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## **Thesis Documents for Master of Fine Arts Degree**

Rochester Institute of Technology  
College of Imaging Arts and Sciences  
School of Design  
Computer Graphic Design

## **Online Cake Instructor**

By Jen-Chun Tseng

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Signature of Chief Advisor

Date

12/20/07

**Associate Advisor:** Dan Deluna, Assistant Professor, Computer Graphics Design

Signature of Associate Advisor

Date

Dec 20, 2007

**Associate Advisor:** Nancy Doubleday, Associate Professor, Information Technology

Signature of Associate Advisor

Date

12/20/07

**School of Design Chairperson:**

Patti Lachance, Associate Professor, School of Design

Signature of Administrative Chairperson

Date

1-21-08

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## **CONTENTS**

- A. Thesis Proposal
- B. Research
  - 1. E-learning: the Advantages, Restrictions, and Perspective
  - 2. The Application of 3D Technology in E-learning Material Design
    - Uses my thesis (Online Cake Instructor) as example
  - 3. Conclusion
- C. Process
  - 1. Preparation
  - 2. Sketches
  - 3. 3D modeling
    - 3.1 Technical issues
    - 3.2 Cakes
    - 3.3 Kitchen
    - 3.4 Animation
  - 4. Programming
    - 4.1 Technical issues
    - 4.2 Flowchart
    - 4.3 Questions, answers, and called variables (stepWrong)
    - 4.4 Possible results of a finished cake
  - 5. Website design
    - 5.1 Design consideration
    - 5.2 The design for the interface

D. Conclusion

E. Appendix

1. Reference images for cakes
2. Reference images for the virtual kitchen
3. Reference images for the virtual tools

F. Bibliography

## ***A. Thesis Proposal***

### I. Abstract

This thesis will be an e-learning website about making cakes. Users will learn how to make a cake in a virtual environment by following the instructions and interacting with the surroundings, instead of learning from text statements.

“Simulation” will be a focus in this thesis. Users will go through the cooking process by using virtual tools and a virtual oven. The final goal of the online courses is that users should use those virtual materials and tools correctly without a cue. Still images, videos, 3D models, and animations will be used to simulate the whole process.

As an e-learning material, there will be two sections, instruction mode and quiz mode, in this website. When people practice in the virtual kitchen and make a mistake, there will be instant feedback will be given in the form of suggestions.

Regarding the technology issues, I want to explore the usability of 3D technology in e-learning material design. In my opinion, 3D technology, which is usually used to simulate the reality in computer graphics arts, should bring the advantages of e-learning materials, simulation, and virtual experience, into full play. In addition, programming in e-learning material design plays an important role. How to use it to judge users’ “mistakes,” give them rapid feedback, and make the cake-making process smooth are other challenges in this thesis.

The URL: <http://www.yushiu.com.tw/cake/index.html>

### II. Project Description

- The two sections of the website:

1. Instruction mode

In this mode, detailed instructions and clear steps are available with a basic sponge cake recipe. Users will learn how to make a cake step by step with the interactive objects and illustrations in a simulated environment. Key points to the success of cake production are mentioned in the instructions.

2. Quiz mode

In this mode, users will be challenged to make a cake by finishing all

questions without any instruction. Users are supposed to know every step in each stage. The answers they make will influence their cake results. Users will know the score and the amount of wrong answers in the end.

- Target audiences:
  1. Females.
  2. People who are not familiar with making cakes
  3. People who want to learn baking but have no time to learn it in school.
  4. From 15-year-old people to the elderly.
  
- Development objects
  1. Pleasing interface and colors
  2. Game-like environment
  3. Convincing and realistic 3D models and textures
  4. Reasonable steps for simulating the process
  5. Programming to call different visual and text feedback in the end
  
- Software
  1. Flash - for interaction and website design
  2. MAYA - 3D models and animations
  3. Illustrator
  4. Photoshop
  5. After Effects
  
- Target System Requirements  
A computer which can connect to the internet
  
- Keywords  
Virtual kitchen, virtual cake, simulation, cake-making, 3D environment, e-learning, sponge cake, on-line

## ***B. Research***

### **1. E-learning: the Advantages, Restrictions, and Perspective**

#### **1.1 Introduction**

E-learning represents the perfect connection between education and technology. Compared with the traditional approach to education, it is more convenient, flexible, and engaging and can save personnel expense. People who know how to use a computer (it has become a basic skill in modern life) can benefit from e-learning easily- they're not restricted to time and location anymore. By inserting a CD-ROM or connecting to the Internet can people begin their own class anytime and anywhere, and even stop it for any reason. They can readily control the whole learning process, and the well-designed environment and interesting interaction and feedback will create a wonderful learning experience.

The goal of this case study will focus on the essential factors of successful e-learning materials which will involve interaction in design and content organization. I want to explore the general idea of e-learning design, thus I will broaden the range of the analyzed targets. All kinds of successful e-learning projects will be mentioned in the case study, no matter who is the target audience, either the public or the employees.

#### **1.2 The Advantages and the Restrictions**

##### **a. Advantages**

- Save Personnel Expense

In traditional ways, we need at least one teacher to teach lessons. We not only pay to the teachers themselves but spend money on other supplementary teaching materials as well. Spending a lot money may be taken for granted in essential education before we grow up, but such expenses will cause big financial problems for general companies, especially for large-scale companies. Every year they spend huge amounts of money in the development of employee education, but such required and boring courses are usually rejected by employees and achieve little. For those companies, e-learning systems undoubtedly are a good choice. Educating employees by a multimedia CD-ROM or from the internet, the document can be used and copied again and again to meet the requirements from other branches and thousands of employees.

Indeed, the engaging interaction and processes in e-learning materials will be more attractive and effective. (Of course, the E-courses should be well-designed first.)

