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Master's Thesis
Academic Year 2017

Design of Web Animation Tool Based On
HTML5–WATON

Graduate School of Media Design,
Keio University

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A Master's Thesis
submitted to Graduate School of Media Design, Keio University
in partial fulfillment of the requirements for the degree of
MASTER of Media Design

Su Han

Thesis Committee:

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Abstract of Master's Thesis of Academic Year 2017

Design of Web Animation Tool Based On HTML5–WATON

Category: Design

Summary

At present, a variety of computer animation software enables users to generate complex and exquisite animations. However, there are still some limitations of these animation software.

This paper describes a Web Animation Tool: WATON based on HTML5 technique for supporting people to create animation online directly. Different from computer animation tool which have to be installed in users' PC, the function will be limited by the operation and hardware environment and the created animation content need Flash or other plug-ins to play in the website. Our web animation tool can provide an independent environment and simple interaction just based on web browsers. Through theoretical research and using the program practically can understand the features of HTML5 technique and make the prototype of web animation tool.

According user tests can figure out that actually, using HTML5 technique can make 2D animation as well as play these productions on website directly don't need any plug-ins, decrease the risk of internet application. Also, this kinds of animation can be accept by users. Web animation tool could have a responsive performance in different resolutions of browsers. About practical application, Some users have tend to use this web animation tool as a education method for kids animation workshop.

Keywords:

2D animation, web animation, HTML5

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Chapter 1

Introduction

In recent years, with the development of web technology, more and more web tools which have the same functions as computer software appear. These web tools even solved some problems what computer software can't solve, provide a More convenient experience for uses. Therefore, we speculate that the traditional computer animation can also be transformed into web pages, web animation tool could provide a more free production environment and enable novices can create animation more easily, as well as stimulate their interest in making animations.

1.1 Research about 2D animation making

Development of 2D animation making

Animation includes a lot of hard work. Its a process of creating something that is unique, which has never been done before is endlessly fascinating. Animation means that always been trying to make the pictures move, the idea of animation is older than movies or television. Animation is all around us like TV commercials, music, movies or even videos. There are many types of animation and lots of methods to develop the animation(Wang 2014).

Traditional animation is also known as classical animation or cel animation or hand drawn animation. It is a process where each frame is drawn by hand. This technique has been dominant a long time until computer animations emerge. In the traditional animation process, animators start their work by drawing sequences of animation on transparent sheet called Acetate sheet in one picture or "frame" at a time. The key animator or lead animator draws a key poses in an action with the help of layout as a reference. The drawings are photographed scanned and synced with the soundtracks.(Spencer et al. 2009) This allows the animation to be reviewed before giving work to the assistant animator or in-betweeners who adds details to the remaining frames.1.1

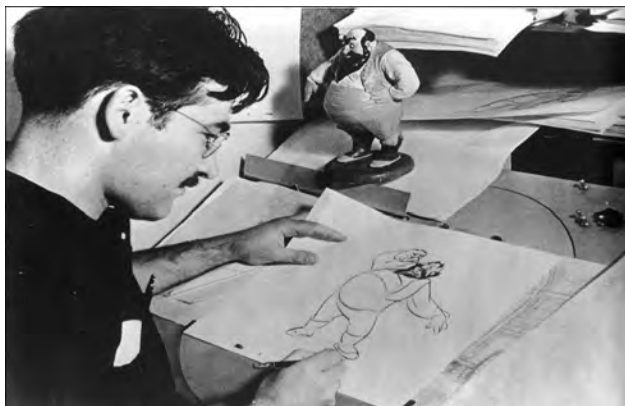


Figure 1.1: The traditional animation

Traditional animation is also known as foundation or part of 2D animation.

Traditional 2D animation involves making a drawing and then making a second drawing of the same pose, but with a very little change (such as a closed mouth to an open mouth or a person taking one footstep). It is the process of making hundreds of drawings (unique drawings are made that go from the beginning of a scene to the end of a scene) and animate the drawings by playing them in rapid succession (typically 24 frames, or unique drawings, per second)(Wang 2014). This is the most common form of animation, and has been used for several decades across several forms of media. This gives the illusion that the numerous still images form a complete, fluid animation.

With the technique development of animation. Creating animation in 2 Dimensional space (height and width) with the help of digital technologies is known as digital 2D animation. Instead of creating models or drawing the frames by animators. Animation figures are created or edited on the computer using 2D bitmap graphics, created and edited using with 2D vector graphics. This includes automated computerized versions of traditional animation techniques, interpolated morphing, onion skinning and interpolated rotoscoping.(Yan 2015) Animators can use frames to create different animation effects like rotate, fade-in fade-out and so on. Using 2D software or application, animators can limit the number of drawings used, which makes them easier to create digital 2D animations. This process can also be used to digitally add color to characters, rather than having to hand-paint each and every frame, greatly reducing the number of unique drawings that need to be made. Digital 2D animations are becoming very popular and prominent.(Wang 2014)

The summary of existing computer 2D animation software

Nowadays, most 2D animations are aided by the use of computers. Some programs, such as Adobe Flash, allow animators to draw out characters and backgrounds right into the computer, eliminating the need for ink and paint. Through using the modern computer animation software practically, can understand the function and feature of these software, as well as figure out that actually there are still some limitation of computer animation software, and these limitations can be broken out by using web animation tool. As the foundation of creating an animation tool, we must understand what kind of functions are necessary in the making steps and what kind of UI can be accept fast to users. Therefore, the first step is trying to use and analyzing the existing computer animation software practically.

There are many applications can make 2D animation such as Flash animation, analog computer animation or Adobe After Effects, and so on:

Adobe Photoshop

Adobe Photoshop is for making traditional animation, where users can draw every single frame and it has the best drawing tools among others. Now users can find a lot of tutorials for how to create animations using Photoshop. In addition, it has layers that can give tremendous freedom for creations. But the timeline of PS is too simple to make an animation and the layout function is complicated and require users have a level of animation knowledge to use it. After finishing the production, also need a huge storage to save the file. Thus, PS isn't suitable software to produce animation video. It is still a good graphic software for users.

Adobe Animate CC

In early 2016, one of the famous animation production software Flash Professional was renamed Adobe Animate CC. Adobe Animate CC is a software which is created by Macromedia company to make 2D animation. If a newbie who want to make a small cartoon in 2D, Adobe Animate CC can help them. The basic tools used in the software and the graphics they draw are vector graphics. The characteristics of vector graphics and the data capacity is small which can spread fast. As the interface of Flash is simple and easy to learn, so supported by animation creators. A lot of creators use Flash to make some MTV or animation videos. In order to match the new standard of web site, Adobe Animate CC also add some new functions for promoting and adapting the development of web technology.

There are four important functions of Adobe Animate CC (Zhao 2013)

1. Stage the main workspace when users make animation, they can modify the

characters, background, buttons, and video on it.

2. Timeline is used to control the different appeared time of each object also used as layout.
3. Library panel used to store the objects of making animation, something like graphics, media, videos audios and so on.
4. Action panel control the motion of each object in a timeline by using ActionScript.

And, there are six main steps for users who want to produce animation by using Adobe Animate CC(Zhao 2013):

1. Prepare the animation Stage

Create an Canvas document and set the stage and document. Access a vector image to use as the background to the animation1.2.

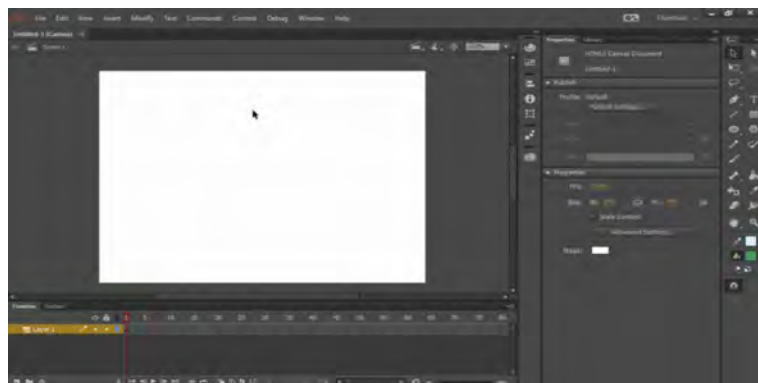


Figure 1.2: Prepare the animation stage

2. Create the scene

Add layers to the composition and use drawing tools, such as the Rectangle, Pen, and Brush tools to finish drawing the background scene1.3.

3. Import and prepare the character

Create a new layer for the character. Then, import the character. Create movie clip symbols and separate the layers to prepare all parts of the character for animation.

4. Animate the character



Figure 1.3: Create the scene

Learn the difference between frames and keyframes and motion tweens and shape tweens. Then, apply these concepts to apply looping animation to the different parts of the character to create the appearance of realistic movement.

5. Add animation to the main timeline

Learn the difference between movie clip animation and animation on the main timeline. Animate the character across the main timeline and fine-tune its path1.4.



Figure 1.4: Add a character and create animation

6. Publish your project

Use the publish settings to export your project for use on the web, in Dreamweaver, Muse, or InDesign projects, or to a custom publishing target. also can share your animation on social media.

Even Adobe Animate CC as a production software has a long period of time and has some features suitable for newbies to use. But it is still an old technique, the limitation of Adobe animate CC is the UI and function are too fixed to use in some situation like creating a flip over effect. On the other hand, The size of vector graphics are small but the color isn't good enough to use, there still need another graphic software to draw the graphics and export in CC to create animation. Also, because of the high price, the software is still a lot expense for users.

Toon boom harmony1.5



Figure 1.5: The UI of Toon boom harmony

Toon boom harmony is one of the most famous animation production software in America. Cause it has powerful function of animation and video making, already has been used by lot of animation or video studios such as SouthPark studio, Universal company even the UBISOFT and so on. Harmony provides amount of functions enable users to create 2D animation and game assets efficiently Toon Boom Harmony comes in 3 different tiers, Harmony Essentials, Harmony Ad-

vanced, Harmony Premium, each with a higher price point.

The biggest consideration for a 2D animation software is the drawing tools. Harmony offer great vector drawing tools, also offers bitmap drawing and painting tools as well. These are only available in the more expensive versions of Harmony, but they are well worth it ,if the user is a digital painter and want animation to have a richer more handmade look.

