a reaction, leading to story fragments which contain elements of the backstory. In practice, many readings are required for a reader to learn how to trigger these story fragments. An inexperienced reader will initially feel that there is little that she can do to actively uncover the backstory, as the reader has little direct control over revelation of past information.

Reading again to reach closure is thus problematic in *Façade*, as there is a disconnect between the core mechanic (triggering responses in the social games), and the goals which the reader forms (reach a specific ending or uncover the backstory). In both cases, readers tend to exhaust the possibility for partial rereading after 1-2 repeat readings. Variation tends to be in terms of specific local interactions, and readers quickly find that it is easier to get kicked out than engage with the story.

6.3 Rereading beyond Closure

Our model has explained why readers of *Façade* rarely engage in reading again to reach closure. For the reader who actually does reach closure (by either achieving a desired ending or coming to an understanding of Grace and Trip's situation), or has given up on reaching closure, the question is then whether there is any possibility of engaging in either simple or reflective rereading.

Simple rereading requires that there is some experience which the reader wants to recapture. At the level of interaction, the reader may be motivated to repeat certain satisfying choices, which may have led to a particularly rewarding ending. This, however, is purely at the mechanical level. At the emotional level, as Ryan [27, p. 57] describes, the reader is not able to form any emotional attachment with the characters, and therefore is unlikely to have any desire to repeat the experience. This can be explained in terms of the disconnect between the core mechanic and the reader's goals. Being unable to directly engage with the story, the reader does not have any strong experience which she would want to repeat. This suggests that readers are unlikely to engage in simple rereading.

In terms of reflective rereading, the reader may, as described by Knickmeyer et al. [22], be motivated to experiment with different interaction strategies. This could constitute a form of reflective rereading, but it is more likely to involve a desire to master the system, given the disconnect between core mechanic and narrative goals. As such, this type of reflective rereading would be disconnected from the story, and would not be satisfying as a *narrative* experience.

Alternately, the reader may be trying to reread reflectively to understand the message the author is trying to communicate. The underlying message of *Façade*, as described by the authors, is: "To be happy you must be true to yourself" [13, p. 9]. This is not, however, the message that is conveyed through

the interaction which the reader has with the system. The interaction tends to convey the feeling that a third party, no matter how close she is to a couple, can never really make an impact on their relationship. The reader experiences the frustration of standing to one side as two people tear each other apart. All the reader can do is attempt to "push their buttons". This quickly degenerates into "playing the system". As the core mechanic is not connected to the deeper meaning, it is difficult to engage in reflective rereading.

7 Implications

Our model of rereading in interactive stories has implications for both the design and study of interactive stories which are intended to be reread. It also has implications for the study of rereading in non-interactive stories.

One implication of the model is that, since readers initially read again in an attempt to arrive at some form of closure, interactive stories which are designed to be reread should support this goal. Otherwise, as we have seen in our discussion of *Façade*, readers will not be motivated to reread. This suggests that authors should provide interaction mechanics which allow readers to pursue *narrative* goals, and these mechanics should be designed to support the pursuit of these goals *across* readings. In addition, our observation that readers' goals *change* after reaching closure suggests that authors should provide interaction mechanics that can *adapt* to these new goals, or again readers will not be motivated to reread the story.

The application of our model to the analysis of *Façade* also suggests some issues related to simple and reflective rereading in interactive stories. It is not clear what it means to engage in simple rereading in an interactive story. If a reader wants to recapture the experience of an interactive story, does this involve making the same choices? Or experiencing exactly the same story fragments? And if so, could this type of reexperience still be considered an *interactive* story? It is also not clear how readers could engage in reflective rereading in an interactive story. Can this type of "playing with the system", if it is done with the aim of understanding the underlying "moral physics" [14] of a storytelling system, be considered reflective rereading? Or are there other categories of rereading not captured in our model? Is this type of play similar to the ways in which players attempt to break game mechanics in other kinds of games? These questions suggest that more work needs to be done to study these types of rereading.

Our model also has implications for the study of rereading in non-interactive stories. If what readers are looking for, and what readers are doing, changes in subsequent rereadings, this impacts the ways in which, for example, the question of anomalous suspense [28] and readers' reactions to spoilers [29] should be approached. The importance of partial rereading in our model suggests that this type of rereading deserves more attention in non-interactive stories. In particular, the question of how partial and reflective rereading may overlap in complex narratives is worth investigating, in both non-interactive and interactive stories. Finally, focusing on *what the reader is doing* when rereading, and how this changes after closure, may provide new insights into rereading in general.

