

Storytelling in Serious Games

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Abstract. This chapter about storytelling and interactivity in storytelling first explains on various serious games examples foundations of storytelling. Then storytelling in Interactive Media with regard to serious games is described. Further the current state of the art on Interactive Digital Storytelling is presented including example experiences, authoring tools and challenges in the field combined with examples of serious games. This chapter closes concluding with open storytelling challenges and opportunities in serious games development and recommending further literature on the subject.

Keywords: Narrating techniques · Serious games · Interactive media · Interactive digital storytelling

1 Introduction

Nearly all nations formulate their identity by narrating stories [44]. Stories, firstly being oral narrated, represent an important aspect of culture since the beginning of human being. Stories help to connect cultural values and learning or moral items in a meaningful correlation and they make them recountable and understandable. Therefore, using storytelling means recording and distributing histories, myths, and values of nations. Many types and different genres of narrations exist today, from oral histories, literature, films to games. This opens an interdisciplinary research field, from cultural and literature studies to media science and game studies.

According to Henry Jenkins not all games tell stories, but many games have narrative aspirations [34]. Particularly in a serious games context stories play an important role. They help to connect serious context with playing games. By using narrations the game designer is able to transport the ‘serious sense’ behind the play, mostly an educational sense or training items. But this must not be a big linear story like an epos or a drama in literature. The original serious text information has to be transformed to game action. For this narration helps besides other didactic aspects to add serious context into games [34].

“A discussion of the narrative potentials of games need not imply a privileging of storytelling over all the other possible things games can do, even if we might suggest that if game designers are going to tell stories, they should tell them well. In order to do that, game designers, who are most often schooled in computer science or graphic design, need to be retooled in the basic vocabulary of narrative theory” [34]. To analyze narrating parts of serious games, it is necessary to understand narrating techniques, the “basic vocabulary”, as Jenkins emphasizes. Essential storytelling basics are significant in all kind of narrating types, also in games. In Sect. 2, important storytelling basics, mostly linear told, are presented: the narrative structure, the narrators perspective, time and place of narration and characters. Furthermore, their meaning for serious games context and significant characteristics are added.

While the basic principles of storytelling are fundamental to understand and design narratives for serious games, the interactive natures of games rises further challenges. Even if the story is not meant to change through the interaction, the actions performed by the player have to be take into account for the story presentation. Section 3 gives an overview of the challenges and the research work performed on the presentation of a story in an interactive medium though the lenses of discourse and user interaction.

Section 4 furthers the analysis of implications of storytelling in serious games by analyzing the technical and design challenges of designing stories that dynamically adapt to the player’s actions. A series of games examples and research works are presented to report the state of the art of both interactive storytelling experiences and of authoring tools, which allow designers to produce content for the engines.

Lastly, Sect. 5 concludes the chapter with a short overview and an analysis of the future of the field, with open research questions and potential research directions.

2 Storytelling Basics

Narrative structure means a literary element and describes the structural framework that shows the order and manner of a narrative. Two items are necessary to distinguish: plot versus story. Plot contains the sequence of events inside a story, connected by the principle of cause and effect. The story represents the meaning, which the reader constructs behind the plot, a second-level-construct [7]. Literature about narrative structure has to be read carefully. There exist different meanings and terminologies. In the structuralist terminology the what of the narrative is called story, the how it is told is called discourse [14].

In game design not all story elements have to be written before a game starts. This second item story is important to analyze in serious game context, particularly to analyze the meaning behind constructed by the authors of games. This could be demonstrated at the alternate reality game *World without oil*, designed i.a. by Jane McGonigal and settled for a few weeks in 2007 via a website [25]. A serious game for a public good, could be read the official website.

“If you want to change the future, play with it first.”
 STEFANIE OLSEN, CNET

WORLD WITHOUT OIL is a serious game for the public good. WWO invited people from all walks of life to contribute “collective imagination” to confront a real-world issue: the risk our unbridled thirst for oil poses to our economy, climate and quality of life. It’s a milestone in the quest to use games as democratic, collaborative platforms for exploring possible futures and sparking future-changing action. WWO set the model for using a hot net-native storytelling method (“alternate reality”) to meet civic and educational goals. Best of all, it was compellingly fun.