With Harmony there are a higher level initial learning curve, because their features and tools are designed to be used in specific ways that might not be intuitive.

Toon Boom on the other hand has always targeted the the professional animation market, and their current offering.This software always be used by some professional studio or animators. So, Harmony might not make it the best choice for beginners and hobbyists.

Clip Studio1.6



Figure 1.6: The UI of Clip Studio

Clip Studio is the rename of painting software ComicStudio. It is one of the famous computer software for painting, drawing and comic. Now also add the animation function enable users to make simple motions as well.As a graphic software, the most important feature is the software reproduces a natural, real touch like drawing on a piece of paper with a pencil or pen has a correction functions to smooth hand-drawn lines.And has a huge source stock for users to support their projects and save the time. The new version of Clip Studio already support for Windows and IOS,Newly released for IPad. It supports the input and output of image files in a generic format including Photoshop format and can be smoothly federated with other software

users can create animation and moving illustrations using easy pens and brushes and handy coloring tools and export the work as a movie or animated GIF. But using Clip Studio to make animation the process more like creating the traditional 2D animation which require to draw each frame. When users finish every frame work ,they can use the animation function to set the display order and speed of each frame in the timeline^{1.7}. So the animation function of Clip Studio is not such convenient as professional animation software. It is still a production software for drawing and comic.



Figure 1.7: The timeline of Clip Studio

Open Toonz^{1.8}

Open Toonz is an Open-source animation production software. This is software for producing a 2D animation, and has some different edited model for users to choose. It is based on the software "Toonz", which was developed by Digital Video S.p.A. in Italy, customized by Studio Ghibli, and has been used for creating its works for many years. This software can be used by anyone free of charge, no matter whether the purpose of use is commercial or not. Open-source means users can modify its source code freely.

As a free and open-source animation software, Open Toonz is usable for some users just want to make animation for fun. But the timeline's style of Open Toonz is different between majority animation software. So, for some users who already have experience to make animation, it is a little hard to adapt this kind of timeline to set motions. As well as the UI of Open Toonz is complicated and difficult for novice to understand and master. Because there are different developers edit the interface and add the new function, but actually some of design and function is unnecessary.



Figure 1.8: The interface of Open Toonz

The limitations of computer 2D animation software

After analyzing and comparing the features and functions of different computer animation software, can learn that computer animation software still have some problems as below:

1. The hardware situation is still a limitation for some users, and some functions or the effects will be limited by the hardware environment of users' PC. Also, some software just support for single operation system, they only can be installed in Windows system or IOS.
2. Required familiarity with the software packages and a level of painting ability as well as the knowledge about animation making. for novices, still need a long time to learn how to master computer animation software as a professional animator.
3. Some software is monopolized by a few leading and famous companies separately which means users have to spend bunch of money to buy them

4. The UI of these software also can't fit in different screen under different resolutions.
5. The productions created by computer animation software need the plug-ins to help them can be played on web pages, can't be post on the internet directly.
6. The most serious problem of computer animation tool is the saving problem. Even though software developers try their best to promote the saving function, but at present, the software still can't save the file in the real time. Once the system or the software is broken down, the user can't save their products timely, all the efforts will in vain.

Production play on web page

There are some limitation about playing animation, video or another platform on the internet directly. For example, Flash Player plug-ins are required when the animations made by Adobe Animate CC in web pages. so we have to save the file format as SWF. But these plug-ins will slow down the loading speed of web page and make some security problem. Even the size of a file is very small.

At present, Flash Player has cross-platform application features, is supported by most web browsers and operating systems. However, the higher quality of the video is played online the more CPU resources is occupied then the broadcast will become intermittent. It is still a basic problem that Flash needs to solve. On the other hand, With the advent of more and more mobile devices, some new problems have appeared. For example, some operating system on mobile devices like IOS, Android and windows8 require Flash create some new features to match them. (Vesel et al. 2199) Mobile devices use the battery instead of the power supply, that means mobile devices requires low energy consumption when play videos, but the Flash Player as a plug-in just can be used in computer, as it cost a lot of electric power. For these reasons, today people should create another video format instead of using Flash player on mobile devices. Flash is an older technology, as compared to HTML5 in the Internet environment .

1.2 Definition of web animation

Web animation also be called "UI animation" "CSS animation", "JavaScript animation", "HTML5 animation". Web animations and transitions have become

increasingly common for modern web design due to the development of HTML5, CSS3 and JavaScript. But "web animation" is an umbrella term for all these things (Chang 2016):

web-first technologies like CSS, JavaScript, HTML, Canvas, WebGL, SVG that don't require plug-ins. Web animation always work on an interaction design project. As with any other design techniques, animations can be subtle or they might be in front of your face and hard to avoid. User add this technology to animate things from dashboard drawers to games to data visualizations (Vesel et al. 2199).

Web animations are often saved as GIF, CSS, SVG, WebGL or video. They can be anything from a simple underline that appears when users hover over a word to a full-screen video or background image. When it comes to animating for the web, it falls into two equally easy to understand categories: large and small. (You can probably guess how these look.)

Large animations are ones that have a scale to them. Often in the form of a video with a run time, large-scale animations fill a significant portion of the screen and are characteristic of a short movie. These animations serve as a focal point in the overall design. Users often don't have to perform any action to see the animation in motion. The large web animation also can be a complete small cartoon in a web page or become web page itself.

Small animations are the little bits and pieces that you discover as you start interacting with a website. These divots might be in the form of hover states, tiny bits of ornamentation or usability guides or tools. Small animations are an accent that contribute to the overall aesthetic, but are unlikely to be the focus of the design. small animations are already applied to each website in order to enhance the interaction between users and web pages.

From the user experience point of view, web animation brings the interactivities to the UI elements. Purpose of the animation is to attract users' attention for a notification, call an immediate action from the user, indicate a relationship between elements that user is aware of in the interface, and to show the continuity in a transition between UI states (Chang 2016). But at present, web animations are not only used in this situation but also used in making some leading animation videos or the cool albums. There are already showing the connection between traditional animation and web animation.

1.3 Research Purpose

According to the description of web animation can learn that web animation technology already used in making a small cartoon of 2D. The web animation techniques of HTML5 already have enough function to make lots of different physical animate effects which can be used to control different objects like graphics or audios, give them different action effects to create an animation. Because the interesting expression method and the novelty, I choose the field of web animation as a research topic. It brought a great curiosity to explore how to use this technology to make a 2D animation, and if this kind of technique can product the 2D animation. Depend on the development of web technology, can we create a online tool enable users to make animation by using web animation technique on the Internet directly? At the present, thousands of software can create animation, they still have several limitations. Therefore, I want to find out a interesting and novel method to balance the digital function and hand written beauty, and use the advantages of web technology attract more and more people to joining in creating their own web animations.

The purpose of this rearch is designing a web animation tool which can enable users to upload their own graphical elements and audio sources, combine them with animation effects to generate a complex animation video or a small cartoon. Such web animation tool may be provided as a server executable application which is accessible through conventional browser technology.

1.4 Thesis Outline

This research will focus on the theoretical and practical parts.

- In the theoretical part, I first plant a theoretical basis for animation, focus on the 2D animation.
- In the next step, including summarizing the feature and function of HTML5 technique, what kind of technique of HTML5 will be used in web animation also be described. Based on the study will support for the design demo of WATON.
- In the practical parts, I design the prototype of WATON ,study the traditional Disney animation theories to investigate which rules are still suited

for web animation. Combine the Disney animation theories with the web animation techniques, set up a series of our own web animation rules.

- In order to understand the usability of web animation, I conduct usability tests for the UI design, and then generate a 2D animation that is made by web animation program and make a comparing test with the 2D animation SouthPark, to learn the attitude of users about web animation.
- In the conclusion, I summarize the findings from the research along with the limitations of the design and discuss the future work.

Chapter 2

Related Works

2.1 Web animation techniques of HTML5

The history and development of HTML5

HTML5 as a new web language was submitted from 2008 by W3C and Opera company, also combined new technologies of these two companies improves on HTML4 which was standardized in 1997. It is the latest iteration of HTML, Hypertext Markup Language, a language for structuring and presenting content for the World wide web. HTML5 represents two different concepts (Anthes 2012). So, it is a new version of the language HTML, with new elements, attributes, and behaviors, and a larger set of technologies that allows the building of more diverse and powerful Web sites and applications. This set is sometimes called HTML5 friends and often shortened to just HTML5. HTML elements are the building blocks of web pages. At the time of writing, the HTML5 specification is still developing, but a number of features are considered stable and ready to use, like the canvas element and by adding new elements to support for multimedia content, such as audio and video. It offers new features that provide not only rich media support but also enhance support for creating web applications that can interact with users, their local data, and servers more easily and effectively than was previously possible.

HTML5 is an evolution compare with the HTML4, HTML5 combines the existing HTML, CSS3, JavaScript and other technologies, also use the scientific method to adjust and delete some previous HTML tags make web animation effects come true. The local database, canvas, and API such some new features are added in HTML5 make the function totally different between HTML4 (Shapiro and Julian 2015). HTML5 has a new element and support for multimedia contents, such as audio and video. The user can manipulate elements programmatically using JavaScript to control and create animation. this technology is free to the

public and easy to use. Web pages which are made by HTML5 haven't need to install Flash Player or another additional plug-ins anymore because of the Canvas function, that can protect the web system reduce the security problem. Just through using tags and Canvas function can create and play animation easier than before. So HTML5 become a support of nearly all web browsers.

Except for these new functions, HTML5 also add some new API, In addition to the original kind of application of HTML and XML document object model, DOM. For example:

- Can replay videos and audios
- Support the offline storage
- Support text edit
- Support drag the mouse
- Support view and control the history of web pages

When HTML5 is used in mobile devices can solve the problem of Internet access. HTML5 can save current web pages enable users can view pages even though Internet access situation is not good.

Animation on the web is at the incubation stage, not only now considered a viable alternative to using plug-ins like Adobe Flash, in recent years, developers have pushed the boundaries of speed and performance in web browsers. Because this is still a highly competitive area, developers can look forward to more optimization and improvements to come. Using the browser such as provided by Mozilla TM, users at any one of the client devices can interface With the animation tool that resides centrally at the server.