- Share education resources equally

People who live in remote or poor districts usually lack educational resources. New teachers reject teaching in such a place or don't stay for a long time, and the amount of electronic equipment is less and poorer than that in a big city. E-learning is an effective remedy and worthy of development in this situation. There's a good example in Taiwan. The Yong-An elementary school in Taitung, a hilly county in eastern Taiwan, had suffered from the loss of many teachers for a long time. Three years ago, the new dean rebuilt their school website and encouraged teachers to upload their instructional materials and sorted them by several special topics. Today, those special topics not only enhance students' knowledge, but also become the new teachers' important references—they will not waste their time finding suitable teaching approaches and content to which those students have been accustomed to. Because of the website, students in that elementary school will not be isolated by lack of information, and the website gives them a chance to use or learn how to get information from the internet.

- Encourage students to make mistakes

In my opinion, "simulation" is the most outstanding factor in e-learning. Simulation provides a chance for users to solve problems which they may encounter in the same situation in the reality as well. Dr. Roger C. Schank advocates that e-learning systems create a valuable atmosphere that all students are encouraged to make mistakes in this virtual world, and mistakes will certainly inspire people to learn. Dr. Schank and his team have designed several e-learning systems for famous companies, such as IBM, Wal-Mart, and Deloitte Consulting. Those e-learning CD-ROMs not only have been copied several times by the clients, but those companies usually come back and ask them to design other courses. Why were they so successful? Take the case of Deloitte Consulting as an example. The company asked for a flexible e-learning course for inexperienced managers to learn project management. Dr. Schank and his team then created a virtual client and their project manager Jocelyn who was hard to deal with. Now, when users go through the course, they will try to deal with



Jocelyn's uncooperative attitude and bad temper with several options of reaction. The system will make suggestions to users after they decide how to solve each setting problem in the virtual project; thus, users will practice their skills of negotiation and social intercourse in the simulation experience, never worried that they may damage the relationship with the client by improper behavior. The vivid character really helps those users to remember the lessons.

- Convenient and fast

Similar to the benefits you gain from the internet, e-learning is fast, varied, and convenient. After connecting to the e-learning webpage, people can learn any time and anywhere without being restricted to their countries, their work time, the traffic or anything which may obstruct learning in a real school. Students can practice again and again or actively participate in on-line discussions but still feel comfortable, especially for those people who are too shy to ask for help.

Furthermore, the on-line resources or CD-ROMs will be strong references and supplements to solve problems. For instance, another reason why Dr. Schank's products are so popular is that those employees can consult or review the courses easily by checking the learning files in the CD-ROMs. Generally speaking, students can't gain such an immediate and systematic support after leaving their college, but problems always happen when people practice their skill in reality.

b. Restrictions

- Require strong motivation

Traditionally, students need to follow teachers' instructions and their rules to make the whole learning process go smoothly. Teachers will use body language, reward and punishment to draw students' attention. However, a real supervisor won't be available when you proceed in e-learning. Flexible time and the surroundings may be harmful to your concentration and learning stability. The more flexibility e-learning provides people, the lazier people may become. If a person doesn't have an intense motive, any trivial thing can be an excuse to stop your on-line education. The situation may cause parents' hesitation to e-learning and will damage the development of e-learning. How to stimulate and attract users continuously is one of the focuses in design.

- Apparatus requirement

Mr. Te-Huai Chen advocated a formula in his book: "*information accessibility= information connectivity + device availability + personal affordability*" (P.Ⅲ). It means that if people want to proceed with e-learning (information accessibility), they are required to own the devices, which is generally a computer which is able to connect to the internet. Even though the personal computer has been ordinary equipment in the modern world, many families still can't afford one. Besides a computer, the requirements of basic computing skills and broadband transmission are also common obstacles to popularizing e-learning.

- Not suitable for everyone

Now e-learning mainly targets three applications: to students in elementary and high schools, adults, and employees (Chen P.Ⅶ). However, learning on the internet is not suitable for everyone, especially for children. Children should learn communication and social skills by interacting with other people and gaining knowledge and good behavior by observing teachers. Even though children will never be addicted to e-learning and confuse the virtual world and the real worlds (although it's a common side effect for on-line game players,) learning from a computer does decrease their chances of learning from the environment.

### 1.3 Misconceptions

"Digitalization" is happening everywhere in modern life. Regarding those technologies that we have been accustomed to rely on, people push and look forward to the innovation of these technologies; however, for e-learning, many people still doubt the effect and resist trying. Generally there are numerous misconceptions about e-learning, even for those people who have designed several e-learning products.

a. "E" or "Learning"?

The untrained teachers or the supervisors in company educational programs usually regard e-learning as "on-line Word documents" or "PowerPoint materials". It is a common misunderstanding in Taiwan. Unskilled people merely duplicate the content of textbooks to the internet; skilled people are enthusiastically devoted to designing interesting animations and creative functions. They forget that e-learning should be designed to replace boring textbooks and to assist students in

learning more easily. In other words, students' requirements, not technology, should be the priority of e-learning design.

b. Does interaction in e-learning equal a gimmick?

If "E" is not the focus of e-learning design, are those interesting interactions and videos trivial gimmicks? Not exactly. E-learning can be a replacement for teachers, but it should be as educational as actual teachers. People generally cannot learn by listening negatively or by watching a demonstration by a real teacher in an e-learning website. Instead, they will go through the courses by interacting with the virtual environment. Thus, clear instructions, suitable interaction and demonstration will be required in the design. Besides, students need engaging functions and illustrations to keep their attention. To sum up, we can't ignore the importance of the content, but how to make the "virtual classroom" effective by technology is also the designers' responsibility. Ideally, one e-learning project should be co-designed by technicians, instructional content editors (teachers), and multimedia designers.

c. A Replacement of a Real School?

