

Digital Storytelling for good with Tappetina Game

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Abstract

Context: Storytelling is an important asset in today's society. Digital platforms for storytelling can facilitate collaborative development of stories. The storytelling process, if properly facilitated, can lead to the creation of stories that improve the relations between the players. Moreover, stories convey important information about the players and their interaction. Extended knowledge and better tools are needed about how to facilitate storytelling for good and analysis to exploit the power of the generated data.

Research Question: How to facilitate Digital Storytelling for good?

Method: The investigation is based on a case study approach in which participants have been engaged in the creation of stories. The study is based on empirical data collection and analysis: from the stories recorded, we extract the storytelling features and performance. We have provided qualitative (Domain Expert) and quantitative (Machine Learning) analysis of the stories. In total, 58 users played the game in 15 sessions.

Results and Conclusions: The main result is a framework for analysing digital stories. The analysis gives an indication of which game building blocks lead to stories for good. Future work will include a redesign of the game and its building blocks which lead to stories for good and further analyses.

Keywords: Digital storytelling, Data Analysis, Machine Learning, Games for Good

1. Introduction

Storytelling is a natural skill of human beings and, as some authors defend, it is the reason that makes us humans [1]. Stories are part of our legacy and cultural heritage and they are commonly used, for example, in education contexts as tools to teach and engage students [2], in work-search situations [3] or in marketing studies [4].

Belman et al. [5] makes an overview of different efforts to promote **games for Good** that try to promote certain ethical values. Games for Good have often the goal of teaching problem-solving (see *Four Little Corners* – An interactive storybook app about friendship [6]). Games for Good take several forms: some may deal with exploring one’s identity (*Who Am I? Race Awareness Game* [7]) or to simulate social interaction (*Hall of Heroes* [8] – helps teens adapt to middle school).

There are popular entertainment games that use different forms of storytelling in their mechanics: an older game genre that features collaborative storytelling is tabletop role-playing games, such as *Dungeons and Dragons* [9]. In *Dungeons and Dragons*, the story is created by a central narrator as each player takes on a character and role dice to determine results. In contrast, other games make all players to contribute equally to creating the story, such as *Once Upon a Time* [10] by Atlas Games. *Once Upon a Time* combines fairy tales and more traditional, competitive card playing.

One of the main outcomes of storytelling games, in addition to the joyful time, is the data generated from the story. Each story and its storytellers can be analysed and rated. In this sense, the analysis of stories is not a new topic: Aristotle’s Poetics [11] is usually referred as earliest work on dramatic theory. In his dissertation, Aristotle depicted the seven elements of good storytelling. Therefore, it has been widely used to rate stories and storytellers and was the basis of storytelling analysis. However, digital tools provide more information that can be added to the evaluation process.

Even if the relation between Artificial Intelligence and Storytelling has been explored in the recent years, such as in works [12] [13] [14] [15], there is still a lack in the literature related to frameworks to perform automatic analysis of stories to develop new knowledge and tools for facilitating digital storytelling for good.

In this paper we focus on how data related to digital storytelling games can be collected and analysed in order to provide key features to game designers to increase the impact of the game on players’ performance. First,

we explore how digital storytelling has been traditionally evaluated, which information is key to understand users' capabilities and how storytelling impacts the society. Then, we explore new approaches to analyse this information through automatic collection and processing of audio and textual data, gathered from the stories. This paper is organised as follows: after this introduction, Section 2 presents the related work. Section 3 introduces our design approach of the Tappetina Empathy Game. Section 4 explains the research approach and Section 5 provides the results of the analysis. Section 5.4 presents the proposed framework. Conclusions are given in Section 6.

2. Related work

Digital storytelling is becoming more popular day after day, both in research and in practice. It is a valuable tool in the field of *edutainment*, as it provides an enjoyable and effective way of learning [16].

This section reviews theories, techniques and empirical studies that provide contributions to the central aspects of our work that are: Narratives and Game Play (2.1); if the game is for good and how (2.2); issues about storage and analysis of stories (2.3).

2.1. Narratives and Game Play

There are different **techniques** to facilitate storytelling. Sweetser et al. [17] makes a distinction between:

- *Emergence* that is based on game design ruled by unplanned behaviour and interactions with reusable elements. *Emergence* entails having an environment which responds to the players.
- *Scripting* that is based on making pre-planned activities with predictable behaviours and low-level entities. In *Scripting*, the designer decides before-hand on the player's experience without letting the player think about any sort of consistent world simulation.

As it will be explained in section 3, in our approach we build upon *Emergence*.

The relation between *narrative* and *games* has been explored in the literature [18]. Game narratives are not linear nor essential as movie narratives. Game designers are not storytellers, but *narrative architects*. The role of the game designer is to create game spaces that facilitate narrative experiences, or spatial stories. Four approaches to such environmental storytelling

are suggested by Jenkins [18]: (1) making spaces that evoke narratives the player is already familiar with, (2) enacting the narrative at certain spots of the game, (3) revealing the plot by embedding bits of info in the environment, or (4) letting narratives emerge spontaneously within the game. While only approaches (2) and (3) deal with telling a pre-planned story in the game, all approaches have potential use in designing the game. In our approach, we build mainly upon (1) by introducing three familiar characters and (2) by enacting the narrative by providing clues at certain spots of the game.