The feature and browser supporting of HTML5

HTML5 is an editing language constructed by different elements and tags. Comparing with HTML4, some new tags like "header", "article", "section", and so on are added in HTML5. These new tags make the div of web page files easier to understand than before (Schumacher-Rasmussen 2011). As well as, web developers can define the web construction directly through searching the codes of background web program. And the doctype for HTML5 is very simple. To indicate that your HTML content uses HTML5, simply use:


```
!DOCTYPE html;
```

Doing this will cause even browsers that don't presently support HTML5 to enter into standards mode, which means that they'll interpret the long-established parts of HTML in an HTML5-compliant way while ignoring the new features of HTML5 they don't support. This is much simpler than the former doctypes, and shorter, making it easier to remember and reducing the amount of bytes that must be downloaded.

In HTML5 standard, web developers can use element "section" to divide the different modules. The section element represents a generic section of a document or application. A section, in this context, is a thematic grouping of content, typically with a heading. Examples of sections would be chapters, the various tabbed pages in a tabbed dialog box, or the numbered sections of a thesis. A Web site's home page could be split into sections for an introduction, news items, and contact information. A general rule is that the section element is appropriate only if the element's contents would be listed explicitly in the document's outline. As using this element, it becomes simpler to control the different elements in web pages. Tag "Article" is able to indicate some documents which have complete contents and independent of the web page. (Anthes 2012) Authors are encouraged to use the article element instead of the section element when it would make sense to syndicate the contents of the element. Except this, we can use "header" "footer" and others elements to label these external document contents.

It become very easy to put-in and play some videos, audios and animations in web pages Through inserting `<audio>` or `<video>` some HTML5 new elements in the web pages directly. The `<audio>` element is used to embed sound content in documents. (Indrayanto 2199) It may contain one or more audio sources, represented using the "src" attribute or the `<source>` element: the browser will choose the most suitable one. It can also be the destination for streamed media, using a `MediaStream`.

Added in HTML5, the HTML `<canvas>` element can be used to draw graphics via scripting in JavaScript. For example, it can be used to draw graphs, make photo compositions, create animations, or even do real-time video processing or rendering.

Mozilla applications gained support for `<canvas>` starting with Gecko 1.8 (i.e. Firefox 1.5). The element was originally introduced by Apple for the OS X Dashboard and Safari. Internet Explorer supports `<canvas>` from version 9 onwards; for earlier versions of IE, a page can effectively add support for `<canvas>` by including

a script from Google's Explorer Canvas project. Google Chrome and Opera 9 also support `<canvas>` (Geary 2012). The `<canvas>` element is also used by WebGL to draw hardware-accelerated 3D graphics on web pages.

HTML5 doesn't require special operating system to support and there are some browsers which can run HTML5 program perfectly. For instance, IE9, Maxthon3.3, Chrome 18, Firefox11,Opera11.6 and Safari 5.1 can run HTML5 smoothly. In some mobile devices, browser like Firefox10, Safari 5.0 and so on also support for HTML5.

Data storage of HTML5

Before HTML4 there are several types the data is stored on the user's computer by the user's web browser while the user is browsing (Zhang 2014):

1. IE use cookie;
2. Firefox use global Storage;
3. Flash use plug-ins

One of the reasons that certain technocrats favor native applications is their ability to store data locally on the client. Actually, this kind of method is not safe when users surfing the Internet and the storage is totally not enough for saving. The security of this data generally depends on the security of the issuing website and the user's web browser, and on whether the data is encrypted. Security vulnerabilities may allow a data to be read by a hacker, used to gain access to user data, or used to gain access (with the user's credentials) to the website to which the save data belongs. But now, developers invented two new methods to solve this problem.

1. Indexed Database API

This document defines APIs for a database of records holding simple values and hierarchical objects. Each record consists of a key and some value. Moreover, the database maintains indexes over records it stores. An application developer directly uses an API to locate records either by their key or by using an index. A query language can be layered on this API. An indexed database can be implemented using a persistent B-tree data structure (Lamberta and Peters 2011).

User agents need to store large numbers of objects locally in order to satisfy off-line data requirements of Web applications. This specification provides a concrete API to perform advanced key-value data management that is at the heart of most sophisticated query processors. It does so by using transactional databases to store keys and their corresponding values (one or more per key), and providing a means of traversing keys in a deterministic order. This is often implemented through the use of persistent B-tree data structures that are considered efficient for insertion and deletion as well as in-order traversal of very large numbers of data records.

2. Web Storage

It is a simple client side database that allows the users to persist data in the form of key/value pairs. It has a fairly simple API to retrieve/write data into the local storage. It can store up to 10MB of data per domain. Unlike cookies, the data stored are not included with every HTTP request.

IE7 and older versions do not support Web Storage. All the other browsers like Chrome, Opera, Firefox, Safari and IE8+ support Web Storage.

Types of Web Storage:

Local storage: Stores data with no expiration date. The data will be available even when the browser/ browsing tab is closed or reopened. Through storing the key value, the stored data can be saved forever unless the user deletes the data spontaneously. As a local storage of saving data, even the user closes the browser, the next time, when they open the browser again, the data still can be restored. So users can share the same data in a same domain name server.

Session storage: Stores data for one session. Data persisted will be cleared as soon as the user closes the browser. Session Storage that means this kind of storage method just save data in the current. If users close the web page, the data will be cleaned at the same time (Anthes 2012).

In both the cases, the web storage data will not be available between different browsers.

Compare to cookie, HTML5 in web storage has four advantages (Zhang 2014):

1. The storage of HTML5 is 5MB, but cookies just have 4KB.

2. HTML5 user local storage to save data, but cookies will interact with the server and save the data on the server. Cookies are sent with every HTTP request, thereby slowing down the web application performance.
3. HTML5 is more practical and easy to operate interface for data storage it is more convenient than cookies.
4. HTML5 has local storage ability can separate different space for saving data, will provide a more stable environment for data saving.

When web application store data locally on the client,By HTML5 Store method, the client doesn't require to interact with the server to deal with these data each times. It is helpful for the server to save more space and reduce the security risk the Internet. When users use the mobile terminal device from a network under normal conditions suddenly into a short period of no network environment, the browser has the ability to cache web and use the network application as normal.

Offline web application of HTML5

As more applications move to the Web, it is tempting to assume 24/7 uninterrupted connectivity for all users, but the reality of the Internet is that interruptions happen and, in situations like air travel, can happen predictably for several hours at a time.

If the applications depend on communication with remote hosts, and those hosts are unreachable, the application won't work. However, when there have an Internet connection, web applications can always be up-to-date.

If applications require only occasional communication, they can still be useful as long as the application resources are stored locally. With the advent of browser-only devices, web applications that continue to function without continuous connectivity will only grow more important.

HTML5 exposes control over application caching to get the best of both worlds: applications built with web technology that run in the browser and update when they are online but can also be used offline. However, this new offline application feature must be used explicitly, because current web servers do not provide any default caching behavior for offline applications.

The HTML5 offline application cache makes it possible to augment an application to run without a network connection. Users do not need a connection to

the Internet just to draft an e-mail. HTML5 introduces the offline application cache that allows a Web application to run without network connectivity.

An application developer can specify specific additional resources comprising an HTML5 application (HTML, CSS, JavaScript, and images) to make an application available for offline use. There are many use cases for this, for example:

- Read and compose e-mail
- Edit documents
- Edit and display presentations
- Create to-do lists

Using offline storage can avoid the normal network requests needed to load an application. If the cache manifest is up to date, the browser knows it does not need to check if the other resources are also up to date, and most of the application can load very quickly out of the local application cache. Additionally, loading resources out of a cache (instead of making multiple HTTP requests to see if resources have been updated) saves bandwidth, which can be especially important for mobile web applications. Currently, slower loading is one way that web applications suffer in comparison with desktop applications. Caching can offset that.

The application cache gives developers explicit control over caching. The cache manifest file allows users to group related resources into a logical application. This is a powerful concept that can give web applications some of the characteristics of desktop applications. users can use this additional power in new, creative ways.

Resources identified in the cache manifest file create what is known as an application cache, which is the place where browsers store the resources persistently, typically on disk. Some browsers give users a way to view the data in the application cache (Anthes 2012) (Schumacher-Rasmussen 2011).

From the related research about HTML5 can understand that HTML5 is unarguably one of the most widely used languages by web designers and developers. It provides us with rich feature set such as cross browser compatibility, well defined tags, ease of use, eye catchy visual elements, support for script such as JavaScript to enhance functionality, integration of cascading style sheet (CSS) to redefine appearance etc. With the emergence of HTML5 some new aspects are added such as animation, video and audio. Now modern browsers no longer rely on plugins for displaying interactive animations. A deadly combination of JavaScript,

HTML5 and CSS3 can create mesmerizing animations. These animations make users' website more presentable and thus giving more possible for users to change.

2.2 Cloud computing technique

With the rapid development of processing and storage technologies and the success of the Internet, computing resources have become cheaper, more powerful and more ubiquitously available than ever before. This technological trend has enabled the realization of a new computing model called cloud computing, in which resources (e.g., CPU and storage) are provided as general utilities that can be leased and released by users through the Internet in an on-demand fashion(Griffith 2010).

In a cloud computing environment, the traditional role of the service provider has divided into two: the infrastructure providers who manage cloud platforms and lease resources according to a usage-based pricing model, and service providers, who rent resources from one or many infrastructure providers to serve the end users. We can build our web animation tool by using cloud computing because of these advantages:

1. Lowering operating cost:

Resources in a cloud environment can be rapidly allocated and de-allocated on demand. Hence, a service provider no longer needs to provision capacities according to the peak load. This provides huge savings since resources can be released to save on operating costs when service demand is low. These enable users can post a lot of graphics and audios into the Internet and have enough storage to save them when the animation was made out there still enough space to store and spread.

2. Easy access:

Services hosted in the cloud are generally web-based. Therefore, they are easily accessible through a variety of devices with Internet connections. These devices not only include desktop and laptop computers, but also cell phones and PDAs.

2.3 The example and limitation of existing web animation tool

Through the related research, can learn that there are already several web animation tools was developed and can be used on the Internet.

In this section will introduce three kinds of web animation tool.

