

# Using Interactive Storytelling to Identify Personality Traits

Raul Paradedada<sup>1,2</sup>, Maria José Ferreira<sup>1,3</sup>, Carlos Martinho<sup>1</sup>, and Ana Paiva<sup>1</sup>

<sup>1</sup> INESC-ID and Instituto Superior Técnico, University of Lisbon - Portugal

<sup>2</sup> Rio Grande do Norte State University, Natal - Brazil

<sup>3</sup> Madeira Interactive Technologies Institute, Madeira - Portugal

{raul.paradedada, maria.jose.ferreira}@tecnico.ulisboa.pt,  
{carlos.martinho, ana.paiva}@gaips.inesc-id.pt

**Abstract.** Each person feels and understands stories in a unique way. Stories have different meanings to people, and those depend on their personal experiences and personality. Each one of us is unique, with unique personality traits, classifiable through personality trait theories, such as the Myers-Briggs theory. In this paper, we describe how we have created a database of 155 individuals to extract their personality classifications based on Myers-Briggs Type Indicator and then used the fact that each person's individual traits impact the interpretation of interactive storytelling. With this work, we intend to perceive transparently (i.e. without questionnaire and using the language of the interactive experience itself) the person's personality in order to create through the use of persuasion a personalised narrative experience. Through a concrete study, we show how an Interactive Storytelling scenario can be used to identify users personality traits. In particular, by extracting the decisions taken by a user in an interactive storytelling scenario, we are able to predict the user's MBTI personality traits.

**Keywords:** Interactive Storytelling; Personality Traits; Myers-Briggs Type Indicator; Decision Points; Preferences.

## 1 Introduction

Interactive Storytelling (IS) emerges from the overlap of narrative theory and computing [11]. Fundamental to IS is the role of the user who can perform activities that will significantly affect the story delivery or the story world [2]. In fact, IS has been used widely in different areas, such as to aid children to expand their imagination, improve their understanding of sensations and situations and to assist in the literacy learning [14, 7]. Furthermore, a storytelling focused approach to education can be applied to learning literacy, both in primary and secondary school [16].

Yet, all of us are understand, interpret and feel stories in different ways. The personality traits of the students influence the way they approach education and how they learn. A good example is the work of [10] that claim that students are

more likely to perform well and to trust their efficacy if they are interested in a topic. Student's preferences and personality affect their effort and persistence affecting their performance. That is, a person's personality has a vast influence on their way of life, their preferences, and how to take decisions.

Additionally, even in the games industry [6], the strategies of IS are used to lead the player through a path inside a story depending on the decisions made by that player. Famous games such as *GTA*<sup>1</sup>, *Assassin's Creed*<sup>2</sup> and *Diablo*<sup>3</sup> use features of IS. Yet, in such games where there are different paths to take, which path the player should choose to enjoy more the game? Or, more specifically, which path can be better given his/her personality traits?

In some games, the choice of the path or even the game to be played depends on how the player think, feel and behave, which is dependent on the players' personality traits. For example, it seems more likely that a sportive person would enjoy soccer games, or a pacifist person would choose the more peaceful path in a war game.

Having the aforementioned in mind, this work describes the use of an IS scenario to identify the personality traits of the players according to the Myers-Briggs Type Indicator (MBTI) theory. The idea is that, as a user navigates through an interactive story she/he will have several Decisions Points (DP's), and those decisions are made according to the user's personality. Thus, as these DP's are shown during the story and are the trigger to activate a particular path, depending on the decision made, we can, in fact, determine the personality of the person. In other words, without applying questionnaire and using the language of the interactive experience itself, we will be able to perceive the person's personality in a transparent way. On the other hand, if we know the personality traits of the user, we can predict the path the user is going to take. Besides, with the correct identification of the person's personality and applying a persuasion technique, it will be possible to create a more individualised narrative experience that might be more attractive for different individuals.

In the research here presented we describe this dual influence. To do that, first, we applied an MBTI questionnaire to classify the person's personality traits and at the same time create a dataset to future comparisons. Secondly, with one small group of users that answered the MBTI questionnaire, we asked them to play our carefully designed interactive story. Finally, we compared the results obtained in the game and the questionnaire for this small group. The results show that we can identify (based on their decisions) in which MBTI personality, the player's personality traits can be associated. We were also able to establish

---

<sup>1</sup> Grand Theft Auto. Developers: DMA Design and Tarantula Studios. Publisher for Windows: Rockstar Games. Release: October 1997.