Façade [19] is a game that puts the player in an interactive marriage drama. The player takes a story design role by interacting with the non-player actors. This shows how an emergent narrative can be structured to support the player as narrative designer. Natural language processing and AI are used to facilitate the game play and interaction between narration and play, while in our work we use natural language processing and AI to analyze the collected stories.

The Game Play in *Murder on Grimm Isle* [20] is based on the idea that players are asked to design and argue for a crime story based on clues they can find by exploring a 3D environment. As in our work, parts of the narrative are embedded in the game while giving the player enough control to come up with the actual story.

FaTe2 [21] is a project that provides a virtual space for collaborative storytelling. In this 3D virtual world the players can take any role (narrator or spectator) using a game-style interface. This mechanism is more flexible than the one we adopt in our proposed system and gives some possibilities that we are considering to exploit in future work.

GEMS (Geolocated Embedded Memory System) [22] is a location-based game to share memories among family and friends. Thanks to the location services available on smartphones, users can record personal stories or memories on certain locations so other users (future generations, ideally) may be able to recall that reflections. *GEMS* builds on the concept of emotions with clues like “Show me a place where you experienced fear”. In our system we provide the emotion as a clue without linking it to a place or another concept. To link emotions to memories, either as places or real characters, can be a direction that we want to explore in the future in our system.

In *Fiabot* [23] the authors explored the design criteria for designing a digital storytelling game for children. The game is structured in 3 modules that allows the definition of the story and the plot, the creation of media and sharing the story with others.

2.2. Games for Good

Games for Good are games that try to promote certain ethical value [5]. Positive feelings have been widely studied in games, as presented in Papoutsis and Drigas' survey [24]. In their meta-study, they reviewed and classified 20 mobile applications related to empathy and highlighted the opportunity to promote it that arises from the actual massive use of apps.

Murder on Grimm Isle [20] is a serious game study that combines storytelling with writing lessons. In terms of learning benefits, the results showed more sustained motivation and curiosity in the pupils.

Bratitsis, and Ziannas explored the possibilities of Digital Storytelling to fostering social empathy with kids age 3 to 5 (including those with special needs) [25]. The authors concluded that digital storytelling is a promising tool to introduce difficult skills to kids, such as emotion recognition or empathy.

Voices Beyond Walls program [26] empowers marginalised youth from refugee camps through the use of digital storytelling. The study reports the results of a three year workshop program centered around Digital Storytelling. The study provides useful guidelines about how to set up digital story telling workshops. These include guidelines for how to train workshop facilitators that are particularly relevant for making our work sustainable.

Belman et al. [5] make an overview of different efforts to promote **Games for Good** that try to promote certain ethical values. Of note, two dimensions are identified in these studies. Firstly, Dispositional vs Induced Empathy, where studies may look behaviour affected by empathy vs how empathy can itself be changed. The second dimension is Low- vs High-Involvement. In a game, this would determine how much the player is immersed in terms of time, engagement and building relationships in a player community.

The study by Dickey et al. [20] exploit a game that both embeds and evokes narrative using the environment, resulting in sustained motivation and curiosity while learning writing skills.

In [27], Anderson et al. describe the research dedicated to making a link between violent video games and decreased pro-social behaviour. In contrast, more recent studies have been going in the opposite direction, to investigate the positive effect of games on empathy. So-called pro-social games are shown by Greitemeyer et al. in [28] to increase empathy along with a reduction in being pleased at someone else's misfortune. Greitemeyer et al. then shows support for the positive aspects of the General Learning

Model (GLM) of Buckley et al. [29]. The GLM is an generalised version of the General Aggression Model (GAM), which was solely used to look at the negative effects of violent games. With the GLM, games are portrayed as a media that when exposed to, one’s mental state can be affected, leading to possible reactions in behaviour.

2.3. Storage and analysis of stories

In *GEMS* [22] users record personal stories or memories so other users (future generations, ideally) may be able to recall that reflections. Participants created a total of 54 records (3 median records per person, with a range of 0-11). The authors propose the use of open, axial, and selective coding to analyze the data at the individual player level. They also present a number of specific quotations that are representative of the discovered trends. The hypothesis was that the completion of a directive would take place over a period of hours; however, the players often took multiple days to contemplate directives. Players needed time to think of a meaningful place and an appropriate story. Thus, engaging with a directive and creating a record required a significant amount of thought. From the evaluation the authors concluded that narrative and game mechanics provided an engagement experience but the motivation factor is actually important to keep the game interesting. The interesting idea of this game is the notion of time that is not present in our system. In our present system, players are asked to play in a synchronous setting, but we may want to introduce asynchronous game play on a long time duration in future versions of the system.

