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Master's Thesis

Academic Year 2017

Entia:
Design of a Digital Game for Personality Assessment through the Five-Factor Model

Keio University Graduate School of Media Design

Leandro Navarro Hundzinski

A Master's Thesis
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
MASTER of Media Design

Leandro Navarro Hundzinski

Thesis Committee:

Professor Keiko Okawa	(Supervisor)
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Abstract of Master's Thesis of Academic Year 2017

Entia:
Design of a Digital Game for Personality Assessment through the Five-Factor Model

Category: Design

Summary

Recent studies have identified the potential of games in assessing personality through gameplay and data. This research utilizes the Five-Factor Model for personality assessment through gameplay. Entia, as the game is titled, is composed of different mini-games, each analyzing different facets of the personality model. The model serves as a basis to classify players based on the play-through results of mini-games and the player's decision-making. Results of personality obtained from Entia are based on results attributed to the facets, through each mini-game.

Through evaluation of Entia, players were given both Entia and the short form for the IPIP NEO-PI (questionnaire to assess personality in terms of the Five-Factor Model). Entia showed positive results in regards to identifying the facets for each player, meaning that personality assessment can be achieved through gameplay. Additionally, Entia focused more on the experience than the mental effort of traditional questionnaires, while providing players with engagement and increased interest in games as a media for personality assessment.

Keywords:

Design, Game Design, Five-Factor Model, Digital Games, Personality Assessment

Keio University Graduate School of Media Design

Leandro Navarro Hundzinski

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Chapter 1
Introduction

The constant evolution of technology brings with it the possibility of new technological interactions. Games form a new kind of media that always strive for new forms of experiences and engagement. This evolution allowed for games to develop not only being limited to entertainment, but also as tools and for scientific purposes. Studies have been conducted in regards to understanding data obtained from digital games, aiming to retrieve useful information about the players and from user interactions. In this context, a field of growing interest and significance is the identification of personality and human behaviour through digital games. Studies on the field of player profiling have been a strong force on developing and enhancing methods for such purpose.

Understanding personality is a field of knowledge that relates to the importance of categorizing individuals based on their preferences and inclination to certain behaviours. This kind of knowledge can have many benefits, such as information for companies' human resources area, identification of most effective learning methods for each individual, and preferences as consumers. Many of the methods of assessing personality are still based on old formats and media, still lacking the potential of new media for their application. Noticing this, efforts have been made by researchers in order to utilize the power of immersion and data generation of digital games towards identifying and categorizing players in regards to personality types. As a new form of media for such tests, it presents enormous opportunity for improvements on both fields of personality assessment and game development. The advancement of research on games and personality measurement highlights the efforts and applicability of games as a media that enables for personality assessment, forging the path for further developments.

The multimedia aspects of games allows for researchers and game designers to understand the applicability of games on the layer of personality assessment, enabling the use of games as new tools for this kind of assessment. As a field of research, games enable the utilization of their potential as a media comprised of

interaction and gameplay, as tools with unique features for assessing personality. In regards to personality, several are the models utilized for human personality assessment. The Five-Factor Model is one of the most utilized, assessing personality and the individual in regards to five big areas of behaviours and patterns. This model has been utilized in previous studies and explorations of personality assessment through games.

The design of a game from the ground up can highlight important design decisions in terms of gameplay and player interactions. This presents as an opportunity to understand game design elements to assist on this kind of personality assessment.

The main objective of this research is to design a game for personality assessment, considering design choices for gameplay and game mechanics as elements to contribute to player personality identification. Each mini-game design elements are described in details on the Game Design Document present on this thesis, linked to the personality assessment they aim to identify.

Throughout the evaluation, the personality assessment results obtained from Entia will be analyzed, compared with the results of the short form for the IPIP-NEO questionnaire. This aims to check the results obtained from the gameplay in relation to the original questionnaire, on the perspective of the Five-Factor Model. Thus, another objective of this research is to investigate game design elements and if those elements can be utilized to successfully replicate the results of a formal personality assessment questionnaire, through gameplay instead.

Comparing the results from the NASA Task Load Index for both the questionnaire and gameplay, this research also aims to understand those activities in regards of workload and experience. Finding the benefits and gaps of each personality assessment method can lead to a better understanding of the media and format for personality assessment to be conducted. This aims to highlight the potential of games in comparison to traditional assessment methods.

At last, through pre-surveys and post-surveys related to the evaluation, this research also aims to identify and explore the perspective of the participants. This focus can help highlight their perception on the results and on the experience, enabling for feedback and improvements of the design focused on user interaction and experience. With this, Entia aims to address the following research question: *Can the design of a digital game provide a more fun, memorable and meaningful experience for personality assessment on the perspective of the participant, when compared to traditional personality tests and questionnaires*? This also embraces

the feedback from users in regards to their opinions on the experience from both the game and the original form of assessment.

1.1 Contributions

The contributions of this research are as follows:

1. Implementation of a game experience with layers of personality assessment based on the Five-Factor Model facets;
2. Description of the iterations related to implementation and personality assessment;
3. Detailing of specific game mechanics and their parallel's to personality assessment, being able to serve as a guideline for future implementations;
4. Feedback from users based on the experiences, through surveys and the NASA Task Load Index.

1.2 Scope of this research

The scope of this research is to link gameplay with the assessment from the facets of the Five-Factor Model, but not to substitute the official assessment method with this tool. For that, it would be necessary to study in more depth the utilization of games for personality assessment, and with psychology professionals qualified to assess the questionnaires and psychology methods for assessment. As a game designer, my focus is to implement a game experience that relates mechanics with the facets, comparing the results through user testing. The motivation of players and the use of game as a unique media for assessment is also part of this design, as it enables to explore different aspects and perspectives to personality assessment, based on gameplay.

1.3 Structure

This subsection aims to describe this Master's Thesis structure, exposing the contents of each chapter as follows:

- Related Works section, which aims to gather a pool of knowledge about personality assessment in regards to the Five-Factor Model and its origins, highlight current efforts on player's personality identification and use of games on personality assessment, as well as describe important elements related to game design that are core for the design of a game, regardless of application purposes.

- The Design chapter starts by describing the structure of a Game Design Document, enabling the proper documentation of Entia and the aspects of its design. For Entia, each mini-game is described in detail on this section, linking the mechanics and their coverage in regards to personality assessment. Links to Five-Factor model facets and each gameplay aspect are also described in detail on the Game Design Document.

- The Implementation section focuses on the iterations and prototyping process for Entia. The beginning of the chapter describes in high detail the implementation of Entia as is on its final version. Following sub-chapters will describe the iterations process and design choices taken during its development, both on the perspective of game design and personality assessment features.

- The Evaluation chapter describes the results from the application of Entia in user testing. Firstly, it serves as a validation for the design choices for the mechanics and game elements comprising the mini-games and personality assessment. Secondly, the results are described in regards to the data from the application of the NASA Task Load Index and characteristics of the workload for the game and the questionnaire. Lastly, it describes the experience of Entia in comparison to traditional personality assessment, as well as in regards to assessing personality in comparison to the Five-Factor model facets. The surveys utilized will be available fully on the Appendix section of this thesis.

Chapter 2
Related Works

Initially, the contents of the Related works section of this thesis will refer to the topic of Personality Assessment. Personality Assessment is a field in constant development, in which many methods for assessment can be identified. This step aims to describe personality assessment on the Five-Factor Model.

Creating a parallel between personality assessment and games, the focus of the following section is to present works and research conducted in regards to player's personality identification. The field of player profiling will be described as an application of identifying personality in games. It is important to clarify that this research does not apply player profiling techniques for the generation of mechanics or of its game design, but its personality assessment design can assist in identifying opportunities for research and expansion of the field.

After that, the media of games and its definitions will be discussed. This will serve as the basis for understanding games as a form of media that can enable a distinct kind of user experience, through gameplay. Elements such as game mechanics and structures will also be analyzed.

Lastly, an exposition of how this research contributes to the fields of games, player profiling and personality assessment is shown. The aim of this section is to clarify and define the scope in which this research and thesis can possibly contribute in regards to its academic outcomes.

2.1 Personality Assessment

Several are the methods that can be utilized in order to assess personality. For the scope of this research, the Five-Factor Model will be used as the basis for personality assessment. But before listing the components of the Five-Factor Model and how it applies to the design of Entia, it is essential to first understand how research on psychology defines personality and what was the basis that consolidated

the Five-Factor Model and its facets.

Personality and individual traits categorization

Personality represents an unique and persistent composition from factors effecting emotions, thoughts and behaviours of an individual (Irengun and Arikboga 2015); (Cervone and Pervin 2013). However succinct this definition might be, many are the approaches which aim to define the basic dimensions of personality, identifying the most important differences in regards to emotional, interpersonal, experiential, attitudinal and motivational styles (McCrae and John 1992).

One of the approaches to understand those differences is the Lexical Hypothesis. Accordingly to this hypothesis, the most important individual differences to be spotted on individuals are encoded as single terms contained on languages (Goldberg 1993). The Lexical Hypothesis serves as a basis for the grouping of such differences into categories that could infer about individuals' personality (John et al. 1988), in which models have been developed and researched upon. The most widely utilized classification system for personality traits is called the Big Five, based on trait-descriptive adjectives drawn from the lexicon (DeYoung et al. 2007). The Big Five and the Five-Factor Model are models with many similarities and that follow same basis for assessment, but it is important to describe their spectrum and range in regards to what those terms mean for the purpose of this and other researches.

The Big Five and The Five-Factor Model

It is crucial to understand the coverage of the terms Big Five and Five-Factor Model. Though both are utilized interchangeably due to largely consonant models, their distinction is on the fact that the Big Five term was "originally associated with studies on personality traits used in natural language" and the Five-Factor Model "has been more commonly associated with studies of traits using personality questionnaires" (Srivastava 2017).

As this research will utilize the structure of those personality questionnaires to design the game experience, the Five-Factor Model will be referred to. It is important to understand that the developments on the Big Five and its definitions were elements that contributed to the Five-Factor Model and its relevance to personality questionnaires. In this sense, the huge influence and utilization of

the Big Five on research is also a driver for the research and development of the Five-Factor Model.

Research on the Big Five has driven the creation of a body of work that structured its trait taxonomy in five domains of personality: Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to Experience (John et al. 2008). Those five domains describe personality, in regards to a scale of low or high score. Those results are neither good or bad, just descriptive of traits incidence in people's personalities.

Those domains, accordingly to the NEO PI-R™(NEO Personality Inventory-Revised) structure, are comprised of six facets each. Related to this structure of assessment, the facets and their score render on how distinctively those domains are present on the person being analyzed (Costa and McCrae 2010).

Each of those domains and facets will be explained on the following sub-sections. Entia game elements are based on some of those specific facets that comprises those domains, and as such, it is essential that they are properly defined and described, as the game design will utilize those references in its structure.

The following description for the domains and facets are obtained from the explanations provided by the IPIP-NEO (International Personality Item Pool Representation of the NEO PI-R) assessment. Those descriptions were elaborated upon extensive reading on scientific literature related to personality measurement, work by Dr. John A. Johnson. As those descriptions will base how the personality assessment will occur on Entia, it is important that they are shown without changing on the wordings or meaning. Thus, in order to retain the fidelity and integrity to how they were officially described on Dr. John A. Johnson's work, the descriptions on the following sub-sections are cut and quoted from his definitions as-is on (Johnson 2017). They do not represent the definitions in its totality, but serve as a reference to the structure Entia will be designed upon. For a full description and definition, the reader should reference to the guidelines given to test takers, as in (Johnson 2017).

Extraversion

Definition to the domain of Extraversion and its facets:

"Extraversion is marked by pronounced engagement with the external world. Extraverts enjoy being with people, are full of energy, and often experience positive emotions. [...] Introverts lack the exuberance, energy, and activity levels of extraverts. They tend to be quiet, low-key, deliberate, and disengaged from the

social world."

- Friendliness: "Friendly people genuinely like other people and openly demonstrate positive feelings toward others;"
- Gregariousness: "Gregarious people find the company of others pleasantly stimulating and rewarding."
- Assertiveness: "High scorers on assertiveness like to speak out, take charge, and direct the activities of others."
- Activity Level: "Active individuals lead fast-paced, busy lives."
- Excitement-Seeking: "High scorers on this scale are easily bored without high levels of stimulation. [...] They are likely to take risks and seek thrills."
- Cheerfulness: "Persons who score high on this scale typically experience a range of positive feelings, including happiness, enthusiasm, optimism, and joy."

Agreeableness

Definition to the domain of Agreeableness and its facets:

"Agreeableness reflects individual differences in concern with cooperation and social harmony. Agreeable individuals value getting along with others. They are therefore considerate, friendly, generous, helpful, and willing to compromise their interests with others. [...] Disagreeable individuals place self-interest above getting along with others. They are generally unconcerned with others' well-being, and therefore are unlikely to extend themselves for other people."

- Trust: "A person with high trust assumes that most people are fair, honest, and have good intentions."
- Morality: "High scorers on this scale see no need for pretense or manipulation when dealing with others and are therefore candid, frank, and sincere."
- Altruism: "Altruistic people find helping other people genuinely rewarding."
- Cooperation: "Individuals who score high on this scale dislike confrontations."

- Modesty: "High scorers on this scale do not like to claim that they are better than other people."
- Sympathy: "People who score high on this scale are tenderhearted and compassionate."