We should never advocate that people will never need teachers and schools in the future because of e-learning. In fact, it is a misconception that causes anxiety of the counter people. E-learning should be used as a supplement to regular education. While growing up, students will gain additional knowledge or guidance from e-learning materials; after graduating from high school, people can find something actively that they really want to learn (it won't be required any more) and gain further academic achievements. E-learning is not designed for teaching dating or party tips, but from the approach, what "learning" should be will be realized—pursuing knowledge by self propulsion. What can be obtained from e-learning will be different from real schools, both functionally and mentally.

#### **1.4 Conclusion**

E-learning is an inevitable trend. In such a competitive society, learning is the only way to equip yourself. Along with the improvement of broadband transmission, e-learning becomes the most suitable way to satisfy the learning needs of those busy, modern people. By connecting to the internet, people can proceed their advanced education easily and quickly. Compared with the achievement of e-learning in the

West, it is still developing in Taiwan. Although several on-line or distance courses have been available in some colleges and adult education centers, generally the public still hesitates about this new education approach. In order to promote this technology, first we need to correct our misunderstandings of e-learning. Focusing on students' requirements, designing a simulated environment which will help to solve people's problems and to memorize the knowledge, e-learning will become a powerful and reliable approach to promote users' success. In my opinion, more and more interaction and simulation will be the focus of e-learning innovation. The devices and approaches to e-learning will be cheaper, easier and more varied in the future. At that time, e-learning will penetrate into our daily life, as popular as cell phones and digital products.

### **1.5 Bibliography**

(This section is combined with the bibliography of the thesis paper in the end)

## **2. The Application of 3D Technology in E-learning Material Design**

### **-- Uses my thesis (Online Cake Instructor) as example**

#### **2.1 Introduction**

3D technology, in this paper, is regarded as a general name of 3D modeling, shading, and animations. As the result of the powerful effects of 3D technology for simulating reality, creating more and more realistic models and visual effects has been a trend in film production. Furthermore, 3D technology gradually has become a very popular element in 2D computer graphic design recently. The combination and application of different software have been unavoidable in computer graphics design.

The design of e-learning materials will involve education and multimedia design. How to use attractive visual effects and effective interaction, instead of boring text description, is the point of e-learning material development. 3D technology so far does not play an important role in such a virtual school; however, the simulation that 3D technology can achieve should be a powerful potential for e-learning material improvement.

The main point of this paper is to explore the possibility of 3D technology in simulation for e-learning material design based on my thesis project "Online Cake Instructor," which will be a website where users can learn and practice the baking process by virtual tools. What 3D technology can do and cannot do are the two issues in this paper

#### **2.2 Advantages of 3D technology**

##### **a. Simulation**

Making mistakes is an effective way to learn new things, as is to learn making cakes. However, the expense of ingredients and the countless unsuccessful cakes will undoubtedly be troublesome for learners. An e-learning website will be an ideal place to make mistakes without the needless worry of wasting food and money.

Nevertheless, for the e-learning website designers, it will be very inefficient to prepare huge amounts of images for learners as visual feedback for mistakes. 3D technology is a good solution to the problem. By changing or animating the textures on cake models, it will be easy to present various results of unsuccessful cakes such as burned, broken or under-raised.

b. Saving the expense of ingredients

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c. Reducing the difficulty in process record

In addition to the expense of ingredients, the whole baking process is also time-consuming. Most important, after mixing, the batter cannot be delayed to bake for a photo shot because the bubbles which help cakes rise may break or escape. Actually, timing is the key in cake production, so it is not practical to expect perfect instructional photographs and videos which are shot at various angles. The process cannot be delayed. Making virtual cakes by 3D technology will solve the problem easily.

### **2.3 Disadvantages of 3D technology**

a. Inability to interact

Needless to say, 3D technology is powerful to create a virtual experience. However, the inability to interact with those 3D objects is its weakness, but interaction is one of the requirements in e-learning materials design. Thus, how to interact properly with other software will be a challenge. My solution is to render the animations as image sequences and import them into Flash. I can then make them interactive by action scripts.

b. Thankless task in simulation

Even though 3D technology makes realistic simulation possible, we can rely on the effect too much. The more realistic visual effects designers pursue, the more critical audiences will be. It is not practical or necessary if we designers are too fussy about

the vivid effects achieved by 3D technology in e-learning material design. I will try to shoot several short movies, incorporate them with the 3D models and the animations, and edit them in After Effects. For example, simulating the batter beaten by a mixer will be hard. I will use a movie instead of dynamic effects.

c. Comparatively cold impression on audiences

According to my experiences playing video games, general 2D Flash games are visually warmer and friendlier than 3D games. Sometimes I feel uncomfortable because of the stiff characters and the deathly still feeling which may result from the lighting, the textures, and the flawless objects in the virtual environment. Maybe it is another side effect that results from people's unforgiving eyes. However, visual unfriendliness is especially not allowed in instructional design. In order to get rid of the weakness in 3D elements, bright and warm colors, lively music, and the combination of 2D illustrations will be other key points in design besides 3D models.

## **2.4 Conclusion**

To sum up, 3D technology is a powerful technology to simulate reality. In e-learning materials design, the feature will improve the quality both in visual effect and learning process. The virtual 3D environment will help people get into new issues easily. Furthermore, in some cases, 3D technology will reduce the difficulties of making instructional movies. However, 3D environments may be not acceptable for some people because of the unrealistic appearance and cold feeling in the environment. My solution is to incorporate other elements, such as audios and 2D illustrations, to make the environment more cheerful. Those 3D materials will be components in a Flash-based file, so I can enhance the interaction of the "Online Cake Instructor" e-learning website. The application of different dimensional images and software are not only the main topic in this thesis but also an important issue in computer graphic design.

## **Bibliography**

(This section is combined with the bibliography of the thesis paper in the end)

### 3. Conclusion

In the first paper, "E-learning: the Advantages, Restrictions, and Perspective", I want to explore the definition, the features, and the future of the e-learning materials. This is the most important thing that I need to figure out before starting the thesis. I realized the advantages and the restrictions of e-learning material from this paper.