Animatron studio¹

As an open source on the browser provides a plurality of graphical integers Which a user can use to generate an animation. also, allow users upload their own graphical elements to make a slide or digital album. Animatron has two edit mode for users to choose and lots of social media link let users share their productions on the Internet directly. However, if a user uploads too many objects will burden the browser and in the current the loading time of this web application is till not fast.2.1

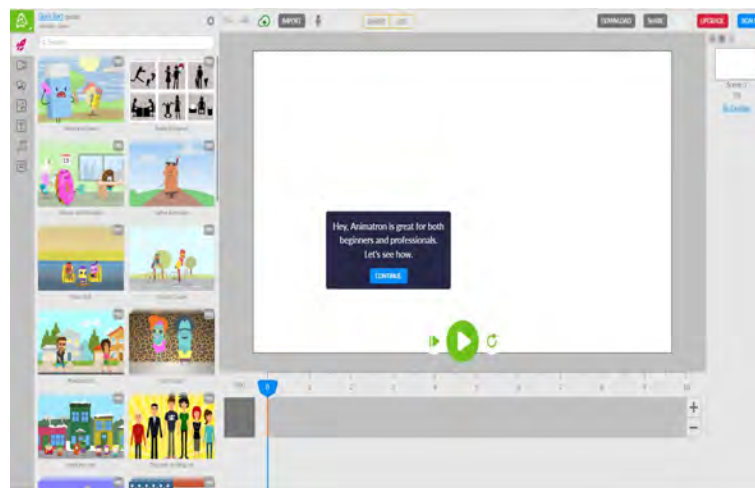


Figure 2.1: The interface Animatron

HTML5 MAKER²

HTML5 maker as a web animation tool is more like a animation effect editor which has very simple UI and operation easy to understand. HTML5 MAKER just can be used to make a slide or show the web animation effect to provide the

1 Animatron studio <https://www.animatron.com/studio/whiteboard-animation-software>

2 HTML5 MAKER <http://html5maker.com/app/>

lots of web animation effects like easy-in/out, rotate out, etc to users to use as a reference. also show the code of animation effect as a dictionary for web designers

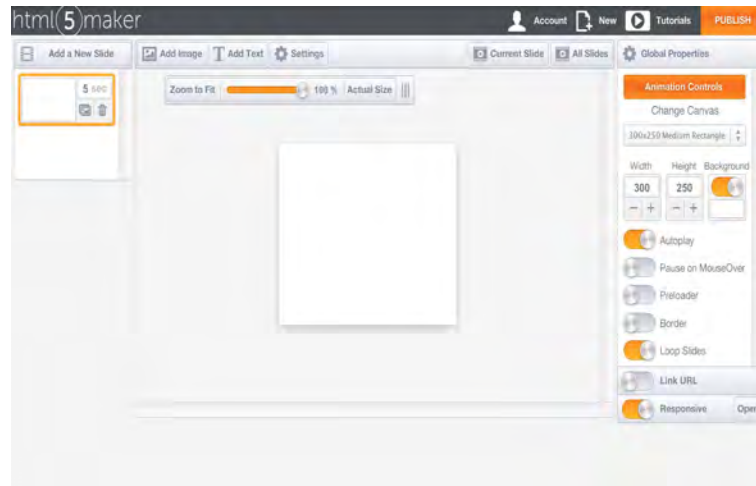


Figure 2.2: The interface of HTML5 MAKER

Animasta³ 2.3

Animasta is totally an independent web animation datastore where enable users to play with collections of pre-made CSS animations. The idea was to create a playground of a sorts where a collection of pre-made animations could be tested and tweaked before actually using them. Seeing how various options like easing, delay, duration and others affect the animation proved to be very useful. But this tool can't make any productions just show the animation effect and provide the original codes. It is a web page helps people learn web animation.

summary

By analyzing the existing web animation tools, we can find that currently, online web animation tools just enable users to make a slide, a digital album as well as provide users the codes of each animation effect. Almostly, using the web animation tool as a data store of web animation. They haven't provide more functions enable users can create more high level productions. And lots of web animation tools are created by personal or little group, haven't been make full use of network technology. We believe that web animation technology could take more possibilities for our life. Therefore, I want to make a new web animation tool

3 Animasta <http://animista.net/play/basic/flip-2>

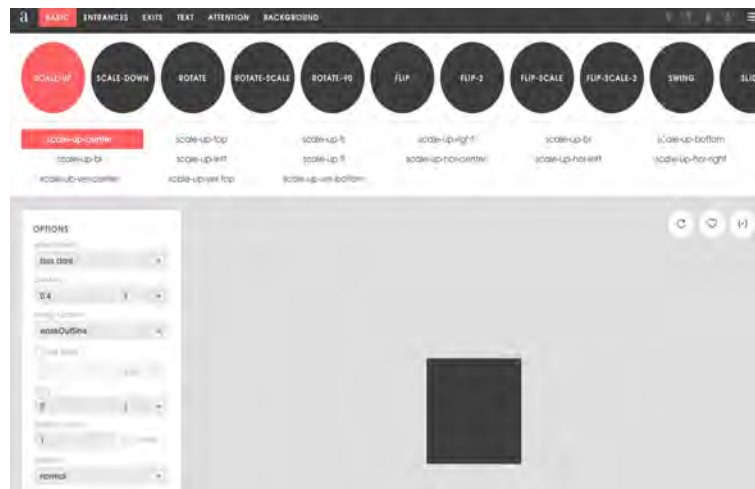


Figure 2.3: The interface of Animasta

which enable users to upload their graphics or audios on the website and create more complicated animation video than now.

Chapter 3

Design of web animation tool WATON

3.1 The design concept

After researching the situation of animation making in several chapter before, at present, a variety of computer animation software enables users to create complex and exquisite animations. To create these animations a user typically requires familiarity with the software packages that are used to generate the ultimate animation. These packages require a high level of familiarity before a user can easily generate animations. This animation software also have to be installed on users' own computers and are run from the desktop that means some functions or features will be limited by the software and hardware environment of computer. Also, the animation software can't save the product in the real time, sometimes will cause a big problem to users. Even these tools have the function which can support a group work via Internet and provide online type output. Other reason is that this software is already monopolized by a few leading and famous companies separately which means users have to spend bunch of money to possess the certain specialized knowledge to use such software. So we can understand there still some limitations of computer animation software should be solved in order to provide a better user experience.

Since the promotion of the modern web program and the fast spread of the cloud computing which allows end users to run computer program online in a web browser. Some problem of computer software or desktop software can be solved by transferring the software into Internet to create a new online version. At the same time, More and freer online tools are turned out as open source have provided much convenient and open service for users. The similar phenomenon also happened in the field of computer animation.

Developers have pushed the boundaries of speed and performance in web

browsers and JavaScript engines, HTML5 is the latest iteration of HTML, it has a new element and support for multimedia contents, like audio and video. Users can manipulate elements programmatically using HTML5 web animation technique to control and create animation. Because it does not require an additional plug-in to be installed and can protect the web system reduce the security problem. Basing on the existing foundation of web program can be used in another work improving the work efficiency

Then, there are some web animation tools come up and as a new method that enables users to make slides or digital albums online, users can delete, modify objects provided by these tools or some picture uploaded by themselves. But lots of existing web animation tools just have oversimplified functions which are not enough for users, it is difficult to users to create each object or each action of one object in the same workspace, through using web animation tools, users only can move a single picture and give it a motion effect like PowerPoint can provide, the layout motion can't achieve in these tools.

In order to change this situation, It is necessary to develop a new style web animation tool has more practical function to promote the usability enable users can create their own animation on Internet.

Pre-interview

Before study, I also interview 3 people who have experience of using computer production software to make video, animation or illustration, In order to learn what kind of user points they need. After the interview, I summarize these needs as below :

1. The save problem.

There are always the common problem of desktop software. If the computer stop to work or the software is broken down suddenly, but the user haven't save the products timely. It will cause a serious consequence. This problem always bother a lot of animator or video maker.

2. The UI problem .

Actually when the computer production designer start to work, some of the function of the software they don't need will still on the screen and some time ,the needed tool button will be hidden, they have to operate and find

them. The user interface is a little inconvenient to use, but it is not such big problem to users.

3. The hardware problem.

Some computer software are limited by the different operation system,like the software just has Windows version or IOS version, and because when the software work will bring a serious load to CPU and need some storage to cache the data, the computer animation software will cause damage to users' PC. So, sometimes as a professional designer of animator users have to prepare a High-profile computer to install these software.

Target user and purpose

After analyzing and researching the function and feature of existing computer animation software and summarize the web animation technique, also learned from user interview.I want to design a new type web animation tool which can use the strengths of HTML5, in order to help users who have interested in making animation but lack of basement skill or time to learn the process of using computer software, enable them to make interesting contents aren't limited by the environment.This kind of tool will be provide for children animation making experience, wherever they are, they can through the browser to create animation video with other kids together.

The purpose of our web animation tool is not only used as a web animation effect data store but also enable the user to upload their own graphical elements and sound sources combine with the animation effect to generate a complex animation. This is a service for such users who want to generate animations for entertainment but without requiring a detailed knowledge of the complex environment of the commercial animation tools and show the beauty of traditional graphic. On the other hand, due to the tool provides the codes of web animation effect as a dictionary, which enabled web designers to use these codes in their own work as a reference.From the words"web animation tool" I want to name the tool as "WATON".

3.2 Functional design

These time, according using HTML5 technique, we can create the web animation tool has several function as below to help users create animation In summary of

above, the assumption of this design work is as below:

1. Use the HTML `<canvas>` element with either the canvas scripting API or the WebGL API to draw graphics and animations. By using this element, we can draw some vector graphics reduce the files size as well as create animation effects even the 3D animation effects in the designated place in the web page. Web animation technique can be used to make 2D animation ,and this kind of animation can be accept by people.
2. HTML5 play the media materials through inserting `<audio>` and `<video>` element in the coding. This new feature support media playing on web site, and already be used in different browser, So HTML5 technology can play the 2D web animation on the web page and don't need any plug-ins. Our web animation tool will enable users to post and watch their animation videos directly, enhance the connection between users and social network.
3. HTML5 allows delegation of JavaScript evaluation to background threads, allowing these activities to prevent slowing down interactive events. Also provide a new generation of JavaScript engine that function will become more powerful than before. History API allows the manipulation of the browser history. This is especially useful for pages loading interactively new information. These day, the developers of HTML5 already declare that HTML5 technique become standardized, can be used by majority browsers, web technology and experience will have a revolution in the near future. Therefore, we can make a web animation tool enable users to create animation on the Internet directly.
4. The HTML5 drag and drop API allows support for dragging and dropping items within and between web sites. This also provides a simpler API for use by extensions and Mozilla-based applications. Fullscreen API controls the usage of the whole screen for a Web page or application, without the browser UI displayed. And HTML5 has responsive performance API, So we think that the performance and the function of web animation tool can adapt different resolutions of different web browsers and operation systems.
5. Users can use the web animation tool to create their own simple cartoon may be 1 or 2 minutes. the least frame rate of WATON performance may act about 30fps. Because all of the motion are achieved by the coding, so a single web animation effect may be active around 30fps.