Conscientiousness

Definition to the domain of Conscientiousness and its facets:

"Conscientiousness concerns the way in which we control, regulate, and direct our impulses. [...] Conscientious individuals avoid trouble and achieve high levels of success through purposeful planning and persistence. They are also positively regarded by others as intelligent and reliable. On the negative side, they can be compulsive perfectionists and workaholics. [...] Unconscientious people may be criticized for their unreliability, lack of ambition, and failure to stay within the lines, but they will experience many short-lived pleasures and they will never be called stuffy."

- Self-Efficacy: "Self-efficacy describes confidence in one's ability to accomplish things."
- Orderliness: "Persons with high scores on orderliness are well-organized."
- Dutifulness: "This scale reflects the strength of a person's sense of duty and obligation."
- Achievement-Striving: "Individuals who score high on this scale strive hard to achieve excellence."
- Self-Discipline: "Self-discipline - what many people call will-power - refers to the ability to persist at difficult or unpleasant tasks until they are completed."
- Cautiousness: "Cautiousness describes the disposition to think through possibilities before acting."

Neuroticism

Definition to the domain of Neuroticism and its facets:

"[...] Neuroticism refers to the tendency to experience negative feelings. Those who score high on neuroticism may experience primarily one specific negative feeling such as anxiety, anger, or depression, but are likely to experience several of these emotions. People high in neuroticism are emotionally reactive. [...] At the other end of the scale, individuals who score low in neuroticism are less easily upset and are less emotionally reactive. They tend to be calm, emotionally stable, and free from persistent negative feelings."

- Anxiety: "people who are high in anxiety often feel like something dangerous is about to happen."
- Anger: "Persons who score high in anger feel enraged when things do not go their way."
- Depression: "This scale measures the tendency to feel sad, dejected, and discouraged."
- Self-Consciousness: "Self-conscious individuals are sensitive about what others think of them."
- Immoderation: "Immoderate individuals feel strong cravings and urges that they have have difficulty resisting."
- Vulnerability: "High scorers on vulnerability experience panic, confusion, and helplessness when under pressure or stress."

Openness to Experience

Definition to the domain of Openness to Experience and its facets:

"Openness to Experience describes a dimension of cognitive style that distinguishes imaginative, creative people from down-to-earth, conventional people. Open people are intellectually curious, appreciative of art, and sensitive to beauty. They tend to be, compared to closed people, more aware of their feelings. They tend to think and act in individualistic and nonconforming ways. [...] People with low scores on openness to experience tend to have narrow, common interests. They prefer the plain, straightforward, and obvious over the complex, ambiguous, and subtle. They may regard the arts and sciences with suspicion, regarding these endeavors as abstruse or of no practical use. Closed people prefer familiarity over novelty; they are conservative and resistant to change."

- Imagination: "To imaginative individuals, the real world is often too plain and ordinary."
- Artistic Interests: "High scorers on this scale love beauty, both in art and in nature."
- Emotionality: "Persons high on emotionality have good access to and awareness of their own feelings."
- Adventurousness: "High scorers on adventurousness are eager to try new activities, travel to foreign lands, and experience different things."
- Intellect: "High scorers on intellect love to play with ideas. They are open-minded to new and unusual ideas, and like to debate intellectual issues."
- Liberalism: "Psychological liberalism refers to a readiness to challenge authority, convention, and traditional values."

2.2 Games as tools for personality assessment

The application of games in regards to personality assessment lies in the assumption that different players will have different behaviours and patterns accordingly to their play style. Research results have identified that personality aspects can be detected from player gameplay behaviour (Lankveld et al. 2011).

As a media, games are versatile and comprise many opportunities to expose elements for players. This allows for information to be obtained in different and unrelated ways. Utilizing games can be seen as a way to obtain personality information automatically, based on gameplay and exposing the player to information in implicit/explicit ways, through observational items, and also by self-reporting. (Lankveld et al. 2009)

Analyzing player behaviour encompasses personality assessment, but is not restricted to it. Many applications have been developed through this kind of analysis, such as, but not limited to (Sifa et al. 2017):

- Game design improvement;
- Monetization management;
- Behaviour prediction;

- Games recommendation;
- Fraud identification;
- Identifying human behaviours patterns.

Those applications highlight the potential that identifying player's personalities through games can have, both commercially and scientifically. The identification of the player base can leave to improvements in overall game design and in how to approach different kind of players through adapting interactions and features.

Player profiling opportunities and features have also been identified in commercial games, through research correlating game behaviours to scores on personality tests (Spronck et al. 2012).

Game interactions can also be utilized as a natural way to observe game behaviours and player patterns. The results of those observations can be automatized and, thus, processed by further methods. In this sense, many are the motivations to link personality assessment tools and techniques from personality tests with game environments, as they represent a wide range of opportunities for game designers and the researchers from the field of psychology and game design.

Before further specifying the concept of Entia and its features, it is necessary to define some elements in regards to gameplay and games. Those definitions are essential in the sense of describing games as a media and what they comprehend.

2.3 Defining Games

Many are the definitions existent to describe games. It can be defined in regards to the base of what a game is, such as: a way to interact with set rules (Selinker et al. 2011), or; activity that requires at least one player, rules and a victory condition (Crawford 1984), or even; a formal closed system that represents a subset of reality in a subjective way (Rogers 2014).

A common point from those definitions is that a game, considering the game artifact itself, has a well-defined boundary, being its rules defined by the system intended to be represented.

In relation to the interactions with the game artifact, Salen and Zimmerman describe that playing a game is making decisions and taking choices, in regards to a system built in order to support significant types of choices (Salen and Zimmerman

2003). From this definition, we can think of the player as an active agent that interferes on the system state through their inputs, in regards to the choices they want to take.

As a simulated environment accessed by player inputs and feedbacks they receive, players are encouraged to experiment with the game system. It is in this context of interactions with the game system that Jesse Schell (Schell 2008) defines that:

> "A game is a problem-solving activity, approached with a playful attitude."

As playful attitude, Jesse Schell relates the curiosity related to the act of exploring such systems. The author also defines (Schell 2008):

> "Play is manipulation that indulges curiosity."

This exploration of the boundaries, rules, systems and structures of a game brings us to a core element of games, gameplay.

Gameplay

Gameplay can be analyzed both from the perspective of the game designer and the player. The game designer aims to create the components related to the game structure in order to engage the player in a specific kind of activity.

Thus, in the perspective of the game designer, gameplay can be understood as the techniques, tools, strategies and activities included in the design of a game for the player to keep engaged and actively involved (Prensky 2002).

As gameplay is an element created by the designer, but experienced by the player, it is important to understand the player's perspective. As such, defining gameplay in terms of players is an important approach to analyze the game based on the player experience.

The following definition of a player-centered approach for gameplay, by Fabricatore aims to address the need for a player-oriented focus (Fabricatore 2007):

> "A player-centered approach can lead to define gameplay as the set of activities that can be performed by the player during the ludic experience, and by other entities belonging to the virtual world, as a response to players actions and/or as autonomous courses of action that contribute to the liveliness of the virtual world."

The Game Design Document for Entia, to be presented on the Chapter 3, emphasizes gameplay based on the focal point of the game designer, utilizing game mechanics and elements to build up the game experience.

The gameplay structure related to the player experience can then be observed on the Chapter 5, in regards to players impressions on gameplay.

2.4 Contribution of this research for the field

The contributions from this research to the field of games for personality assessment are related to the utilization of the facets of the Five-Factor Model in association to game mechanics. The setting from Entia and its overall aspects aim to create a scenario in which personality assessment can be conducted in a game, avoiding biases from player's role-playing as a character, as the setup of the game aims to situate the player as themselves in the game world. This can provide inputs on how to design personality assessment features in games.

Chapter 3
Design

3.1 Introduction

The initial motivation for the design of Entia came from the personal wish of understanding myself better. During many phases of my life, different drives lead me to explore myself and try to understand why certain behaviours and feelings happened. In the core of it all, is the belief that self-understanding can lead us to a happier and more fulfilling life. While this may sound as cliche, being able to understand ourselves better leads to better decisions in life, which then might lead to choosing what makes us more ourselves, then, bringing happiness and the feeling of accomplishment.

In trying to understand myself better, I ended up taking several kinds of personality tests. One common point between those tests was how textual they were. Normally printed or in online forms, the experience of filling up those questionnaires was certainly not something memorable or unique.

Entia aims to utilize the power of games as a media to execute those tests, also enabling for the utilization of generated game data and game mechanics as input for existing personality assessment methods or as tools for the further development of new methods. It also aims to be a memorable experience for takers of personality tests.

3.2 Initial Design Process

One interesting factor of playing games with others is the empirical observation that different people have different play-styles. Many are the strategies and routes a player may choose while playing a game. This observation opens up the discussion and analysis of gameplay styles representing different kinds of personalities.

Though not realizing, many players are making choices during their gameplay

sessions. Being it in choosing which class of character they want to play with (barbarian, wizard, cleric, etc.), the style of their avatars or even the pace and intensity they enjoy playing the game presented.

There are discussions that a player may be playing a role when involved in a game: they adequate to the context of the virtual world, and knowing its a fictional representation, might behave differently than they normally would. While this might be true, the way players choose to behave also can serve as an information for personality identification. In Entia, the simulation of a daily life environment (bedroom) and objects (computer, smartphone, bed) aim to minimize the assumption of a role from players, stimulating them to be themselves.

In order to describe the ideas and inspirations of Entia in further detail and in a format in which it can be implemented from, information about the design needs to be documented. It is in this context that the structure of a Game Design Document serve as a basis for the design and implementation of Entia, describing its unique features, interactions with player and intended experience.

Before going into detail on the Game Design Document for Entia, the following section will describe some of the inspirations that influenced the elements of the game.

3.3 Inspirations

Inspiration from other games

The following games were inspirations for the design of Entia, in regards to their gameplay, settings, aesthetics and game progression:

1. Wario Ware, Inc.: Mega Microgame$! is a game developed and published by Nintendo. It was released for the Game Boy Advance portable platform, in the year of 2003. It had a remake published for GameCube console, in 2004. It is, essentially, a collection of mini-games with simple objectives. The Player has a very short time to solve each one of those microgames, guided by a word or short sentence. Each micro game has different objectives, but with its own simple controls and interactions.

Figure 3.1: Wario Ware, Inc.: Mega Microgame$! cover

Figure 3.2: Wario Ware, Inc.: Mega Microgame$! mini-game example

2. Rhythm Heaven is a game developed and published by Nintendo, for the Nintendo DS platform in 2008. It is a collection of rhythm based mini-games, each with a unique setting, objective and song. Players advance by completing different mini-games, which are equivalent to the stages from the game.

Figure 3.3: Rhythm Heaven Cover

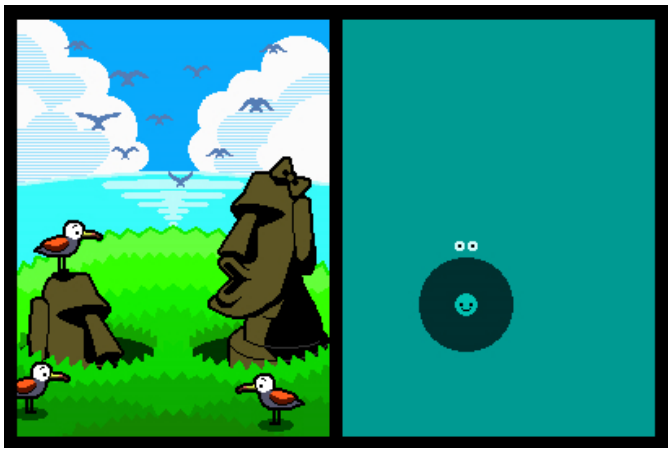

Figure 3.4: Rhythm Heaven mini-game example

3. Feel the Magic: XY/XX is a game developed by Sonic Team and published by Sega, for the Nintendo DS platform, in 2004. It is a collection of mini-games, each with increasing difficulty as the player advances through the story and different stages.

Figure 3.5: Feel the Magic: XY/XX cover

Figure 3.6: Feel the Magic: XY/XX mini-game example

The core mechanics of all those games are an inspiration to the development of Entia's game mechanics. Through simple controls, players are presented with simple and immediate objectives to be completed. After each mini-game and its stages are completed, the player may advance to the next one. The next mini-game has a context unrelated to previous mini-game. The link for mini-games is present on the plot or scenario, which is a collection of mini-games with different objectives and smaller plots.

The aesthetics of those games is similar in regards to being simplistic and cartoon-ish in style. This could be due to limitations of hardware, but also creates a simpler and less complex aesthetics. Those choices builds up to the gameplay, which is quick and simple variations on the mini-games objectives, not distracting

the player too much with the graphics and keeping them focused on the simple mechanics variations.

As such, those games serve as inspirations and references for Entia, in regards to the their modular gameplay mechanics, simplified plot highlighted by the scenario, simple but concise aesthetics and accessibility.

3.4 Game Design Document

Before presenting the Game Design Document structure for Entia, it is crucial to understand what kind of information about the design those documents convey.

Game Design Documents are dynamic and should fit the purposes that each game project requires. They serve as a tool for memory and communication, allowing for: the storing of important decisions defining why and how the game works, and provide a space to find and fix weaknesses in the game design (Schell 2008).

Additionally, the Game Design Document is a piece of document directed for the developers of the game, not for the players. Instead of a concept for a pitch or gameplay manual, it will contain the description of every elements that compose the game, from needed assets to a description of stages and in-game components to be added during development (Oxland 2004).