In the second paper, "Application of 3D Technology in e-learning Material Design", I want to explore the possibility and usability of 3D technology in e-learning material design. I not only tried to improve the visual effects in the "Online Cake Instructor" website but also made the simulation convincing and very helpful.

To sum up, I need to find the balance between the three elements in the website: fun, education, and usability. A clear flowchart, a fluent process, informative instructions, and pleasing visual effects are required to be organized and considered deeply.



## **C. Process**

### 1. Preparation

There were several tasks in this stage. First, I chose one proper cake recipe, which should be easy enough for beginners, and incorporated most of the basic cake-making skills. Second, I reviewed related knowledge and developed the contents of my website. Third, I visualized the cake-making process based on the recipe and came up the storyboard. Finally, I figured out how many models I should create.

Here is the basic sponge cake recipe I chose for my thesis:

#### **[SPONGE CAKE]**

##### **• Ingredients**

- a. 5 egg whites
- b. 1/4 cup white sugar
- c. 5 egg yolks
- d. 1/4 cup white sugar
- e. 3/4 cup cake flour

##### **• Directions**

- a. Preheat oven to 350 degrees °F (175 degrees °C).
- b. Beat egg whites to form moist peaks. Gradually beat in 1/4 cup white sugar and salt. Beat until very stiff and shiny.
- c. Beat egg yolks and 1/4 cup white sugar together until very light and fluffy. Stir in cake flour. Fold meringue gently into batter. Pour batter into an ungreased 9 inch tube pan.
- d. Bake for 45 minutes. Remove cake from oven, and invert until cool. Loosen edges, and remove cake from pan

#### **[STEPS]**

- Prepare: preheat the oven
- Prepare: sift flour & sugar
- Prepare: let eggs become room temperature

- Beat whites & add sugar gradually
- Beat yolks & add sugar
- Add flour
- Fold meringue into batter
- Pour into a pan
- Put into the oven
- Test the doneness
- Cool the cake
- Done

2. Sketches

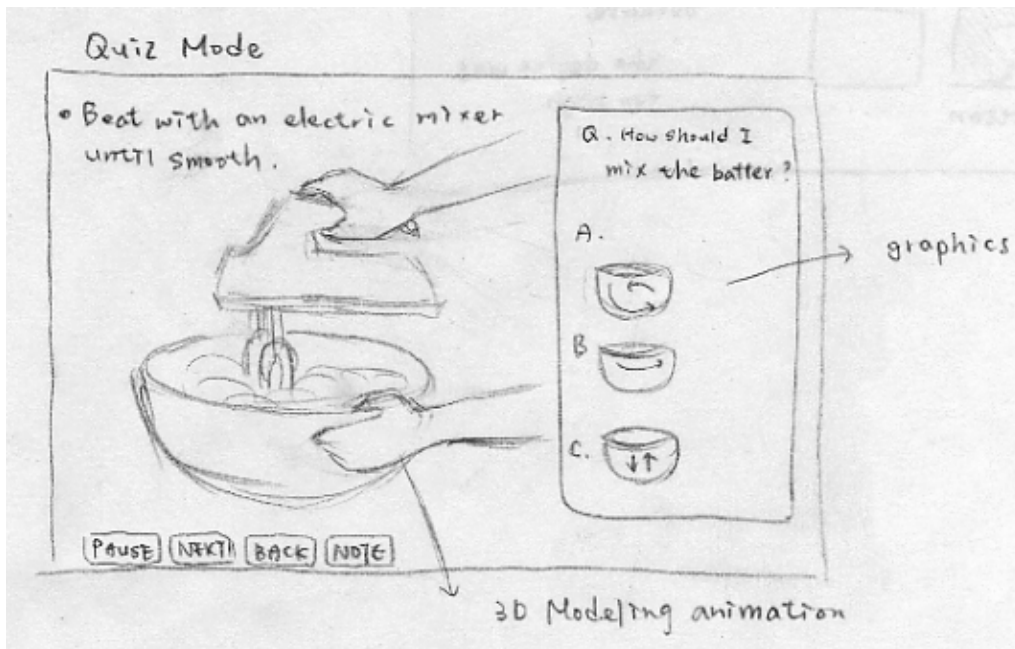
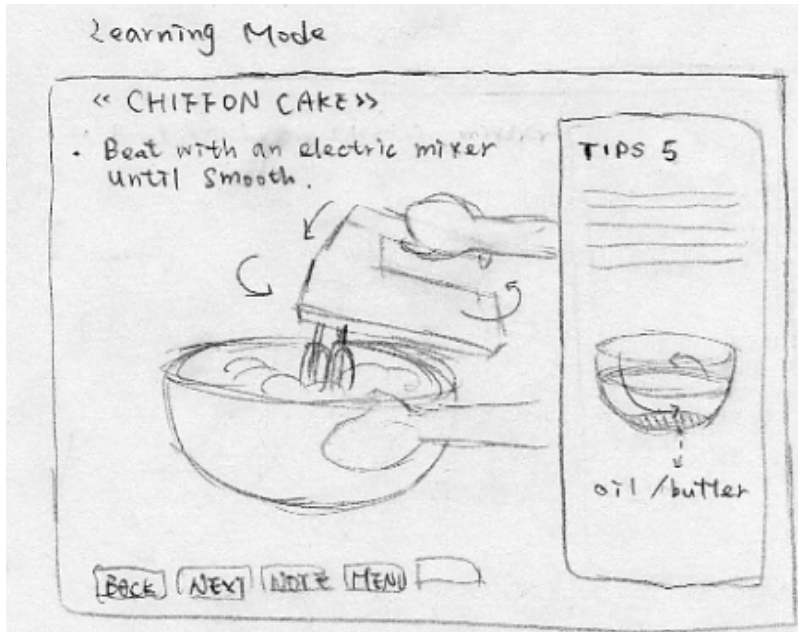
**Original design for the homepage**



