# Bartle Taxonomy-based Game for Affective and Personality Computing Research

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## Abstract

The paper presents the design of a game that will serve as a research environment in the BIRAFFE series experiment planned for autumn 2021, which uses affective and personality computing methods to develop methods for interacting with intelligent assistants. A key aspect is grounding the game design on the taxonomy of player types designed by Bartle. This will allow for an investigation of hypotheses concerning the characteristics of particular types of players or their stability in response to emotionally-charged stimuli occurring during the game.

## 1 Introduction and Motivation

Affective Gaming (AfG) [Lara-Cabrera and Camacho, 2019] is an area of research concerned with how games can measure and detect player emotions, and then use this information to adapt the game environment accordingly. If these modifications are also aimed at directing the player's affective state, e.g., towards specific emotions desired at a given stage of the game, then one can call this an affective feedback loop in which the game and the player interact (see Fig. 1).

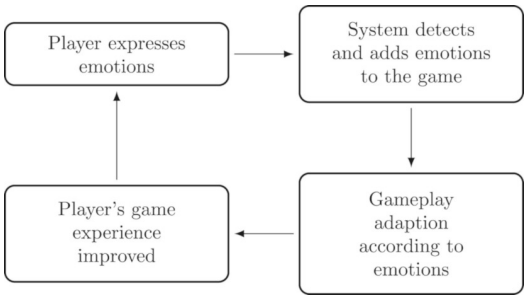


Figure 1: Affective game feedback loop [Lara-Cabrera and Camacho, 2019].

Studies in the AfG area do not just focus on entertainment. It can also be part of research projects concerning education [Dormann *et al.*, 2013] or the design of intelligent assistants, as in the BIRAFFE series of experiments [Kutt *et al.*, 2021a]. In the latter case, games are used as a fully controllable experimental environment that allows for accurate monitoring of the user's interaction with the system [Żuchowska *et al.*, 2020]. This is possible due to the similarities in human-in-the-loop [Nunes *et al.*, 2015] and affective loop interaction schemes. However, in order to extend the results of AfG research to interaction models of intelligent assistants in the future, careful game design and a system for logging the whole game context are required [Kutt *et al.*, 2021b].

The notion of context is understood as a component of emotion, according to the theory proposed by Prinz [2006]. In this view, context is anything that allows one to interpret a particular physiological activation and give it an appropriate interpretation. In the BIRAFFE series of experiments, the primary contextual information is behavioral data describing the interaction with the system/game – both the user's actions and the stimuli appearing in the system/game. In addition, demographic information (gender, age) and personality profiles are collected. Ultimately—when we move from a game-based experimental environment to real-world intelligent assistants—external sources of context, e.g., calendar data, current weather, will also be used. Importantly, once we have refined the low-level context storage mechanisms described in this paper, we also plan to attempt to derive higher-level context from them, e.g., instead of relying on changes in the position of individual characters in the game, we will operate on the information "the player is attacking an enemy" or "the player is running away from an enemy" instead.

This paper summarises the work carried out to prepare the game for the third experiment in the BIRAFFE (*Bio-Reactions and Faces for Emotion-based Personalization*) series. The motivation for developing the game in question was twofold. The first intention was to improve the experimental environment based on lessons learned from previous studies [Kutt *et al.*, 2021a; Kutt *et al.*, 2021b], in particular to provide a more accurate game context logging system. The second motivation was to extend the game design to include different types of interaction for different types of players. Combining information on the said types with personality profiles and physiological characteristics—obtained in all BIRAFFE experiments—will enable broader analyses that could lead to the identification of a set of characteristics for each type of player. It will also allow to investigate if and how the types and characteristics of users change during the course of the

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game.

The rest of the paper is organized as follows. In Sect. 2, Bartle taxonomy of player types is introduced. The design of the game with multiple paths for all player types is discussed in Sect. 3. Then, in Sect. 4 the set of logged contextual information is described. The paper is concluded in Sect. 5.

## 2 Bartle Taxonomy

The Bartle taxonomy [Bartle, 1997] is created on a 2D space, where the X axis is described as "Player – World", meaning the involvement of real people instead of non-playable characters (NPC) or world exploring in any way possible. The Y axis is set as "Acting – Interacting", which directly implicates the preference for acting or interacting. Each quarter of the space defines a different type of player as presented on Fig. 2.

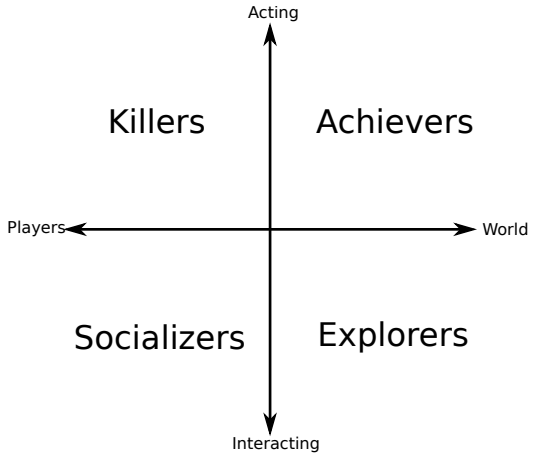


Figure 2: Bartle's taxonomy of player types [source: https://en.wikipedia.org/wiki/Bartle_taxonomy_of_player_types].