8 Conclusion

Based on our earlier empirical studies, we have proposed a new model of rereading in interactive stories. According to our model, readers initially read again to find closure, which is equivalent to Calinescu's *partial rereading*. Readers do not consider this to be rereading. When they achieve closure, they can potentially shift to either *simple* or *reflective* rereading, which they do consider to be rereading. We have used our model to explain inexperienced readers' behaviour when rereading *Façade*. Our model has implications for the design and study of rereading in interactive stories, and for the study of rereading in general.

This paper has focused largely on reading again to reach closure, which we have characterized as analogous to *partial* rereading. Our observations suggest that more work needs to be done to look at other types of rereading, analogous to simple and reflective rereading in non-interactive stories. We have also been looking at the desire to *immediately* reexperience an interactive story. It may be worth investigating why people may want to reread interactive stories after some time, as this type of rereading is likely to be different from immediate rereading.

Finally, we have focused on interactive stories which involve the reader making choices in terms of configuring or exploring the story. We have excluded approaches where the reader contributes content or connections to the story, and approaches where the reader's actions do not change either the story or the discourse. It would be very interesting to explore the impact of changing the role of the reader on the process of rereading. This suggests that there is still much work to be done to explore the issue of rereading in interactive stories.

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Where's the Story? Forms of Interactive Narrative in Current Digital Games and Other Digital Forms

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Abstract. The theoretical understanding of interactive digital narrative must evolve in order to accommodate recent trends and development in the practice of this constantly evolving form of human expression. This edition of our workshop series at ICIDS concentrates on artifacts produced or released in the last two years. In addition, it broadens the perspective by asking participants to present examples of their own choosing to the workshop in order to ensure as much breadth in the understanding of current works as possible. The presented artifacts will then be analyzed and classified with a cutting-edge theoretical perspective based on our continued research into a combined universal theoretical perspective for interactive digital narrative.

Keywords: Interactive Digital Storytelling Theory and Practice, Classification System, Artifacts, Digital Media.

1 Overview

Interactive Digital Narrative (IDN) is a constantly evolving form of human expression. While researchers from humanist-derived viewpoints work hard to develop theoretical perspectives and matching analytical methodologies for IDN, practitioners continue to push the envelope of interactive narrative forms. Our workshop bridges this gap by bringing together current examples of IDN with cutting-edge theoretical perspectives and analytical understanding. In previous editions of this workshop [1,2,3] we explored several frontiers of IDN theory – from the need of a shared vocabulary, to a common theoretical framework, the mapping of outer fringes of IDN and, finally, an identification of analytical categories to add to our practical toolbox. This year, we will analyze and discuss current trends and evolutions of IDN.

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 214–215, 2012.

We believe that effective analytical methodologies need not only to be based on historical examples, but also to be strongly grounded on the latest pieces and developments. Our perspective is that analytical methods need to prove their value in particular through application to the most recent productions and by contributing to the development of the field. We invite a high degree of audience participation in this workshop by asking participants to present one digital work of their choosing from within the last two years. It is not required to offer a full theoretical analysis of the work, but the presentation should relate it to IDN. To help position the works, we will provide short examples from previous workshops, as well as diagrams and papers.

Over the previous editions of ICIDS, our workshop series on theoretical aspects of IDN research has quickly gained broader recognition by the IDS community. We expect the size of the audience to keep growing and thereby help consolidate and extend our approach towards an inclusive and universal theory for IDN. This workshop edition will be the next important part in our continuing endeavor and we plan to make the results available on a website and in an upcoming article.

2 Workshop Format

The full day workshop will engage participants right from the start. After a short welcome, each participant will present their IDN candidate, which will then be subjected to analysis by the group. Participants will collectively brainstorm about the most effective strategies to study and describe the selected examples. Special attention will be devoted to identify general descriptive categories that could be applied to several artifacts. In the second part of the workshop, selected aspects of the organizers' research and that of others in the community will be presented to extend the previous brainstorming sessions. Participants will be asked for feedback on current theoretical efforts, which the organizers will contextualize for future research directions.

The examples and contributions offered throughout the workshop will be consolidated with the theories discussed so far to finally sketch a shared analysis of relevant and current IDN works.

Temporary conclusions will be presented to a wrap-up panel of experts that will summarize and comment on the results of the workshop. Finally the organizers will wrap up the workshop.