6. HTML5 is a kind of program language, web developers can write different codes of each animation effect by using HTML5, and any people can view the background codes. So, Web animation tool can provide the program code for web developers as a reference for their work.
7. HTML5 already has several functions for mobile device, support the gesture when a user pressing touch screens and do react. Also has device orientation allow to get the information when the device on which the browser runs changes orientation. This can be used as an input device (e.g., to make games that react to the position of the device) or to adapt the layout of a page to the orientation of the screen (portrait or landscape). Therefore, The web animation tool WATON can be used in different mobile device.

Each assumption will be verified in the later chapters or the future work.

3.3 Design details

Through practical test and the analysis of comparing the features of computer production tools, (from the describe Figure 3.1) we can understand the basis of production tools are constituted with three features for creating an animation. there are a basic workplace, toolbar, and the timeline.

	Clip studio	Fire alpac	Open toonz	Toon boom harmony	Adobe Animate CC
type	Painting Software	Painting Software	Animation Software	Animation Software	Animation Software
toolbar	Improved brushes draw smooth Easier color select	Simple brushes but can edit brushes No quickly save button	Simplist brush can t draw Simple Onion skinning	Brushs are enough to draw Easier skeleton tool help improve work efficiency Onion skinning	Simple brushs 360° rotatable canvas Faster color changing Colored onion skinning
workspace	Intricate bar and tool icon Can change the mode and size of workspace	Simple workspace can change the size of window and bar	Multiplex types of workspace but difficult to hold the function	Color icon of tools. has comment easily be understood Difficult to change the space	Multiplex types of workspace Control audio looping directly on the timeline
timeline	no	no	yes Can display any parts difficult to select frame timeline jus go down not go right	yes Provides total control over texture and colour on every frame.	yes Control audio looping directly on the timeline independent frame easily to control

Figure 3.1: The feature of computer production software

In order to shorten the lead-in learning time for users who already have the experience of animation making, but still require familiarity with the interface, we tend to simply the traditional animation making function as the reference and

use the similar interface of computer production tools to our web animation tool interface.

The prototype of WATON

This part will introduce the demo and the basic features of our web animation tool interface in details. Figure 3.2 and Figure 3.3 are the main test web pages of our animation tool.

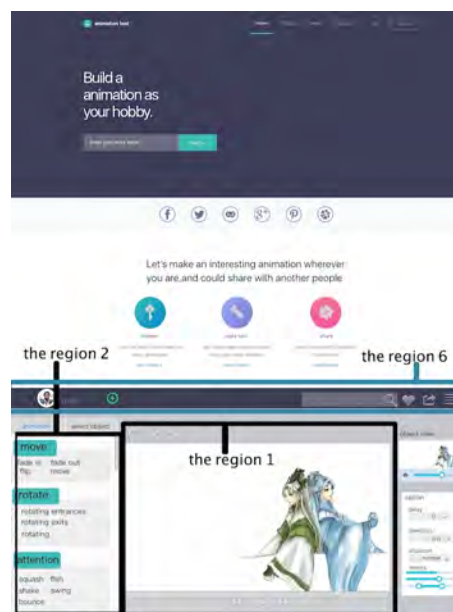


Figure 3.2: UI design of WATON1

The animation tool includes a graphical user interface and provides a plurality of animation elements. Users can upload their own graphical elements which can be individually selected by the user and placed in a workplace. The graphical user interface is provided on a browser window such as Firefox.

Region 1, workspace

The region 1 is provided as the main workspace where a user can pick and place the graphical element, check the animation effect, generate animation and replay the animation video.

Region 2, animation effects list

The region 2 is a list of providing a plurality of graphical element effects that could be applied onto each of the graphical elements, these kinds of animation

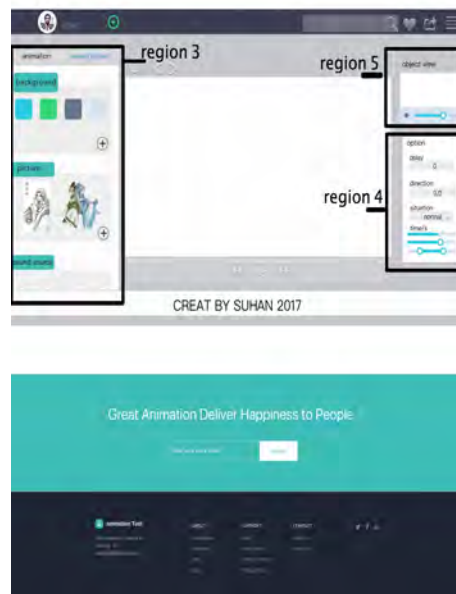


Figure 3.3: UI design of WATON2

effects are classified according to three types: the move, the rotate and the attention. All of the animation effects are already set down, users can select the effect and only need to change the parameter to control the motion of a graphical element.

Region 3 , object place

The region 3 is an area where enable users to upload their graphical elements and sound sources that are available for selection. It is divided into three parts: the background, the picture and the sound, supporting the PNG and JPG format for graphical elements, depending on the web limit, only the MID and WMA format of sound can be accepted.

Region 4 , option list

The region 4 is the option window enable users to control the animation effect like start from (0px, 0px) then move to (100px, 100px) during 5s. Using the time control instead of the traditional timeline like delay 5s, or continue 7s. In JavaScript, there are more options for easy animations creation. It can be created by using the animation transitions to move the element from one place to another. the appearance of the graphical elements in animation can be modified, like high 6px width 7px by changing the options parameter.

Region 5 , little screen

The region 5 is a little screen that displays each graphical elements are used,

enable users to check the action of each object.

Region 6, title area

The normal title also provides the link channel let users post their productions on the SNS. If users checking the menu will view the codes of each animation effect also can get the copy files.

The second and third regions desirably occupy the same location on the user interface but are no viewable at the same time. By using the mouse, it is possible to interchange between the elements that are provided as graphical elements, the population of the second region, graphical element effects have already been set down.

The tool enables a user to select individual graphical elements from the third region and place them using a mouse onto the first region.

The desired animation effect for that graphical element may be associated with that by dragging that effect from the second region onto the appropriate graphical element that is provided on the first region. Then just set the option of each object and animation effect.

Through checking the menu, user can learn the HTML5 program of each animation effect and get the free copy codes.

What kind of web contents that WATON can create? As a basic hypothesis, at first, we hope users can make some short animation videos around one or two minutes that enable the user to post it on their SNS or download quickly. Secondly, about the frame rate of animation video, which is already known that cause beyond 22fps, the human eye cannot perceive the obvious change that makes a video looks fluent. The normal animation frame rate is 24fps. and the frame rate of 60fps is reckoned to be the target for smooth performance, giving users a time budget of 16.7ms for all the updates that need to be made synchronously in response to some event. However, consistency is especially important: if the user environment can't deliver 60fps, it's better to deliver lower frame rates more consistently, and avoid sudden dips in the frame rate which cause the site to freeze. So the least frame rate of WATON performance may act about 30fps. Because all of the motion are achieved by the coding, so a single web animation effect may be active around 30fps. However, the final effect will depend on the users' real environment.

Rule set for web Animation Tool

In order to let user can understand how to make a web animation quickly, we try to find a compact rule to define some basic animation effects. The utility of physics in motion design reflects the core-principle of what makes for an animation that plays tribute to how objects move in their real worlds. the rule set is a series of animation effects that will be used as various basic actions and can combine to an animation or small cartoon.

Disney animation principles apply to web animation

About 2D animation making,we can learn Disney animation principles as a reference. Animation is the illustration of motions. The twelve principles are the concentration of Disneys deep understanding of how things move and behave in real-life.

Twelve Principles by Disney :

1. Squash and stretch: define the rigidity and mass of an object by distorting its shape during an action. It used in form of motion blur, dramatic squashing, and stretching.
2. Timing defines the weight, size, and personality of objects by adjusting the spacing of actions.
3. Anticipation indicates that the character prepares an action to indicate the audience whats happening next.
4. Staging presents the idea so that it is unmistakably clear and attract views attention in the scene. It includes timing, acting, camera position, and lights setting.
5. Straight ahead pose to pose illustrate the actions. Straight ahead is to animate each frame while the action is happening. It used to object that has unpredictable movement, such as fire, water particles, explosions etc. On the other hand, pose to pose is to first define start and end of an action, then animate out the movement in between. It indicates clearly whats to animation in between the frames.
6. Follow through overlapping action terminate an action and indicate the relationship to the next action, such as inertia in actions. This is opposite to anticipation as it reminds the audience previous actions.

7. Slow in and slow out adjust the speed and spacing of the frames to emphasize the action. This makes the action more realistic to show how the speed changing during an action.
8. Arcs show the movement path realistic as the most of the moving objects have a circular path, such as when throwing a ball.
9. Exaggeration: exaggerate the characters expression, action or pose to increase the amount of impact on the audience.
10. Solid drawing takes volume, weight, and balance in consideration to achieve effects that characters are in three-dimensional space.
11. Secondary action: it used to make the main action more believable; it shows the action of an object resulting from another action.
12. Appeal: the character should have some charismatic aspect to like about them and it applies to every character not only the main roles. Appeal is a mysterious thing because you know when youve got it and you know it when you dont have it but you have no idea how to get it. (Thomas and Johnston 2010)

The rule set and application example

The Disney animation principles not only applicable when creating animated characters, but also teach us how to control the movements and expression via any type of animations. The vocabulary terms used in animation principles can be used in web animation as well. After combining with the features of web animation effects will set 5 rules as our basic animation rules. But it is not the final setting of our web animation tool , in the future, we still need do a lot of user testing to improve and perfect the rules.