<sup>2</sup> Assassin's Creed. Developers: Ubisoft, Gameloft, Griptonite Games and Blue Byte. Publisher: Ubisoft. Release: November 2007.

<sup>3</sup> Diablo. Developers: Blizzard Entertainment, Synergistic Software (Hellfire expansion) and Climax Group. Publishers: Blizzard Entertainment and Sierra Entertainment. Release: December 1996.

some patterns related to the personality traits, in particular, whether players with the same personality will choose the same paths.

## 2 Personality Traits

Personality traits are essential characteristics of the human being, and they are factors that can influence our preferences and decision making. In the work of [17], the author describes a study aimed to find out how the personality affects ratio preference. The methodology used was, firstly was classified the personality traits according to a personality theory and, then, asked the participants to estimate the preferences to 15 horizontal and 15 vertical rectangles with different ratios, respectively. As results, the authors describe that there is a tendency of preference for the ratio of a square, the average degree of preference for golden ratios and a gradual declining dislike for ratios after golden ratios; and the personality impact the ratio of preference.

The research previously mentioned is just an example of how our personality may define what we enjoy or not. In this way, our main research tries to understand *the potential of IS to determine personality traits*.

The term personality trait was created to relate to enduring personal characteristics that are revealed in a particular pattern of behaviour in a variety of situations. In the literature, it is possible to find several instruments that can be used to categorise the person's personality traits, in particular, the Myers-Briggs Type Indicator (MBTI). MBTI is an introspective self-report questionnaire designed to indicate psychological preferences in how people perceive the world and make decisions [8]. It was constructed by Katharine Cook Briggs and her daughter Isabel Briggs Myers, and it is based on the typological theory proposed by Carl Jung [3]. *"The underlying assumption of the MBTI is that we all have specific preferences in the way we construe our experiences, and these preferences underlie our interests, needs, values and motivation."* [4]. This theory considers 16 personality types, resulting from the combination of four opposite pairs, representing preferences or dichotomies. The four possible pairs are Extraversion (E) - Introversion (I); Sensing (S) - iNtuition (N); Thinking (T) - Feeling (F) and Judging (J) or Perceiving (P). None of these types is "better" or "worse"; however, Briggs and Myers theorised that people innately "prefer" one overall the combination of type differences [8]. These types are typically referred to acronyms of four letters, the initial letters of each of the four type of preferences (except in the case of intuition, which uses the abbreviation 'N' to distinguish it from introversion). For instance, *ESTJ* stand for Extraversion, Sensing, Thinking and Judgement.

In this work, it was adopted the MBTI [15] as an instrument to evaluate and measure the decisions and preferences made by the player. Because, it has the characteristics of allowing to relate the scores obtained in the questionnaire with a context, for example, the scores in 'EI' and 'JP' dichotomies are regarding attitudes (or orientations) that reflect the ways in which the person is energized and how is the structure, or live the life; and the dichotomies 'SN' and 'TF' are

regarding the mental functions. The ‘*SN*’ is related on how the person gathering the information and are used for perception; and the dichotomy ‘*TF*’ is regarding on how the information are organised and the decision-making and are used for judgment. With these characteristics, the use of this theory shows as a promising strategy to use in an Interactive Storytelling scenario. As the player must deal with decision making during the story.

### 3 Personality Traits in Interactive Storytelling: Methodology

In an IS scenario, the listener can be considered as a player since he can be an active element of the story, which performs activities that will significantly affect the story outcomes or the story world and its characters [2]. In the book [13][p. 106], the authors present seven types of players, a description of how important this distinction is when it is intended to know and define some players characteristics. Having the aforementioned in mind, the person’s personality has been a recurring choice in player modelling. The work of Birk, M,V., et al. [1] show that several player characteristics have an impact on motivation, expressed in terms of enjoyment and effort. They also argue that player enjoyment and effort, impact players in-game behaviours. In this sense, the MBTI theory makes sense by focusing on how the player perceives information in the world and makes decisions based on that. For example, in [9] the authors describe a model that have seven different archetypes of players, how they can be related to the typology of MBTI and how each archetype characterises a particular playing style.