“Eerily plausible.”
 CHARLIE HIPHOP

WORLD WITHOUT OIL simulated the first 32 weeks of a global oil crisis. It established a citizen “nerve center” to track events and share solutions. Anybody could play by creating a personal story - an email or phone call, or for advanced users a blog post, video, photo, podcast, twitter, whatever - that chronicled the imagined reality of their life in the crisis. The WWO site at worldwithoutoil.org (archived here) links to all these stories. The game encouraged excellence with daily awards and recognition for authentic and intriguing stories.

“A huge, twisting network of news, strategy, activism, and personal expression.”

Fig. 1. The official website world without oil

The big story behind this game with a strong serious context concludes a fictional global oil crisis. The gamer have to find solutions to live without oil and save the nature within their personal living conditions. The stories and ideas were incorporated into an official narrative, posted daily. Gamer could post their solutions as videos, images or blog entries. While playing the big story were added by hundreds of personal narratives. These narratives were compressed to a central paper with solutions how we can manage our lives without wasting oil [48] (Fig. 1).

But how story and plot points could be structured? The most famous narrative structure until today represents the drama structure originally developed by the Greek philosopher Aristotle in 335 B.C [32]. The author emphasizes the important role of plot or mythos for drama, particularly the type of tragedy. He subdivided the tragedy in three different narrating parts: Exposition, middle part including the climax and finally the resolution. The connection between the three acts is called plot points or turning points.

The German writer Gutav Freytag expand the plot structure into five stages in his developed Freytags pyramid in 1863. His theoretical work subdivides the tragedy into: exposition, rising action, climax, falling action, retarded moment and denouement [27]. Both structures are compared in Fig. 2, referring to Aristotle and Freytag [27,32].

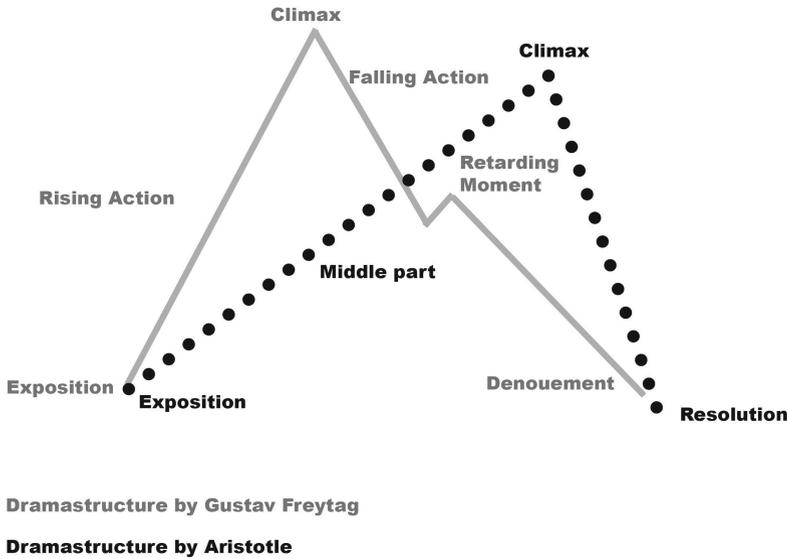


Fig. 2. The drama structure by Aristotle and Freytag

Until today narrators, also in media field, refer to Aristotle three-act-structure or Freytags pyramid, particularly the most famous American screen-writer Syd Field. This is the structure of the Syd Field “Paradigm” in three acts: Passing the first plot point in the first act the main character protagonist is faced with a goal to achieve. The main conflict is settled. The second act is named the “confrontation” and contains a midpoint. At this turning point the character fortune changes dramatically. The last act includes a climatic struggle to achieve the settled goal, or not [26].

Game Designer have been inspired by this drama structure by developing the level structure until today. This does not mean simply copying this structure, originally coming from literature. They have to find a way to install a suspense line considering the nature of game playing. The interaction while playing influences the length of the different acts, for example. In many games a big challenge can be found at the end, according to the climax of a traditional narrative structure. A good structured suspense line can increase users involvement, but have to respect players freedom of choice. So game designer have to find the right balance between reception of the story and playing.

