APPLICATION GAME OF PERCEPTIVE SIMULATION DISASTER QUAKE AND FLOOD BASED ON ANDROID ON BADAN NASIONAL PENANGGULANGAN BENCANA IN WEST JAVA

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ABSTRACT

Indonesia is a region with high potential for disasters, including the area of West Java which frequently experiences floods and earthquakes. BNPB is a non-departmental government agency that has the task of coordinating the planning and implementation of disaster management activities. Prevention and Preparedness is one of the fields in BNPB that has a work program to socialize disaster response to students with the aim of helping to prepare for disasters. In its implementation, BNPB has difficulty in conducting socialization related to the lack of students' interest in paying attention to the material presented. These problems result in a lack of student understanding of disaster management knowledge. So that additional media are needed to help the dissemination of material activities become more interesting, researchers use simulation games to help BNPB socialization activities to be of interest to students. This research uses the GDLC (Game Development Life Cycle) method with stages of initiation, pre-production, production, trial, beta, release. The modeling analysis used is object oriented using UML (Unified Modeling Language), while game material uses BNPB's socialization data on disaster response. Based on the implementation and testing using Black-Box and UAT (User Acceptance Test). So it can be concluded from the results of interviews with BNPB, 81% stated using media games can help the delivery of material to be more interesting, 99% of questionnaires to elementary school students stated that disaster response simulation games are interesting games and help socialization activities.

Keywords : simulation games, disaster, earthquake, flood, BNPB Wast Java, GDLC, UAT

1. PRELIMINARY

Indonesia is an area that has high potential for disasters, because Indonesia is an archipelago which is surrounded by four tectonic plates, namely the Asian Continent, the Australian Continent, the Indian Ocean and the Pacific Ocean. Indonesia is also included in the ring of fire zone so that the possibility of disasters can occur frequently, ring of fire is a term for areas that often experience earthquakes and is an active mountain path. Education, training and simulation on disasters need to be the main thing for people in various regions of Indonesia, so that people are not only quick to respond after a disaster, but also have been prepared and able to act pre and post-disaster.

Badan Nasional Penanggulan Bencana is a non-departmental government agency that has the task of coordinating the planning and implementation of disaster and emergency response activities in an integrated manner and carrying out disaster management. Prevention and Preparedness is one of the fields in BNPB. Based on the results of interviews conducted on 12 June 2019 with Mr. Ari Wibowo as staff in the Prevention and Preparedness Field, this field has one of the work programs to disseminate disaster response to the general public and students. Forms of socialization carried out by way of introducing about disasters using presentation slides, video screenings, performing demonstrations and conducting evacuation simulations when disasters occur. In its implementation the Prevention and Preparedness Field has difficulties in conducting socialization related to problems such as lack of interest in students paying attention to the material presented so that the material delivered is not optimal. From these problems result in a lack of understanding of students about disaster management knowledge. The Prevention and Preparedness Sector has conducted socialization to several elementary schools including 127 Sekeloa Public Elementary School and 189 Neglasari Public Elementary School, based on the results of a questionnaire that was conducted to 58 students in grades 4 and 5 about disaster management, 24 of 58 (41.4%) students stated that they did not know what to do when a flood or earthquake occurred and 20 out of 58 (34.5%) said they did not know. So that it indicates that the students' interest in the material presented is less attractive, it needs additional or alternative media that support to convey material information to be more interactive. Game media has become one of the learning media that can be used today. Game is one of the learning media that will build memory

memories of stories and emotional memories, because the game can produce knowledge with a form of learning Learning by Doing so that a game player is required to learn to solve the problems that exist in the game [1].

To help the construction of this simulation game, researchers conducted a review of several previous studies. Among them is research on a Safety Way Out simulation game, the game provides knowledge to players who will learn how to handle and deal with it in situations or emergencies [2]. In other studies about educational games, the study teaches users to be able to find out herbal ingredients and how to process them by introducing medicines and herbal treatment methods using natural ingredients [3]. Subsequent research related to disaster games created interactive games for children to raise awareness of the consequences of global warming [4].

So based on the existing problems, a learning simulation game media is needed to provide education about disaster response to children or elementary school students. Where the game provides knowledge about disasters and about disaster response simulations.

