

The Study Of Principles Of Puzzle Game Design

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Abstract—Puzzle games are about the integration of educational content and games, so that when learners are participating in and controlling the games at the same time grasping the learning content. In regard to young children, they are provided with the development features of curious, lively, actively, so they are easy to become tied of cognitive learning of plane geometry. This paper focuses on the elements of Puzzle games and the problems must be considered in the process of designing the Puzzle games. The research desserts how to penetrate the games into learning by combining with the process of designing Tangram. It can make the children learn plane geometry in a pleasant, cheerful animated world. This study not only provides for reference for primary school teachers but also pecess the value of application.

Keywords—Puzzlegames;Flash;Tangram;Human-Computer Interaction

I. INTRODUCTION

In recent years, the development of educational games has become an important topic of attracting domestic and foreign education researchers. Educational games are the games that are specially devised in order to teach people a subject, extend the concept, find out a history or culture, or help people to master a skill when they are playing the games. Education games can be devided into 3 types: Puzzle games, Action games and Shooting games. In these 3 types, the Puzzle games are the most popular. Puzzle Game is an area of enquiring in a range of disciplines, including psychology, education, media studies, computer science and so on. Flash was explored by Micromedia Corporation which was used to make animation. However, its biggest ascendancy is making interactive games especially Puzzle games.

II. THE ELEMENTS OF PUZZLE GAMES

The elements of Puzzle games include graphics, sounds or background music, human-computer interfaces and feedback, storylines and game-play.

A. Graphics

The graphics can be built up with images or pictures that are dealt with by Photoshop, 3D, Coreldraw or Illustrator. The application of the software can fetch up the disadvatages of Flash and the processed images are more favored by the players for the sense of sight is the first factor of attracting them. It is noted that the size of the images should be suitable according to the interface, if it was too big, the range of the motion may be restricted. However, if it was too small, it is harm to the players' eyes.

B. Sounds or background musics

The style and the rhythm of sounds or background music should be match the games.

C. Human-computer interaction and feedback

With respect to the design of human-computer interface and feedback, the most important principle must to be taken into consideration is the interface should be frendly. On the other hand, interactivity is an extremely important characteristic of Puzzle games which provide communication between the users and the games by clicking on the Mouse or controlling the direction of the keyplate. The Puzzle games can effectively improve the Children's cognitive development by mens of interaction. Timely feedback can promote learning and deeper ponderring in the wake of the users throw themselves into the games via constent decision-making or dialogues.

D. Storylines and gameplay

The storyline is usually used to offer information for the players that is the main purpose of the Puzzle games. The aim of planning the storyline is to creat situation, set goals and challenges that the players can achieve by practicing. Gameplay is ofen offer interactivity and entertainment while playing Puzzle games. The main purpose of the Puzzle games is to produce challenges and interesting interactions.

III. THE ISSUES MUST BE CONSIDERED BEFORE DEVISING PUZZLE GAMES

In order to achieve good results in education and entertainment, additionally, Puzzle games relate to computer science, media studies, psychology and education therefore, the following aspects must be considered:

TABLE I. THE ASPECTS MUST BE CONSIDERED

Items	Principles
Content	Dose the game agree with the teaching objectives? Are the descriptions and the principles easy to understand? Is the information presented in line with the Childrens' cognitive development? Is the game appealing? Does the system furnish necessary help for the players?
	Does the game use suitable media? Are the pictures clear? Are the images, sounds, languageus and animations suitable

Manifestations	sounds, languageus and animations suitable for the users?Are the animations and the images in the game related to the content?
HCI	Are the interface frendly and clear? Is the order of the learning contents logical? Is the principle of the game easy to understand? Is the screen appealing? Does the game offer closely interaction with the players? Can the user get a record of the game? Is the speed of the game controlled by the user? Can the users control the pace of the game in the light of their situations?
Feedback	Can the learning process be saved during the game? Can the feedback supply timely manner? Are the explanation in the game easy to follow? Can the teachers revise the feedback of the games? Can the game offer proper evaluation on the basis of the user's ability ? Can the players skim over the feedback history any time?

IV. THE DESIGN PROCESS OF TANGRAM VIA FLASH

A. The long history of Tangram

Tangram is an intellectual game which is the invention of working people in ancient China. It was originated from China whose history could be traced back to at least the first century BC to the basic shape of the Ming Dynasty, it got popularized in Ming and Qing dynasties.

As its name implies, the Tangram is consists of seven parts, including five isosceles right triangles, a parallelogram and a square. The Tangram can expound a number of important geometric relations, the principle is " The principle of out of the complementarity" of the ancient arithmetic. These seven plates can spell a lot of graphics (above 1600), such as triangle, parallelogram, irregular polygon, the players can build up all kinds of letters, figures, animals, plants, bridges, housing, towers, room pavilion , etc., it can be played by one player and also can be played by the team.