The analysis phase in *Fiabot* [23] consists of: observations were gathered during the activities and then analysed to provide with an insight into the pupils and teachers user experience in using the artefacts to achieve their goals. There is focus on the fairy tales genre. The fairy tales follow a structure with a beginning (“Once upon a time...”), a middle, and an ending (“They lived happily ever after.”). In addition, a fairy tale has these ingredients: the protagonist/hero, the anti-hero, the hero helper, the anti-hero helper, and the magic object/animal. The authors conclude that a good story, worth a high score, had to include all the ingredients and be consistent with that specific structure. In our system provides a less sophisticated structure of ingredients that allow the generation of stories that are guided by the imagination of the players.

Recent advances in text mining and Natural Language Processing (NLP) have provided researchers with automated tools for analysing textual content

from stories. Topic modelling, specifically Latent Dirichlet Allocation (LDA) [30], is an unsupervised automated analysis to extract important information in large corpora, such as the main topics of interest, groups of similar stories, etc. LDA has been used to process spontaneous speech as well, such as in [15]. With topic modelling, one can automatically classify and measure issues about the hidden structure of spontaneous speech. By using LDA topic modelling in analysis the gossip topics were clearly separated from all other topics such as storytelling (stories about a third, but external person), cooking, duelling, playing games, etc.

The study reported in [12] has collected seven folk stories. They applied three tools for data analysis, named: entity recognition by using an ontology based on Propps formal model; Extraction of the story characters, based of this ontology, and some implemented Jape rules; A co-reference resolution tool, by enacting anaphoric resolution to eliminate co-referenced words. Three nding relationships between characters was integrated in order to link two noun phrases with a verbal phrase.

Researches such as Schlachter et al. in [13], depicted the ability of text mining to cope with Big Data. In their work, a set of metrics that assesses narrative structures in big textual databases was proposed, in an attempt to transform useful narrative structures into narratives.

De Troyer et al. [14] used hand-coded domain knowledge to simulate data rather than analyzing it. Based on the scenario that promotes the objective: “recognize that by comforting the victim, you are making the victim feel better” Domain Experts are given a tool for editing scenarios and expressing them as Ontological elements using a special, Controlled Natural Language (DSML). First, the participants received a small introduction on the purpose of the tool and how to use it. They also received an example story model and an outline of the syntax rules (in text). They were then asked to model a small, prescribed story provided in textual form. For this purpose, we used a scenario about a player who has to escape from a locked house and having three possible ways of doing so. The participants were then asked to sketch the story-ow on paper. Next, they were invited to model the story with the help of our modelling tool. The participants were provided with a comprehensive list of actions and entities (nouns, pronouns, verbs, adjectives). They could ask for assistance at any given time. After completing the exercise, the participants were prompted to reect on their experience and the difculties they encountered

Table 1 [31] reviews several Games for Good that have been of inspiration

for the design of Tappetina game. Our system aims at facilitation of thematic stories by letting the players choose a theme.

3. Our Design Approach

Our design approach is mostly inspired by *Emergence* [17] that means more uncertainty and creative control, as one cannot expect exactly what will happen. Since players may interact with the system in unpredictable ways, the experience will be harder to foolproof and to measure feedback on.

The system is based on the prototype version of Tappetina’s Empathy [32] a storytelling game for mobile devices based on textual cues and collaboration to create stories. In this case, the game was adapted and updated to provide a multiplayer cooperative tool to reflect emotions through storytelling.

We use players’ mobile phones as tools to play, record and reflect. First, mobile phones act as displays, showing all the necessary information to carry out the game and asking users’ about their decisions. Second, they register users’ interaction, by recording and “timestamping” all users’ actions. This way, the game play can be reconstructed after the session. Finally, the phones record users’ voices so the story can be reproduced and the emotional reflection can be analysed.

3.1. Game play

The game relies on cooperation and emotions (as main game building blocks) to create the story. The cooperation allows all users to work together to create the story but decisions are made individually by turns. This is, in every turn the player in control contributes to the story and makes the decisions on her own, without discussing with the rest of the players. During the turn, the rest of the players’ screens are blocked, so they cannot see the information provided or the options to choose. Despite of the individual decisions, players are encouraged to follow the story line and complete the main story. Regarding the main game blocks to make the story, we provided emotions, so users were less constrained about the issues that aroused that emotions.