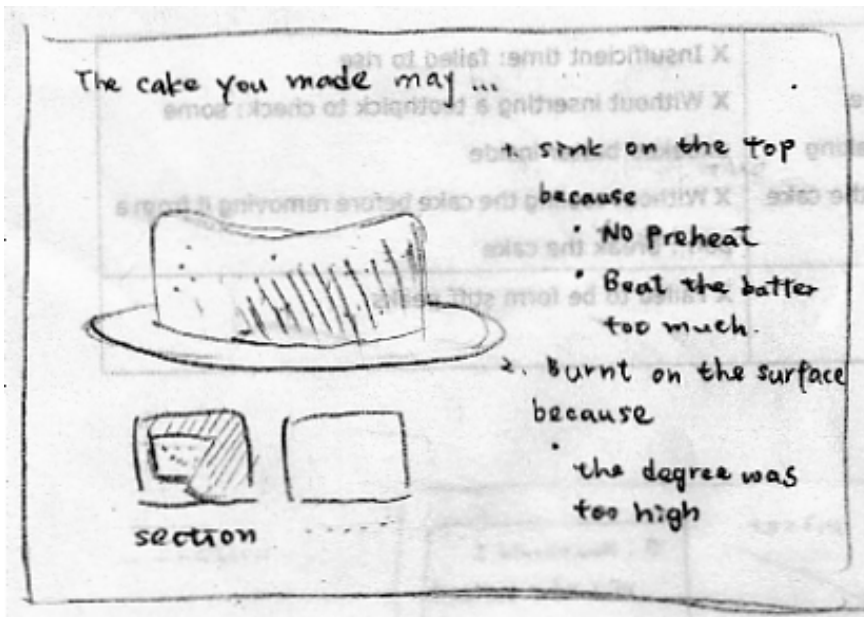
At first, I planned to have a parallel-scrolling interface. However, considering that there would be lots of text contents and animations, this interface would not be

user-friendly, so I changed my mind.

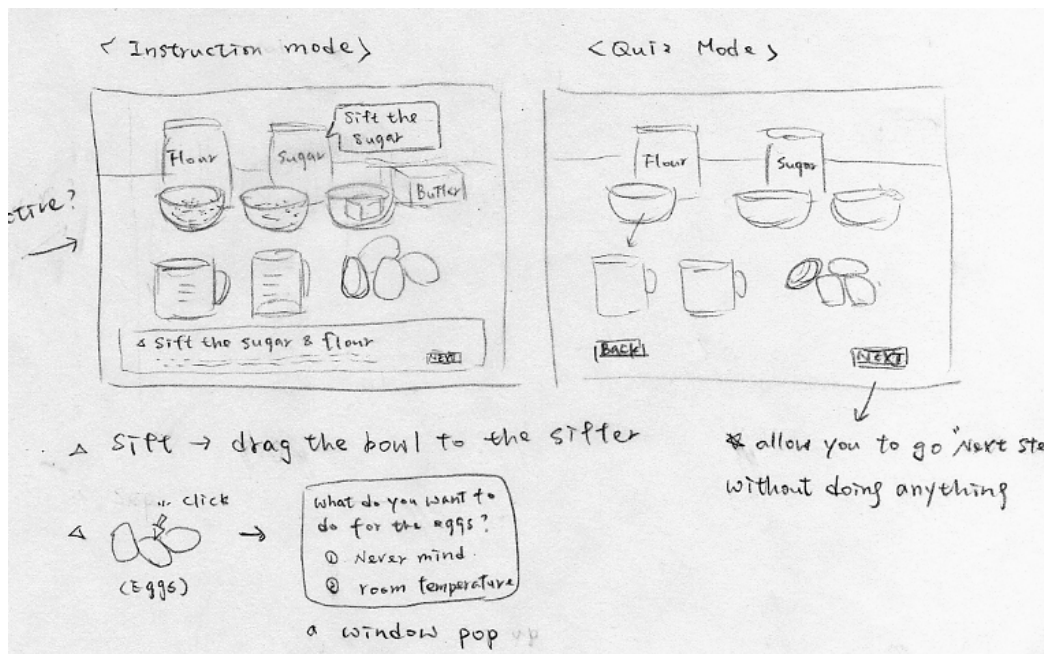
**The design for quiz mode and instruction mode**



The design for the result page



The design for the interactive area



### 3. 3D modeling

#### 3.1 Technical issues

Since my goal is to create a vivid environment and convincingly simulated experience, realistic textures, lighting and models are the biggest challenges in my thesis. I collected lots of related reference images from the internet and kitchen decoration books and observed the textures, lighting, shade and shape on those objects in the images. All of the 3D models were made in MAYA and then composed or added effects in Photoshop.

#### 3.2 Cakes

The procedure included:

- a. Finishing the models in MAYA;
- b. Composing the textures in Photoshop

#### **Different results of users' cakes**



Excellent



Flat



Burnt



Surface-broken





Flat & burnt



Flat & surface-broken



Excellent section



Mix-failed



Under-baked



Tunneled



Tunneled and mix-failed

### 3.3 Kitchen



#### **The model of my kitchen**

In my plan, the kitchen should be pleasing, friendly, but also fashionable.



#### **The first version**

This is my first attempt at lighting. The ambient lighting left the 3D models absolutely flat and dull.



#### **The second version**

I tried to use Global Illumination to simulate the natural light and shade. The result was much better this time. However, in my plan, there should be sunshine projecting into my virtual kitchen.



### **The final version**

I added several windows and more objects in the kitchen. The scene outside the kitchen is an image which I composed in Photoshop.



### **The close-up of the oven**

Creating the texture on the panel and wrapping it properly on the model was also an interesting challenge.



### **Models of the tools**

In my website, users will use the tools on this table to make their own cake.