As such, the ideal Game Design Document should be the major guide for the developer, and with it, be able to describe how to implement the game as envisioned by the designer. It should detail all functional requirements of the features to be implemented, specified as needed and with clarity enough for successful communication with developers (Bethke 2003).

The Game Design Document is an ever-evolving document, following changes adopted during the development cycle of the game, being updated in regards to the player experiences desired (Bates 2004). As such, the Game Design Document for Entia, as exhibited in this master's thesis, is its final version, which aims to be a full representation of the components of the final build of Entia.

Regarding the implementation of Entia, refinements of the design, gameplay and assets are details resultant from iterations of the concept through prototyping, validation of gameplay and play-testing. Those steps can be seen in detail on the Chapter 4 - Implementation.

As such, this chapter aims to provide a final picture on the Game Design Document utilized to create Entia, as this was the main reference and method

of implementation for the concept, following game design recommendations and orientations.

3.5 Game Design Document - Entia

Summary

Entia is a collection of mini-games that analyses player choices and inputs during gameplay, in order to identify personality aspects based on the facets of the Five-Factor Model.

In total, 19 out of the 30 facets from the Five-Factor Model are assessed through playing Entia. In order to include all facets, new game mechanics would need to be created. It is also important to note that some facets might present more difficulty in being identified than others, due to their characteristics.

The following figure shows the scope of Entia, in regards to the number of facets being assessed through gameplay for each category of the Big Five:

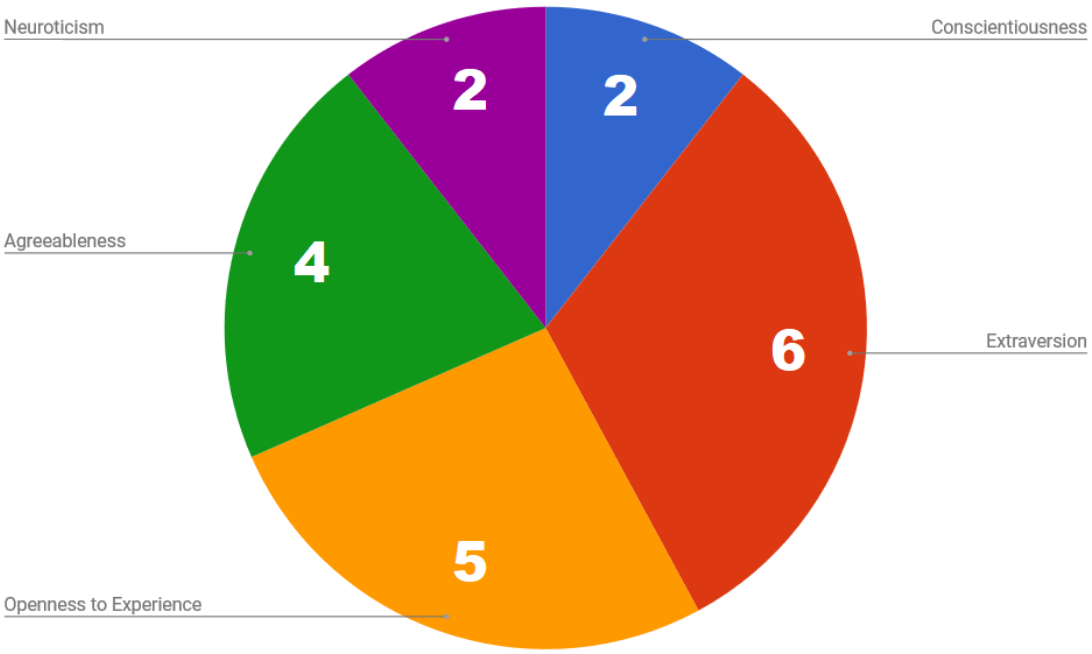

Figure 3.7: Number of facets identified through Entia

Each mini-game's mechanics are described in tables relating each of the facets contained on the mini-games to how they are weighted in-game. The tables for each mini-game are presented on their descriptions in the Game Design Document.

The different mini-games happen on the environment of a bedroom, utilizing interactions with daily life objects, computer and smartphone. This setting aims to bring the player to an environment they are familiar with, encouraging that they express themselves while playing the game.

Gameplay

Each mini-game consists of a simple mechanic and interaction for the player. Depending on those interactions, gameplay information will relate to different aspects of personality. Each mini-game mechanics and their relations to personality assessment will be explained in more detail in each mini-game's session.

One layer of gameplay to be emphasized is the use of textual choices for decision-making by the players. The texts contained in each mini-game correlates with the facets present on the Five-Factor Model, and as such, mechanics are based upon them. The choice of going to a more textual approach in some of the mini-games was based on the iterations of the concept and the need for adjustments in order to enable personality assessment by adapting the Five-Factor Model. Referring to the lexical origin of the assessment, text became a game element for decision-making and contextualizing information for the players in Entia.

Mindset

The pace and flow between different mini-games aim to provide the player with engagement and challenges, requiring different decisions and behaviours. Each mini-game contains different elements in regards to the facets from the Five-Factor Model, sometimes highlighting specific links with the mechanic and the facets for personality assessment. In their own sub-sections, each mini-game is explained in more details according to to their experience and personality assessment objectives.

Aesthetics

The choice for a more simplistic but cohesive art style lead to the utilization of flat design elements. Those elements emphasize the use of flat colors and can be considered minimalist. The choice for an art style based on minimalism follows the artistic directions from the games seem as inspirations for this game, as well as aim to maintain simplicity to the player interactions. Excessive graphical elements can be distracting and gather the focus of the players, opposite of what is in intended for the art style of Entia. As such, the art style aims to be simple, cohesive and minimal, serving as a tool to evidence the intended gameplay interactions requested from the player instead.

Technical aspects

Equipments and softwares

The following equipments and softwares were utilized for the development of Entia and its assets:

- Personal Computer
- Wacon Intuos pen and touch small
- Unity Personal Edition version 5.6.0f3 (64 bit)
- Visual Studio 2015
- Adobe Photoshop CC edition
- FL Studio 12 Producer Edition
- Audacity

Unity scene organization

The following screenshot represents how the game scene is organized on Unity. The environment is organized in a 3d project inside Unity's structure:

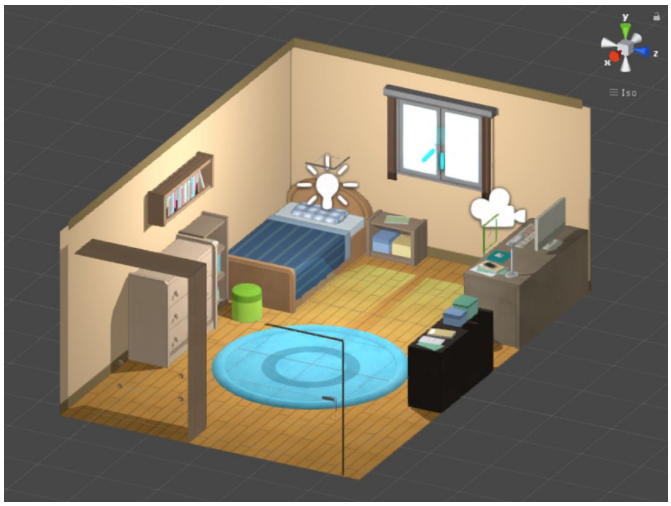

Figure 3.8: Unity Scene for Entia

Entia is comprised of the following main screens, to be shown to players in different steps of the game:

- Start screen: screen shown for the player as the game starts. An input is requested from the player for the mini-games to start.
- Mini-game screens: Both the in-game computer screen and in-game smartphone are utilized as screens for the mini-games. The implementation of gameplay on those screens aims to associate the use of personal daily life objects with the gameplay. The implementation of the mini-games are in 2d, but they are positioned on a 3d environment. This is also to situate the player in an environment where they would simulate an interaction with real-life objects.
- Computer screen: Contains the "X Marks the Spot" mini-game. After pressing start, the player will be directed to the computer screen in order to play the first mini-game. After conclusion, the player will be prompted an input in order to change to the Smartphone.
- Smartphone screen: Contains the "Hangout with Friends" and "Timeline" mini-games, respectively. Both mini-games happen on the phone screen, asking different inputs from players.

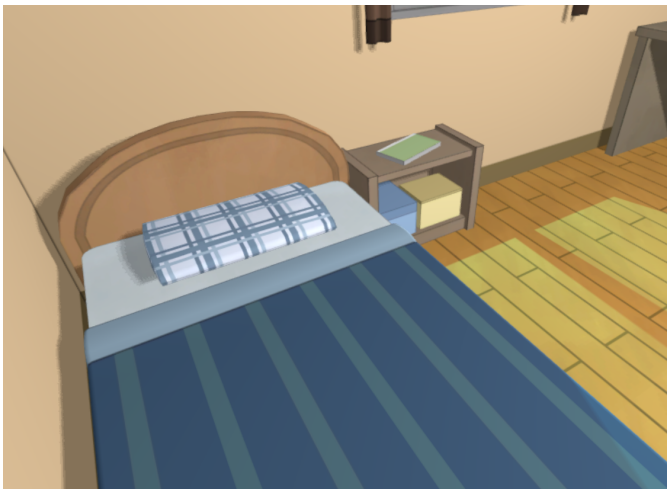

Figure 3.9: Start Screen - Entia

Controls

The implementation of controls are both on the layers of the environment and of each specific mini-games. For each mini-game, the controls are based on the 2d mechanics presented, played utilizing inputs through the mouse and clicking. In order to control the 3d environment and the 2d gameplay from a 3d scene, the programming was based on the utilization of raycasts to identify where in the 3d environment the 2d interactions are. The following image shows this implementation, which controls the 2d player interactions through the 3d environment:

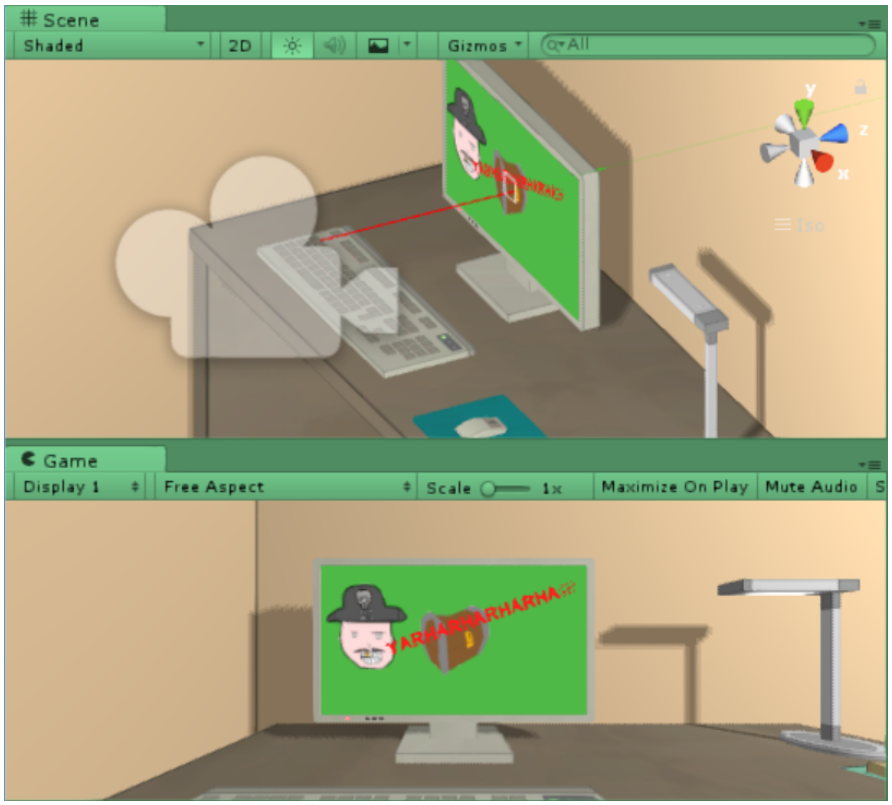

Figure 3.10: Top-view: Developer Scene View / Bottom-view: Player's view

For the player, the gameplay of the mini-games work as in a 2d only environment. The 3d environment is utilized as a setting and scenario, but for such, required further mechanisms to be implemented for the controls to enable the player interactions within the game.

The following sub-sections will list each of the three mini-games from Entia in detail, in regards to their design elements.

Mini-game #1: X Marks the Spot

Description

Before the start of the game, the reasons why the player will be in search of treasure are shown. The brief explanation aims to confer the player with a sense of importance for his goal. The player will then bring their pirate ship to the x spot on each map, each subsequent one presented with increasing difficulty.

After three stages, the player fails to capture the treasure chest, interrupted by another pirate. After this happening, a sequence of choices is given to the player. The player can choose from one of two answers. The chosen answers will lead to different story decisions and outcomes.

Mechanics

X Marks the Spot can be separate in two different core mechanics:

- Drag-and-Drop and clicking, gameplay for each of the ship's stages. Each of the three stages simulate pirate ship sea navigation, on a maze-like environment. Coins are available for the player to collect, exhibited on a counter on the top-left of the screen. The coins are not obligatory for the player to collect, being reaching the x spot the final goal for each stage.
- Storytelling decision making, gameplay for choices between actions relating to the plot. The player will be able to decide how the plot develops, based on what option they pick.