The first player is in charge of choosing the main character of the story. This decision is made as soon as the game starts. In order to provide guidance, there are three pre-set personas. Besides, each character is introduced with some background information. Both the personas and their background characteristics were selected carefully, with the aim of suggesting different

Table 1: Summary of main Games that have inspired the Tappetina Game

Name	Producer	Year	Theme
Four Little Corners - An Interactive Storybook App about Friendship	DADA Company	2013	yes
Who Am I? Race Awareness Game	Playtime Interactive	2010	yes
Hall of Heroes Game	Centervention	2016	yes
Once Upon a Time: The Storytelling Card Game	Lamber, Richard and Rilstone, Andrew and Wallis, James, Atlas Games	2003	no
Darfur is Dying game	Susana Ruiz	2006	Theme: the crisis in Darfur
Peacemaker game	ImpactGames	2007	Theme: the Israel-Palestine conflict
World Without Oil game	Ken Eklund	2007	social problem solving in a world with no oil
Dragon Dad game	Tiltfactor	2016	environmentally healthy daily practices
3rd World Farmer game	Frederik Her-mund	2005	poverty: hardships as a poor farmer in Africa
Global Conflicts: Palestine game	Serious Games Interactive	2007	Peace: be-friending the locals

emotions (negative, neutral and positive). Regarding the characters, we chose a homeless person, that may arise negative emotions on the players; an assistant manager, neutral; and a millionaire, positive. All of them were presented as nameless and genderless options, giving the player the opportunity to create and explain all this information. Regarding the background, each character is presented with three characteristics. They are different for each one, but they follow a common schema: one piece of information is related to her work, another one provides information about her family/personal relations and the last one introduces a problem the character has. We have chosen these characters as each one with their characteristics represent timely phenomena that we wish to stimulate discussion about. In summary, the characters and background information presented is:

- **The homeless person:** works in a cleaning company, has a friend in another country, has a bad police record.
- **The assistant manager:** works in a hotel, has a spouse, has a drinking problem.
- **The millionaire:** owns a social network company, has two children, becomes easily angered.

How turn taking is orchestrated is a key design decision. Players take turns to create the story. The game is pre-configured to play two full rounds. This is, all players have two turns but the first player, who has an extra one to choose the persona. In every turn, the player is prompted with the following question “Something new happens that makes him/her feel...” and she has to choose one of the three emotions presented on the screen. The set of emotions was extracted from the “Robert Plutchik’s Wheel of emotions” [33] and classified according to their meanings:

- **Positive emotions:** Appreciation, Energetic, Feel that everything is right, Hope, Interested, Joy, Kindness, Love, Peaceful, Proud, Satisfied.
- **Negative emotions:** Afraid, Angry, Ashamed, Bored, Confused, Feel that everything is wrong, Frustrated, Hate, Hopeless, Panicked, Sad.

Figure 1 shows a diagram of an example game play. The group is formed by 4 players. Player 1 is in charge of choosing the persona. Then, each player

is presented with three positive emotions in one turn and three negative in the other turn. This way, the storytelling system forces the user to react and build the story from both sides. Finally, after all players finish their turns, they are asked to come up with the story all together, in a collaborative way.

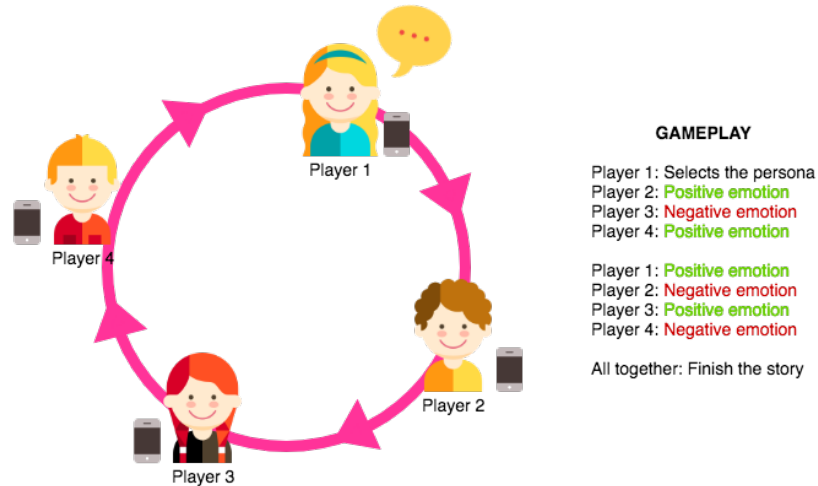


Figure 1: Gameplay example (Drawings taken from www.freepik.com)

An example of the screen is presented in Figure 2. As it is shown, the player has to choose between bored, hopeless and afraid. After choosing the emotion, the player has to explain why the character feels that way to the rest of the group. In other words, she has to create and tell the story. Then, at the end of the turn, the player is presented with another screen where she is asked to link her contribution to the story to one of the previous pieces.



Figure 2: Emotion selection screen example. In this case, the player has to choose among negative emotions: bored, hopeless and afraid

3.2. Game artefacts

The game is programmed to record players' voices during each turn and store audio files accordingly. Additionally, it also records all the interactive events that happen: information presented to the user, emotion selection, time spent telling the story, etc. This way, the story and game play can be reconstructed and analysed after the session. Figure 3 presents a diagram of the building blocks of the game.

The main node (and information provider) is the story. Each story is composed of a set of fragments, two by each of player of the group. These fragments are based on emotions. Although players are presented with three emotions each turn, they have to pick one and tell the story regarding that emotion. Finally, the story has one main character, chosen by the first player. As it was said before, each character is introduced by three characteristics related to her background, so players can build the story on top of them.