2.1 The Time of Narration

The time of narration has to do with the relation between the narration and the story. The time regulates the narrator’s temporal position relative to the events being told. The French specialist of narratology Gerard Genette gave some methodological choices referring the time to writers: they can vary (1) the order of

the narrative, (2) the speed of the narrative and (3) the frequency of events [28]. Changing the order of a chronically narration often means to create suspense. The most popular techniques of changing the order of time in narration are: previews or flashbacks. The narrative speed means how detailed or abbreviated a passage of a story is told and the frequency, how often a single or periodic detail is told. Gerard Genette's theoretical work based on studies about Marcel Prousts "In Remembrance of Things Past" [52]. It fits into the German and Anglo-Saxon academic tradition and contains a culmination and a renewal of this school of narratological criticism [52]. Flash backs and forecasts is also a famous film technique. Looking back or forth in a stories increases the dramatic suspense line and because of this the involvement of the audience. But changing the order of time in narration assumes a linear reception of a story. If it is possible to arrange a change of order of time in games, has increased a discussion in game design: Using Quake as an example, Jesper Juuls argues that flashbacks are impossible within games, because the game play always occurs in real time [34]. Yet, this is to confuse story and plot. Games are no more locked into an eternal present than films are always linear. Many games contain moments of revelation or artifacts that shed light on past actions. Carson suggests that part of the art of game design comes in finding artful ways of embedding narrative information into the environment without destroying its immersiveness and without giving the player a sensation of being drug around by the neck [34]. Looking at the time in games, it seems to be difficult to find similarities. Player could influence the time of narration via interaction. But narrating clips or textual based fadings inside a game contain this technique for increasing the motivation to play a game to the end. So you could see the kidnapped princess at the beginning of Super Mario Land to demonstrate the mission of the game at the intro [49]. At the field of serious games this narrating parts are used to show the sense behind the game, often at the beginning or end of a level.

2.2 The Place of Narration Environmental Storytelling

Beyond the time the setting is essential to formulate a story. Environmental storytelling uses techniques of architectural or exhibition design to tell stories. Stories are told or established in particular spaces. The most famous author is Jury Lotman, a Russian structuralist [42]. He subdivided a story environment mostly in good and worse. In his opinion places have a profound meaning for the storyline. Particularly in game design the environment is useful to settle narration parts into a game. In open world games this technique is often found today. There are virtual environments in which computer games are played, which are designed by computer game authors. The story isnt linear, it is being constructed by players interaction through the game environment. "Game designers don't simply tell stories; they design worlds and sculpt spaces. It is no accident, for example, that game design documents have historically been more interested in issues of level design than plotting or character motivation. A prehistory of video and computer games might take us through the evolution of paper mazes or board games, both preoccupied with the design of spaces, even where they also provided some narrative context" [34]. The serious game Global conflict

Palestine represents an example for this [56]. The user plays the character of a freelance journalist. The goal is to write an article for a newspaper by collecting quotes from the dialog during the game. The player has to act carefully respecting both sides of the conflict. So important serious aspects are to take different perspectives and learn more about the people within the conflict. The game is used in educational context, including a teachers manual and further resources. The storyline seems to be a didactic play by the German writer Berthold Brecht. While playing it the people understand the didactic aspects.

So famous patterns of environmental storytelling can be discovered by analyzing games. They “fit within a much older tradition of spatial stories, which have often taken the form of hero’s odysseys, quest myths, or travel narratives” [34]. The American mythological researcher Joseph Campbell analyzed the structure of mythological texts all over the world [12]. His results he formulated in the heros journey, which includes basic stages every hero quests goes through. His theoretical work influenced successful Hollywood filmmakers like George Lucas writing the story for Star Wars, but also game designer. “The Star Wars game may not simply retell the story of Star Wars, but it doesn’t have to in order to enrich or expand our experience of the Star Wars saga. We already know the story before we even buy the game and would be frustrated if all it offered us was a regurgitation of the original film experience. Rather, the Star Wars game exists in dialogue with the films, conveying new narrative experiences through its creative manipulation of environmental details. One can imagine games taking their place within a larger narrative system with story information communicated through books, film, television, comics, and other media, each doing what it does best, each relatively autonomous experience, but the richest understanding of the story world coming to those who follow the narrative across the various channels” [34].

2.3 Changing the Perspective

Mostly narrators present their story from one of the following three perspectives: first-person, third-person limited or omniscient. They are also called narrative modes. The Austrian expert of storytelling Franz Stanzel developed a circle of narrators perspectives as a central point of writing a story [60].