2. CONTENT OF STUDY
2.1 Literature Review
Literature Review aims to provide an explanation of information from various sources and theoretical studies related to the research development of the Application of the Game of Earthquake and Flood Disaster Response Simulation at the Badan Nasional Penanggulangan Bencana in West Java.

2.1.1 Definition of Disaster
Disaster is a series of events that threaten and disrupt people's lives and livelihoods caused either by natural factors or non-natural factors caused by humans themselves, resulting in human casualties, environmental damage, property and material losses, and psychological impacts. The definition states that disasters are caused by several factors, namely natural, non-natural, and human factors. Therefore, Law No. 24 of 2007 defines natural, non-natural, and social disasters [5].

2.1.2 Game
Game is an entertainment media that is widely used by various groups, both young and old. Today's game has experienced a very rapid development. Proven this is marked by the many types, products and a variety of diverse tools, which are used to play games and currently there are also many different companies competing to develop and build games [6].

2.1.3 Simulation Game
The simulation game is intended to place the player as a regulator of certain activities and try to make it look as realistic as possible. In a sense, all electronic games are simulations, because in general games cannot exist without simulating real-life aspects. However, the simulation genre only includes games that focus on imitating real-life activities. This does not mean that simulation games must be truly realistic, for example protected animal rescue simulation games, which differentiate simulation games with other games is the emphasis on realism and details comparable to those found in real life.

2.1.4 Android
Android adalah sebuah sistem operasi *mobile* yang berbasis Linux dan mencakup sistem operasi dan *middleware*. Fasilitas *opensource* atau sistem operasi yang dapat dikembangkan dengan bebas bagi para penggunanya membuat banyak orang untuk mendevelop dengan inovasi – inovasi yang semakin baru terhadap sistem operasi maupun pada pembangunan aplikasi *mobile* -nya tersebut [7].

2.1.5 Unity
Unity is a game engine, which is software that is used to make it easy to make games. Unity also has an IDE or also called Integrated-Development-Environment, MonoDevelop which aims to integrate all scripts built into Unity so that it can be directly processed. Unity is usually used to make mobile games or browsers, but can be used for consoles and PCs. Unity games were developed using the C / C ++ programming language and well support a variety of programming languages including C #, BOO,JavaScript [8].

2.2 Method
The methodology used in this study can be seen in Figure 1.
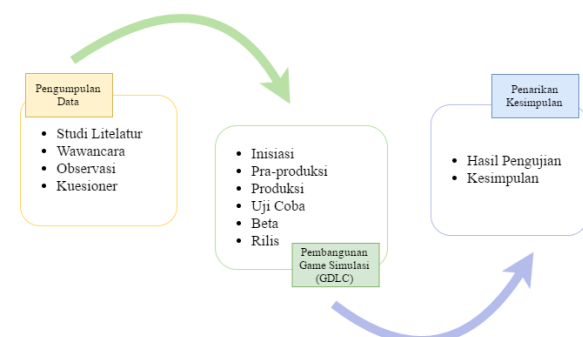
Figure 1 Research Methodology

2.2.1 Data Collection Stages

This stage begins with a literature study that discusses the importance of issues regarding knowledge about disaster response.

The interview stage is carried out by conducting interviews with the staff of the Prevention and Preparedness Field by identifying the problems that occur that are obtained from the results of the interview.

Observations and questionnaires were carried out by visiting 2 elementary schools and giving questionnaires to 58 4th and 5th grade students aged 10-12 years, to find out the extent of students' knowledge about disaster information. This is used as research data which will later be used as a tool or reference for application development. The research data can be seen in Figure 2.
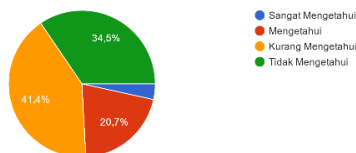

Figure 2 Student Questionnaire Data

2.2.2 Stages of Development of Simulation Games

Development of simulation games using the Game Development Life Cycle (GDLC) method, which starts from the stages: 1. Initiation: Designing the initial idea of making a game. At this stage the pattern and how to play (concept) will be determined in the game to be built, 2. Pre-Production: based on the results of determining the concept at the initiation stage, this stage will be made character-design, background-design, object-design, and what tools I need to build the game, 3. Production: At the production stage the coding, game flow planning and development process will be carried out so that game play can be run as it should, 4. Trial: This stage will be carried out internal trials using try playing to find out and assess the game's functions and balance-players, 5. Beta: The beta phase requires an external tester or testing to the user of the game being built. Where the game development requires changes in features or gameplay, then the GDLC cycle can be repeated, 6. Release: Stages of completion of the game that has been built and ready to be published or released [9].