Level design

The navigation stages increase in difficulty, as the player advances each level. Coins are more difficult to be collected, and new obstacles are presented. The following screenshots show snapshots for each of those stages:

Figure 3.11: X Marks the Spot: Navigation Stage 1

Figure 3.12: X Marks the Spot: Navigation Stage 2

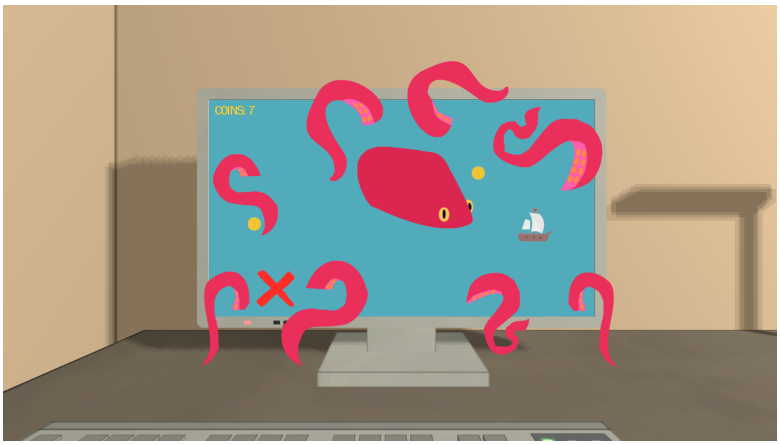

Figure 3.13: X Marks the Spot: Navigation Stage 3

After the stages and failing to collect the treasure, the player is then present with decisions in regards to how the story advances. The decisions chosen by the player and their impact on the facets of the Five-Factor Model will be described next. The following screenshot shows an example of those decisions:

Figure 3.14: Storytelling decision making

List of Five-Factor Model facets related to mechanics

X Marks has two steps: the first one is related to advancing the stage by reaching the X and collecting coins; the second one is related to the choices the player takes in order to advance the story through decision-making. The following figure

represents all the facets considered in the mechanics of this mini-game. The scores are attributed to each facet as the player takes the decisions matching those scores and advancing through the game:

X Marks the Spot

Collecting coins				
Facets		-	neutral	+
Achievement-striving		Did not care about collecting	Gave up but tried to collect all	Collected all coins
Self-discipline		Gave up but tried to collect all	Did not care about collecting	Collected all coins
Vulnerability		Collected all coins	Did not care about collecting	Gave up but tried to collect all

Negotiate / Fight				
Facets		-	neutral	+
Trust		Chose to Fight		Chose to Negotiate
Cooperation		Chose to Fight		Chose to Negotiate

Split / Threaten				
Facets		-	neutral	+
Morality		Chose to Threaten		Chose to Split

Claim / Truce				
Facets		-	neutral	+
Assertiveness		Chose to Truce		Chose to Claim

Figure 3.15: Facets of the Five-Factor Model reflected on "X Marks the Spot" gameplay

Assets list

- Ocean background image
- Grass background image

- Pirate Ship sprite
- X Mark sprite
- Kraken head sprite
- Kraken tentacles sprites
- Obstacle - Barrel sprite
- In-game animations
- Closed treasure chest sprite
- Open treasure chest sprite
- Story scrolls
- Evil Pirate sprite
- Collecting coin sound effect (coin)
- Reach the X sound effect
- Evil pirate laugh sound effect
- Ocean sound effect
- Air breeze sound effect
- Kraken sound effect
- Barrel collision sound effect
- Storyline choice input sound effect
- Treasure chest locked sound effect
- Treasure open sound effect
- Win fanfare sound effect

Mini-game #2: Hang out with Friends

Description

This mini-game simulates a messenger app on the smartphone, asking the player conversation inputs in response to a friend. Many decision routes are presented for the player, depending on the answers chosen. The conversation aims to mirror the frequent use of app messaging systems, common environment in modern technology. Being a common place with users, it aims to keep the player in environment where they mirror their daily life personality. The following picture shows the initial prompt for starting the mini-game:

Figure 3.16: Chat notification on smartphone

Mechanics

The mechanic is based on decision-making by the player. Accordingly to the messages received, the player can choose between replies to state his impressions. It aims to simulate a chat with friends through smartphone. The following picture exemplify this mechanic, through conversation contents and reply options:

Figure 3.17: Chatting with friend

List of Five-Factor Model facets related to mechanics

Hang out with Friends simulates a conversation with a friend through a smartphone messaging app. According to the answers the player picks, the conversation will go to different routes, taking different facets of personality into consideration. The answers picked will describe how each facet is scored. The following figures show in details the facets included on this mini-game:

Hang out with Friends

Phone Message 1				
Facets		-	neutral	+
Cheerfulness		I'm ok. How about you?		Good! And you?

Phone Message 2				
Facets		-	neutral	+
Gregariousness		Relaxing at home :)		Let's meet up! :D

Phone Message 3				
Facets		-	neutral	+
Excitement-seeking		Movies		Games
Artistic interests		Pub!		Let's go to an art event

Phone Message 4				
Facets		-	neutral	+
Imagination		Online games		Story-rich games
Imagination		Documentary		Action Movie!
Liberalism		Modern Design Expo		Oil on Canvas Exhibition
Gregariousness		Let's enjoy some music together		Let's go someplace good for talking

Figure 3.18: Facets of the Five-Factor Model reflected on “Hang out with Friends” gameplay - part 1

Phone Message 5				
Facets		-	neutral	+
Assertiveness		Sure! See you online then!		Sure. Let's pick some good quests.
Friendliness		I will take a look.		Sounds fun! I will play it for sure!
Friendliness		Thanks! I will look for it.		I did, it was great!
Cheerfulness		Sounds fantastic! I will check it out!		I like the whole trilogy! :D
Adventurousness		Around the Keynote Speaker stage!		On the Design Experiments Showcase area!
Excitement-seeking		Blue. Looking forward for it!		I'm curious! What is it?
Excitement-seeking		Blues! Meet you there.		Some Rock! See you there.
Friendliness		Let's go by ourselves, so we can catch up!		Sure! Call as many as you want.

Figure 3.19: Facets of the Five-Factor Model reflected on "Hang out with Friends" gameplay - part 2

Assets list

- 3d model of smartphone
- UI for the messaging
- Phone background picture
- Phone messaging interface
- Text messages content

- Text message system script
- Friend picture
- Smartphone ringtone
- Smartphone vibration (notification) sound effect
- Receiving message sound effect
- Sending message sound effect

Mini-game #3: Timeline

Description

This mini-game simulates a timeline from social media services, where the player is presented with pictures of diverse situations, objects and settings. The player is then prompted to give an impression to it, by choosing between one of five emojis. The inclusion of timeline features aims to mirror the increased use of social media and the inputs users utilize to react to publications presented on those environments. The following picture shows the initial prompt for starting the mini-game:

Figure 3.20: Timeline notification on smartphone

Mechanics

The player is presented with mechanics of decision-making, choosing between a range of options for giving his impression in regards to the graphics being shown. The impressions, chosen through emojis, range through the following responses:

- Happy
- Love
- Sad
- Surprised
- Neutral

The following picture exemplifies the mechanic, by showing one of the 15 pictures given to the player, as well as the emojis given for the players to choose from:

Figure 3.21: Timeline example

List of Five-Factor Model facets related to mechanics

Timeline gives choices to the player through emoji. For each different image being shown, the player should choose an emoji about how they react to that

image. According to the emojis the player picks, the different facets scores will be attributed. The following figures show in details the facets included on this mini-game:

Timeline

Concert				
Facets		-	neutral	+
Excitement-seeking		Sad	Neutral / Surprised	Happy / Love

Funny Fox				
Facets		-	neutral	+
Cheerfulness		Sad	Neutral	Happy / Love / Surprised

Pizza				
Facets		-	neutral	+
Immoderation		Neutral	Surprised	Happy / Love / Sad

Books				
Facets		-	neutral	+
Imagination		Sad		Love / Surprised
Intelect		Neutral		Happy

Cycling				
Facets		-	neutral	+
Excitement-Seeking		Sad	Surprised	Happy
Adventurousness		Neutral	Surprised	Love

Figure 3.22: Facets of the Five-Factor Model reflected on “Timeline” gameplay - part 1

Funny horse				
Facets		-	neutral	+
Cheerfulness		Sad	Neutral	Happy / Love / Surprised

Cinema				
Facets		-	neutral	+
Imagination		Sad		Surprised
Artistic interests			Neutral	Happy / Love

Acoustic guitar				
Facets		-	neutral	+
Cheerfulness		Sad	Neutral / Surprised	Happy / Love

Desserts				
Facets		-	neutral	+
Immoderation			Neutral	Sad / Surprised
Gregariousness			Neutral	Happy / Love

Landscape				
Facets		-	neutral	+
Artistic interest			Neutral	Happy / Love
Adventurousness		Sad	Neutral	Surprised

Figure 3.23: Facets of the Five-Factor Model reflected on “Timeline” gameplay - part 2

Bedroom				
Facets		-	neutral	+
Gregariousness		Love	Neutral / Happy /Surprised	Sad

City				
Facets		-	neutral	+
Activity-level		Sad	Neutral / Surprised	Happy / Love

Sad Dog				
Facets		-	neutral	+
Cheerfulness			Neutral	Happy / Love
Sympathy				Sad / Surprised

Videogame				
Facets		-	neutral	+
Excitement-seeking		Sad	Neutral	Happy / Love / Surprised

Board game				
Facets		-	neutral	+
Gregariousness		Sad	Neutral	Love
Intelect			Neutral	Surprise / Happy

Figure 3.24: Facets of the Five-Factor Model reflected on “Timeline” gameplay - part 3

Assets list

- 3d model of smartphone
- Phone background picture
- Impression #1: Happy
- Impression #2: Love
- Impression #3: Sad
- Impression #4: Surprised
- Impression #5: Neutral
- Picture: Concert
- Picture: Bedroom
- Picture: Cycling
- Picture: Board Game
- Picture: Cinema
- Picture: City
- Picture: Desserts
- Picture: Funny Fox
- Picture: Funny Horse
- Picture: Sad Dog
- Picture: Landscape
- Picture: Acoustic Guitar
- Picture: Pizza
- Picture: Books
- Picture: Videogame

- Smartphone vibration (notification) sound effect
- Impression input sound effect

Play-through results description in regards to Personality

The results to be applied in regards to the play-through follow the figures describing the facets for each mini-game, highlighting the links to the Five-Factor Model facets and gameplay. After the play-through, each of the facets involved in that specific mini-game will present a degree of neutrality, increase or decrease. It is a simplified version of the results from the questionnaire, focusing on the analyzed facets. On the User Test section, the results from the users facets obtained on the play-throughs are compared to the results of the official IPIP NEO-PI test, creating a parallel between Entia and the questionnaire.

Chapter 4
Implementation

Chapter 2 discussed the theoretical background, similar researches and applicability of utilizing a game for personality assessment. Those contents aim to create a basis on which the concept for Entia can sustain upon.

Chapter 3 highlighted the conceptualization and design of Entia as a game, through inspirations, references, and ultimately, the generation of a Game Design Document structure to serve as a guide for implementation.

The scope of Chapter 4 is to describe the process which Entia followed for its implementation. It is an iterative process, comprised of refinements of the design and its contents. It is important to notice that the Game Design Document presented on the previous chapter reflects the structure of the final version of Entia. Previous iterations brought alterations to the game's structure. Those previous iterations will also be discussed on this chapter, after the description of the implementation process Entia underwent.

4.1 Implementation process for Entia

The following process overview aim to be a visual reference and represent the implementation process completed for the final version of Entia as-is:

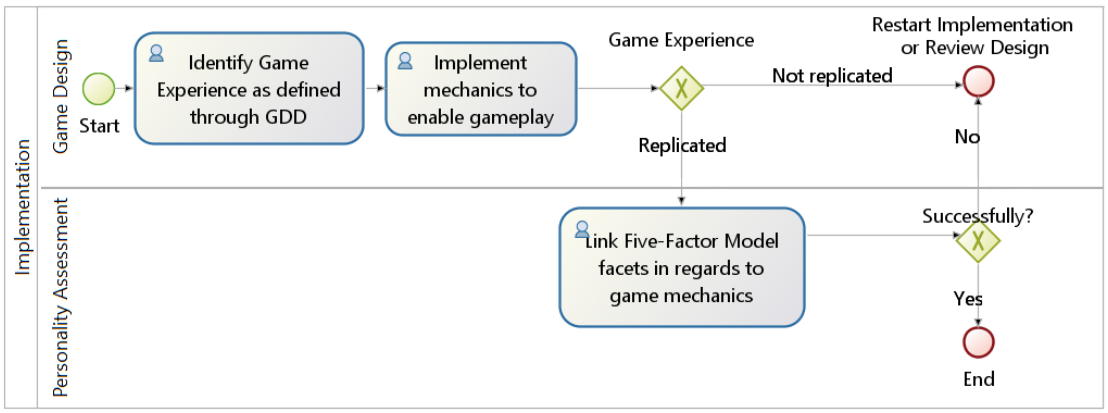

Figure 4.1: Process notation for the Implementation step of Entia

For the implementation of the final version of Entia, this chapter will follow through each of the activities described on the previous process (portrayed on Figure 4.1), evidencing the outcomes of each step in regards to the final design obtained.