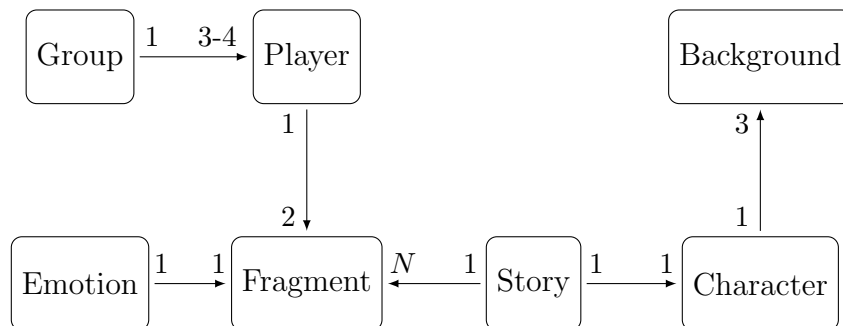


Figure 3: Game building blocks

4. Our Research Approach

The investigation is based on a case study approach in which participants have been engaged in the creation of stories. The research question is: How to facilitate Digital Storytelling for good?

4.1. Selection of Subjects

Participants were recruited from the “Experts in Teams” (EiT) course at NTNU [34] and the Computer Science Department of NTNU and from colleagues at the University.

In total, 58 people were recruited (35 male, 23 female). On average, they were 31

years old and they came from 24 different countries. All the participants had at least a BSc. Degree, but some of them held also an MSc. and/or PhD. All the groups used English as the language for the story, although only a minority of them were native speakers.

EiT is a disruptive study program in which MSc. students (over 2500) enrol a village (a class supervised by a professor) to address a challenge. After explaining the challenge and the possible customers, students work in teams of 4 to 6 people to propose a solution. Apart from the outcome of their projects, the working and learning processes are an important part of the course, as one of its main goals is to improve team-working skills among the students. Therefore, the experiment was introduced as an activity in class related to team-working, so students were more open to collaborate.

4.2. Gaming sessions and Data Collection

The empirical investigation consists of several sessions in which each team is invited to participate at a time. Every session takes an hour and is organised as follows:

- Short presentation of the experiment and the game;
- Each participant is asked to fill a consent form to accept his/her participation and to provide some demographics (age, gender, country of origin, profession and background).
- Participants play the game. During the game, all the conversations are recorded. and all the interaction is registered. This way we collect data both to recreate the game play and the story. Moreover, recordings are used to automatically extract audio and text features to evaluate storytelling skills, as it will be explained in further sections.
- After the game, players are asked to answer the SUS questionnaire to assess the general usability of the system. In addition to the questionnaire, a blank space is available at the end of the document so players can reflect their experiences, insights and issues.
- Finally, an informal talk about the game and the experience take place in order to get more feedback and suggestions from the participants.

All the stories were recorded on the players' phones and processed to remove noise and cross-talks manually. Then, the audio files were manually transcribed into text. Despite the fact that there is existing technology to automate the aforementioned process, the current volume of data allowed for a straightforward transformation of audio streams into text by four humans. Moreover, other studies such as Xiao et al. [35] relied on automatic transcription and it limited the quality of the text analysis.

4.3. Analysis Procedures

4.3.1. Qualitative Analysis

In order to carry out the qualitative analysis, the authors listened to and transcribed the stories recorded. This analysis was carried out by two researchers (independently) and results were compared and summarised. The process is divided into two stages: first, the general emotion of the story was

annotated along with the main topic of the story (in one or two words). This way, we wanted to study the relation between the personas (based on stereotypes) and the actual stories. Then, a more extensive analysis was carried out. The researchers followed the “Aristotle seven elements of good storytelling” and rated the stories regarding the seven dimensions, interpreted as follows:

- **Plot:** a summary of the story built by the players.
- **Character:** the main role that the first player chose.
- **Theme:** related to the topic covered on the story.
- **Dialog:** how the story was presented (first or third person).
- **Melody/Chorus:** did the players repeat or emphasise previous parts of the story?
- **Decor:** understood as the level of detail.
- **Spectacle:** in terms of plot twists.

4.3.2. Automatic Analysis

The automatic analysis is based on text mining and machine learning. The majority of story elements such as theme, chorus and decor can be effectively analysed using text-mining techniques.

One of the main categories of text mining is topic modelling. It is considered to play a significant role towards providing insights of the text without requiring manual, laborious work [36]. Topic modelling reveals details about the theme, the decor or even the spectacle elements of a story. Prior to applying this method, some basic text pre-processing steps have to be done:

- *Tokenization:* the process of retaining linguistic elements and removing any punctuation marks, numbers, etc.
- *Removal of stop words:* neglection of high-frequency and common words such as “a”, “the”, “of”, “and” etc.
- *Part-of-Speech (POS) tagging:* the process of understanding and classification of a word to a specific morphological category such as noun, verb, adjective, etc.