The stages in the construction of this simulation game use the GDLC method applied in the activities in Figure 3.
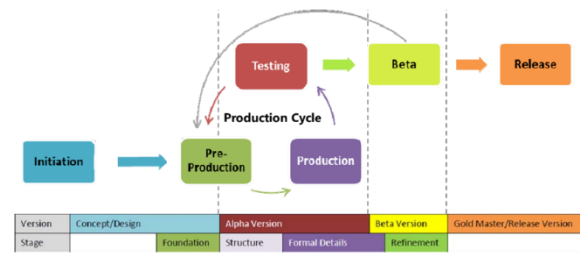

Figure 3 Method GDLC

2.2.3 Initiation

The game that will be built has the name "Si Bena", this game was built by applying game technology as a bridge to present material about disaster response. This game development uses 2D graphics (2 Dimensions). This game is a game that illustrates a simulation of preparing for when there will be a disaster, while the target users who will play this game are children aged 10-12 years (Elementary School).

1. Description of the simulation game that will be built is as follows:
a. This simulation game is used as a learning aid for the introduction of actions and what preparations should be used when a disaster occurs.
b. The game is played by touching, tapping and dragging. This tapping is used instead of the function. The mouse that the player uses when interacting by touching the screen on an Android phone.
c. The simulation applied is for pre-disaster and during disaster where pre-disaster players must prepare all their needs and preparations before a disaster occurs and when a disaster is requested to save themselves from a disaster.
d. In this game has two simulations, in each gameplay simulation there are different missions that must be completed.

The game material used in this study uses data from the BNPB disaster response book and video, 8 main materials were used as the focus of this study.

In every game gameplay in this simulation there are some rules that must be completed by the player in order to finish the game being played. The following rules in the game that will be built :
a. In every gameplay the player must complete every mission given, if the mission is not completed all, players cannot continue the game (gameover).
b. If the player does not complete the mission with true, then the player must repeat the game again.

The storyline design used in this study is that the earthquake and flood response simulation game tells the story of a boy named Bena. One time there was a disaster that made him almost killed because he did not know what actions and preparations I needed when a disaster occurred or before the disaster, so he

was asked to prepare everything that was needed before the disaster occurred and at the time of the disaster. So that if a disaster occurs again he can save himself from the disaster.

2.2.4 Pre-Production

Based on the results of determining the concept at the initiation stage, at this stage a pre-production stage will be made which is used for the analysis stage before the production stage.

a. Character Analysis

Character analysis contains an explanation of the characters contained in this game, can be seen in Table 1.

Table 1 Character Analysis

Name	Picture	Philosophy	Information
Bena		The main character is 10 years old, wearing orange and blue colored t-shirts where the colors depict the colors found on BNPB.	Bena is the main character in the game that will be played by players. Bena is a little boy from a city.

b. Control Button Analysis

Analysis of the controls contained in the game to be built. Following are the control buttons that will be used in the application to be built, the control functions and the description of the control keys that will be used can be seen in Table 2.

Table 2 Control Button

No	Button Image	Function	Information
1		To move the character to the left in the disaster response simulation gameplay.	The left button control is used to move the character to the left in the disaster response simulation gameplay.
2		To move the character to the right in the disaster response simulation gameplay.	The right button control is used to move the character to the left in the disaster response simulation gameplay.
3		To move the character jumps on the disaster response simulation gameplay.	The jump control button is used to move the jump character in the disaster response simulation gameplay.
4		To move the character to take items in the disaster response simulation gameplay.	The capture control button is used to move the character to take items or other actions in the disaster response simulation gameplay.

c. Game Features

In the analysis phase this feature will be carried out to find out what features are used in the game to be built. The features that are used in this game, namely the development of concepts, story lines and genres that have been designed before-in order to get the following features:

1. Adventure

The adventure feature has a mission to prepare everything for disaster.

2. Puzzle

In this feature the player is asked to do a mission to choose an action or choice what should be done by the player.