In Stanzel’s typological circle contains “three typical narrative situations”, including various possibilities of structuring narratives: “mode”, “person” and “perspective”. These can be subdivided into three oppositions “narrator/reflector”, “first person/third person” and “internal perspective/external perspective”. The first narrative situation is “authorial narrative situation”, which can be described by the dominance of the external perspective. In the second narrative situation “First-person narrative situation” the story is presented by a “narrating I”, who is part of the action. The last narrative situation is “The figural narrative situation” and it can be described by the dominance of the reflector mode.

Learning social skills means to be able to change perspectives and this could be done by serious games very easily. There are different characters, which can



Fig. 3. Screen shot of the game “Re-Mission”

be chosen. Project Peacemaker is a government simulation game about the Israeli-Palestinian conflict [33]. The player can choose the perspective of the leader of Israel and the Palestinian Authority. The serious meaning of the game is a better understanding of the long time conflict and promoting peace. The most popular perspective in game design is the “narrating I” perspective, that contains a high involvement by the player, well known in the Ego-Shooter-Games. Also serious games use this perspective, for example the game Re-Mission. In the health game player, often young ill children, fight against cancer and win. They flight in ego-shooter-perspective through a human being body and kill cancer cells [54] (Fig. 3).

2.4 Characters and Archetypes The Role of Empathy

The importance of characters for a narration is very simple. Characters bring action into the story. Their relationship is important for the development of a story. Conflicts between characters, for example, cause an increasing suspense line. Joseph Campbell did researches about famous archetypes often found in myths, influenced by the Swiss Psychiatrist Carl Jung [12]. The central figure of a myth are heroes. Their antagonist represents so called shadows or enemies. In some cases the enemy is within the protagonist, his dark side. Mentors guides the hero through the challenges. Herald brings the call to adventure. This could be also an event. Threshold guardians stand in the way at important turning points. They inhibit like jealous enemies, professional gatekeepers the heroes journey. Sometimes they are inside the main character, representing the heroes own fears

and doubts. Shapeshifters, creatures like vampires or werewolves, change shape. Further tricksters are clowns and troublemakers. Allies help the hero throughout the quest. And finally woman a temptress: This is a female character, a femme fatale, which offers often danger to the hero.

These archetypes also can be found in serious games. Interesting characters keep the gamer playing and a high involvement can be reached by identification with the characters. Characters differ according to game genre. For example in serious games for health context medical experts are needed as an intelligent agent. Dealing with emotional items like cancer in a competent way causes big challenges in character design. One famous character in health context is Roxxi [54]. In the game Re-Mission gamer fight from a ego-shooter-perspective against cancer by this nano-robot and learns besides more about this illness. The narrators perspective is important in this kind of game, because ill children could fight actively against their cancer. Studies proved an increasing self-powerness of the gamer [44]. Roxxi has an friend as a learned guide inside, a Holographic Guidance. This simulated holographic companion provides audio suggestions and occasional guidance through a holographic navigational arrow. The interaction between Roxxi and her holographic friend are also generating funny sequences. Besides Roxxi and the Holographic Guidance there friendly and enemy characters are settled in the game. So the characters install the classical narrating structure of the fight between good and bad guys. For this, characters are a big opportunity and also challenges for serious game designer.

3 Storytelling in Interactive Media

The idea of interactive narrative is not strictly bound to digital and interactive media; however, with the advent of these technologies and the development of fields such as artificial intelligence, computer graphics or sound synthesis a number of new forms of interactive narratives became possible (e.g. computer games or training simulations). For instance, real-time computer graphics [2] allows the generation and modification of the visual representation of the story in response to story changes and user actions; techniques such as planning or machine learning can be used to automatise some narrative theories and enable real-time story generation [69].

One of the fundamental challenges in developing and in designing and developing interactive narratives using digital media is the contrast between the freedom of interaction of the user and the designer's control of the principles of drama. As pointed out by Szilas [62], these two aspects of interactive narrative are often in conflict as the user has potentially the freedom to disrupt the principles of drama by, for instance, not looking at a specific character in the virtual world or by not triggering a specific event in a specific moment. The vast majority of the research work in the area attempt to directly or indirectly addressing this contrast by improving the freedom of interaction and, at the same time, introduce more intelligent algorithms able to adapt the narrative so that it is consistent with the both user actions an the principles of drama.