Move

The move means the elements can do the most basic moving on the screen. It always means the position change, when users want to move the element to different position, just use the move effect ,then set the end position and the moving time.

Ease parameter

Ease parameter is the mathematical functions that define how fast or slow animation occur in different parts of animation's total duration. As the Figure 5.7

an easing type of ease-out is the converse of this: the animation start and continues at a constant speed before it gradually decelerates during the final part of the animation. much like the physics-based motion, easing can provide power into the animation, easing produces an animation that starts, runs, and ends more variable.

Fade

Fade that means when an animation effect will start and finish there would provide some buffer time for connecting with another animation effects. The principle support is the action. animation occurs in three parts: the preparation for the action, the action itself, and the termination of the action. Anticipation is the preparation for the action.

Squash Flash Shake Swing Bounce

These animation effects are kind of additional action when an object is moving, putting these actions in basic motion reasonably will let the motion looks more physical and fluent.

Rotate

When an object is moving, it not always maintain the same orientation, maybe have some rotations on the object or in the moving path. This is especially truly happened in the motion of human figures and the action of animals. Rotation is used extensively in animation since they create various motions.(Anthes 2012)(Lamberta and Peters 2011)

In the next section will introduce how to make an animation effect by using JavaScript

For example, like the Figure3.4, move to right, fadeout, rotate, just using this kind of words to describe the animation will act in the object. at least user can realize what the motion the object will act.

The item firstly starts move to the right, when it is moving the orientation always changing follow a principle, finally the easing array tension value increases the vibration speed at the tail end of the animation. By tweaking these values, users can give each animation a unique movement profile which helps to reinforce the differentiation between their individual behaviors.

Breaking up compound properties into their sub-properties for the purposes of animation gives user increased control over values (Peng 2010), like the fadeout include the independent effect to be defined. Users can specify independent values for each sub-property, also makes the animation code easier to read and easier to maintain. JavaScript properties drop the dashes between words and all words

```

<script>
// animation rules
const rules = {
  moveToRight: parameters => {
    return {
      keyframes: { transform: [`translate(${ parameters.from })`,
                              `translate(${ parameters.to })`] },
      effect: { duration: parameters.duration,
                delay: parameters.delay, fill: "forwards" }
    }
  },
  fadeOut: parameters => {
    return {
      keyframes: { opacity: [parameters.from, parameters.to] },
      effect: { duration: parameters.duration,
                delay: parameters.delay, easing: "ease-out", fill: "forwards" }
    }
  },
}

```

Figure 3.4: Code1

past the first must be capitalized like fade-out becomes fade Out.

Then just required to set the parameter values of each action rule, like the moving path, during the time, action delay time and others. Later it will get an animation effect like the Figure3.5 which means the object will move to right from 0px to 100px using 1000ms with 0 delay. The timing of one animation does not affect another, It is easy to change individual durations without redoing math and can go back and easily set animations to run either in parallel or consecutively.

```

// user animation
const animations = [
  //{ name: "moveToRight", target: "div", from: "0px", to: "100px",
    duration: 1000, delay: 0 },
  { name: "fadeOut", target: "div", from: 1, to: 0,
    duration: 1000, delay: 500 },
  { name: "rotate", target: "div", one: "rotate(0deg) translate(0,0)",
    two: "rotate(-90deg)", three: "rotate(-180deg) translate(-300px, 0)
    scale(0.5, 0.5)", duration: 1000, delay: 0 },
];

```

Figure 3.5: Code2

Refer to the time setting of our web animation tool, because the feature of Code program, our web animation tool was used the time option like setting the duration time and delay time option, instead of the traditional timeline have to set each action on each frame to generate the animation. So, the traditional timeline tool may be in WATON. Then, just write the parameter of each time option will

control the action time of an animation effect but not use a frame to control each action.

Specify the duration option, which dictates how long an animation effect takes to complete. In milliseconds(1/1000th of a second) provide the user to specify arbitrary duration value or as one of three shorthand duration: "slow"(equivalent to 600ms),"normal"(400ms),or "fast(200ms).the advantage to using the names shorthand duration is that they express the tempo of an animation effect when user review the code(Odell 2014).



Figure 3.6: Example of web animation

By using this kind of programming rule user can upload their own picture to our web browser and then can make an animation effect3.6, and if users have interests in learning HTML CSS3 or JavaScript, we also provide the free codes to help them to do self-education.

Chapter 4

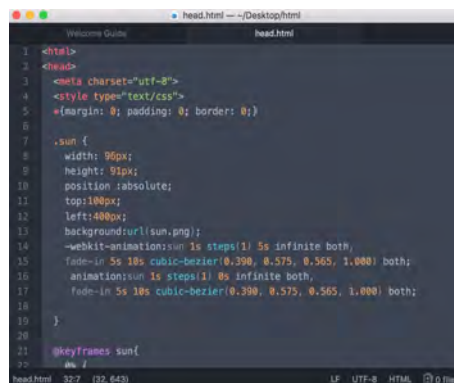
Implementation

4.1 Create Software

the UI design using some well-know software to draw, like Adobe Photo Shop and Adobe Illustrate. And using the professional prototype software Axure to create the prototype of WATON and set interactive effects.

HTML5 Editor

There are lots of Editor can be used to write HTML5 program, such as Atom, EditPlus, Dreamweaver. I use Atom4.1 to help my project.



```
1 <html>
2 <head>
3 <meta charset="utf-8">
4 <style type="text/css">
5 {margin: 0; padding: 0; border: 0;}
6
7 .sun {
8   width: 96px;
9   height: 96px;
10  position: absolute;
11  top: 100px;
12  left: 400px;
13  background: url(sun.png);
14  -webkit-animation: sun 1s steps(1) 5s infinite both;
15  @keyframes sun {
16    animation: sun 1s steps(1) 0s infinite both;
17    fade-in 5s 10s cubic-bezier(0.390, 0.575, 0.565, 1.000) both;
18  }
19 }
20
21 @keyframes sun {
22   aw /
23 }
```

Figure 4.1: The window of Atom

Another very useful HTML Editor is DreamWeaver4.2.It is a professional tool to create website, has a lot of function support for website making. Web design or maker can use it create website or write program and check the output effect at the same time. The web page production can be applied in different browser,also enable users can upload their own media sources and application or plug-ins to create production. DreamWeaver help us to create the website prototype of WATON.



Figure 4.2: The window of DreamWeaver

4.2 Responsible performance of WATON on different browser

Because there are a various of browsers and screen size people used, what is the best screen size to design for our web animation tool to adapt the majority of screen and browser? For reference ^{1 2} 1366*768px, 1920*1080px, 1440*900px, 1280*800px and 1600*900px are the current top5 desktop screen resolutions world-wide recorded recently.

It is impossible to design our website to look the same in every browser because of the functional limitation and the difference of human-computer interface between desktop. In order to promote the UX, a common size should be designed for WATON, then opt for a fluid layout for the website to fit a user browser setting or try to consider responsive design solutions that can achieve much the same thing.

viewable area(unit:px)								
screen	1		2		3		4	
common resolution	1366	768	1920	1080	1440	900	1280	800
Chrome	1343	768	1897	1080	1377	900	1257	800
IE	1345	620	1896	932	1419	752	1259	652
Firefox	1349	585	1903	749	1423	717	1263	617

Figure 4.3: The list of browsers' viewable area

According to Figure4.3 which show the top 4 desktop screen size and the top3 desktop browsers viewable area in difference resolutions. Most broadly used desktop resolution and browser they are 1366*768px and chrome.

From this list, it could easily figure out that the wide screen is gradually becoming a trend of modern website design. But 1024*768px, which was the most widely used resolution for a long time, of course, the general guideline is to optimize for users common resolution. The 1024*768px is still as a common design choice should be considered. Window size variability is even greater, since users don't always maximize their browsers, at the end the 1349*585px and 1024*768px are chosen as the basic design size of WATON. In order to fit different screen sizes of mainstream browsers, responsive website³ design and using a liquid layout that stretches to the current users window size can solve this problem. It is one of special feature of HTML5 technique. Responsive website design (RWD) has emerged as a very likely solution to screen size challenges. This method moves away from using fixed width websites and instead uses Media Queries in CSS style sheets to create a website that responds to size the different view-ports of hand-held devices and smaller screens that people use(Ping et al. 2013).

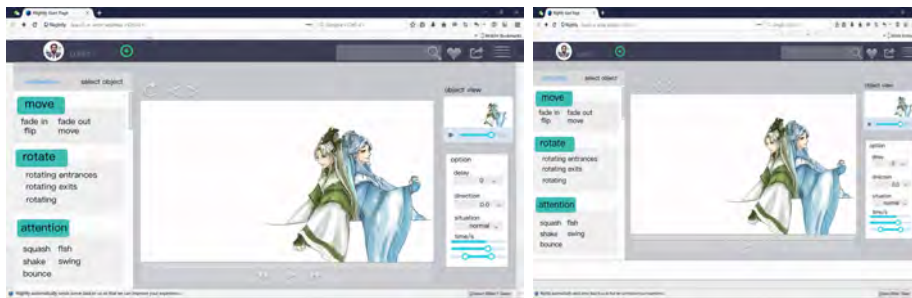


Figure 4.4: Different performances size

The Figure4.4 show the different performances of WATON, the resolution are 1366*768px and 1024*768px on Firefox. There keep some white space when the resolution is 1366*768px.

When users modify the window size of the web page

When a user changes the width of the browser (like Figure4.5), only the workspace (the region1) has been changed with the browser size, the height of WATON page and the size of another region keep invariable. But the region2,3,4,5 will be moved with the widow, ensure they can be displayed on the screen and havent hidden elements. So the user can see it without scrolling.