To investigate the link between IS and personality, we framed our problem around the following two research questions:

- **RQ1** “*The decisions taken during a Storytelling Experience can identify the player’s personality traits?*”
- **RQ2** “*Do people play Interactive Stories according to their real personality?*”

In order to answer our research questions, we have built a model capable of identifying the player’s personality trait in real-time using an IS. In this sense, our methodology was divided in four: (1) the MBTI questionnaire; (2) the story design; (3) the system development; and the (4) final study to assess the validity of the approach.

#### 3.1 MBTI Questionnaire

The MBTI test has many versions with different numbers of questions and in this work, was used a questionnaire with 70 questions<sup>4</sup>. The 16 distinctive personalities are typically referred to as an abbreviation of four letters, as already mentioned. In this questionnaire, each question has two choices ‘*a*’ and ‘*b*’ that

---

<sup>4</sup> <http://tracymanford.typepad.com/test.pdf>

identify a pair of dichotomies. For example, the first question measure whether the person can be classified as ‘*E*’ or ‘*I*’, the second measure whether the person can be classified as ‘*S*’ or ‘*N*’, and so. From the 70 questions that composed the questionnaire used, 10 classify the ‘*EI*’ dichotomies, while the ‘*SM*’, ‘*TF*’ and ‘*JP*’ are distinguish from 20 questions respectively. In this questionnaire, the personality traits classification is the sum of answers ‘*a*’ and ‘*b*’ for each dichotomy. This means that whenever the person has more ‘*b*’ answers for questions that measure the dichotomies ‘*JP*’, she/he tend to be more *Perceiving* than *Judging*. The use of this specific questionnaire is regarding the number of questions, allowing person to answer it in a short period of time (less than 20 minutes) and the fact that has been used in previous works such as [12, 17].

In this way, we intend to apply this questionnaire to as many participants as possible to create a database that contains their MBTI personalities. Besides, we intend to identify which questions are more relevant and discriminating for each dichotomy. Suppose that in the first question all the participants that were classified as ‘*E*’ had chosen the letter ‘*a*’ as the answer and all the participants that were classified as ‘*I*’ had chosen the letter ‘*b*’, then this question could be considered a discriminant question. We decided to follow this approach because it is not interesting to create and apply an IS with 70 DP’s (one for each MBTI question). Although, we intend to identify and use just the most relevant questions to make a relation between each DP and the MBTI questions (see the next sections for a better explanation). In order to identify those relevant questions for each dichotomy, it was used the Cohen’s Kappa coefficient, equation (1), between questions. In our analyses, it was used the dichotomy regarding the answer made in the question as relative observed agreement and the dichotomy given by the result of the MBTI questionnaire as the hypothetical probability of chance agreement. For example, a person was classified as having the preference ‘*E*’ by the MBTI test result (hypothetical probability of chance agreement) and her/his answer to a specific question that measures the dichotomies ‘*E-I*’ it will be the relative observed agreement.

$$k = [Pr(a) - Pr(e)]/[1 - Pr(e)] \quad (1)$$

In equation (1),  $Pr(a)$  is the relative observed agreement,  $Pr(e)$  is the hypothetical probability of chance agreement and  $k$  is the Cohen’s kappa index value.

Since some questions stand out more than the others (see results in section 4.1) we decided to calculate weights for each option (‘*a*’ and ‘*b*’) of those relevant questions. This was considered to be appropriate once we were using only a set of questions from the MBTI questionnaire. The weights of each option will be given to each option of the DP’s in the IS, according to the equation (2).

$$W(q) = Np(Opx)/[Np(Opx) + Np(Opy)] \quad (2)$$

In equation (2),  $W(q)$  is the weight to be assumed by the question ‘*q*’;  $Np(Opx)$  is the total number of participants which answered the first option,

' $x$ ' and  $Np(Opy)$  is the total number of participants which answered the second option, ' $y$ '.



Fig. 1. Screen layout with the first scene of the IS.

### 3.2 Story Design

As mentioned earlier, an IS has DP's that work as triggers, to change the story flow. Using this feature, we intend to create a story with different paths that have DP's related to the MBTI questions. Particularly, as far the decisions are taken during the story, we intend to determine in which dichotomies of MBTI theory the players' personality trait can be related. For example, in a particular DP is measured whether the players have the predisposition to ' $E$ ' or ' $I$ '.