This adaptation is implemented at different levels either handling the changes in the story or the ones in the discourse [15,70]: in the first case the narrative experience adapts to the user actions by changing the events composing the story, while, in the second case, the adaptation is focused on the way the events are presented to the user. This section focuses in the latter case, while the adaptation of the story events is covered in Sect. 4.

3.1 Computational Discourse

Game discourse plays a fundamental role in enabling serious games to correctly engage the players and effectively achieve their purpose [54,68]. To achieve this result all of its components have to be correctly designed and implemented.

El-Nasr [23,24] identifies three different aspects affecting the discourse in games: camera shots, light effects and character movements. She further analyses the challenges of designing an interactive narrative architecture in which story generation is separated from story presentation, which is handled by a “Director Agent” controlling the virtual camera, the lights and the characters.

Following similar architectures, many researchers have focused on different aspects of discourse generation and their combination. One of the most developed areas in this field are probably virtual cinematography and camera control [18], in which researchers have been studying for many years the process of translating the cinematographic language to interactive media. Drucker et al. [21,22] initially addressed this problem by defining a language to translate cinematographic shots into instructions processable by a machine; this involved defining a domain specific language for the shot description and a series of algorithms to interpret these descriptions and translate them to camera movements. Since this initial work, research in virtual camera control has evolved mainly in two directions. On one side, researchers focused on finding methods and algorithms to allow computers to design the overall visual discourse, such as shot plans, transitions and cuts [17,36,41]. On the other side, researchers have focused on finding efficient algorithms to animate and accurately place the camera in real-time in response to the given shot plans [6,10,53].

Tightly connected to virtual cinematography research are the studies on automatic lighting of three-dimensional virtual scenes. One of the first works in the area is CameraCreature by Tomlinson et al. [63]: in their work, they envision visual discourse as a multi-agent process, in which a team of ethologically-inspired agents control cameras and lights according to their motivations and their emotional state. El-Nasr [23], instead, proposes a more top-down architecture in which a unified system controls the overall lighting of the scenes following formalised principles of lighting such as the ones described in [64]. The process of formalising such principles and automatising the light placement has itself been focus of research works such as [57] or [31].

The third element of visual discourse identified by El-Nasr [23] is character animation: good character animations are clearly a major contributor to the visual quality of an interactive narrative and automatising the process of animation has been a major research topic in computer graphics for a long time [43].

Within the field of computer graphics, researchers have studied different problems connected to automatic character animation, such as the realistic generation of facial expressions [13], body movements [5] or the synchronisation of realistic lips movements with the characters speech [8]. Many of these technologies are now commonly employed in commercial animation products or game engines (e.g. Autodesk Maya or Unity3D).

Beyond the aspects of discourse enlisted by El-Nasr [23], we can identify many other aspects that contribute to the presentation of a story in a digital audio-visual media: for instance, Jowel [35] proposed a system that generates automatically a sound track given an annotated version of a cinematographic animation. Another example of area related to story presentation is procedural generation of virtual environments in games: a number of works in this area have attempted a story-driven approach, in which the environment is generated to support the completion of a number of quests composing the games story [3,20].

3.2 Discourse and Interaction

In a combination, the aforementioned technologies and methods can be used to generate automatically full story visualisations and implementations such as [36, 41] are two examples of such visualisation based on slightly different approaches. However, the idea that discourse and interaction are connected only by changes of the storyline and that, therefore, the discourse can be directly generated from a formal representation of the story is insufficient to capture the full extent of an interactive narrative experience.

As shown by the studies conducted by Martinez et al. [45] and Burelli [9], visual discourse in interactive experiences has a profound impact on the user experience; therefore, potentially affecting the ability of the user to interact with the digital narrative and to perceive the story narrated [36]. Furthermore, examples of adaptive visual discourse based player interaction and playing style [11] show that interaction can be used to drive camera movements improving the quality of the interactive experience.

The extents of the interplays between story, interaction and discourse revealed by the aforementioned studies highlights even further the importance of studying the relationship between the designer's control of the narrative experience and the user's freedom of interaction, not only at story level, but also at discourse and interaction level. This would allow to envision interactive narratives in which, not only the story itself, but the way in which the user interacts with the story and the way the story is presented can evolve during the experience. For instance, due to a twist in the narrative a first-person perspective game could switch to a third-person view while changing the color palette lowering the pace of interaction to support a more contemplative phase of the experience.