The achievers' goal is to *act* within the *world*. They wish to master the game, find the best possible weapon, get all the points (or achievements). People who take care about ranking and hierarchy can be considered achievers, therefore every competitive player is most likely an achiever. Another famous concept for achievers playing type is *grinding* – playing a game as long as it requires to get a desired outcome [Hilgard *et al.*, 2013].

Explorers start at simple exploring a topology of a game (breadth) and end at breaking the laws of in-game physics (depth), searching and using bugs. They are interested in *interacting* with the *world*. This player type is searching for knowledge and likes to be praised by others for having it. While game glitches are fun, players who like to find a specific, unique places and interesting features are also considered explorers. Additionally, speed-runners can also be labeled as a mix between achievers (if ranking is involved) and explorers.

For socializers, the most important part of the game is community and people, relations with them and interactions. They love to talk, sympathize and joke with others and appreciate the significance of *interacting* with *players*. For some socializers, observing the gameplay is enough. For others, some minor exploration can be included, in order to understand what other person is referring to. The act of killing is not required nor wanted for such a person to have fun. For single-player games, the socializer can be more entertained by making interesting NPC's with interesting backstory, multiple dialogue options and arcs, thought-provoking and engaging plot can be enough for socializer too.

Killers are a very specific, narrow group of people. Intentions behind a mind of a killer are clear to some extent. They enjoy being superior and high in hierarchy, however this is not in the same nature as achievers. Killers tend to do things they wouldn't normally do in real life, varying from punching a person to brutal murder. They also cherish the fact that they can do something to real human, who feels emotions and reacts, instead of NPC. Enjoyment comes from *acting* on *people*. Killers see other people, especially achievers, who can face the challenge, as their prey.

## 3 Game Design with Multiple Paths for Bartle's Player Types

The main goal of the game is to use the knowledge of player types in order to get closer to creation of a truly affective experience. As the BIRAFFE3 experiment is aimed to check the associations between the gamer's personality traits, physiological characteristics and in-game decisions (as introduced in Sect. 1), the proposed game provides an open world with as much non-linearity as possible [Gary, 2018]. The affectivity of the game has also been taken into account in the design – important choices will be accompanied by emotionally evocative stimuli, both sounds and images.

This game is fairly different than previous ones [Kutt *et al.*, 2021a; Żuchowska *et al.*, 2020], as it provides a pleasant gaming experience – something for everyone, no matter if a skilled player or casual person with no gaming background. Multiple point-increasing interaction systems have been introduced, such as dialogues with in-game characters (see Fig. 3). The story of each character is very simple, but rewarding enough to keep it entertaining for a subject [Torta and Minuty, 2017]. Some tasks and quests can be done for NPCs, mostly in a cute-bubbly way. In order to achieve that, all interactable, pickable objects have a type – consumable, plot, weapon or non-consumable. The next important interaction type is attack, which allows to kill an NPC or an animal in game with a previously found and equipped weapon item. It is important to notice that there is no difference in points added, whether the action is peaceful or not, the outcome in terms of points is always the same.

The sole purpose of the aforementioned affective pictures and sounds is to induce certain emotions in players, and see their reactions – the images and sounds will be displayed after some actions have been made. One of the most important activities, resulting in revealing a questionable image and/or sound, is chest opening. Opening such a special chest is one of many ways to gather points, however there is a trick to it. There are three types of chests: one with pleasant sounds and images, second one with 50:50 ratio to get a pleasant or disgusting image, and the third one which always displays an unpleasant, gore image. Every chest varies in terms of


Figure 3: Dialogue with the NPC.


Figure 4: Information about completed achievement.

amount of points it gives, which may result in an interesting insight on the subject's importance of points and horrible image watching. Of course, some people might not be interested in gathering points in the first place, which creates a challenge to overcome, as the images are a crucial part of affective experience. As far as Bartle taxonomy is considered, all types of gamers will find a way to see an affective image and hear a sound on a regular basis during the gameplay. Another ways to get the subject to look at such a picture include displaying an UI interface by talking with non-playable characters or reading boards and interacting with objects. After some random number of lines of text has been displayed, an image will be displayed in the background, however there will be no points for that, and the image will be random. Additionally, when achievement is unlocked by the player, depending on its type, a pleasant or undesirable sound will be played.