Another situation is when a user changing the height of the browser, the workspace still has been changed with the browser size, the size of another region still keep unchanged, but the bottom parts of region2,3 and region4 will be hidden,

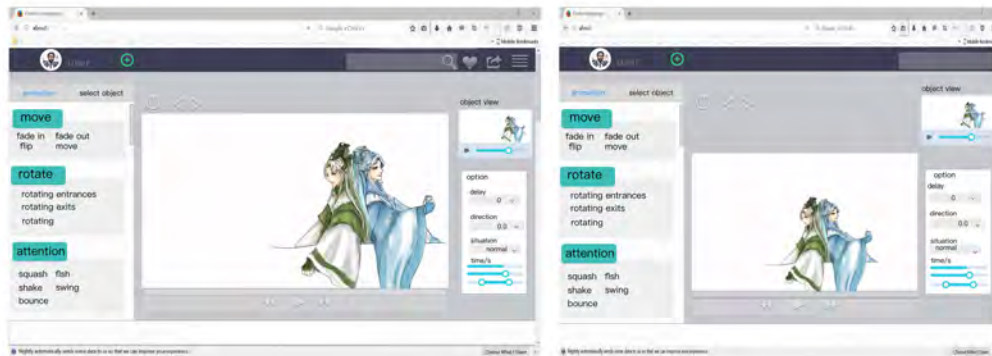


Figure 4.5: compare with the full screen size between the width reduced

user need to scroll the scroll-Y to see the hidden parts, we try to design the website which avoids the table to scroll horizontally when users view the page content.

Whatever the user changes the size of browser randomly, it will show the combination result of 1 and 2 as much as possible avoid to use scroll-X in the web page.

This paper hasnt mentioned the resolution design on mobile devices like tablet and smart phone, but mobile device is on the rise, so we still need to think about how mobile friendly our website really is form the start in the next step. But it is a little difficult for users to use their fingers interact with our tool in a small screen of mobile phone. So I think It is unnecessary to design the mobile Phone version of our WATON at least in the present.

Firefox browser

Such web animation tool may serve as a server executable application which is accessible through conventional browser technology. Our WATON uses the browser such as provided by Mozilla TM, because the browser Firefox is very compatible with HTML5 API. Users using any of the desktop client devices can interface with the animation tool that resides centrally at the server. So as a foundation web browser, may be the Firefox can be a good choice for supporting the web animation tool. Firefox uses the Gecko engine⁴ as their Rendering Engine. Gecko is an embeddable browser, developed as part of the Mozilla open source project and based on W3 Standards rather than the proprietary approaches of the past. Adhering to web standards simplifies cross-browser web development and enables accessibility. Gecko is a cross-platform browser engine which is compatible with

a number of Windows versions including Windows, IOS and Linux. Account for Geckos cross-platform nature, functionality is pretty much similar on a different platform. It is an open source rendering engine that any web developer can help to create the program and write the code to add new functions as well as develop the compatibility. So the animation tool also may be used in some mobile device unlimitedly. Even WATON was created mainly based on Firefox browser, using the JavaScript engine as the background supporting, using the HTML5 API to create enable WATON can provide a fabulous application effect in different devices. If we hope our tool spread widely and can be used by lots of people, we should pay more attention to consider the compatibility problem, in order to reduce the miserable situation happened.

As a assumption, One of the solutions is trying to use the universal JavaScript grammatical rule in our coding in order to improve the compatibility between different browsers, for example:

Codes like `()` or `[]` can be used in IE to gain some collection class objects, but in Firefox just the `[]` can be used, in this situation, only writing `[]` in coding to gain collection class objects will improve the web compatibility.

Notes

- 1 Market Share Reports- desktop screen relations 2017 <http://www.netmarketshare.com/>
- 2 Market Share Reports-browser sharing 2017<http://www.netmarketshare.com/>
- 3 <https://www.smashingmagazine.com/2011/01/guidelines-for-responsive-web-design/>
- 4 https://developer.mozilla.org/en-US/docs/Archive/Mozilla_Gecko_Compatibility_Handbook.

Chapter 5

User test of WATON

5.1 Description of user text

I plan the test from two parts: find out the usability from WATON model test to promote the UI design. Get the opinion about web animation from users in order to verify the availability and the interaction design of The web animation tool and the concept.

The first plan is to conduct usability test for the web animation tool WATON mainly to find out issues in the UI design. I will use observation method and interview method to collect the user action when they interact with WATON demo and learn their thoughts When using WATON. Later maybe need to discuss with the web-development team, select the usability issues which could be solved and improve the UI design.

The second step, I will using the comparing method to verify the availability of WATON, especially to learn if the web animation tool is usable and helpful for users and if they have interested in trying to use web animation to make a small cartoon. Also what to search if it is necessary to narrow the scope of the target users.

Findings from these study will be concluded in the summary part. According these findings will make some change to WATON to promote it.

5.2 WATON demo user test

Develop test contexts

Before the test start, I need develop the research questions. The question is: What aspects need to be improved in the current UI of WATON in order to let the web animation tool adapt the browser environment better. The research question can be further anatomized into a list of small questing which can help me record the

user actions and interview them more logically:

- What is the first impression of WATON as a web animation tool?
- How do users interact with the menu bar?
- How do users start exploring the tool?
- How do users read or interact with animation effects from the tool-bar?
- How do users create a new project by using tool menu?
- How do users edit an animation in the workspace?
- How do users treat the data after animation are generated do they export the report or pin the animation on SNS?

These questions are the skeleton of the tasks list which will be performed during the test by each participant.

Recruiting test participants and planning test

When the research question and objectives is approved. I start planning to recruit the participants

The number of the participants: according to Jakob Nielsen(Jakob 1999), the ideal amount participants of the usability test is between four to eight. The accuracy of the behavior results will not increase linearly with the amount of test participants. (Figure5.1)

There are two basic attributes for targeted participants: Have graphic or animation software experience; No graphics or animations production experience.

Participants who have rich experience of using some graphic or animation software would have pre-formed behavior patterns and expectations for the web animation tool even they havent used or heard the tool before.In the other hand, participants with zero experience in making graphics and animations will give original feedback to the web animation tool.

Finally, I have 9 participants for the test. In the group, there are 4 participants they have rich experiences of using graphic and animation tools, and

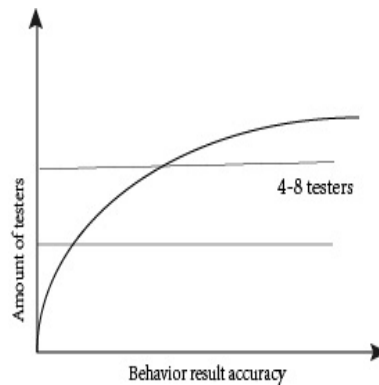


Figure 5.1: Number of participants VS. Behavior results accuracy

another 5 participants haven't any experience of using graphic and animation tools. The age scale of participants is from 14 to 28 years old, there are 5 girls and 4 boys in the test group.

Through letting each participant play with the WATON demo freely at least for 10 minutes. I will observe and record the action of users during the test, under considering the questions from the list. And will focus on observing the small pauses and mistakes happened on users during test.

After each test is finish, I could ask some questions to each participant. These questions are related to the actions what the participant has done, also interview them to collect some advice and thoughts about web animation tool.

Because the user test just needs a computer and a quiet environment, it can be implemented easily. When the test starts, I sit in the oblique back about a meter or so position from the participant to see the screens and observe the actions of participants, also can give guidance when they needed.

After all the adjustments done, it is time for the test. Depending on the available schedule of the participants, we can book a flexible time for each test.

Running the test

Each test has a standard procedure: Welcomes participant, asks participants to explain their background and reason to attend the test. Before starting

the test, I also demonstrate how to use WATON once and introduce our test task today, and declare there aren't right or wrong about the actions or answers, just do a test. This is a warming up session before the official test starts. The duration of the test is at least 10 minutes, over 10 minutes participants can finish the test whenever they want.

After the test starts, I need to observe and record user actions under these questions:

- what is the first action when the participant starts. (To understand what information user observes when logged in to the web animation tool, do they understand the task)
- Can they recognize the object menu, and upload the test graphic. (To know if the upload bar is easy to use or not)
- While participants notice how to interact the graphic with animation effects. (the most important part of web animation tool, to check if the interaction rule setting is reasonable or not)
- When all the interaction finished, what the participant will do, does she/he can notice the "share" button.

Then, observing and taking notes about their actions while participant performs with the UI. A question session is held after participant finishes the task. I ask open-end questions or the questions related to what participants have performed during the test. After no more questions from the observers, I ask a general feedback from the participant for test and show the thanks to each participant.

The results of user test

After all the tests are finished, I make a list to collect and analyze the results and feedback from participants:

About stating

Even I show each participant how to use the tool before the formal test starting, two of participants who have no experience of animation making still don't know the right step to start their task. They use the mouse to search the screen and check the animation effect list several times because

there havent any feedback,then they give up to do this action.After searching another function area several times, finally they get the true step and start to create their own task.

Latter, I ask why they check the animation effect list first instead of uploading the graphic to edit. They tell me they want to explore what kind of animation effect the tool can make but forget this is no way to do this without anything to control in the workspace. This phenomenon inspires me, maybe can set an initial picture object on the workspace, the picture can be deleted and play a guiding role to interact with users in the workspace when users start a new project to show them the different animation effects.

Animation effect list

Each button of animation effect list has a very similar look, participants have difficulties to distinguish them. When they finish adding an animation effect to graphic there are lack of feedback to the users.It will cause some problem, users feel confused and forget what is the effect they used on the graphics. So I should change the UI of each animation effect button to make them looks more clearly to chose and add some feedback like changing the color or add highlighting when users chose the button.

Play button

After setting down all the animation some participants became confused to find the play button to view the final effect. Maybe the reason is the play button locates under the workspace and on the timeline using a gray effect that make it looks inconspicuous. In order to solve this problem, I need change the position of play button, set it in the top of workspace and change the color to make it looks more clear.

About sharing

Not all the participants were able to notice the share button. Some of them just create the production and finish the test directly. Some participants start to open a new project forget how to deal with the old one. After the test I asked the participants who havent click the share button, they told me that they havent the habit to share a personal product on the Internet directly, they will consider if it is worth or good enough to post and show to other people. The important reason is they dont have the habit to post anything on the Internet so that makes them forget the share button unconsciously.

On the other hand, some participants didn't click the share button because they think it is only a test, they haven't recognized to use all the function even they noticed the share button. So this result shows the limitation of the test environment different from the natural environment. In order to grow a shared habit of users maybe need to build a society communication environment through adding an SNS system like an interest group enable users to communicate with each other.