- *Stemming and Lemmatization*: these are two interrelated steps that help text mining algorithms perform better. Stemming reduces the extracted textual features to the root elements of each word. For example, “automatic”, “automate” and “automation” are converted into the stem “automat”. Lemmatization replaces words with their base form. For example, the words “caring” and “cars” are transformed into “car” in a stemming process whereas lemmatization reduces them to “care” and “car” respectively.
- *Exclusion of game-related phrases*: due to the nature of the game, each player is introduced to certain key phrases that are either related to the story scenario or to the emotion status, therefore, both sentiment analysis and topic modelling components should be expected to be highly influenced by such phrases.

After the pre-processing steps we experiment with three different versions of word neighbouring context, namely single words, bi-grams and tri-grams.

5. Analysis

5.1. Qualitative Analysis

The evaluation process yield to fifteen recorded sessions, giving fifteen stories. All the stories are related to real (not fantasy) themes and the most chosen character is the homeless person.

According to the emotion summary, the researchers agreed that most of the stories had a negative emotion, regardless the main character (homeless person, assistant manager or the millionaire). This result is interesting as, for example, we expected a positive story from the millionaire, but all of them had a negative emotion. Thus, we can not predict the emotion only based on these stereotypes, as the cues provided and the building process of the story seem to have a bigger role on that.

Then, regarding the “Aristotle seven elements of good storytelling”, all the stories can be valued as good, as they included all the necessary ingredients. In part, this success was motivated by the game play, which guided the players to create complete and attractive stories.

- **Plot**: all the stories are complete, including a beginning (the main character background), middle and end (decided all together).

- **Character:** most of the groups (8 out of 15) chose the homeless person as the main character. And only 4 groups gave a name for the persona.
- **Theme:** the topics covered included contemporary matters, such as refugees, borders and taxes. However, the most common topics were related to money and drugs.
- **Dialog:** only one of the groups used first person to tell the story. The rest used the third person.
- **Melody/Chorus:** almost all players repeated previous parts of the story to continue building on it.
- **Decor:** the level of detail was variable. Some players provided many details while others limited to the building blocks presented on the game.
- **Spectacle:** plot twists were presented in all the stories, as they were granted by the alternation of positive and negative emotions.

We give in the following five examples that cover the three different characters. We give two examples of stories with homeless as main character.

For example, group 1 **plots** the the story of a homeless person (the **character**) with past tax problems and an entrepreneur and self-realisation spirit. Other **characters** are, in addition to the homeless person (man), his friend and a future love. The **theme** is tax payment. The **dialog** is in third person. There is **Melody**. Concerning **Decor**, there are not many details. The **Spectacle** is characterised by many twists (because of the emotions). Love in the end.

Group 2 also **plots** a homeless person (female **character**) who has a friend (other **character**) in another country (Mexico) and they can not visit each other. The **theme** is a hot topic: Mexico, Trump and the borders. The **dialog** is in third person. There are many interruptions and crosstalk. There is **Melody**. The **Decor** does not provide many details and there is not **spectacle**.

Group 4 **plots** the millionaire **character** John with family problems due to excessive work. The other character is a lost sibling. The **theme** is work - family balance. The **dialog** is in third person. There is **Melody**. The **Decor** provides details about the background of the main character.

Spectacle gives twists related to the emotions, lost of the child and his background.

Group 5 **plots** the character Assistant manager, who works in a hotel and has a drinking problem and family issues due to the alcohol. The **theme** is drinking problems. The **Dialog** is in third person. The **Melody** is repetitive. There are not many details (**Decor**) and there is no **Spectacle**.

5.2. Quantitative Analysis

Textual analysis via topic modelling facilitates reflection to understand how constructive a story is. For example, if we need to understand the emotion from a story, then we can consider as clue the use of positive or negative words. A topic for the LDA algorithm is a set of words that co-occur frequently within collection of texts. We have used R programming language and MATLAB, which give the same results.

In Figure 4, we see that when we remove the game-related phrases that are given to the players, there are two main families of words.

A quick look can reveal phrases that could be related to the theme of money since there are elements such as billion, tax files, mobile phones but also some decor elements that enrich the theme of money such as “Brazilian lady”, “falling apart”, “new life”, etc. Similar conclusions could additionally be drawn by the second (rightmost) part of the figure. There is the term “heroine” with significant frequency, but there are also some clues that enrich the story or even serve as shifting elements about the scenario, such as “new girlfriend”, “refugee camp”, “new motivation”, etc.



Figure 4: Term cloud for two topics, as returned by the LDA algorithm.

This is better illustrated on Figure 5, which depicts the most commonly used bi-grams as a connected graph between each term. As observed in this figure, users tried to introduce some plot twists, which are related to the spectacle attribute stories such as “new life”, “something new”, “new girlfriend”, “Brazilian lady”, “completely different”, etc. The graph that relates the commonly used bi-grams as a network. We can see that the most interesting grouping is appearing on the lower left part, where all phrases that share the term new are grouped together. Therefore, we can see that users often use the word “new” accompanied by a noun to create plot shifts and continue the story. Other interesting findings include phrases that were used to decorate the story such as “private photos”, “Japanese tourists”, “Brazilian lady”, etc.