Identifying Game Experience as defined through the Game Design Document

The experience intended with Entia is the experience of filling a personality questionnaire, but through gaming interactions. It should turn the task into a more playful, game-oriented activity. Game components should build-up with this goal in mind.

Observing the games structure in its four main core elements (Schell 2008) - technology, aesthetics, story and game mechanics -, allows to understand the building blocks that will form the desired experience as a whole.

The technology revolves around the utilization of Unity as the game engine for implementing the game experience. Unity will be the main software for implementation, while being a development suite and incorporating assets from many other sources inside its production pipeline.

The aesthetics are responsible for creating a unified whole of the game experience, and are a very noticeable aspect for the player. The choice for flat design as the main artistic expression, as well as a 3d environment with cel-shading style graphics aim to create synergy between the 3d and 2d environment. While both styles are simple, the 3d style can be seen as more complex and realistic (in com-

parison, as both are cartoonish) than the 2d interactions. This choice was made so that the 2d interactions (mini-games) give a similar impression to real-life, when people are inserted in a reality more complex than the interface being interacted with. Therefore, the goal is to make the players feel inside the bedroom as their real environment. By placing themselves in the game world, the idea is that the players convey their personalities more clearly through the game system.

The story is based on the context presented to the player, being that the bedroom they are inserted in. Though the mini-games have stories of their own, the main story overlapping all mini-games is the player being at a bedroom while engaging in other interactive activities. This is based on the scenario the player is placed in, so it is a narrative absorbed by observation, not told to the players directly.

The game mechanics goal is to back up this environment, presenting different mechanics on everyday objects. They mirror decision-making and simple player interactions, but creating different small experiences inside the major one. The implementation of mechanics will be discussed in more details on the following sub-section.

Implementing mechanics to enable gameplay

Two layers were worked upon to implement the mechanics in Entia. The first layer is the 3d features. The 3d scenario was deployed and adjusted to the scenes, and its objects tweaked for the creation of mini-games as a 2d interaction in the 3d objects. The real gameplay mechanics are in the mini-games, 2d interactions. In order to retain coherence to the desired game experience, this layer needed to be developed. The second layer was the one for the development of each mini-game environment. Setups were made for each of the mini-games structure, creating the interactions with the computer screen and the phone, trying to simulate a real-life common situation. Those can be seen as technical layers, but necessary to retain the game experience in which the mechanics should take part in.

For the mechanics, the gameplay features and objectives were adjusted between iterations. There is a parallel to be traced in order to understand how these final mechanics took place, as they were being developed by the iterations of implementation. The parallel is that all version retained the idea of inserting different mini-games with distinct mechanics, creating differentiation of interaction. This aimed to enable the assessment of different personality aspects, as different mini-games could potentially include different facets to be explored.

After the first two technical layers were deployed, the specifics as described on the Game Design Document were implemented during development. The assets were added to each mini-game, and the interactions tested. The following step was to make sure that the game progress and interactions were clearly represented, in order to link the mechanics to the Five-Factor Model facets.

Linking Five-Factor Model facets in regards to game mechanics

The linking between the mechanics and the Five-Factor Model facets consisted of a verification process, to make sure every mechanic detailed and associated to the facets was correctly implemented and present in the game environment. This represents a technical aspect before the user testing takes place, ensuring that the variables can be detected, assessed and do not have their reliability impacted by other elements.

The consistency of the interaction and the outputs from gameplay are crucial for the creation of an experience that can be replicated for many players, with regards to assessing personality consistently. This implementation step was the most difficult to achieve, as the system needs to convey the necessary information to be assessed.

Both the room escape concept and the visual-based gameplay prototype, which will be described next, became previous iterations of Entia because of this. Keeping a clear view on how the assessment is being conducted is a premise that must be respected, in order for the system to stay reliable and consistent.

Steps after implementation

After implementing the Game Design Document and obtaining the envisioned game experience, play-tests were done to detect bugs and certify the game stability. Preparations to the user testing took place, opening up space to make final minor adjustments to the Game Design Document, to represent small changes made necessary through the development cycle.

4.2 Previous iterations

The activity of linking the Five-Factor Model facets to game mechanics in order to assess personality was the point where previous iterations were not successful. Revisions of the design and game concept were conducted, in order to readjust the game experience and thus, mechanics, to successfully allow for linking gameplay to parameters that can be compared with the results of the Five-Factor Model facets.

This mirrors a natural process on game design, and iterations were essential in making Entia more cohesive on the final version. Some elements persisted from the first version, a room escape game experience, while others were refined based on a visual-based gameplay approach. Those represent great opportunities for understanding the design of Entia as-is now, in its final version. As such, those previous iterations will be detailed next.

Game development is a process that revolves iterations. Play-testing is fundamental to assess if your design enable the desired experience, as well as highlights parts that need improvement. The biggest difficulty found on both previous iterations was on linking personality assessment aspects to the game mechanics, and thus, obtaining the player profiles in regards to their facets. The changes in design and lessons learned through the iterations were a decisive driver in generating Entia's current design.

As such, learning from iterations can be seen as a great tool for understanding a design, as well as predicting more refined methods for future designs.

Room Escape concept

The first iteration was a real-life non-digital experience, focused in assessing personality. The gameplay was intended to be presented through many small puzzles, in which players joined as a group. The setting was similar to the setting utilized in the mini-game "X Marks the Spot", and it was based in a pirate treasure hunting activity. One actor would play the role of the evil pirate, getting in the way of the group searching for the treasure.

The nature of personality assessment would be, in this case, observational. Even if the mechanics were built to reflect aspects of the facets of the Five-Factor Model, the association with such results were not as clear. Due to the assessment on the game design being based in the personality assessment through questionnaires, the models for assessment were presenting divergences and, thus,

were not reliable. Elements of personality assessment related to a group-oriented activity also added a new layer of complexity, not able to be explored fully within the range of this research.

The concept and early mechanics prototypes were discarded, but served as inspiration for the treasure hunt, coins collection and conversations with the evil pirate, presented as mechanics in the mini-game "X Marks the Spot". Adjustments were made to the digital format, and the concept was reworked in order to fit the expectations of outputs for the study of facets, but the context and setting for the adventure was kept the same.

Though the mechanics were starting to be prototyped, the change of scope made necessary for the game experience to be redesigned and restructured, presenting a big conceptual change for the design.

Visual-based gameplay

Still inspired in the idea of different small puzzles, that is when other game concepts based on compilation of mini-games presented itself more clearly, and through digital format. The mini-games concept and mechanic were similar to the games listed as inspiration for the design of Entia, being compilations of mini-games, without a common environment in where they happened, and without many textual elements.

The following picture are representations of those mechanics:

Figure 4.2: Mini-game mechanics for the visual-based gameplay

The need to reiterate came from two distinctive aspects. The first and more structural is related to the linking with the Five-Factor Model facets. As the Five-Factor assessment method is highly textual and based on the lexical approach, having a game mostly comprised of visual-based interactions increased the difficulty in detecting certain facets. Leaning towards a more text-based decision-making gameplay brought the final concept of Entia, with longer mini-games, but that have more tangible information in regards to linking and establishing parallels between the game elements and the personality assessment.

The second need for another iteration of the concept and implementation was based on the creation of a cohesive environment for the mini-games to take place. The visual-based gameplay was based only in 2d interactions, not situating the player in any kind of environment. In order to create an environment that put the player as themselves in the game environment, the decision to utilize a bedroom as the 3d environment scenario took place. This brought the need for technical restructuring, as discussed prior in terms of programming and setting up the game environment both in terms of 2d and 3d interactions.

The aesthetics style was also reworked, changing from a more comical and satirized artistic visual to a more organized and clean direction. The previous style was based on the games that served as inspiration for the mechanics of Entia, but the new artistic style based on flat design served better the purpose of creating a clean and more to the ground experience.

Chapter 5
Evaluation

The evaluation for Entia consisted in having users play the game, assessing their personality through gameplay. The user tests are applied in regards to playing Entia as a game experience for personality assessment, considering how players experience gameplay. The following topics are aimed to be addressed by testing with users:

- Playing Entia as a game experience for personality assessment;
- Comparing the assessment results from the facets considered in the play-through to possible overlaps with the original short-version of the IPIP NEO-PI results;
- Detecting the Workload involved in both the game and the original short-version of the IPIP NEO-PI questionnaire, through the application of the NASA-Task Load Index;
- Obtaining user testing information and feedback.

5.1 Method

The following list describes the flow of the user tests for each play-through:

1. Application of Pre-survey (annex in the Appendix section - A);
2. Playing Entia;
3. Obtaining the Workload, through the NASA-Task Load Index related to playing the game;
4. Filling in the short-version of the original IPIP NEO-PI questionnaire;

5. Obtaining the Workload, through the NASA-Task Load Index related to the short-version of the original IPIP NEO-PI questionnaire;

6. Application of Post-survey (annex in the Appendix section - B).

The ordering of the game and the original questionnaire are changed in between users, considering the Latin Square. In turns, the order of application is swapped for "2. Playing Entia" and for the "4. Filling in the short-version of the original IPIP NEO-PI questionnaire", as well as the corresponding NASA-TLX assessment. This is done in order to avoid biases and influences that could be related to a fixed order of application, allowing for a clearer assessment of the users results in relation to the method of testing.

After the user testing, overlaps of the facets evaluated on each gameplay with the results of the short-version of the IPIP NEO-PI questionnaire are compared, highlighting the ability of mechanics to detect the same characteristics in facets. This way, each users personality outcomes from the gameplay and questionnaire are compared, allowing for deeper analysis of each users results.

Scope and limitations

It is important to emphasize that the objective of the user tests is not to prove that Entia is a substitute for the short-version of the original IPIP NEO-PI questionnaire. Entia is evaluated in regards of how the facets compare with the results of the game and questionnaire for the users, having its assessment tested from this comparison. The facets from the play-through and the questionnaires are compared, considered the ratings of low, neutral or high. The scoring provided by Entia is not a precise substitute for the scoring system present on the IPIP NEO-PI questionnaires, but traces a parallel between the overall facets results for the user. Those ratings of low, neutral or high for each analyzed facet are the aspects of Entia that aims to identify users characteristics through gameplay actions and, as such, are the rating considering in the comparison between the game and the original questionnaire.

Additionally, not in any way does this research claims to be better than other forms of assessment. It aims to clarify the positive and negative points of having personality assessment through a game experience, from the perspective of the player and of the tool.

From the perspective of the players, user feedback through interview provides information in regards to their interaction with this form of media for personality

assessment, as well as their impressions. More than an interactive questionnaire, Entia aim is to add game elements to its structure, creating a memorable and fun experience for assessing aspects of human personality. The feedback of players is then considered as an important element in understanding the gameplay of Entia from the perspective of the player and user experience.

5.2 Results and analysis

Seven users were assessed in regards to the user testing method. Participants will be listed from A to G throughout this section as substitutes for their names, in order to keep their results of personality assessment anonymous. Initially, each user results from the play-through of Entia and IPIP NEO-PI questionnaire will be compared. Next, the results of the NASA Task Load Index will be exposed and analyzed, in order to identify specific aspects and results of Entia and the short version of the IPIP NEO-PI questionnaire. User feedback will then be considered, in regards to the user experience and gameplay of Entia from the perspective of the player. Lastly, a discussion subsection aims to wrap up all the previous subsections, reaching out for more in-depth commentaries on the results.

Comparison of results from Entia and short-version of IPIP NEO-PI: facet ratings comparison

For the participant A, the results were as follows:

- From 27 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 6 corresponded to the questionnaire results accurately, 12 were neutral and 9 were inaccurate;
- The most precise mini-game was “X Marks the Spot”. Out of 6 traits verification, 3 were accurate and 3 were neutral;
- The traits of self-discipline, vulnerability, trust, adventurousness and achievement-striving presented a high correspondence with the results of the original test.

For the participant B, the results were as follows:

- From 26 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 7 corresponded to the questionnaire results accurately, 9 were neutral and 10 were inaccurate;
- No specific mini-game had more precise results in this play-through;
- The traits of trust, gregariousness, excitement-seeking, immoderation, adventurousness and artistic interest presented a high correspondence with the results of the original test.

For the participant C, the results were as follows:

- From 28 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 14 corresponded to the questionnaire results accurately, 14 were neutral;
- The most precise mini-game was "Timeline". Out of 16 traits verification, 12 were accurate and 4 were neutral;
- The traits of cooperation, cheerfulness, excitement-seeking, immoderation, intellect, adventurousness and gregariousness presented a high correspondence with the results of the original test.

For the participant D, the results were as follows:

- From 28 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 11 corresponded to the questionnaire results accurately, 13 were neutral and 4 were inaccurate;
- The most precise mini-game was "Timeline". Out of 16 traits verification, 10 were accurate, 5 were neutral and 1 was inaccurate;
- The traits of excitement-seeking, cheerfulness, artistic interests, gregariousness, immoderation, intellect, assertiveness and imagination presented a high correspondence with the results of the original test.

For the participant E, the results were as follows:

- From 26 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 7 corresponded to the questionnaire results accurately, 13 were neutral and 6 were inaccurate;
- No specific mini-game had more precise results in this play-through;
- The traits of achievement-striving, vulnerability, trust, cooperation, adventurousness, gregariousness and activity-level presented a high correspondence with the results of the original test.