During the story creation, that was written with the guidance of a professional with expertise in education, we tried to ensure that the participant is not influenced by any personality trait of the main character, after all, the protagonist will be the participant itself. To reinforce the previous idea, before the participants initiate the IS interaction, they were given the suggestion to act as if they were living this particular situation in reality. In addition, to reduce the possibility of incorporating a character very different from the participant it was introduced a character without background, own motivations, etc.

The story happens in the Middle Ages (or Medieval Period), and the user will perform the role of a country leader that received a threat from another country. The main goal of the story is to prevent her/his country from falling into the enemy hands. Furthermore, to captivate the player and increase her/his immersion during the story flow, in each scene a representative image of what is happening in the story is presented.

Fig. 1 shows the beginning of the adventure and how the story is displayed to the player. At the top, is presented a banner with the name of the IS; on the left side, an image representative of the scene described in the middle, and in the bottom, it is presented two buttons with the possible decisions to be made. In this first scene, the dichotomies ' $EI$ ' is measured, with the follow decisions: "*You ask the population to come together to discuss this threat*" or "*You just request the council to discuss actions to be taken*". In this DP, the first choice represents

the extrovert dichotomy, ‘*E*’ and the second option to the introvert dichotomy, ‘*I*’ (both options are related to questions of the MBTI questionnaire).

The IS has a total of 30 DP’s, but to finish it, the participant can go through a maximum of 21 DP’s or a minimum of 16 DP’s it all depends on the decisions taken. As mentioned before, each DP measures a specific dichotomy, so we tried to have the same amount of DP’s for each dichotomy at each player interaction. For example, in the path where the player can reach the end of the story with 16 DP’s, we ensure that he/she has chosen 4 DP’s for each MBTI pair of dichotomy. The story should have an average duration of 20 minutes, and through the decisions made in each DP, we intend to find a pattern among people with the same personality traits regarding the decisions made.

At the end of the IS, we asked participants to fill in a questionnaire that was based on the work of [5] with some adaptations. Our goal with the survey is to measure: a) what the participants thought about the decisions made and b) what was their immersion level in the story.

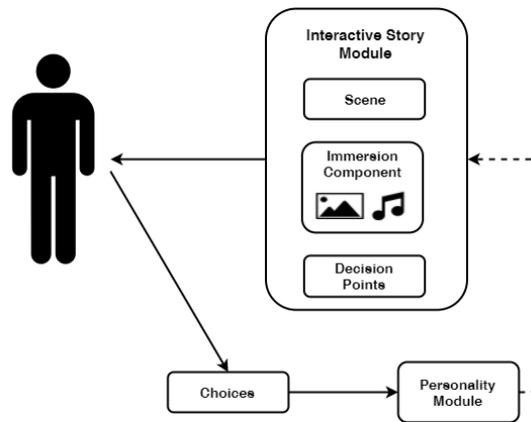


Fig. 2. Model created for the scenario used.

### 3.3 System Development

For the implementation of the IS scenario, we used a multi-platform language, *C#*. This language allows us to use this scenario either as web and desktop platform. The goal is to use the desktop platform in the future, integrated with the frameworks that had been developed in our research group.

Fig. 2 presents the model created for the IS scenario with the modules: Interactive Story Module (ISM) and Personality Module (PM). The Interactive Story module is responsible for showing to the user the text, the decisions to be made and an image. The Scene component gives the scene text, the Decision Points component provides the corresponding decisions, and the image that represents the scene is selected through the Immersion Component, see Fig. 1 for an example of the screen layout. After the user selects a decision, the Choices component

saves it and send the proper preference and the weight of that decision to the PM. This module updates the correspondent preference value. In future, the PM will use the updated value to influence the ISM. At the end of the game, the PM calculates the values received for each dichotomy and save the final MBTI classification according to our methodology. The calculation is done using the following equation:

$$D(x|y) = \begin{cases} x, & \text{if } \sum(w(x)) > \sum(w(y)) \\ y, & \text{otherwise} \end{cases} \quad (3)$$

In equation (3),  $D(x|y)$  is the dichotomy to be given to the participant,  $w(x)$  is the weights of the dichotomy ‘ $x$ ’ and  $w(y)$  is the weights of the dichotomy ‘ $y$ ’.