4 Interactive Digital Storytelling

Interactive Digital Storytelling (IDS) or Interactive Digital Narrative (IDN) is a diverse interdisciplinary research field. Various definitions for concepts of IDS



Fig. 4. Left, Faade [46]: Trip and Grace arguing. Right, Prom Week [47]: decision result forecast

exist so far. Spierling [58] assumes for her working definition of interactive storytelling that “during the interactive experience of a story, members of the audience become participants in a storyworld that enables the resulting story. They take a more or less active role right within that storyworld that grants them some degree of influence on the plot as one possible outcome.” [38] states that in Interactive Digital Narrative (IDN) “digital means enable interactive forms of narrative.” [38] An IDS experience only exists by the time the user is experiencing. On the other hand there is Emergent Narrative which was called an improvisation by [4] that is interpreted as a plot based on the users life experience, also see Heider and Simmel Film from 1944¹. Two notable IDS experiences are Faade [46] and PromWeek [47] providing non-linear storytelling through conversation. Faade Fig. 4 was the first non-linear IDS experience giving users free input choice by providing free text input. Prom Week Fig. 4 is a game providing complex non-linear IDS experience by letting the user choose conversation components and for the first time providing end result forecasts for the user to base decision-making on. Chris Crawford [19] states that in games the user interacts mainly with object while in IDS experiences users interact with other characters.

We can conclude there are various approaches on interactivity in narratives shaped by the audiences experience where (A) in IDS the audience actively enables the experienced story and (B) in Emergent Narrative the audience where the narrative emerges from abstract storytelling based on users life experience. Its necessary to mention that in IDS a story does not exist as one finished product to be consumed by the user like movie or a book but a reactive media form like games or serious games and the users choices produce a story with in the system, meaning every user can experience a different story. Some serious games implemented IDS [29, 55]. Different stories in IDS consist of different actions, characters and events shaping each individual story. The sequence of actions is called a plot. Changing the plot will not change the story. Opposite to serious games IDS experiences have no additional goal adding to entertaining

¹ Film available online, e.g. <https://www.youtube.com/watch?v=VTNmLt7QX8E>.

the end-user. IDS is a feature that can be implemented in serious games. As in games an engine enables the experience. In IDS the engine mostly is called story or storytelling engine.

Koenitz [38] writes: “Interactive Digital Narrative (IDN) connects artistic vision with technology.” In IDS information and methods are coming from different domains following different ontology of highly creative fields such as of film writers, film directors or pedagogues. That’s also the case in serious game development where all content apart from program code comes from experts of other domains such as pedagogy (E-Learning), health experts (Exergames) or hydraulic engineers as in project SECOM² This interdisciplinary constellation produces a collaboration problem tackled by authoring models and their implementation called authoring tools or authoring systems [59].

4.1 Authoring

Spierling [58] states: “the situation for story creators approaching highly-interactive storytelling is complex. There is a gap between the available technology, which requires programming and prior knowledge in Artificial Intelligence, and established models of storytelling, which are too linear to have the potential to be highly interactive.” Producing IDS experiences needs process structures of interdisciplinary development. So far several approaches deal with creative input of content and non-linear stories structures by non-programmers [58,61] called authors whether they are technical and content producing [1] or narrative [58] or other authors who are non-expert in software engineering [1]. Some authoring tools enable children to input stories like the Heider and Simmel Interactive Theater [30] and the Wayang Authoring Tool [67] both evaluated with undergraduates. The question of who is an author and what skills an author should possess and if this must be taken into account when designing authoring tools [1] is still undefined for IDS [58,59]. Opposite to that authors can learn how to program and implement their own idea of an IDS experience but this approach excludes authoring by non-programmers and is therefore not discussed here.

The process of authors entering data or narrative structures into the IDS system tailored for a storytelling engine to run on is called authoring. Producing a game with storytelling and especially with interactive storytelling characteristics involves various steps of designing, authoring, capturing, media production and programming [50]. Researching and writing stories for the game comes before dramatically rendering and translating content into visual content, which then is produced renders the production to an interdisciplinary task. With regard to expensive production costs many prior steps must be prototyped, which makes the interdisciplinary task an iterative process argues [59]. As authors expertise and skills vary, input models called authoring models vary as well as authoring methods implemented in authoring tools. In many systems XML and dialects of it describe non-linear story structures [16,39,40,65,66]. Entering XML structures is a task included in the authoring model and can be implemented by using a text

² <https://www.secom20.eu/>.

editor or a graphical user interface [66]. In all cases a XML experienced author can fall back on a text editor entering XML structures. But graphical user interfaces open a window for non-expert authors widening the target group of authors for an IDS system. That is the wide-spread goal of authoring tools [1, 40, 66].