For the participant F, the results were as follows:

- From 28 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 18 corresponded to the questionnaire results accurately, 4 were neutral and 5 were inaccurate;
- No specific mini-game had more precise results in this play-through;
- The traits of achievement-striving, self-discipline, vulnerability, cooperation, gregariousness, artistic interests and intellect presented a high correspondence with the results of the original test.

For the participant G, the results were as follows:

- From 27 facets obtained from gameplay and their correspondence to the questionnaire results (including repeated traits but accessed through different mechanics): 10 corresponded to the questionnaire results accurately, 14 were neutral and 3 were inaccurate;
- The most precise mini-game was "Timeline". Out of 16 traits verification, 8 were accurate, 7 were neutral and 1 was inaccurate;
- The traits of cooperation, cheerfulness, intellect, cheerfulness, excitement-seeking and artistic interest presented a high correspondence with the results of the original test.

The traits of achievement-striving, adventurousness, artistic interest, cheerfulness, cooperation, gregariousness and trust, considering all the seven user tests, had higher correspondence from the facets obtained in the game, in comparison to the results of the short version of the original test.

NASA Task Load Index results

The NASA Task Load Index results associated with the tests distinguish the workload of Entia as a higher demand on performance. For the workload associated with the personality assessment questionnaire, the higher incidences were in mental demand. A sum of the results can be observed on the figure below (for data from the application, refer to the sections C and D of the Appendix):

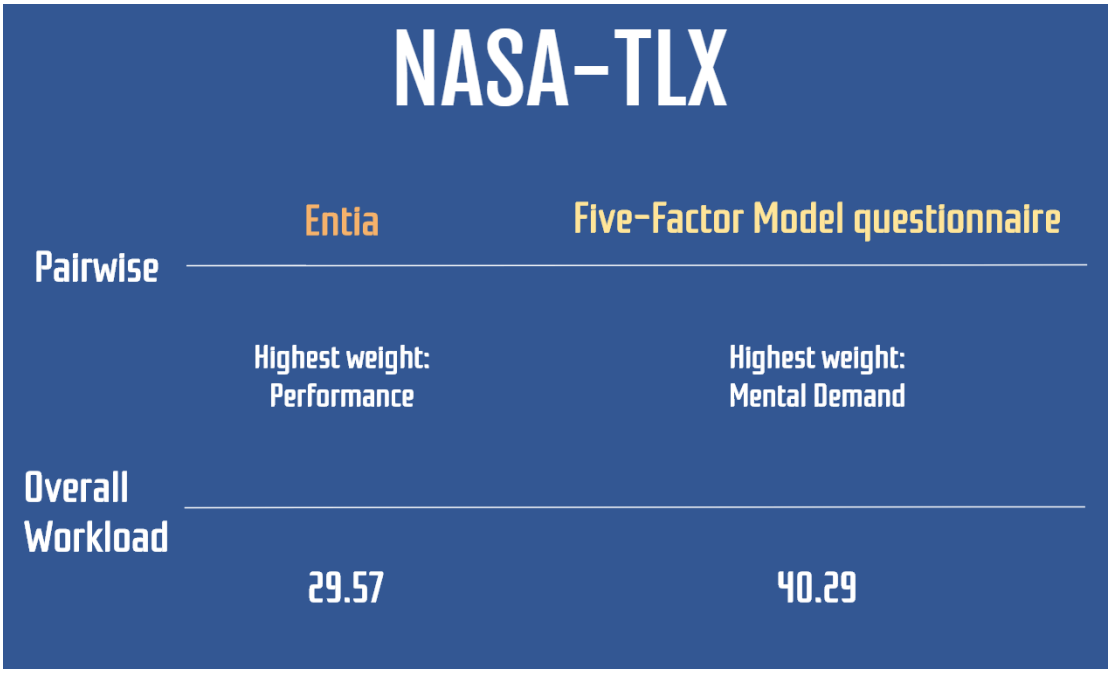

Figure 5.1: Results from the application of the NASA-TLX

From the results, it is possible to assess that users felt relatively less task load when playing Entia, instead of replying to the personality assessment questionnaire. The difference in perception of the weight of the task loads (being the bigger factors performance for Entia and mental demand for the IPIP NEO-PI) bring up the difference of experience from the perspective of the user.

For users, the performance and frustration were influenced by the game objectives in Entia, as they felt compelled to perform better or pressured to do well, some of the users being frustrated when failing to collect all the coins in the minigame "X Marks the Spot". As the coins were not easily accessible, many accounts of trial and error ended up to frustrate some players, thus increasing the workload in frustration. Further development of mechanics might lead to more balanced

gameplay, which can reduce the influence of this factor on the workload.

As for the workload regarding the questionnaire, the mental demand had the biggest impact on the index. With 120 questions, the participants took more than double the time to fill in the questionnaire, compared to concluding the game experience. Some of the users also reported that they felt pressured to complete the questionnaire as soon as possible, due the fact that its structure reminded them of multiple choice tests and exams situations.

User feedback

The participants feedback was obtained from interview and from written feedback on the post-survey form. All of the participants attested that they were playing the game as themselves, not role-playing as another character by influence of the game environment.

A very interesting observation in this regard was in the transition from the mini-game "X Marks the Spot" to the mini-game "Hang out with Friends". After the first mini-game was finished, they were prompted by a notification in game to check their smartphones. All of the participants reached out for their real-life smartphones, instead of navigating to the one on the virtual environment. The 3d scenario of Entia aims to simulate a real-life situation, so that players will feel inserted in a daily-life interaction activity. Checking their own phones was an interesting observation in regards to their association with that environment to their own physical space. Those reactions could indicate that they were immersed in an environment such as their own, backing up the fact that they were playing as themselves and not as a fictional virtual character.

Six of the seven participants showed interest in playing more games related to personality assessment in the future. One of the participants was not sure.

Accordingly to one of the players, playing games and having their personality assessed while playing is a game experience that makes them feel closer to their real personality. As said on interview, "I act more naturally in a game environment where I am not sure how I am being assessed, in comparison to a test-based situation."

In regards to the game experience, all users enjoyed having their personality assessed through gameplay. Some of them said the gaming experience was more enjoyable than the questionnaire, being something unique that they did not experience yet. Four of the seven players emphasized that they look forward to be able to experience this again, in a bigger scale or as a layer on the games they

already play/enjoy.

Four of the seven players, through their feedbacks, said that they believe games are a media with strong potential as a personality assessment method. They believe games have the potential of investigating human personality in different ways and methods, possibly allowing to understand behaviours in a light that no other media can, due to the characteristics of gameplay and having the game layer as the main focus.

5.3 Discussion

Prior to the user testing, five of the seven participants had taken personality tests before. A common point between all users was that the drive for taking personality tests would come from a wish of increasing their own knowledge about themselves. Additionally, none of the participants ever played a game for personality assessment before.

There was little understanding on the aspects that the game wanted to assess in regards to personality, being the real facets hidden by the mechanics. This is a relevant finding, when considering that in the format of questionnaires the connection with the assessment and what is being measured can be interpreted more easily. The game layer was responsible for hiding those connections away.

The potential of games as measurement tools presents itself as a media that demands from the players other workloads and inputs than the assessment through questionnaires. Future studies and the replication of the user testing with a greater range of participants will allow to have more general findings in the applicability of all the facets. Additional mechanics and gameplay could be added in order to enable assessing a wider range of facets with more connections to the official test.

The facets that had a strong relation to the results of the questionnaire were:

- Achievement-striving
- Activity-level
- Adventurousness
- Artistic interests
- Cooperation
- Gregariousness

- Immoderation
- Trust
- Vulnerability

The facets that had good relation to the results of the questionnaire were:

- Assertiveness
- Cheerfulness
- Excitement-seeking
- Friendliness
- Intellect
- Liberalism

The facets that did not have a good relation to the results of the questionnaire were:

- Imagination
- Morality
- Self-discipline
- Sympathy

Chapter 6
Conclusion

6.1 Concept Validation

This research aimed to design and implement a game for assessment of personality, through the perspective of facets from the Five-Factor Model. The iterations of implementation were elements that corroborated to this objective, by constantly refining and improving the intended design and final artifact.

Exploration of the academic field allowed for the perception of opportunities of implementation, focusing on the design aspects of Entia more than the validation in regards of a substitute to the personality assessment questionnaire and aiming to expand the field.

The design of Entia brought elements of mechanics and player interactions as descriptively as possible, being one of its main outputs the link between game mechanics and the facets for assessment during gameplay (exhibited in detail on the Chapter 3, through the Game Design Document).

While the scope of this thesis was not to validate Entia as a substitute for the official Five-Factor Model assessment methods, it was shown that facets present in gameplay and mechanics can be analyzed and linked to the results of the official test.

Considering the player and their interactions, the application of the NASA-TLX clarified the scope of games and questionnaires for assessment, in relation to their workload. The game retained elements of gaming workload, not having the same workload identified in the questionnaires. As such, players were presented with increased workloads in performance and frustration, while the questionnaire presented users with increased workload related to mental demand and effort.

The pre-survey and post-survey, together with the user testing, allowed to better delimit the applicability of games for personality assessment, both in the perspective of the tool and user interaction. User feedback provided valuable information for the refinement of the experience from the perspective of the user,

also reiterating the significance of games as a media for personality assessment.

6.2 Future Works

Future works on this topic can expand the discussion on game mechanics and their applicability to assessing personality, not limited only to the facets. Psychology specialized scientists can also evolve the research in terms of identifying player behaviours and the impact on the assessment results, as well as validating the tool as an alternative for the questionnaire.

Games can be studied as a media for personality assessment, providing an environment where players feel encouraged to act and behave as themselves. This would enable players to share things they otherwise would not in a traditional questionnaire, utilizing the power of a digital and entertainment environment.