2.2.5 Production

The production stage is the stage where in this stage there is coding, application flow, and compilation so that the game can run as it should, for the model used in the construction of a game application for earthquake and flood response simulation is the UML model.

a. Use case diagram

In general, functional, application flow, and interaction between players and games will be illustrated in the use case diagram which can be seen in Figure 4.
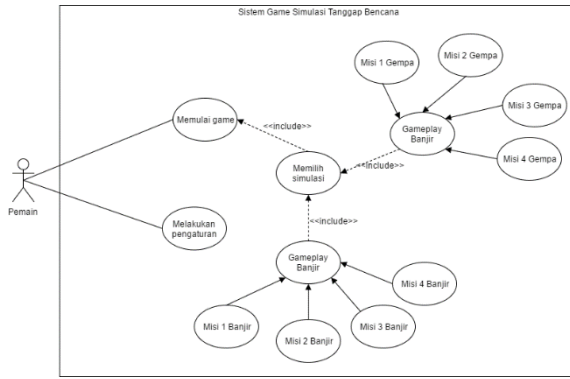
Figure 4 Use Case diagram

b. Sequence Diagram

Sequence diagrams illustrate the pattern of objects in the use case by describing the object's timeline and messages sent and received between one object and another object. Following is the sequence diagram of starting the game which can be seen in Figure 5 and the sequence diagram for selecting modulation can be seen in Figure 6.
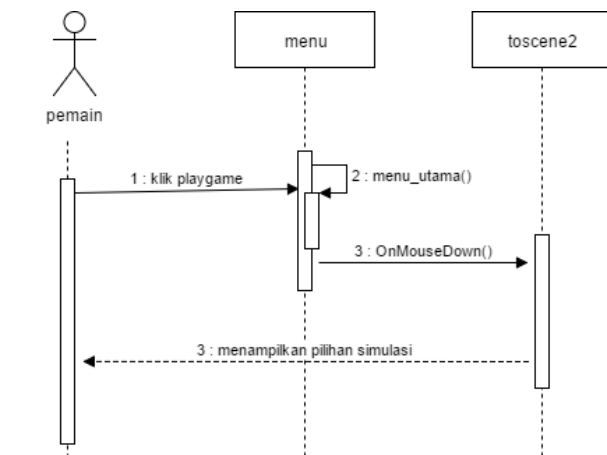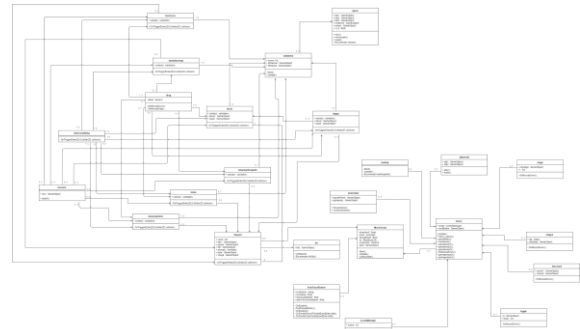

Figure 5 Sequence Diagram Starting a Game
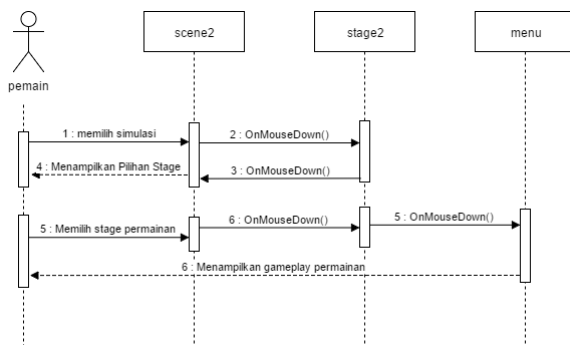
Figure 6 Sequence Diagram Choosing Simulation

c. Class Diagram

Class diagrams are used to describe the structure of the system by defining the classes that will be created to build the system. The class diagram can be seen in Figure 7.