**Different models of beaten egg whites**



Fig. 1 Unbeaten whites



Fig. 2 Soft-peaked white



Fig. 3 Stiff-peaked whites



Fig. 4 Whites with sugar

How to simulate the egg-beaten process and create vivid textures to present different stages of beaten eggs is really difficult. There are three models of egg white which represent the unbeaten, soft-peaked, and stiff-peaked stages. I think Blinn shade can present the highlight on peaks and moist surface very well. The sugar and flour (Fig. 4), which will be added into the whites later, are composed in Photoshop.

**Different models of beaten egg yolks**



Fig. 1 Beaten yolks with sugar



Fig. 2 Done yolks with meringue

The yolks spreading over the wall of the mixing bowl were done in Photoshop.

### 3.4 Animation

The procedure included:

- a. Finishing the animations in MAYA;
- b. Rendering them as IFF sequences;
- c. Composing them with background images and added effects in After Effects;
- d. Rendering them as JPG sequences;
- e. Importing them into Flash as separate frames

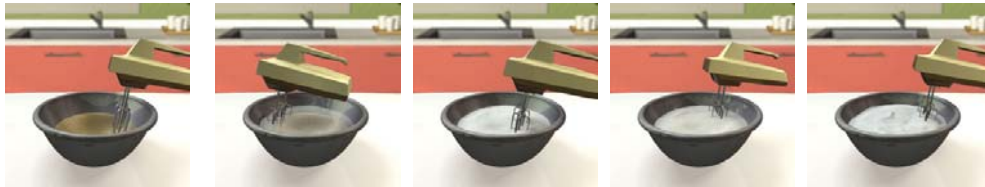
***Functioning mixer***



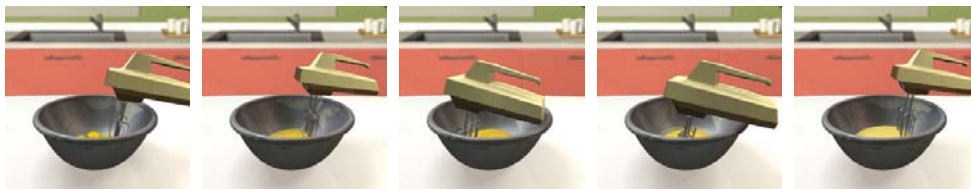
***Sifting the ingredients***



***Mixing the whites***



***Mixing the yolks***



***Stirring the yolks with a spatula***



***Changing the camera view to approach the table***



***Changing the camera view to approach the oven***

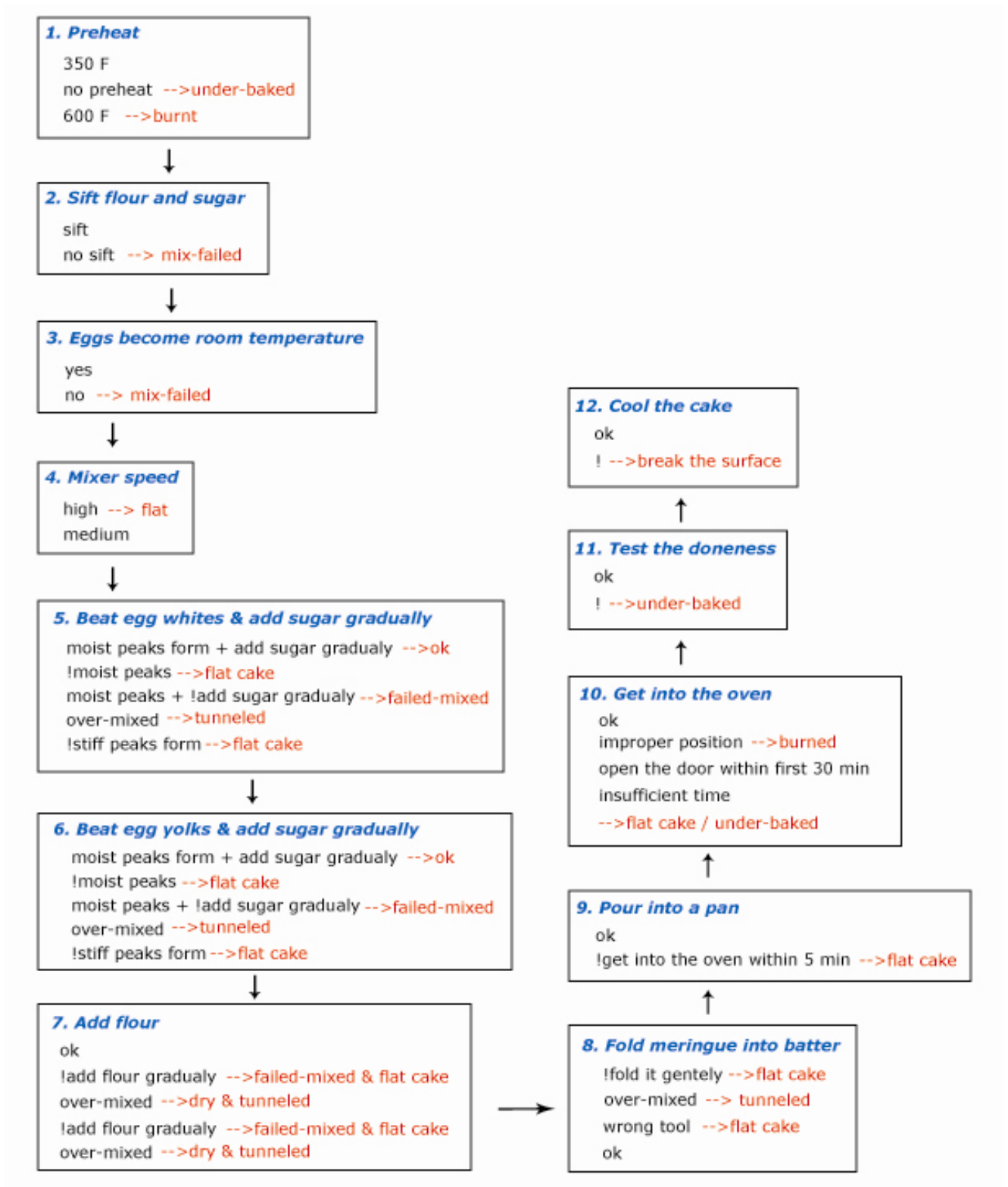


#### 4. Programming

##### 4.1 Technical issues

The main challenge of programming is concentrated on the design of the quiz mode. A key consideration in my e-learning website design is: **ENABLE USERS TO MAKE MISTAKES**. Thus, I need several arrays to store users' answers, call different text feedbacks rapidly, and image feedbacks in the end. A clear flowchart and well-organized Boolean variables are required.