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Appendix

A Pre-survey applied before the user testing

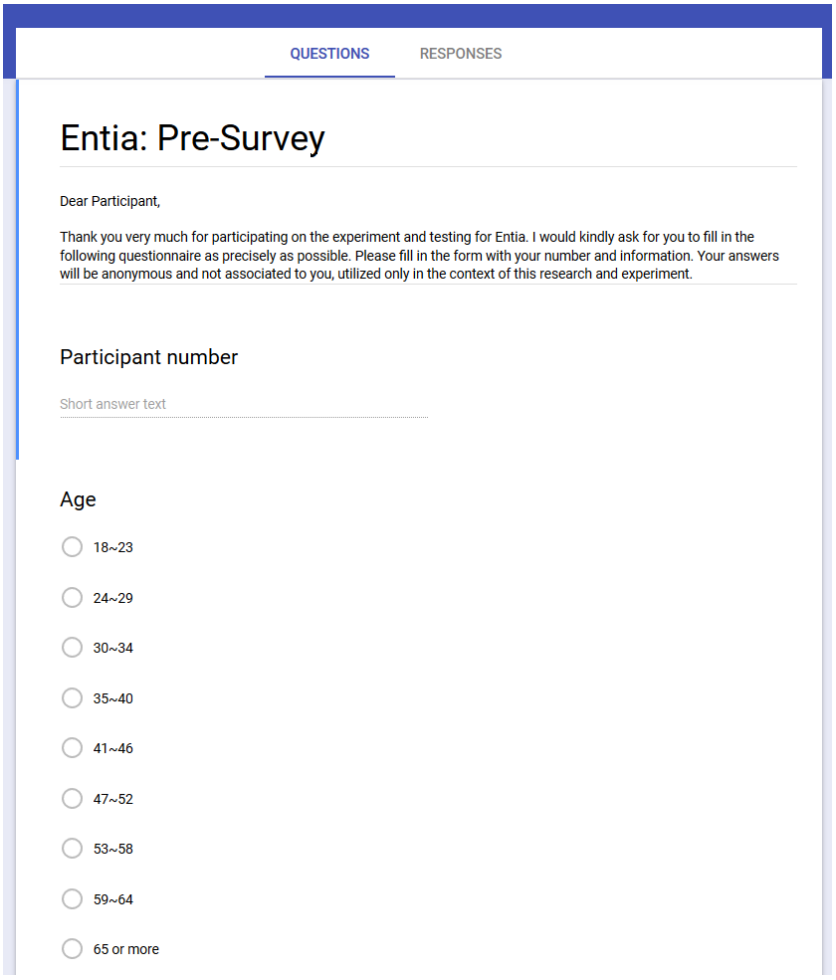


Figure A.1: Pre-survey - excerpt 1

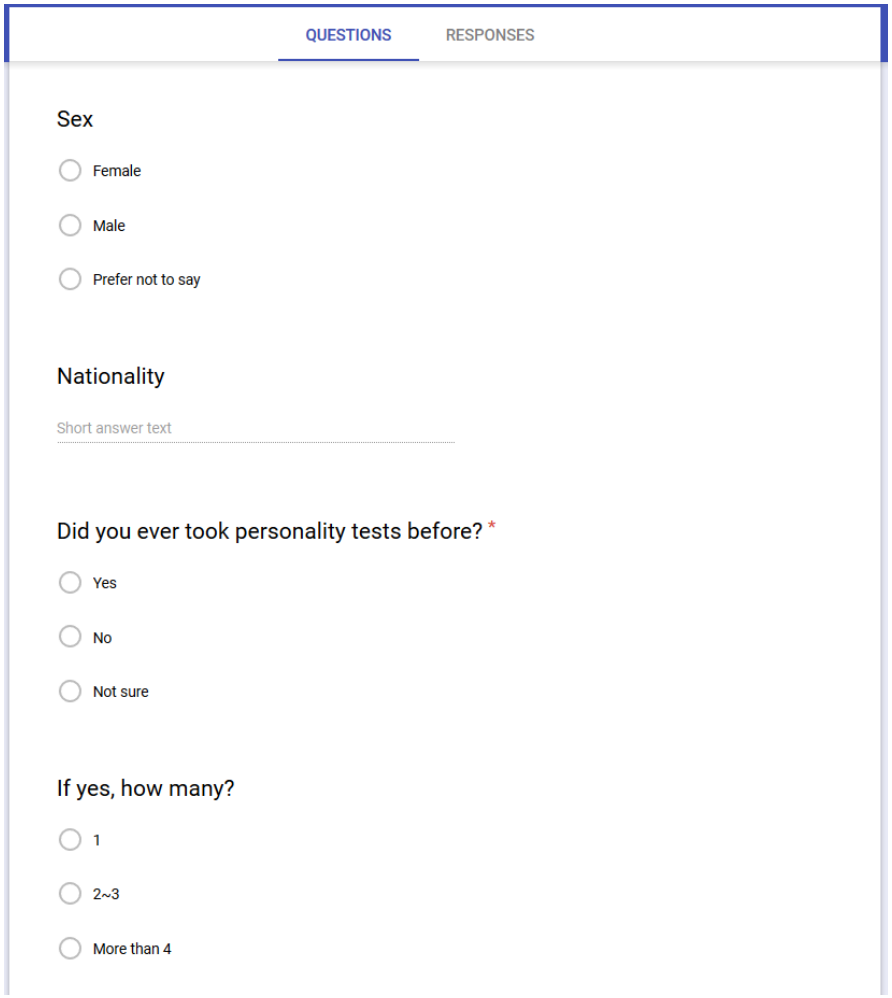


Figure A.2: Pre-survey excerpt 2

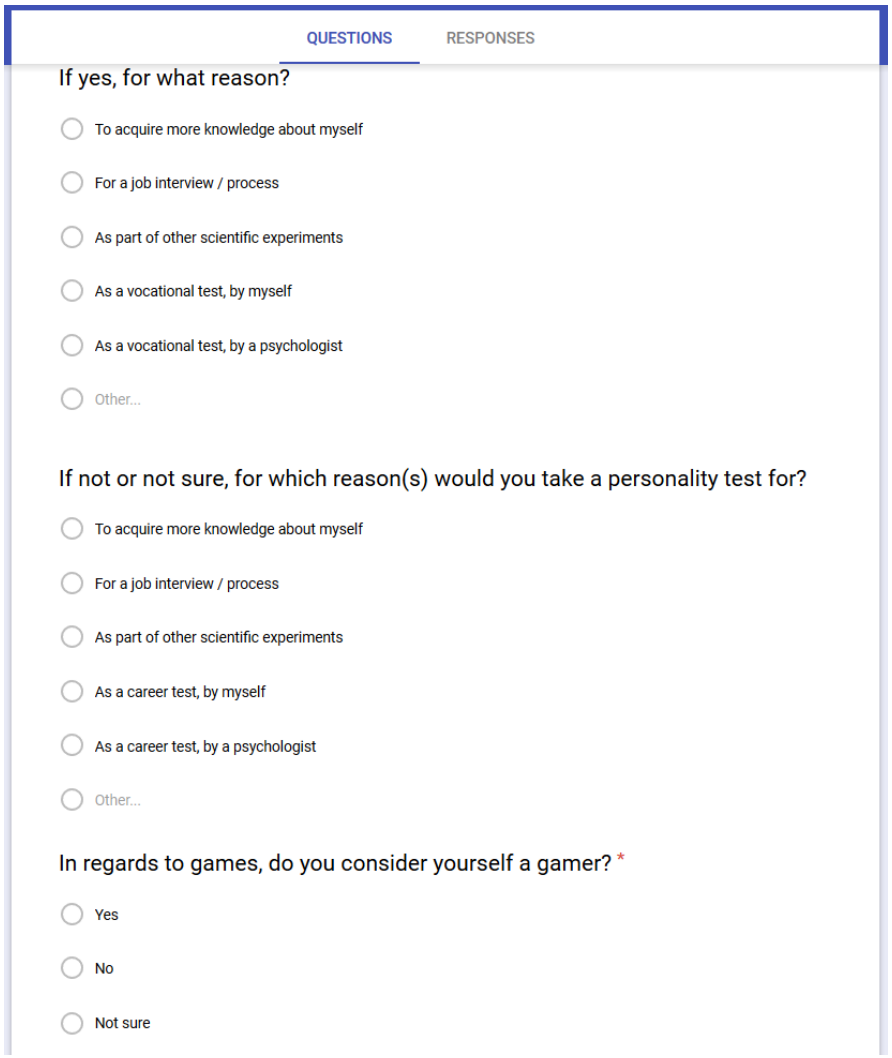


Figure A.3: Pre-survey excerpt 3

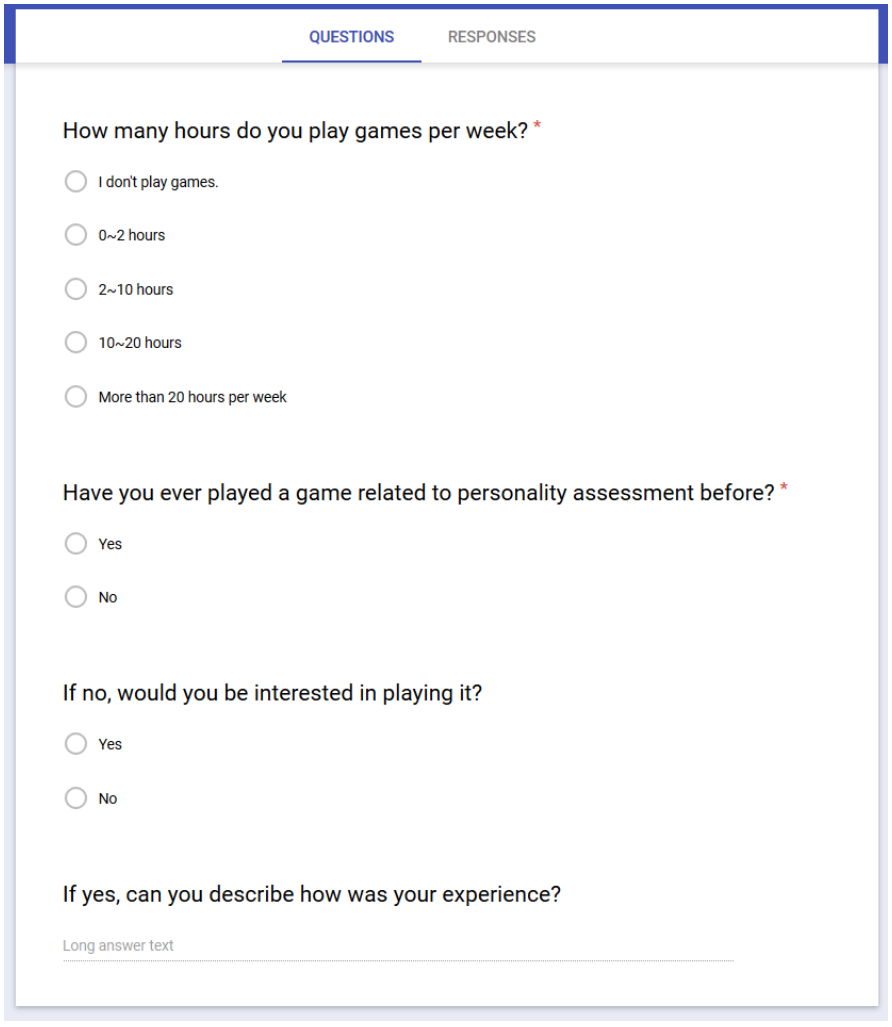


Figure A.4: Pre-survey excerpt 4

B Post-survey applied after the user testing

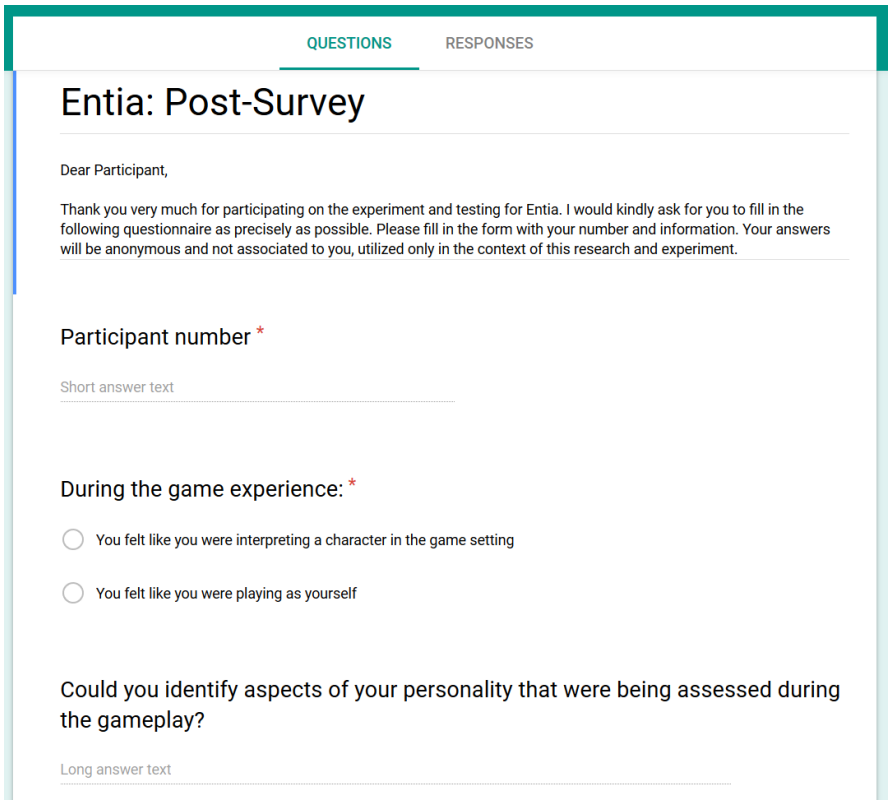


Figure B.1: Post-survey - excerpt 1

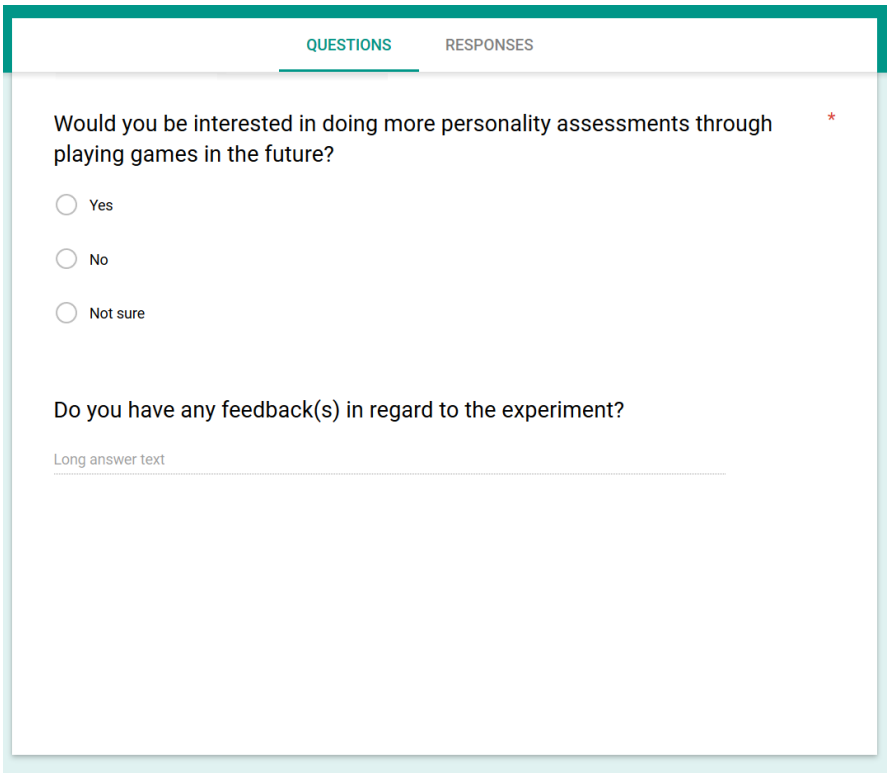
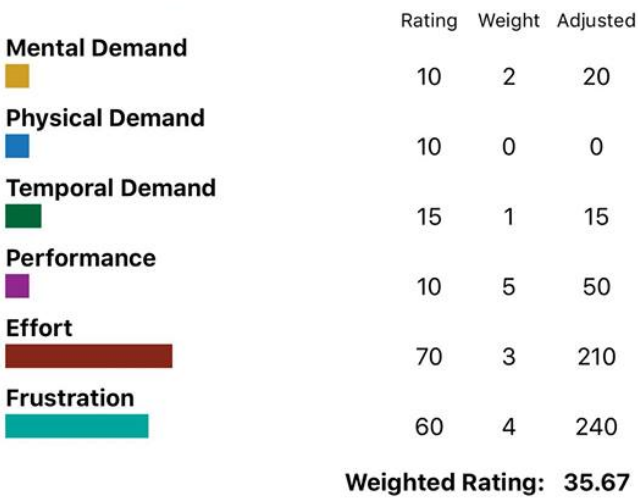