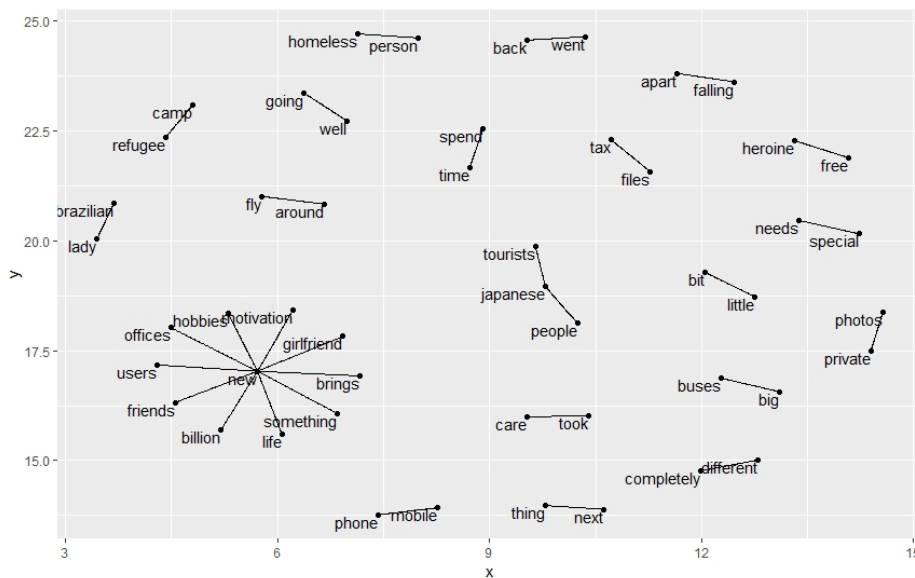


Figure 5: A graph relating the most common bi-grams in the story, upon removing game-related clues.

Finally, Figure 6 depicts the effects of chorus, i.e the repetition or emphasis to previous parts of the story. As one could observe, the majority of tri-grams used by players are fully aligned with the game-provided ready phrases. It emphasises that players made a thorough use of the chorus phenomenon, i.e. the repetition of certain parts of the story, which is reasonable, as it gives them the necessary time to think and prepare the next scenario

outcome.



Figure 6: Term clouds for two topics, considering all parts of the story, including game building blocks using the LDA algorithm.

5.3. Usability

The participants positively rated the system on the usability scale (Figure 7). On the scale of the overall usability [37], the present system scores 69.61 out of 100, which depicts the system to be “just” usable.

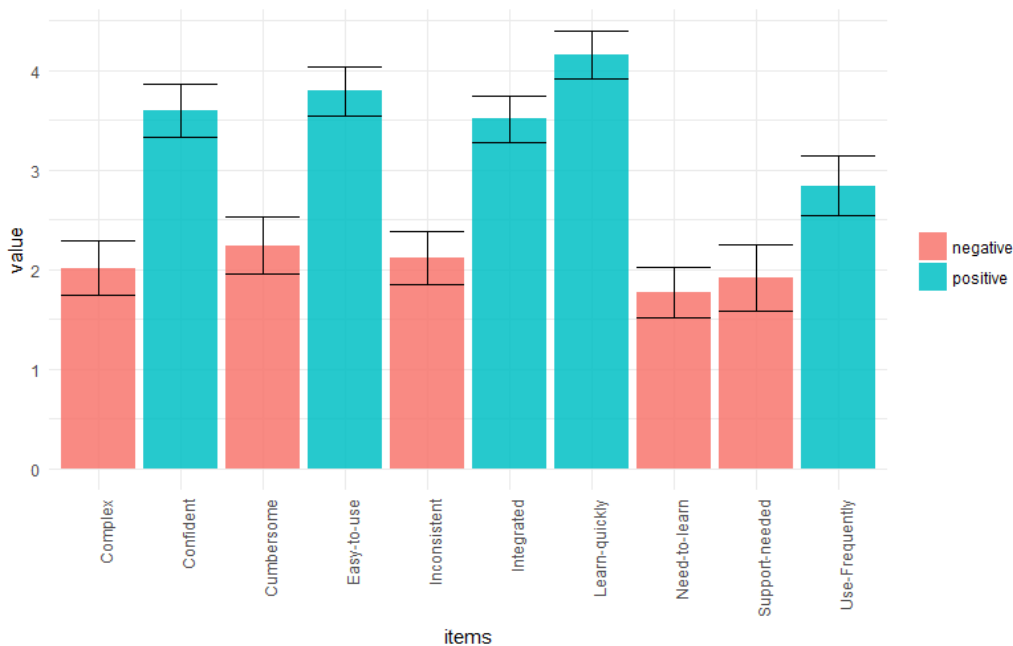


Figure 7: Average score per question. The bars corresponding to questions stated in a negative form are filled in red while the positive are filled in blue.