4.2 Flowchart



4.3 Questions, answers, and called variables (stepWrong)

NO	Question	Options	Array: stepWrong
1	What do you want to do (for the oven)?	1. Nothing 2. Preheat the oven to 350 F 3. Preheat the oven to 600 F	1 14
2	What do you want to do for the flour?	1. Sift it 2. Ignore it	12
3	What do you want to do for the sugar?	1. Sift it 2. Ignore it	10
4	What do you want to do for the eggs?	1. Separate the whites and yolks 2. Separate the whites and the yolks and let them sit at room temperature	16
5	How will you set the mixer speed?	1. High speed 2. Medium speed	2
6	Do you want to beat the whites for longer time?	1. Yes 2. No	Under-beat 3 Over-beat 4
7	How will you add the sugar into the whites?	1. Pour it all at once, then mix it with the whites 2. Add it a little at a time, then mix it with the whites	9
8	Do you want to beat the yolks for longer time?	1. Yes 2. No	13
9	How will you add the sugar into the yolks?	1. Pour it all at once, then mix it with the yolks 2. Add it a little at a time, then mix it with the yolks	9
10	How will you add the flour into the	1. Pour it all at once, then mix it with the yolks	9

	yolks?	2. Add it a little at a time, then mix it with the yolks	
11	How long will you mix the batter?	1. Keep beating to ensure the ingredients blend well 2. Until there's no powder remains, then stop to mix	19
12	How will you mix the batter?	1. 3. 2.	5
13	Which size of pan will you use?	1. 9 inch 2. 12 inch	8
14	Do you want to put the pan into the oven right now?	1. Yes 2. No, I want to wait for awhile	6
15	In which position will you place the pan?	A. B. C. D. F. E.	15
16	If you want to check the cake doneness, when will you do it?	1. After 30 min 2. Within the first half hour	7
17	Do you want to remove the pan from the oven right now?	1. Yes 2. Test the doneness	18
18	Do you want to remove the cake from the pan right now?	1. Yes 2. Cool it for a while	17
19	Do you want to bake the cake for longer time?	1. Yes 2. Remove the cake from the oven right now	Under-baked 20 Over-baked 21

#### 4.4 Possible results of a done cake

- Possible results for exteriority:

- |                   |                                  |
|-------------------|----------------------------------|
| a. Normal         | e. Flat & burnt                  |
| b. Flat           | f. Burnt & surface-broken        |
| c. Burnt          | g. Flat & surface-broken         |
| d. Surface-broken | h. Flat & burnt & surface-broken |

- Possible results for section:

- |                        |                             |
|------------------------|-----------------------------|
| a. Normal              | f. Tunneled & mix-failed    |
| b. Tunneled            | g. Under-baked & mix-failed |
| c. Mix-failed          | h. Tunneled & under-baked & |
| d. Under-baked         | mix-failed                  |
| e. Normal & mix-failed |                             |

.....Up to 63 combinations of the result

- Programming for judging the results

EX. Normal exteriority & normal section

```
if(!flat&& !burnt&& !tunneled&& !brokenSurface&& !mixFailed&&
!underBaked){
    result_txt.text= "excellent!!";
    loadMovie( "normal.jpg", page_mc.cake_mc.loader_mc);
    loadMovie( "normalS.jpg", page_mc.section_mc.loader_mc);
};
```

EX. Flat & surface-broken exteriority & tunneled section

```
if (flat&& !burnt && brokenSurface && tunneled && !mixFailed&&
!underBaked){
    result_txt.text= "flat, surface-broken, tunneled";
    loadMovie( "flat_broken.jpg", page_mc.cake_mc.loader_mc);
    loadMovie( "tunneled.jpg", page_mc.section_mc.loader_mc);
};
```



## 5. Website design

### 5.1 Design consideration

There are three important elements of my concept in this website: FUN, INFORMATIVE, and VIVID. The website is supposed to be both an on-line classroom and a game. It should be more fun than learning in a school, but I want users to really learn how to make a cake while gaming. Thus, I needed to find the balance between “amusement” and “education”, and avoid the defects that usually show in some immature e-learning website—too boring, cool but uninformative, hard to use, and so on.

### 5.2 The design for the interface

At first, I wanted to imitate the style of the “escaping from a room” games, which is my favorite game type. In these games, players need to change their camera views, searching every required tool and code hiding in the locked room, solve the puzzles in these games, and then escape from the room.

#### **One-off R: Escape from the Garage**

([http://www.gotmail.jp/oneoff\\_r](http://www.gotmail.jp/oneoff_r) )



Fig. 1



Fig. 2



Fig. 3

The series of the escaping games is uniformly a 3D environment. The images shown above are from one of the series. The outstanding and realistic models in these games are my goal. In these kinds of games, you can change your view by clicking the arrows on the side of the scene, so you can search everywhere in this room (Fig. 1). When you click on the proper position, you can approach the objects and see more detail (Fig. 2). After you move something by your mouse, you may find those required items hiding behind the objects. (In Fig.3 A hammer is hiding behind the cans.) In the interactive area of my website, I use the same concept for users to progress through the cake-making process.