Figure1. THE ARTWORK OF THE TANGRAM

Here are some works of Chinese children:



Figure2. THE KITTY



Figure3. THE DAYAN



Figure4. THE BOAT ON THE SEA



Figure5. THE MAN ON THE HORSE



Figure6. THE FISH AND THE RABBIT



Figure7. THE DOG



Figure8. THE CHICKEN

It can not only helps children to form preliminary understanding on the line, area, angle and image but also can help to bring up the Children's observation, imagination, imitation ability, the ability of expressing the specific affairs. It is good to make their specific geometry into the Cognitive structure, therefore, it has been an essential tool of developing the intelligence for Children in China.

B. The role of the game

As the image below shows, there are 7 plates in the lower right, we can drag each of the plate to the blue region where shows the pattern requires you to spell by mouse. The players can build up the 7 parts according to the map. If the player could make up the specified pattern within the specified time, he would be won. If you clicked on the small circle on the plate in the process of the game, the plate will rotate 45 degrees clockwise. There are 3 function buttons on the left corner of the interface. "Other graphics" button is used to change the given pattern. "Answer" button is used to decompose the given pattern into seven parts, then you can see how did the original pattern compose. "Restart" button is used to clear the small plates in the blue area to make the game resumed.

The idea of the game is uncomplicated whose linchpin is achieving the controlling of the plates' rotation. To reach this goal , as long as you set the Rotation property of the Movie clip. If you want to achieve continuous clockwise rotation, you need to record the location of the previous point, set it to a 45-degree increments and then set the rotation angle.

C. The process of designing the Tangram

- Make 7 different plates. The game provides the Puzzle answers as the Figure9 hints, so we should make 7 plates.



Figure9. 7 plates

- Create a Graphic element which was Named 1g, all types of the following components were named by digital + component, for example, 1 in the 1g means the first graph, g means the components type is Graphic, after entering the symbol-editing zone, use the line tool draw a triangle, then select Modify / Group command to group together the three straight lines.

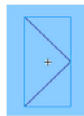


Figure10.

- Then make the plates that used in the games. For you are free to drag the plates, you need to make the small plate components to the button named Button. Create a new Button component named 1b, after entering symbol-editing zone, draw a triangle shape which was filled with color as the same as in Figure 11 by drawing tools on the frame of UP.



Figure11.

- Small plate need to be rotated in the games, each small circle on the plate can be rotated 45 degrees if you click on the small circle on the plates small circle used to rotate the plate were made to button component named Button. Create a new Button component named rotation, after entering symbol-editing zone, draw a perfect circle with ellipse tool in the Up frame, the outline was selected light blue.



Figure12.

- Then combine the component 1b with rotation to the final plates, we need to use Action Script to control the rotation of the plates in the game, so the combination of elements should be made into a Movie clip. Create a Movie clip element named 1m, after entering symbol-editing zone, drag the 1b and rotation respectively to the edit zone. Shift rotation to the appropriate location on the triangle.



Figure13.

- Finally, add AS to the triangle button,


```
on (press) {
    startDrag("");
}

// When you press the mouse, you can drag the button

on (release) {
    stopDrag();
}

// When you release the mouse, then stop dragging.
```

Add AS to the circle button which was used to controlling rotation:

- on (press) {


```
elrotation = getProperty("", _rotation);

// With a variable angle of rotation elrotation
Records

elrotation = Number(elrotation)+45;

// Set variable value is the current angle plus 45
degrees

setProperty("", _rotation, int(eval("elrotation")));
```

Thus, a small plate was completed, you can find that to make a small plate it required to make three different components. Make six other similar small plates with the similar method, a total of 18 components. You can view the source files.

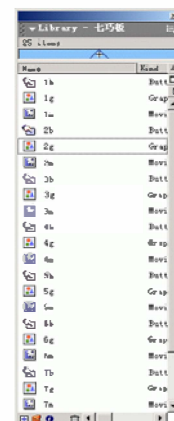


Figure14.

D. Scene layout

- Return to the main scene, set the video size to 440px * 550px, the background color was light blue.
- Rename the current layer as background, draw a square on the stage by the rectangle tool, fill it with blue as the region of puzzle. Enter the help information by the text tool on the Lower left corner of the stage. The information is used to hint the players to rotate the plate by clicking on the small circle. Finally, extend the layers to the 10 th.



Figure15.

- Create a new layer named Pieces, drag the 7 plates onto the stage, then lay them out. Rename the 7 plates instance name: een, twee, drie, vier, vijf, zes, zeven.



Figure16.

- Then create two layers named shapes and solutions where to place the target pattern and puzzle answers. Insert key frame to the 1 th, the 3 rd, the 5 th, the 7 th, the 9 th frame and draw target pattern on each key frame.



Figure17.