The whole game design was made specifically with a view to pursue the characteristics of each player type from Bartle taxonomy. Achievers can find multiple weapons and gather points, look up into current statistics and collect achievements for certain actions. The amount of points gathered thorough the game is being shown all the time in top left corner of the screen. Achievements on the other hand, are only displayed with the moment of completion (see Fig. 4). The first achievement will be very simple, in order to show that achievement gathering is possible, triggering some emotions in subjects with particular tendencies. Explorers will be interested by searching for hidden objects on the map and exploiting the mechanics, as some places have intentionally placed "bugs" as easter eggs. One of those bugs is an askew collider for map. In the bottom left corner of the game, there is a possibility to get out of the map (see Fig. 5) and find a hidden board with a nice message written on it (see Fig. 6). As for socializers, NPC are introduced, with their own backstories and problems to solve. Action with an NPC triggers an UI with dialogue options (see Fig. 3), allowing to know the character better and have a conversation. Killers can find pleasure in killing everybody around and committing acts that would be considered illegal or immoral in real life.

Figure 5: Intentionally placed "bug" in collider, allowing to get out of the map.


Figure 6: Hidden board placed out of the map as an "easter egg".

Technically, according to the assumptions made, the gameplay time should last 15 minutes. After that time, the game will end and proceed with the experimental procedure (as in other BIRAFFE experiments, see, e.g., [Kutt *et al.*, 2021a]). There is no possibility to finish game earlier, however there is nothing that keeps the subject from just standing in place for 15 minutes and stare blankly at the screen. The whole game was developed with the Unity Engine (https://unity.com/).

## 4 Logging System

To conduct a study based on such game, a suitable log handling had to be added. Similarly to the previous research [Kutt *et al.*, 2020], logs are created for each subject, based on their ID defined at the beginning of the experiment. A proper directory is created, along with all files about the game. During the gameplay, data containing current state of the player an the progress is being gathered with 10 Hz frequency. A log with an ID of subject as the name is written into JSON file and is being saved in application persistent data path. Such a log consists of various information about current state of the game:

1. Timestamp,
2. Location – both X and Y coordinates and area,
3. List of unlocked achievements,
4. Amount of interaction button clicks,

Figure 7: Trigger colliders for area logging information.

5. Number of interactions with unique objects,
6. List of particular milestones for NPCs tasks and dialogues,
7. If talking – name of the NPC, else an empty string,
8. Amount of killed NPCs,
9. Current equipped weapon,
10. Points and health,
11. List of items gathered,
12. List of opened chests,
13. ID of played sound and image.

The log file can be separated into groups. The first two items (items 1-2 on the list) are purely about the position over time of the protagonist, which may help with visualization or classification of commonly walked places in game. The "area" is a term describing important places in the world identified by arbitrarily prepared colliders (see Fig. 7). Second group (items 3-12) contains the characteristics of players behavior – did the protagonist gather achievements? Was s/he talking with NPCs? Maybe the subject was killing them? If so, with which weapon? How many points were gathered, etc. This section of logging system is supposed to help in analysis the most, as the heart of information about a pattern of playing. The last item (13) is for affect-related analyses – the ID of sound and image displayed after event.

Another log file contains the data about current state of the world. The characters are moving all the time, therefore their location needs to be written down as well – the position of each character can have an impact on each gameplay.

Finally, the last file, which is the same for all players, is the static map of the game world. It consists of information about the starting position of items, colliders, houses, etc. It's purpose is to allow for possible future visualization of events and analysis of collider interactions between the player and the world.

Keeping the Bartle taxonomy in mind, the log can be also separated into items related to specific gamer types. In terms of achievers, the information about points gathered and achievements unlocked is written, along with particular milestones for NPC's quests. The latter can also be used as a socializer trait, which is why the data on dialogue options clicked is also being saved – who was the player talking to. As for the explorers, the amount of unique objects interacted with together with the amount of interaction button clicks, chests opened and list of items is written into the file. Finally, for the killers, the data on the amount of NPC killed and type of equipped weapon is logged.

## 5 Summary and Future Work

The BIRAFFE series of experiments, which has been running for several years, focuses on the development of interaction models for personalised intelligent assistants based on a range of contextual information about the user: physiological signals collected with low-cost wearable devices, personality assessment, behavioural data describing the interaction with the system, and external sources of context (such as current weather conditions). A means to the goal is to use games as a stimulus-rich yet fully controllable experimental environment.

This paper presents the design of a new affective game to be used in the BIRAFFE3 experiment, scheduled for autumn 2021. In addition to addressing the weaknesses found in previous games, a new contribution of using Bartle's taxonomy during interaction design is introduced. This will enable post-experimental analyses focusing on determining the characteristics of specific user types or investigating the stability/variability of player type in response to positive/negative stimuli associated with their in-game interactions. We believe that inclusion of Bartle player types into both the design of the affective game, as well as data analysis about player interaction with it, provides a new and important source of context.

Finally, the post-experimental analyses will also focus on creating a catalogue of interaction patterns, which will be the basis for creating an improved version of the game, allowing the gameplay to adapt to the player's emotions, i.e., implementing a full affective game feedback loop. This will thus allow a transition from a "Detection and measure" approach to an "Integral approach" according to the Lara-Cabrera and Camacho's taxonomy [2019].

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