Figure 7 Diagram Class

d. Interface Implementation

Implementation is the stage for implementing system design and the results of the analysis results that have been done beforehand. The purpose of system implementation is to explain the program that has been designed to all users who will use the system so that users can provide input to the system builder. The implementation of the interface of the earthquake and flood disaster simulation game application can be seen in Figure 8 while the simulation interface options can be seen in Figure 9 and Figure 10.
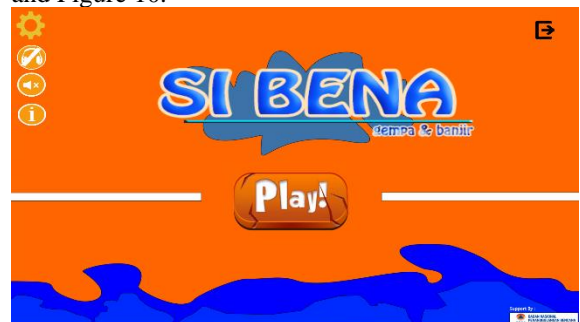
Figure 8 Main course

Figure 9 Earthquake Simulation Options
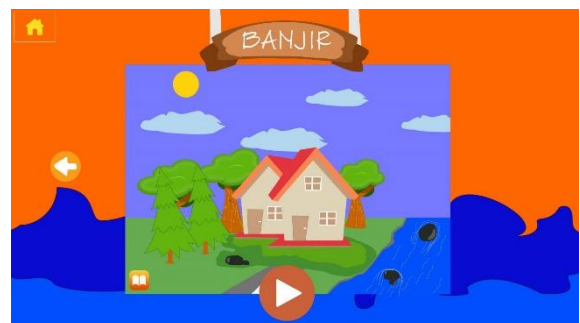
Figure 10 Flood Simulation Options

For pause and successful interface pages can be seen in Figure 11 and Figure 12.

Figure 11 Pause gameplay

Figure 12 Gameplay succeeded

2.3 Results and Discussion

2.3.1 Trial

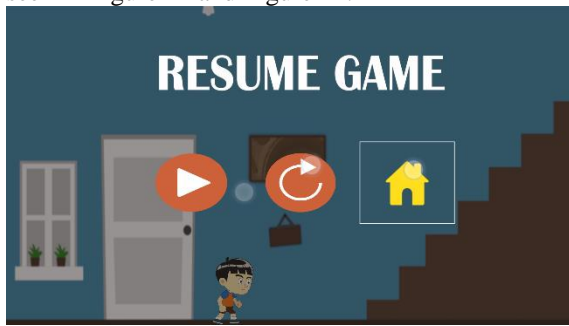At this stage an internal trial using a play test to assess the function of the game is in accordance with expectations or not, in this test using alpha testing while the method used in the alpha testing is the black-box method. The purpose of the black-box testing method is to find a malfunction in the program. Table 3 shows the results of the black-box test.

Table 3 The results of a trial black-box simulation game for earthquake and flood response

No	Components Tested	Testing Method	Test results
1	Start	Black-Box	Be accepted
2	Settings	Black-Box	Be accepted
3	Earthquake Simulation	Black-Box	Be accepted
4	Flood Simulation	Black-Box	Be accepted
5	Gameplay reward	Black-Box	Be accepted
6	Game Resumes	Black-Box	Be accepted
7	Return to the main page	Black-Box	Be accepted
8	Quit the Game	Black-Box	Be accepted

The second test uses beta testing which is the fifth stage of the game application development stage using the GDLC method.

2.3.2 Beta Testing

Beta testing aims to find out whether the software is built in accordance with expectations or not by testing the user. The method used in this test is the User Acceptance Test (UAT) method, conducted by interviewing the West Java BNPB Prevention and Preparedness Socialization Staff and conducting questionnaires using questionnaires to 127 Negelari Elementary School and 189 Neglasari State Elementary School. The test was conducted on 2 staff of Prevention and Preparedness by giving 7 questions. The questions raised can be seen in Table 4.

Table 4 UAT Questions to BNPB Staff

No	Question
1	Does this game look interesting?
2	Is this game application easy to use?
3	Is the material contained in the gameplay in accordance with the provisions of the existing material?
4	Can this application help in the implementation of the socialization?
5	Are the simulations in this application in accordance with the material on socialized disaster response?
6	Is the delivery of material in this application easy to understand?
7	Is this game appropriate to be used to help in the socialization?

From this question, to see the value of the results of the interview used a Likert scale to determine the assessment of responses by the Staff of Prevention and Preparedness for the game being built. The score assessment on the Likert scale can be seen in Table 5.