### 3.4 Study

Our approach involves two steps: the first is gathering the information from the personality traits and the second is to play the IS. Regarding the first step, we had 200 people answering the on-line MBTI questionnaire<sup>5</sup> and as a motivation factor to them (according to participants’ statements, this was motivating) it was sent a report about their personality traits related to a character of a series. To that matter, before filling the MBTI questionnaire participants we asked to choose a series of the following options: *Game of Thrones*, *Marvel Super Heroes*, *Harry Potter*, *Star Wars* and *Disney Princess*. For the second step, we randomly choose from the 155 (after removing duplicates data from the 200) participants 23 (18 female and 5 males) to play our on-line scenario<sup>6</sup> and in the end of the story they were asked to fill an on-line questionnaire<sup>7</sup> about the immersion and the decisions that they had made.

## 4 Results

Regarding our results, they can be divided in two: the Collection of Personality Traits and the Interactive Storytelling Experience.

### 4.1 Collection of Personality Traits

In this stage, from the 200 answers received, we removed duplicates and missing values, resulting in 155 answers cleaned. From these, 45 are males with an average age of 30.6 (7.44 std) and 110 are females with an average age of 34 (11.32 std).

Regarding the analysis of the data from the MBTI questionnaire, it was calculated the individual’s statistics for each dichotomy, see Table 1. For example, for the first pair of dichotomies ‘ $EI$ ’, 68 persons were classified as Extroverted ‘ $E$ ’ which represents 43.87% from the total of 155, in contrast, 87 were classified

<sup>5</sup> <https://goo.gl/dm2KgQ>

<sup>6</sup> <https://goo.gl/mizWck>

<sup>7</sup> <https://goo.gl/SsCgSP>

as Introverted ‘*I*’ representing 56.13% of the total population. On Table 2, it is possible to see the personalities distribution of the 155 participants. The most popular MBTI personality collected was the “*ISTJ*” with 33 persons, representing 21.29% from the total of participants. Making a brief comparison between our results with the results obtained by the Center for Applications of Psychological Type<sup>8</sup> (CAPT) ours follow the same pattern.

**Table 1.** Dichotomy statistics group by pairs of preferences.

<i>EI</i>		<i>SN</i>		<i>TF</i>		<i>JP</i>	
<i>E</i>	<i>I</i>	<i>S</i>	<i>N</i>	<i>T</i>	<i>F</i>	<i>J</i>	<i>P</i>
68	87	109	46	72	83	119	36
43.87%	56.13%	70.32%	29.68%	46.45%	53.55%	76.77%	23.23%

The CAPT results describe the estimated frequencies of the type of personality in the United States population, and our results were almost the same regarding the dichotomy with higher classification. For instance, in the ‘*EI*’ pair the ‘*I*’ stands out from the ‘*E*’, in the ‘*SN*’ the ‘*S*’ stands out from ‘*N*’, in the ‘*TF*’ the ‘*F*’ stands out from the ‘*T*’ and finally in the pair ‘*JP*’ the ‘*J*’ stands out from the ‘*P*’. In addition, the six most popular MBTI personalities in the CAPT were also the same found by us (see Table 2).

**Table 2.** MBTI personalities classification group by total percentage.

<i>ISTJ</i>	<i>ESTJ</i>	<i>ESFJ</i>	<i>ENFP</i>	<i>ENFJ</i>	<i>ISFJ</i>	<i>ESFP</i>	<i>INFJ</i>
33	25	23	14	12	11	8	8
21.29%	16.13%	14.84%	9.03%	7.74%	7.10%	5.16%	5.16%
<i>INTJ</i>	<i>ISFP</i>	<i>ISTP</i>	<i>INFP</i>	<i>ESTP</i>	<i>ENTJ</i>	<i>ENTP</i>	<i>INTP</i>
5	4	3	3	2	2	1	1
3.23%	2.58%	1.94%	1.94%	1.29%	1.29%	0.65%	0.65%

With the results obtained from the MBTI questionnaires, it was applied the Cohen’s Kappa coefficient, equation (1), to obtain the discriminant questions. Thus, it was found moderate agreement in 7 questions representing the dichotomies ‘*E*’ and ‘*I*’ and ‘*S*’ and ‘*N*’, and 8 questions for each ‘*T*’ and ‘*F*’ and ‘*J*’ and ‘*P*’ dichotomies. In this sense, for the questions: of ‘*EI*’ dichotomies we obtain minimum and maximum values of  $k$  [0.467;0.705]; to ‘*SN*’  $k$  was [0.447;0.618]; to ‘*TF*’  $k$  was [0.383;0.515] and to ‘*JP*’  $k$  was [0.387;0.443]; for all dichotomies  $p < 0.0005$ .

