Science Birds Gameplay With a Smile Interface to Promote the Spectator's Emotion

Febri Abdullah[1], Mury F. Dewantoro[1], Ruck Thawonmas[2], Fitra A. Bachtiar[3]
{[1]Graduate School, [2]College} of Information Science and Engineering, Ritsumeikan University, Japan
[3]Faculty of Computer Science, Brawijaya University, Indonesia
{gr0397fs, gr0450xi}@ed.ritsumei.ac.jp, ruck@is.ritsumei.ac.jp, fitra.bachtiar@ub.ac.id

***Abstract*—This demo paper presents a smile interface to promote the spectator's emotion. Here, a smile interface is defined as a human-computer interaction system that detects the user's smile. A past study suggested that watching Science Birds gameplay featuring Rube Goldberg Machine mechanisms with a *domino effect* can promote the spectator's emotion. Science Birds is a clone version of Angry Birds for research purposes. Furthermore, other studies suggested that playing Science Birds with a smile interface has the benefit of promoting the player's emotion. However, such benefit from the spectator's perspective is yet to be investigated. The presented interface will be used in such investigation in the future.**

***Index Terms*—Angry Birds, Emotion, Well-Being, Gameplay, Spectator**

I. Introduction

The popularity of game live streaming keeps growing. Many people enjoy watching game live streaming. According to a report [1] by a game market consultant, Newzoo, the number of game live streaming audiences reached 809.6 million in 2021. The number reportedly keeps increasing over the years; it is predicted to increase by 13.8% in 2021 and reached 921.2 million in 2022. Another report [2] by the same company mentioned that live streaming platforms trend to become more and more interactive.

A past study by Abdullah et al. [3] suggested that certain gameplay viewed by spectators has the benefit of promoting their emotion. Their study evaluated Angry Birds-like gameplay featuring Rube Goldberg Machine (RGM) mechanisms in promoting the spectator's emotion. Other studies [4] [5] suggested that implementing smile interfaces could promote the player's emotion when playing variants of Science Birds [6], a clone of Angry Birds for research purposes. However, the benefit of smile interfaces is yet to be evaluated from the perspective of the Science Birds' spectators. Led by the aforementioned studies, we are curious to know whether employing a smile interface has any benefit in promoting the spectator's emotion and present an interface for exploring this research question.

II. Related Work

A. Smile Interfaces in Science Birds

Yang et al.'s [4] proposed smile interfaces that were implemented in Science Birds. Their study suggested that a smile interface can perform well in promoting the players' emotions if they are not forced to smile. The study by Xu et al. [5] employed a smile interface in Science Birds that rewards the player who smiles with a larger destroying power. However, both studies were focused on the usage of smile interfaces in promoting players' emotion. Moreover, both studies did not feature the RGM mechanisms.

B. RGM Levels of Science Birds

The concept of RGM was invented by a cartoonist named Rube Goldberg [7]. The machine is built from smaller components connected in an overly complex manner to perform a simple task. Each component is activated by its adjacent components, resulting in a *domino effect*. It is usually entertaining to watch a working RGM.

Inspired by RGM, a study by Abdullah et al. [3] evaluated the benefit of watching Science Birds gameplay featuring RGM mechanisms in promoting the spectator's emotion. In their work, an RGM level of Science Birds consists of several connected segments. A segment is a set of Science Birds objects arranged in a way that represents a small component in an actual RGM. Such arrangement can create a domino effect, allowing an RGM level to be completed by a single bird shooting. Their study showed that watching perfect RGM levels, those cleared in one shot, could perform better in promoting the spectator's emotion, compared to imperfect ones. However, it is unclear whether watching a series of perfect RGM levels with a smile interface can enhance such promotion, which has become our research question.

III. Proposed Smile Interface

As a first step towards answering the above research question, we propose a system that detects the spectator's smile while watching a series of Science Birds' RGM levels (five segments per level) generated by the level generator proposed in Abdullah et al. [8]. We define a smile interface as a human-computer interaction system that detects the user's smile.

Following a past study by Seering et al. [9], we distinguish between a spectator and a player based on their interaction with the game. A spectator is defined as any person who mainly observes the game. Unlike a player or an audience, any interaction made by a spectator is neither required for the game to progress nor can impact the gameplay. In the context of Science Birds, the game is progressed by shooting birds to clear a given level. Hence, our system disables the bird-shooting controlled by any human player. Instead, a player

agent is employed that always aims at the right target, which makes each level cleared by a single bird shooting.

When a smile is detected, our system rewards the spectator by showing a series of juice effects. According to Pichlmair and Johansen [10], juice effects are based on a design concept to augment interactivity by showing excessive amounts of feedback in response to user input. They aim to make the feedback perceptually significant during the user's interaction with game objects. By implementing juice effects, our system can provide rewarding feedback that neither affects the game progression nor make any impact on the gameplay. For each RGM level, once a smile is detected, juice effects are enabled and ready to be triggered at their respective timings. They remain enabled until the end of the current level. In addition, we implement a user interface that monitors the presence of smiles in a $1\,ms$ interval. Figure 1 shows a screenshot of our system, while demo videos of the system are also available in footnote number 1 below[1].

A. Smile Detection

To detect a smile in our system, we employed 'face-api.js'[2], a Facial Expression Recognition (FER) module developed in JavaScript. The module detects seven expressions, i.e. *neutral*, *happy*, *sad*, *angry*, *fearful*, *disgusted*, and *surprised*. We empirically found that the *happy* expression has the highest correlation with the spectators' smile. As a result, we consider the spectator is smiling when the *happy* expression is detected. Our reason for choosing 'face-api.js' is due to its capability of running in a web browser. Moreover, the module is compatible with the Science Birds' Unity platform.

B. Juice Effect

To enable juice effects in our system, we employ Squeezer, a tool for designing juice effects developed by Johansen et al. [11][3]. In our system, we created five juice effects, which will be randomly and individually associated to each of the five segments in an RGM level of interest. In Squeezer, after multiple trials, we decided to generate the juice effects using the *EXPLODE* category with $intensity = 3$. A juice effect

[1]https://tinyurl.com/CoG2022RGM
[2]https://github.com/justadudewhohacks/face-api.js
[3]https://github.com/pyjamads/Squeezer

Figure 1. A screenshot of the proposed system showing an RGM level with the proposed smile interface. The level consists of five RGM segments, those individually inside yellow rectangles. The smile user interface is encapsulated in a red rectangle.

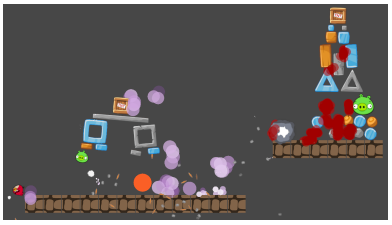

Figure 2. Juice effects implemented in the proposed system.

is attached to all the blocks residing in its segment. A block is a game object in Science Birds that acts as an obstacle and rewards the player with an additional score when being destroyed. A juice effect will be triggered when its blocks are being destroyed (cf. Fig. 2).

IV. Conclusion and Future Work

We proposed a system to be used in evaluation of the benefit of smile interfaces from the spectator's perspective. We expect that our smile interface can enhance RGM gameplay in promoting the spectator's emotion. For future work, we plan to ask game design experts to evaluate the juice effects in our system. By showing better juice effects, we expect to increase the motivation of spectators to smile. Furthermore, we plan to validate the proposed smile interface in terms of user experience to develop an effective smile interface for spectators.

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