The concept of authoring is determining “the relationships between generative technologies underlying Interactive Storytelling engines, and the actual description of narrative content” [51]. Entering other creative content and information for a storytelling engine creates a bottleneck [51, 59] in production process. So far approaches like generating input [58] and output by input combination using Artificial Intelligence based on discourse analysis in conversational systems as well as game-and simulation design [58], as well as component-based approaches [1] did not solve this bottleneck. While using different approaches and models for authoring IDS experiences all works on authoring tools agree on the necessity for all authors including programmers and non-programmers of instant testing of entered content [1, 66].

4.2 Authoring Tools as Technical Challenges in IDS Production

Authoring for IDS systems follows various models depending on the executing system delivering the interactive experience depending on the storytelling engine [51] used. An authoring tool should not only support the presentation of the used technology states [1], but also allow for authors with different backgrounds to create IDS experiences. The author himself should not need to create the underlying structure from scratch, but can fall back on a story template provided by the authoring tool. An authoring tool can also be an authoring toolkit MR Toolkit, [66] The relevant tasks that the author has to fulfill are then reduced to his core domain and competencies, which include selecting and combining components, adapting multimedia content, and calibrating visual representations of components with the appropriate real world objects. says [1].

But there are problems with visualizations of programming structures for non-programmers as [65] states: “The limitations of a single graph to model a complex non-linear scenario are obvious, because an author is forced to define all possible paths through the story in detail.” Describing a fallback to programming structures opposite to creative methods creating narratives. The goal of an authoring tool is to provide communication interfaces between technology experts, storytelling experts and application domain-experts [1]. Szilas and Spierling [59] describe a vicious circle in the process of creating authoring tools between listening to authors and adjusting the authoring tool suggesting that the creation of an authoring tool is rather an iterative building process than a nonrecurring process. Easy to use interfaces are needed for defining complex structures. “The Heider-Simmel Interactive Theater³ [30] allows novice users to easily author movies intended to convey rich narratives that involve various physical, social, and psychological concerns.” Gordon2014 states. This authoring tool can be used by undergraduates as well as the Wayang Authoring Tool [67]

³ Heider Simmel Interactive Theater: <http://hsit.ict.usc.edu/>.

but both authoring tools produce no IDS system operated by storytelling engines but a complete product to watch by the audience though non-expert input by graphical user interfaces are provided by these authoring tools.

StoryTec environment [29] is an example of an authoring tool in the serious game domain where non-programmers like “medical doctors, fitness coaches or members of other user groups can either define fitness programs and game-based applications for sports and health from scratch or retrieve preconfigured programs and templates from the database (repository) and customize those to the needs and characteristics of individuals and groups.” Ergo Active, Y-Move and SunSports Go are serious games developed with StoryTec [29].

Apart from enabling input for non-programmers authoring tools are mainly developed for specialized storytelling engines. StoryNet [55] using hypertext for IDS and HTML browsers as storytelling engines. This is the only project using standardized software and markup language for IDS. Most IDS projects use XML or a self-made XML dialect for describing story structures and content [66], MR Toolkit. [40] and use specialized storytelling engines implementing several planning algorithms [61]. We conclude authoring tool development is a diversified research field of different authoring models and methods providing access to non-expert authors of various domains and an interdisciplinary task with the goal of tackling the authoring bottleneck [59].

5 Conclusions and Outlook

In Summary, this article draws a line from linear told stories to highly non-linear stories in Interactive Media and Interactive Storytelling by showing their importance for serious games. Beginning with the storytelling basics, fundamental narrative techniques are presented, corresponding to traditional and mostly linear told stories. Narrative techniques like narrator perspective, dramatic structures and Character Design are also important for Game Design. Further the chapter “Storytelling in Interactive Media” includes interactive theories related to narrative aspects. The interferences between story, interaction and discourse has to be researched, considering the relationship between the designer’s control of the narrative experience and the user’s freedom of interaction. This has to be done in three levels, the story level, but also at discourse and interaction level. In addition to this, Interactive Digital Storytelling is presented. Various definitions exist today. Working definitions of Interactive Digital Storytelling had been published [38,58], some incorporating specialized authoring methods [58,61] and some implemented Authoring Tools like Scenejo, Heider Simmel Interactive Theatre and MR Authoring Tool [1,30,66] according to authoring models and specific authoring processes. A general definition is missed until now. According to Interactive Digital Storytelling also authoring tools and their particular items are illustrated.