<sup>8</sup> <https://www.capt.org/mbti-assessment/estimated-frequencies.htm?bhcp=1>

## 4.2 Interactive Storytelling Experience

To answer our first research question, we compared the final classification obtained with our model with the final classification of the MBTI questionnaires. In this sense, our model correctly identified always 1 dichotomy from the four needed to obtain a personality. But, our results also reveal that: in 96% (22 out of 23 participants) it hits two dichotomies; in 61% (14 out of 23) reaches three dichotomies and in 17% (4 out of 23) achieve all four dichotomies.

Although our population did not have the ideal size, it helps by providing some good information to use for the future improvements. A good example is regarding the DP's chosen, it was found patterns of choice, in other words, once specific personalities have chosen the same options on the same DP's.

In addition, a statistical analysis was performed, comparing the decisions made in each DP with the answers made in the respective question from the MBTI questionnaire. The data was split into two groups for each pair of preferences. For example, regarding the dichotomy '*E-I*', the first group has the answers collected from the questionnaire MBTI and the second group the correspondent answers in the IS scenario. Based on this, a normality test was performed and the results obtained a  $p < .05$  for all groups, reporting that the data significantly deviated from a normal distribution. Next, to verify whether the person makes decisions according to the answers made in the personality test a correlation test (Chi-square test) was applied and it was observed the contingency coefficient value. As seen in Table 3, the  $p$  value was higher (close to 1) for the pairs '*S-N*' and '*J-P*', showing a high degree of association between these pairs of preferences.

**Table 3.** Results of Contingency-Coefficient.

<i>E-I</i>	<i>S-N</i>	<i>T-F</i>	<i>J-P</i>
v=.098 p=.365	v=.014 p=.904	v=.062 p=.487	v=.015 p=.857

As mentioned before, it was applied a questionnaire after the IS to measure the immersion felt by the player and the decisions made. The questions were answered through a Likert scale of 1 to 5, ranging from 1 - "strongly disagree" to 5 - "strongly agree". The questions related with immersions were: "*I was able to imagine and visualise the environments of the story.*", "*I felt like I was the leader of the country.*" and "*During the game, the time passed very fast.*". The answers collected for all the above questions had an average response higher than 3.5 (4.4, 4.5, and 3.9 respectively). Regarding the decisions taken by the participants, we asked them whether "*My decisions influenced the events of the story.*"; "*I have been able to recognise the consequences of my decisions in the story.*" and "*The end of the story was according to my decisions.*" The results show that the average answer per question was equal or higher than 4.0 (4.6; 4.4 and 4.0 respectively).

According to the global results of this questionnaire, it is possible to say that most of the participants felt immerse in the story and that they also notice how

their decisions influenced the flow of the story. Furthermore, players were asked for suggestions about the IS, some of those were: adding more related images to the scenes, increase the scene immersion with sounds (e.g. door opening, battle screams, etc.), medieval music and more description of scenes.

## 5 Conclusions and Future Work

This work describes an initial model that allows the classification of the person's personality traits using an IS scenario. Although the success rate was not the desired one, 80% for the four pairs of dichotomies. We believe that it is possible to classify the personality traits according to the MBTI theory using an IS approach instead of the traditional one (through a questionnaire). To accomplish this, we need to do some adjustments in the current model.

For the pair '*SN*' and '*JP*' there was found a proximity relationship between the MBTI questionnaire and the IS scenario, this could mean that people follow more their personality during the IS for these preferences. Regarding the pairs '*EI*' and '*TF*' the data collected can be interpreted in two ways. First, people do not follow their personality in the game (some follow their emotions others follow the strategy). Secondly, the DP's for these dichotomies might need some refinement regarding the design follow. Does this means, that some personalities feel more confident to play interactive games with preferences different from theirs than the others?

Despite the good results for the immersion level of the story, in future, we intend to implement the aforementioned improvements on the Immersion component, as well some modifications in the scenes and the DP's. In light of the presented results, we expected that a growth in the population that play the IS after the necessary refinements will provide better results to our future findings. We are also planning on moving from the on-line version for a desktop platform with the introduction of a social robot with the role of storyteller. Finally, we intend to use the person's personality to create a more individualised narrative experience that will be more enjoyable for the person by applying persuasion techniques in a storyteller robot.