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Sharing Interactive Digital Storytelling Technologies II

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Context

The Interactive Digital Storytelling (IDS) field has produced numerous research prototypes over the last years. These prototypes cover several different technological domains, including: drama management; human-computer interaction; language understanding and generation; behavioural modelling; 3D rendering, modelling and animation. Research in the field usually focuses on one specific area. However, it is often the case that other dimensions need to be integrated with one's core contribution to provide the end-user with a complete experience that can be assessed. As a consequence, researchers in IDS tend to become "one-person shows" trying to unite being scientists in multiple fields; engineers in an array of domains; and developers at home with many technologies and processes. Game technologies aim to simplify this challenge by providing, in particular, sophisticated game engines. But since game engines do not cover all IDS needs, important development/integration efforts still remain to be addressed beyond the central scientific investigation itself. This workshop aims at helping IDS researchers identify and adopt existing IDS-relevant technologies, for them to be able to deliver prototypes that are more varied—or better tailored to their needs and goals—with less effort.

Description

A first workshop on the topic was organized last year at ICIDS 2011. With around 15 participants, the workshop confirmed the need for more integration between IDS technologies. Participants confirmed their will to share their technologies, and at the same time, several obstacles were identified. With the first edition, a website was set up[1], with the goal for participants to both share technologies (i.e., a repository) and discuss on various forums. The second edition of this workshop constitutes a second attempt to invest critical effort in animating the community and to encourage sharing technologies. It is strongly focused on establishing suitable mechanisms for overcoming the current barriers of sharing technologies effectively.

[1] http://icids.org/sharing

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, p. 216, 2012.

Nordic Roleplaying Games – The Narrative Approach: A Practical Introduction

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Abstract. This workshop will be offering the participants both a theoretical and practical introduction to roleplaying games, with particular focus on the Nordic tradition of narrative- and character-driven scenarios. The various leading theories for categorizing roleplaying experiences, scenarios and communication will be briefly introduced, along with the relevant theories from the field of interactive narratives, after which the participants will be given the opportunity to participate in one of a representative sample of short-form scenarios. The workshop will conclude with a general discussion and experience-sharing session intended to relate the scenario play-throughs and covered theories with the participants' general work within the field of interactive narratives.

Keywords: Interactive Narratives, Emergent Narratives, Roleplaying Games, Nordic roleplaying game tradition, Scenarios, Narrative Paradox.

1 Introduction

Given the interactive narrative community's increased focus on roleplaying games as containing methods and structures which hold the promise of solving the narrative paradox, it is perhaps appropriate to offer the possibility for members of the community to try narratively-driven, story-focused roleplaying game scenarios. Since roleplaying games, like golf, thesis work or violin playing, require firsthand experience before one can begin to understand the complexities and mechanisms involved, this ICIDS 2012 workshop seeks to offer practitioners in the field of interactive digital narratives, with or without prior firsthand experience, a taste of roleplaying games, through a workshop focused on the narrative- and character-driven roleplaying traditions pioneered in the Nordic countries since the late nineties.

The workshop will give participants valuable firsthand insights into the mechanisms and dynamics of narrative- and character-driven roleplaying game scenarios, both through an introduction, and through participation in one of a number of representative short-form roleplaying scenarios from the chosen genre, with a subsequent discussion of the gained insights and experiences.

The participants should, after participation in this workshop, be able to relate the various studies of roleplaying with regards to interactive digital storytelling, with their

D. Oyarzun et al. (Eds.): ICIDS 2012, LNCS 7648, pp. 217–218, 2012.

concrete experiences, in order to both raise understanding of these studies, and to yield new study ideas through this heightened understanding of the strengths and weaknesses of the current roleplaying game format.

The workshop will feature a short introduction of roleplaying games in general, followed by an elaboration of the Nordic roleplaying game tradition and the consequences of this on the emergent narrative experience. Typology frameworks for categorizing roleplaying game scenarios, experiences and communication will be briefly introduced, along with relevant theories from the field of interactive narratives.

After this introduction, the participants will, in groups of three or four, choose one of the available short-form roleplaying scenarios, and play through this scenario, with a subsequent discussion within the group concerning the scenario and the particular narrative experience gained. Afterwards, all participants will reconvene for a continued discussion and experience-sharing, based both on the terminology gained through the introduction, and their individual fields of expertise within interactive digital narratives.

Author Index