5.4. *The Storytelling Analysis Framework*

Following a player-centred design approach, we give emphasis on the transformation of traditional narrative way of storytelling to a modern, dynamic approach of interacting and collaborating through mobile devices. Having the user/player in the epicentre of our framework, we incorporate three key concepts of digital storytelling that relate the conceptual components: 1) game play, 2) data collection and 3) reflection. The full operation of the proposed framework for analysis of digital storytelling is provided in Figure 8. The figure has the form of a planetary system, with the player being the central object and the three key concepts being the satellites.

The designer of Tappetina, but also of any other digital storytelling game has a conceptual model of the important substances that should be present in the story. Therefore, let us call the first key component of the framework as *Game Play*. The notion of Game Play includes all the necessary parts of the scenario, the key-objectives as they are conceptualised by the designer, the guidance methods and tools used to control the game, etc. The second key element of the framework, named as *Data Collection*, focuses on real-world data, as collected by the game's internal functionality and constitutes the source for allowing analysis and understanding. The third key element, called *Reflection*, models the processes that affect the emotional characteristics of the player, such as empathy, attitude, self-awareness but also other-awareness.

For the task at hand, at game time, our environment is geared toward having the player interact with the game play directives, provide data for analysis and reflect. Upon deploying the game and collecting data, the analysis components of the framework, which are based on applying *Machine Learning Analysis* techniques to textual resources, are responsible for quantifying storytelling characteristics, providing important insights to the game designer about the quality of the story and the outcome of the game, such as the theme, the dialog, the levels of details used, any elements of plot shift, etc. Such information could assist *Domain Experts Analysis* throughout their process toward facilitating digital stories for good.

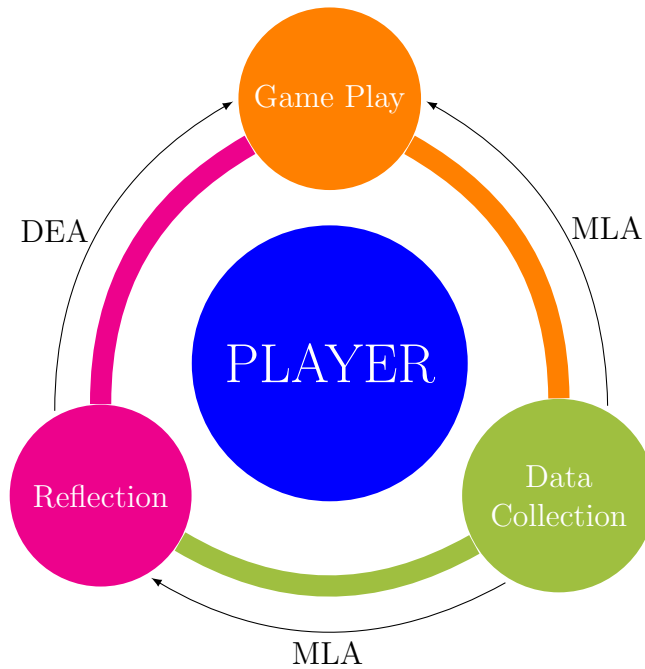


Figure 8: The design framework for analysis of digital storytelling. MLA: Machine Learning Analysis. DEA: Domain Expert Analysis

6. Conclusions and future work

When designing a game, designers are not storytellers, but narrative architects who need techniques and frameworks. In section 2 we have reviewed game design techniques and several storytelling games. We have focused on **Games for Good** that try to promote ethical values and positive relations between the players. The literature provides examples of efforts of automated analysis of digital stories. From the literature review we have identified game design rules and game components that have guided the design of the Tappetina Empathy Storytelling game.

We have presented the design and evaluation of a digital storytelling game. To address the research question “How to facilitate Digital Storytelling for good?”, we have conducted 15 gaming sessions in which 58 players were encouraged to tell stories using the proposed Tappetina Empathy game. The transcriptions of the stories are available¹. We have provided qualitative

¹<https://tinyurl.com/ybqnwq7u>

(Domain Expert) and quantitative (Machine Learning) analysis of the stories.

The main contribution of our work is a framework that connects *Game Play*, *Data Collection*, and *Reflection* about the stories by *Machine Learning Analysis* and *Domain Expert Analysis*.

The next step is to redesign the storytelling game architecture by carefully re-designing game rules and game components (emotions, characters, game play). Concretely, our analysis indicates that 1) some words that from society are good (like for example police) are associated to stories with bad emotions; 2) the interest of players is directed toward characters with misfortune; 3) the game play - switching emotions from positive to negative should be carefully orchestrated.

The new versions of the game have to be carefully evaluated in even broader evaluations in order to generalise our results. EiT with its 2500 MSc. students will serve as an arena to recruit participants to future experiments.

Acknowledgements

This work is carried out during the tenure of two ERCIM “Alain Bensoussan” Fellowship Programme and funded by the Centre for Excellent IT Education, Excited NTNU.

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