### **3 Cats' Escape in the X'mas**

([http://choko-chai.haru.gs/game/nyan\\_xmas/nyan\\_xmas.shtml](http://choko-chai.haru.gs/game/nyan_xmas/nyan_xmas.shtml))

In this kitchen scene, you can use your mouse to click on the faucet, and then

water will start to flow. That is what I want to achieve in my virtual kitchen. Users are allowed to turn on something by themselves, such as an electric mixer or an oven.

I originally designed the interface as an opening 3D environment, which allowed players searching the ingredients and tools stored in a closet or put in somewhere. However, I would spend too much time on modeling, which should not be the only point of the website, and there would be a shortage of space for the instructional contents. So the interface finally was built with regular frames and composition, but I still kept the ambition and used the idea for the design of the quiz mode.

### **My website: Homepage**



The users' first impression on this website is very important. I want people to associate with a cheerful kitchen, a lovely cook book or a gift box from a cake store while browsing the website.

**My website: Instruction Mode**



The menu on the left side (marker 1), which is designed as a bookmarker, provides information about the recipe and steps that users need to follow. The tools (marker 2) hanging on the right top corner are the buttons to the other pages. The sticker (marker 3) tells users what to do. The interaction area (marker 4) allows users to use the virtual tools on the table to make a cake step by step. Users just need to move their mouse, click on the correct item, and the corresponding animations will show (ex. sift the flour). The area (marker 5) on the bottom shows the instruction and key points about the current step.

**My website: Quiz Mode**



The menu (marker 1) keeps the information about the sponge cake recipe, but there is no “step” option in quiz mode. Users are supposed to be familiar with the cake-making steps without any clue. However, there is still a “hint” button (marker 5) under the interactive section, which is prepared for a possible eventuality. In the interaction area (marker 2), there will be no instruction. Even though people may feel confused, the confusion will also occur in reality.



Besides, to search freely in this area with their mouse should be fun as well. If they feel tired, they can get help from the "Hint" button. When the correct item is clicked, a corresponding question will show on the right side (marker 3), and a question mark will show on the interactive section. After an answer is made, a red circle or a cross will show on the bottom (marker 6), and the possible bad influence for the wrong answer will show in the feedback section (marker 4). After the current question is answered, users can go to the next step, and repeat the process (click on a specific item → a question shows → answer the question → go to next step).

**My website: Results Page**



After users finish all of the questions, they can see their own cake, both the appearance (marker 1) and section (marker 2) at the end. Depending on the answers they previously gave, their cakes will be different. The scores and the text statement of the cake (ex. your cake is flat, burnt) will be provided as well (marker 3). Besides, all of the feedback for the wrong answers will be collected in the feedback section (marker 4), so people can review and realize what they should notice for the next try or when making a cake in the reality.

**My website: Credit Page**



## ***D. Conclusion***

To summarize my thesis plan, my ambition is to build a website in which I can incorporate all of the skills I've learned during these two years. Besides, I am interested in e-learning material design, so my goal is to make something as fun as my favorite escape game but also helpful and informative.

3D technology and programming are two of the issues I want to explore and challenge in this thesis. I am engrossed in the amazing effects that realistic models can present in computer graphics arts or game design, but both 3D technology and programming are not easy to me. I spent lots time on solving problems and learned a lot from that.

Regarding user testing, generally all participants were happy with the experience. They had fun with the quiz mode, especially from the images of their own cake at the end. Some participants were people who knew how to make a cake. They carefully answered all questions based on their experience and did a great job for their virtual cakes. Since they did not run through the instruction mode at first, which meant they might not be familiar with the formula of the interaction between those virtual tools but they still could finish the process smoothly and successfully, the design of the cake-making process and questions should be reasonable and effective.

For those beginners or players who did not pay attention to the instruction, most of them could pass the cake-making process without big problems. However, the buttons on this website caused slight confusion for users. It was hard to notice the function of the baking tools hanging on the right top side of the website which would lead people to other pages. The recipe hiding in the bake labels in the menu was ignored. The problems might result from the interactive sections in the two modes of the website: drawing all users' attention and targets to this website were merely "gaming", not "learning". It is also the diploma of the present e-learning material design: the balance of designers' consideration between fun and education. About the design of the interface, they felt relaxed and pleased with the color, atmosphere, and the metaphor of the website.

To sum up, I almost finished all of my expectations for the thesis, and I am very happy and proud of it. Users' reactions are as enthusiastic as I want, and my effort and consideration to the design seems to work. I have learned how to design an e-learning website and solved the problems I encountered while exploring 3D



modeling, lighting, and programming.

### **E. Appendix**

#### 1. Reference images for cakes



2. Reference images for the virtual kitchen



3. Reference images for the virtual tools



## ***F. Bibliography***

### **For the paper "E-learning: the Advantages, Restrictions, and Perspective"**

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< [http://www.goo-net.com/game/game-data/IL\\_DESTINO/destino\\_e.html](http://www.goo-net.com/game/game-data/IL_DESTINO/destino_e.html)>

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***Electronic Sources***

Baking 911

< <http://www.baking911.com> >

The Cheese Cake Factory

< <http://www.thecheesecakefactory.com/default.asp> >

Love to know (for recipes)

< [http://recipes.lovetoknow.com/wiki/Category:Sponge\\_Cake\\_Recipes](http://recipes.lovetoknow.com/wiki/Category:Sponge_Cake_Recipes) >

One-off R: Escape from the Garage (3D game)

< [http://www.gotmail.jp/oneoff\\_r](http://www.gotmail.jp/oneoff_r) >

3 Cats' Escape in X'mas (game)

< [http://choko-chai.harugame.com/game/nyan\\_xmas/nyan\\_xmas.shtml](http://choko-chai.harugame.com/game/nyan_xmas/nyan_xmas.shtml)>

Sphere (3D game)

< <http://www.jigsaw.x0.com/sphere/index.html>>