Figure B.2: Post-survey - excerpt 2

C Results from the Application of the NASA Task Load Index - Entia

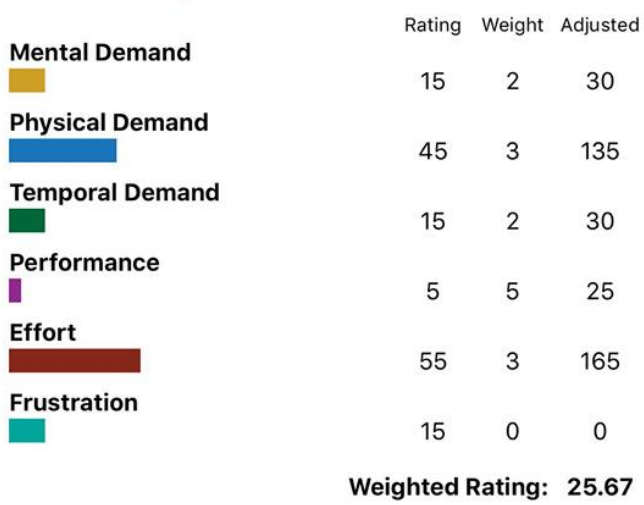
	Rating	Weight	Adjusted
Mental Demand	60	4	240
Physical Demand	5	0	0
Temporal Demand	15	2	30
Performance	40	2	80
Effort	50	3	150
Frustration	60	4	240
	Weighted Rating:		**49.33**

Figure C.1: User A - Entia



	Rating	Weight	Adjusted
Mental Demand	10	2	20
Physical Demand	10	0	0
Temporal Demand	15	1	15
Performance	10	5	50
Effort	70	3	210
Frustration	60	4	240
	Weighted Rating:		**35.67**

Figure C.2: User B - Entia



	Rating	Weight	Adjusted
Mental Demand	15	2	30
Physical Demand	45	3	135
Temporal Demand	15	2	30
Performance	5	5	25
Effort	55	3	165
Frustration	15	0	0
	Weighted Rating:		**25.67**

Figure C.3: User C - Entia

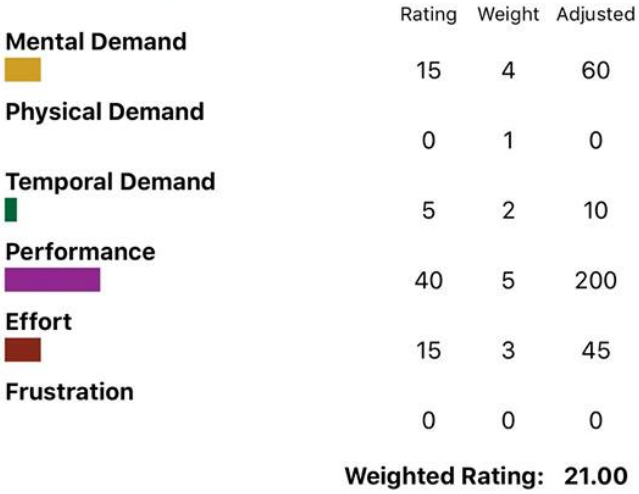


Figure C.4: User D - Entia

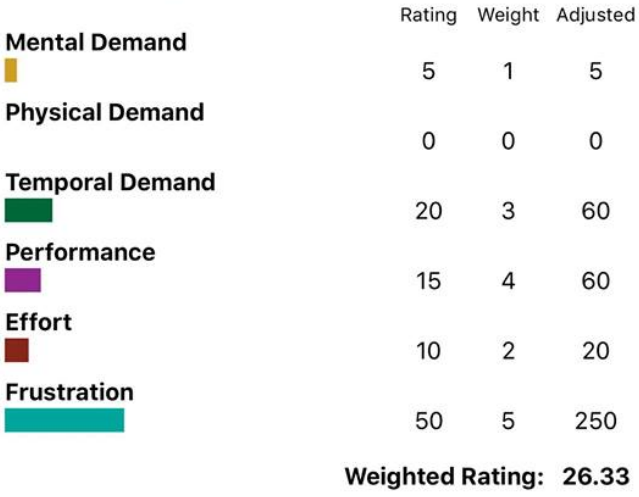


Figure C.5: User E - Entia

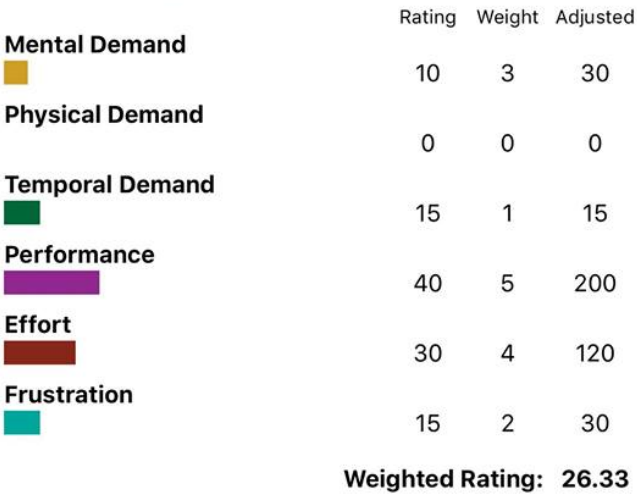


Figure C.6: User F - Entia

Figure C.7: User G - Entia

D Results from the Application of the NASA-TLX - IPIP NEO-PI questionnaire

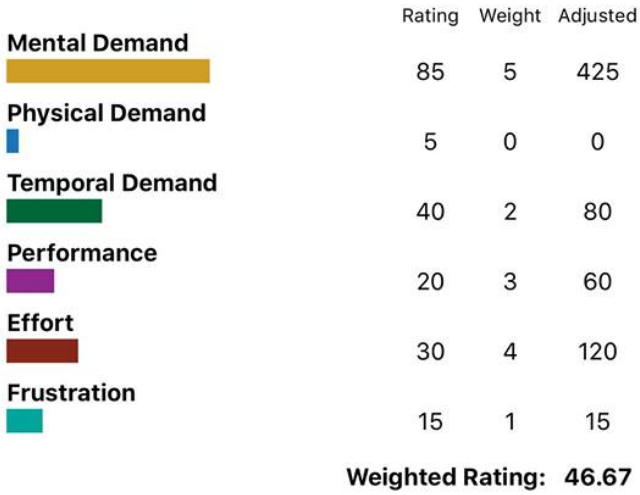


Figure D.1: User A - IPIP NEO-PI

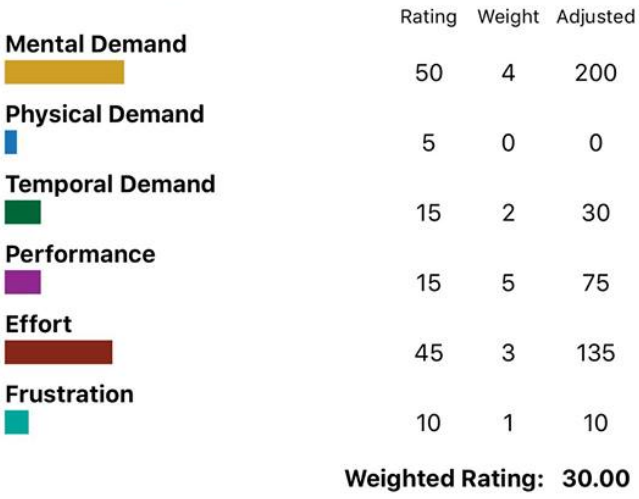


Figure D.2: User B - IPIP NEO-PI

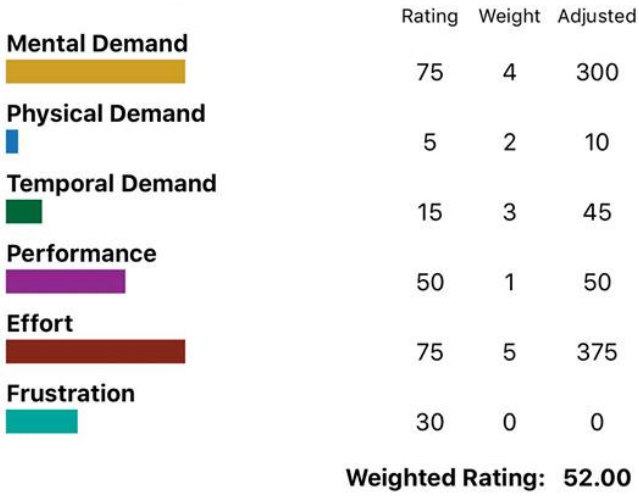


Figure D.3: User C - IPIP NEO-PI

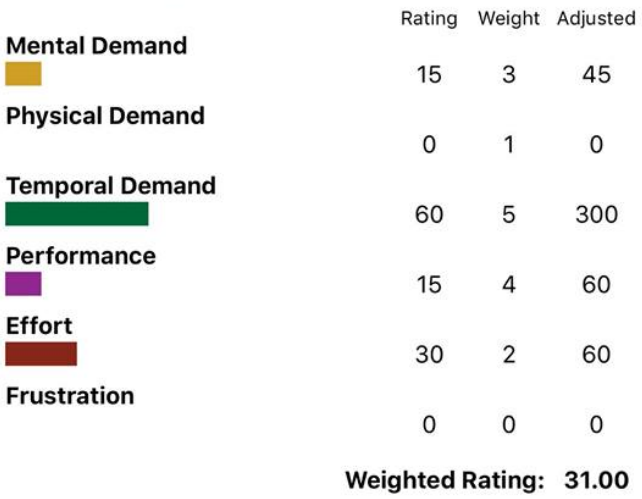


Figure D.4: User D - IPIP NEO-PI

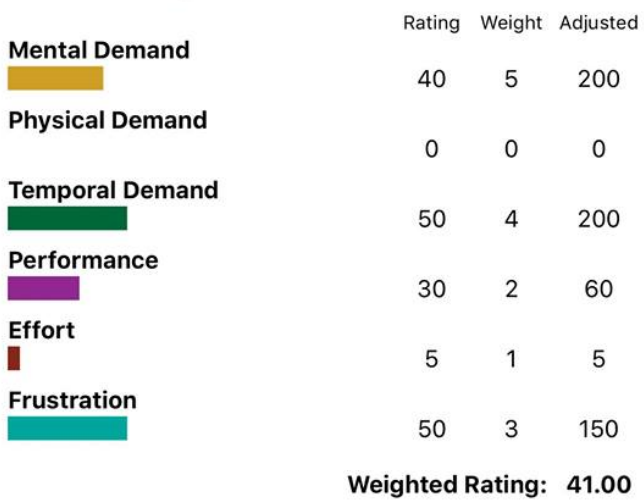
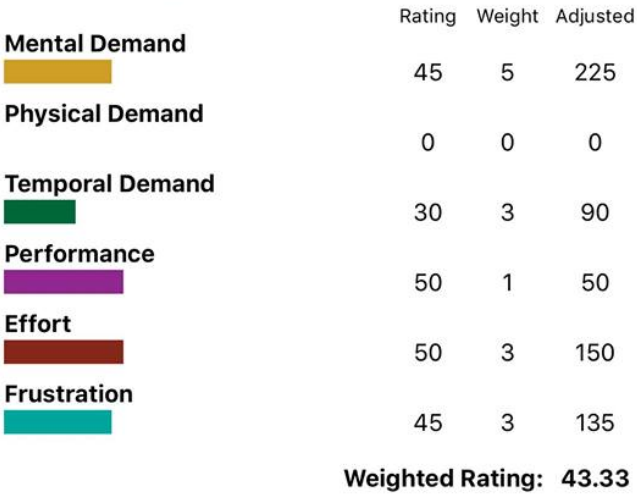
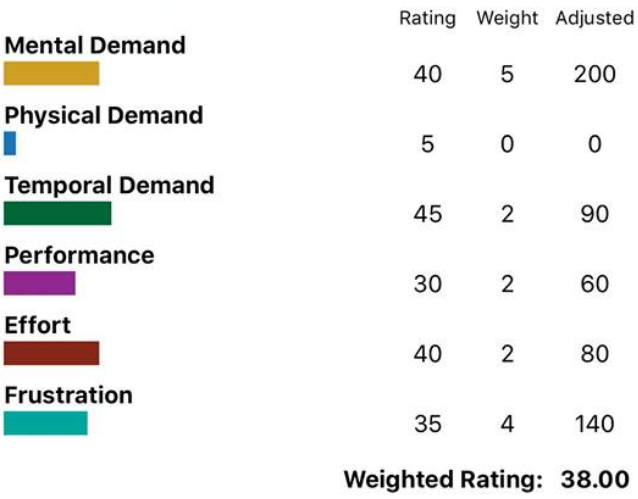


Figure D.5: User E - IPIP NEO-PI



	Rating	Weight	Adjusted
Mental Demand	45	5	225
Physical Demand	0	0	0
Temporal Demand	30	3	90
Performance	50	1	50
Effort	50	3	150
Frustration	45	3	135
	Weighted Rating:		**43.33**

Figure D.6: User F - IPIP NEO-PI



	Rating	Weight	Adjusted
Mental Demand	40	5	200
Physical Demand	5	0	0
Temporal Demand	45	2	90
Performance	30	2	60
Effort	40	2	80
Frustration	35	4	140
	Weighted Rating:		**38.00**

Figure D.7: User G - IPIP NEO-PI