**Acknowledgments.** We would like to thank Professor Isabel Benites who aided in the story creation, the National Council for Scientific and Technological Development (CNPq) program Science without Border: 201833/2014-0 - Brazil and Agência Regional para o Desenvolvimento e Tecnologia (ARDITI) - M1420-09-5369-000001, for PhD grants to first and second authors respectively. This work was also supported by Fundação para a Ciência e a Tecnologia: (FCT) - UID/CEC/50021/2013 and the project AMIGOS:PTDC/EEISII/7174/2014.

## References

1. Birk, M.V., Toker, D., Mandryk, R.L., Conati, C.: Modeling Motivation in a Social Network Game Using Player-Centric Traits and Personality Traits, pp. 18–30. Springer International Publishing, Cham (2015)

2. Figueiredo, R., Paiva, A.: Affecting Choices in Interactive Storytelling. In: AAAI Fall Symposium: Computational Models of Narrative (2010)
3. Jung, C., Adler, G., Hull, R.: *Collected Works of C.G. Jung, Volume 6: Psychological Types*. *Collected Works of C.G. Jung*, Princeton University Press (2014)
4. Kaplan, R., Saccuzzo, D.: *Psychological Testing: Principles, Applications, and Issues*. Cengage Learning (2012)
5. Klimmt, C., Roth, C., Vermeulen, I., Vorderer, P.: The empirical assessment of the user experience in interactive storytelling: construct validation of candidate evaluation measures. Tech. rep., Technical Report, Integrating Research in Interactive Storytelling-IRIS (2010)
6. McDonald, E.: The Global Games Market 2017 — Per Region & Segment — Newzoo (2017), <https://newzoo.com/insights/articles/the-global-games-market-will-reach-108-9-billion-in-2017-with-mobile-taking-42/>
7. Miller, S., Pennycuff, L.: The Power of Story: Using Storytelling to Improve Literacy Learning. *Journal of Cross-Disciplinary Perspectives in Education* 1(1), 8 (2008)
8. Myers, I., Myers, P.: *Gifts Differing: Understanding Personality Type*. Davies-Black Pub. (1980)
9. Nacke, L.E., Bateman, C., Mandryk, R.L.: Brainhex: preliminary results from a neurobiological gamer typology survey. In: *International Conference on Entertainment Computing*. pp. 288–293. Springer (2011)
10. OECD: *Student Learning Attitudes, Engagement and Strategies*. In: *Learning for Tomorrow's World: First Results from PISA 2003*, pp. 109–158. Organisation for Economic Cooperation and Development (OECD), Paris (2004)
11. Paiva, A.: The Role of Tangibles in Interactive Storytelling. In: *Virtual Storytelling. Using Virtual Reality Technologies for Storytelling: Third International Conference, ICVS 2005, Strasbourg, France, November 30 - December 2, 2005. Proceedings*, pp. 225–228. Springer Berlin Heidelberg (2005), [http://link.springer.com/10.1007/11590361\\_26](http://link.springer.com/10.1007/11590361_26)
12. Paradedda, R.B., Martinho, C., Paiva, A.: Persuasion based on personality traits: Using a social robot as storyteller. In: *Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*. pp. 367–368. HRI '17, ACM, New York, NY, USA (2017), <http://doi.acm.org/10.1145/3029798.3034824>
13. Prada, R., Santos, P., Martinho, C.: *Design E Desenvolvimento De Jogos*. FCA (BRASIL)
14. Ryokai, K., Vaucelle, C., Cassell, J.: Virtual peers as partners in storytelling and literacy learning. *Journal of Computer Assisted Learning* 19(2), 195–208 (2003)
15. The Myers & Briggs Foundation: *The Myers & Briggs Foundation - MBTI® Basics* (2014), <http://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/>
16. Van, G.: Potential Applications of Digital Storytelling in Education. Paper presented at the 3rd Twente Student Conference on IT, Department of Electrical Engineering, Mathematics and Computer Science. (2005)
17. Wang, C.Y.: Preference measures of rectangle ratio on mbti personality types. *Art and Design Review* 3(03), 69 (2015)