Table 5 Likert Scale Score Criteria

Scale of Answers	Information	Score	Percentage
SS	Strongly agree	5	100% - 80%
ST	Agree	4	79%-60%
RG	Doubtful	3	59%-40%
TS	Disagree	2	39%-20%
STS	Strongly Disagree	1	19%-0%

To find the interval of each answer, use the formula:

$$P = \frac{S}{Skor\ Ideal} \times 100\% \qquad [10]$$

Information :
P = Percentage value sought.
S = Number of frequencies multiplied by the score each answer has
Ideal Score = The highest score multiplied by the number of samples.

UAT test results with interviews, can be seen in Table 6.

Table 6 UAT Test Results to BNPB Staff

Question	Score	Respondents	Scale value	Result
1	9	2	90%	Strongly agree
2	7	2	70%	Agree
3	9	2	90%	Strongly agree
4	8	2	80%	Strongly agree
5	8	2	80%	Strongly agree
6	8	2	80%	Strongly agree
7	8	2	80%	Strongly agree

As for the total average range scale obtained, it can be seen in Figure 13.
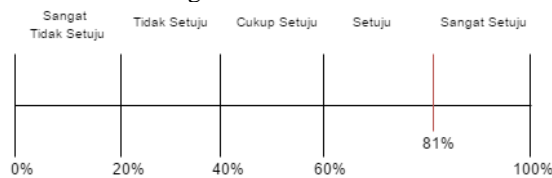
Figure 13 Scale range

While testing UAT to elementary schools using a questionnaire, the test was carried out on 59 respondents aged 10-12 years and each respondent was given 7 questions. As for the questions raised can be seen in Table 7.

Table 7 Testing UAT to SD

No	Question
1	Does this game look interesting?
2	Is this game application easy to use?
3	Is the way to play the game easy to understand?
4	With this game disaster response material easily understood?
5	Can using this game application help you increase your knowledge about disaster response?
6	Can drawing, animation, information and how to play in this game application help explain how to prepare for disaster response?
7	Are socialization activities more interesting with the presence of game media?

From these questions, to see the value of the results of the questionnaire used the Guttman scale The score assessment on the Likert scale can be seen in Table 8.

Table 8 Guttman Scale Score Criteria

Score	Information	Percentage
1	Yes/Good	100% - 50%
0	No/Less	49% - 0%

As for calculating the results of the sum of the scores, namely:

Student respondent's final grade =
$$\frac{Jawaban\ "ya"}{Skor\ Maksimum\ Perpertanyaan} \times 100\% \qquad [10]$$

The results obtained from UAT testing with a questionnaire can be seen in Table 9.

Table 9 UAT test results to SD

Question	Score	Respondents	Scale value	Results
1	59	59	100%	Good
2	57	57	97%	Good
3	59	59	100%	Good
4	59	59	100%	Good
5	59	59	100%	Good
6	59	59	100%	Good
7	58	58	98%	Good

Based on the results of the percentage of questionnaire scores, it can be concluded that the assessment of the questions raised with an average value of 99% of 100% is expected, then the games built in the algorithm can help socialization become more attractive to students.

2.3.3 Release

Release stage is the stage that is carried out after the testing phase is completed with the results as planned, expected, and needed. This game was released done by giving the game apk file with the file name "Si Bena.apk" to the Prevention and Preparedness Department of West Java BNPB.

3 CLOSING

3.1 Conclusions

Based on testing conducted using the UAT method in the preparation of this thesis and referring to the research objectives of the development of the simulation game application "Earthquake and Flood Disaster Response", the results of the implementation and testing were obtained with a percentage value of 81% from interviews to BNPB and 99% from questionnaire to Elementary School, so that it can be concluded that by using earthquake and flood response simulation games can help the Prevention and Preparedness Field in the process of delivering material at the time of socialization activities assisting the Prevention and Preparedness Field by using games as an auxiliary media for socialization activities, and helping students to better understand the material delivered during the socialization process.

3.2 Suggestions

The simulation game "Earthquake and Flood Response" that was built still has many shortcomings.

For that, below are some suggestions that can be given to support the development of this game further, so it becomes even better.

a. The number of missions and materials that can be used in the game is reproduced.
b. The number of disaster response simulations in the game is multiplied.
c. The graphics and how to play from this game application must be developed and refined to make it look more attractive when played.

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