- Insert key frame in the 2 nd, the 4 th, the 6 th, the 8 th, the 10 th frame, each frame is the answer of the former's target pattern. You can assemble the former 7 components according to the former pattern.



Figure18.



Figure19.

- Ceate a new layer named buttons which is used to place the function button in the game, make the button as shown and then place them onto the lower left corner of the stage.



Figure20.

Insert key frame at the 1 st, the 3 rd, the 5 th, the 7 th , the 9 th frame.

Back to the 1 st frame, Add AS to the 1 st button (other graphics);
 on (press) {
 gotoAndStop (3);

}

//Because the target of the 1 st, the 3 rd, the 5 th, the 7 th, the 9 th are target pattern, so these frames

are the goal of the jump button, the principium of the buttons in the following frames is the same.

Add AS to the first two buttons (answer)

```
on (press) {  
  gotoAndStop (2);  
}
```

//The pattern's answers of frame the 1 st, the 3 rd, the 5 th, the 7 th, the 9 th are in the next frame, so the answer of the 1 st had to jump to the 2 nd frame, the button's meaning of AS in the following frames is also similar.

Add AS to the first three buttons

```
on (release) {  
  setProperty("vier", _x, "159.8");  
  setProperty("vier", _y, "505.7");  
  setProperty("vier", _rotation, "0");  
  setProperty("zeven", _x, "181.8");  
  setProperty("zeven", _y, "447.9");  
  setProperty("zeven", _rotation, "0");  
  setProperty("zes", _x, "225.3");  
  setProperty("zes", _y, "502.9");  
  setProperty("zes", _rotation, "0");  
  setProperty("vijf", _x, "262.4");  
  setProperty("vijf", _y, "438.8");  
  setProperty("vijf", _rotation, "0");  
  setProperty("een", _x, "272.9");  
  setProperty("een", _y, "493.1");  
  tProperty("een", _rotation, "0");  
  setProperty("drie", _x, "340.6");  
  setProperty("drie", _y, "446.9");  
  setProperty("drie", _rotation, "0");  
  setProperty("twee", _x, "386.6");  
  setProperty("twee", _y, "493.3");  
  setProperty("twee", _rotation, "0");  
}
```

// The coordinates are set seven plates so that they can return to the initial position of the lower right corner. The blue area is equivalent to a small plate removed, then you can re-play.

Add AS to the following the 3 rd, the 5 th, the 7 th and the 9 th button in accordance with the manner above, the meaning of AS is similar. Pay attention to the dump position of the goto And Stop (n), we will not give details.

- Eventually, you should plug in a layer named

action and insert key frame from the 1 st to the 10 th frame, then add to AS:stop() for every frame.

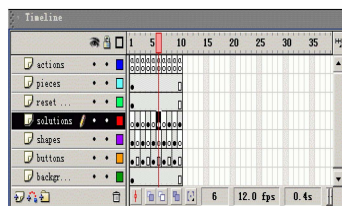


Figure21.

Then the process of designing the Tangram is finished, it is very simple and the Action is not perplexed. The most important is that you should keep patience. If you are interested in it, you could make more images and then the game will be greater.

- [1] David J. Miller and Derek P. Robertson. (2010).Using a games console in the primary classroom:Effects of 'Brain Training' programme on computation and self-esteem. British Journal of Educational Technology Vol 41 No 2 2010 242–255
- [2] Mansureh Kebritchi.(2010). Factors affecting teachers' adoption of educational computer games: A case study. British Journal of Educational Technology Vol 41 No 2 2010 256–270
- [3] Li-Chun Wang and Ming-Puu Chen. (2010). The effects of game strategy and preference-matching on flow experience and programming performance in game-based learning. Innovations in Education and Teaching International Vol. 47, No. 1, February 2010, 39–52
- [4] Garry Falloon. (2010). Using avatars and virtual environments in learning: What do they have to offer?. British Journal of Educational Technology Vol 41 No 1 2010 108–122
- [5] Mansureh Kebritchi, Atsusi Hirumi, Wendi Kappers and Renee Henry.(2009). Analysis of the supporting websites for the use of instructional games in K-12 settings. British Journal of Educational Technology Vol 40 No 4 2009 733–754
- [6] Sancho, P., Moreno-Ger, P., Fuentes-Fernández, R., & Fernández-Manjón, B. (2009). Adaptive Role Playing Games: An Immersive Approach for Problem Based Learning. Educational Technology & Society, 12 (4), 110–124.
- [7] Lim,C.P.(2008).Spirit of the game; empowering students as designer sinschools. BritishJournal of Educational Technology.
- [8] Adcock, A. (2008). Making digital game-based learning working: An instructional designer's perspective. Library Media Connection, 26(5), 56–57.
- [9] Lau, W.W.F., & Yuen, A.H.K. (2008). Exploring the effects of gender and learning styles on computer programming performance: Implications for programming pedagogy. British Journal of Educational Technology, 40(4), 696–712.