Using storytelling in serious games context opens challenges and opportunities. According to Jenkins not all games tell stories, but many games have narrative aspirations. [Jenkins] First of all, narrative techniques particularly in

serious games design have to be defined. The presented storytelling basics have to be examined in game context. In the serious game context narratives are essential to transport the serious sense behind the game. There exist different ways to work with narrating parts in serious games. Not all parts have to be told by the author. The serious game *World without oil*, in which the user tell their own stories how to deal with the oil crisis, is a good example for that. But how correspond this with the immersion, game designer want to reach? This opens a new research field: How influence dramatic storylines or character design the immersion level of the player? And how could we measure this?

Further, interference between interaction and reception in serious games have to be analyzed in detail, considering the players freedom of choice. This also means the mixture between linear and nonlinear elements. Balancing the reception of the story with the interaction with game elements is an important challenge in designing games, but an opportunity as well. New forms of storytelling according to *Interactive Digital Storytelling* opens prospects for learning. Self-determined learning needs a freedom of choice, given by *Interactive Storytelling*. So, gamer learn serious content as a coauthor by active doing and trying it out. This is represented for example by roleplaying in the highly interactive game *Faade* or discovering the *Saalburgs spirit* on players own ways with the mobile location-based serious game *Spirit*. This opens an important research field: How narrative parts and the freedom of choice influence the learning aspects in serious games? It has to be analyzed, how much a guidance is useful for transporting serious sense.

Further, authoring tools are often specialized on certain IDS systems and authoring methods producing different IDS experiences from other authoring tools. Today there is no comprehensive media format for IDS experiences but many IDS approaches mostly implemented as prototypes. Unlike HTML as format for *Hyperfiction* a IDS format of the 80s and 90s [39] today formats diverge seemingly according to different technologies like mobile gaming, theater performances, location based technology, HMDs, Google glass and desktop PCs used for IDS experiences. The question here is weather these diversions are only technical diversions or is there a mutual core of IDS in those models, authoring methods and authoring tools and if yes what is this core? Also, authoring in a game design process opens new challenges: How to visualize realize the concept of interactive storytelling in a game to the author to enable the authoring process in the interdisciplinary team?

Many years of research and discussion have passed, but the coupling of narration and interaction can still spark provocative debates requiring our attention. Therefore further work on the practical and ontological analogies and differences between interactivity and narration is necessary. [38] In *Interactive Digital Storytelling* the authoring bottleneck up to this point is still left unsolved [59].

Last but not least, Learning, Gaming and Storytelling have to be examined as an unity. A big challenge is how to evaluate learning aspects transported by narration in prospect. Single evaluations already exist, particularly in heal care. The 2008 study by Kato, Cole, Bradlyn and Pollock [37] about the serious

game Re-Mission represents a good example for this. But there is no focus on narration parts. It is a common sense that serious games using storytelling can help to understand in a learning context, but there is no general method to evaluate this connection.

Further Readings

We recommend Lee Sheldon's 2013 book "Character Development and Storytelling for Games" for game designing and writing because it highlights the fundamental importance of characters and storytelling for all types of games. "The hero with a thousand faces" (Vol. 17) by 2008 by Joseph Campbell, New World Library combines the insights of modern psychology with Joseph Campbell's unique understanding of comparative mythology and is a good book with many insights into storytelling as well as Henry Jenkins's book "Game Design as Narrative" in *Computer*, 44 from 2004. On Interactive Digital Storytelling we recommend two books: "Chris Crawford on Interactive Storytelling" [19] by Chris Crawford is a second edition from 2012 in New Riders updating his fundamental thesis and understanding of Interactive Storytelling. Koenitz's 2015 book "Interactive Digital Narrative: History, Theory and Practice" [38] in Routledge provides a broad overview of current issues and future directions in the multi-disciplinary field of Interactive Digital Storytelling, it covers history, theoretical perspectives and varieties of practice including narrative game design and it assembles the voices of leading researchers and practitioners in the research field.

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