Except for the result of observation, I also get some advice from participants. Below is the main advice list from participants:

- Difficulty to understand what animation buttons have been selected.
- It is hard to understand the action of some animation button needs to try it to confirm the effect.
- No easy way to start creating a new report from the web page.
- It is difficult for users to notice that they can save and open the current project in the sub-menu in their account icon.
- It is hard to delete the old action on the object. Sometimes they will forget to use the option to set the animation. The setting step is a little complicated.
- Its challenging to understand the animation setting if the user wants to add lots of different actions on an object.
- Add the background music function will be better.

From this test, can learn issues about WATON demo and understand the thoughts of users to promote our work. I adjust the UI of WATON to improved the user experience. After the whole user tests will focus on how to solve these problem and provide a better design. This part will be introduced later.

5.3 The comparison test between web animation and 2D animation.

In this part will use the comparison method to discover how the users think about web animation and find out the pain-points that if users want to use

web animation tool and in what kind of situations they want to use web animation tool.

The preparation of test animation

This small cartoon is made same as the opening music video of a famous American cartoon which named "South Park". South Park is an American adult animated sitcom created by Trey Parker and Matt Stone and developed by Brian Graden for the Comedy Central television network. It is a computer 2D animation even the FPS is not high but includes lots of attractive characters and lots of wonderful topic stories, already has millions of fans around the world. In the web animation video will recreate the opening scene which main content is a man is playing guitar while walking. Some characters will appear in the different part of the screen do some action and then disappear. It seems simple to make but consider the layout and combine the different objects it still a heavy task.

Except the characters and some background objects need to be drawn by illustrator, all of the action and music play will be generated by using HTML, CSS3, and JavaScript these three technologies of HTML5. And then use the Canvas function to let all the objects play in the same area. This will be a small cartoon which is generated totally by the coding program.

The coding of test animation:

```
!DOCTYPE html
<html>
<head>
  <style type="text/css">
.dance {
  width: 240px;
  height: 341px;
  display: block;
  background: url(images/dance.png);
  -webkit-animation: dance 2s steps(1) 0s infinite both;
  animation: dance 2s steps(1) 0s infinite both;
```

```

}
@keyframes dance{
  0% {
    background-position: 0 0

  }
  33% {

    background-position: 0 100%
  }

  66%{
    background-position: 0 200%

  }
  100%{

    background-position: 0 0
  }
}
</style>
</head>
<body>
<div class="dance"> </div>
</body>
</html>

```

because of the length of the article, I cant write down all the coding. The final result of web animation is Figure5.2, and the Figure5.3 is one of scenes form example video of South Park.In oder to show the comparison effect I chose the two scene which looks similar.

This test small cartoon can be outputted as a web page itself directly,because dont need any plug-ins to play, can shorten the loading time. Depend on the function of HTML5 editor tool, this small cartoon also can be transferred into a video format like MP4. In this test, I will put the test small cartoon and the original music video on the same screen let the audience watch, and ask them how much they know about web animation and collect their

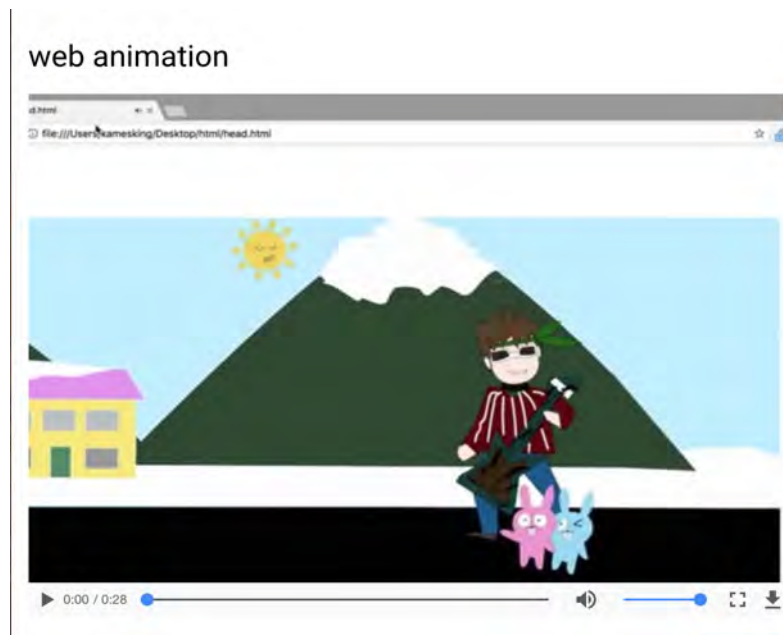


Figure 5.2: The web animation



Figure 5.3: The opening music video of South Park

thoughts about web animation, are they willing to use it and what kind of situation they want to use it to learn the user pain-points.

Running the test

This test was carried out during the KMD forum. It is very simple to operate this test just by showing the different two animation videos in same screen of my computer. There are some students and other guests come our campus to attend the forum. If some participants have interested in my project I will introduce it and communicate with some them in order to learn and collect the cognition of them about web animation. The Figure 5.4 is the test website which was used as a display tool.

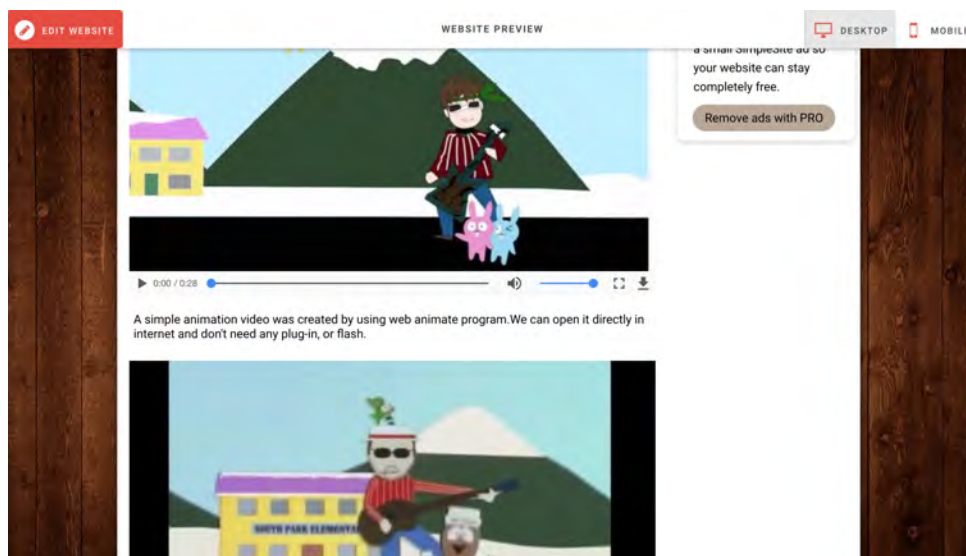


Figure 5.4: The display webpage

During the forum time, there are around 12 guests show the interest about my project but only 8 of them we have short communications. I asked several simple questions and received some thoughts and advice about web animation tool from them. They are 6 adults and two children.

There are the basic questions:

1. What do you think of these two animations, can you finger out the difference between them?

2. Do you know or heard of web animation before?
3. What do you think of the small cartoon which was generated by web animation technology?
4. Are you willing to use web animation tool to make some short animation videos?
5. What kind of function do you want in the web animation tool?
6. What kind of area do you think web animation tools can be used for?

Summary

In this test, firstly, making a small cartoon by using HTML5 technique indicate that in the current the web animation function of HTML5 already has the ability to make the same action effects like traditional 2D animation. At the same time, through the actual application, can figure out the advantages of web animation.

Second, through communicating with guests can understand that actually most of the guests couldnt recognize the difference between these two animation videos, even the character actions in the web animation are not smoothly like original animation video. they think this kind of animation can be accepted and interesting to watch. Only two of adult guests know what is web animation and have heard of the program system. But the rest dont know or even haven't hear of it. Then, after I introducing web animation are always used in some web loading effects and showing the feedback when people chick some button on the web pages, the guests suddenly realized they know it.

Two children of these guests show strong interest in web animation. One of them thinks the web animation could be interactive, just like playing a game. During the display time, he also try to play with the display web page. This action inspired me, web animation technology has such strong function to make an interactive animation not only an animation video, it is also one of the advantages of web animation technology. We can use this special system to make some interactive animation not only to be watched but also can be played with and controlled.

Because many of the guests in KMD forum are children's parents, the advice that they submit more focus on using web animation tool for children educa-

tion. Some guests said that they are willing to use the web animation tools to make some short, interesting animations like GIF which can be posted on their Twitter as well. One guest said he wants the web animation tools can be designed same as "scratch" to provide an environment for children to learn the program and be able to interact with other children. Most guests hope that the web animation tool can be able to use on the mobile platform like Tablet PC and so on.

Through collect and analyze informations from this test, then summarize the users pain-points as below:

- Need a tool to make interactive animation easily.
- Need a tool for children education
- Make some interesting content and share with others
- Mobile environment to use

In the next step, I will develop and fix the web animation tool more usable according to these test results.

5.4 Solving the usability problem

Below, UI prototype shows the new feature of WATON:

Because from the first user test can understand lacking of some UI interaction effects will make users feel confused about choosing the animation effects or click the buttons. Once the UI elements and interaction flow set, animation is considered for the information that are hard to understand for the novice users. According to the analysis, Transitions will take in to consideration to ensure the smooth switch of the UI elements. When a user clicks through the arrow on the button of the menu, information in the button and highlighting frame will be animated to the fits the context. When the user choose the button, the color will change into different, Switching movement of the highlighting frame is designed as well.

The interaction of animation effects button are more complicated, if the user just choose the effect but haven't edit the option to control the object on workspace, the animation effect button would change the color and show

the click movement effect. But when the user starts to edit the option and uses the animation effect to control the graphic object, the UI of this button will be faded to enable the user to understand that now I'm editing this effect. Also with the different actions operated on different objects, the little window in the right of the UI will change the function and play a role to show the user the different situation of each object. 5.6

Otherwise, in order to solve the problem about animation effects button is difficult to distinguish, I add a gray rectangle as a shadow to each button. I hope this can let users recognize each button better than before. 5.5



Figure 5.5: New UI

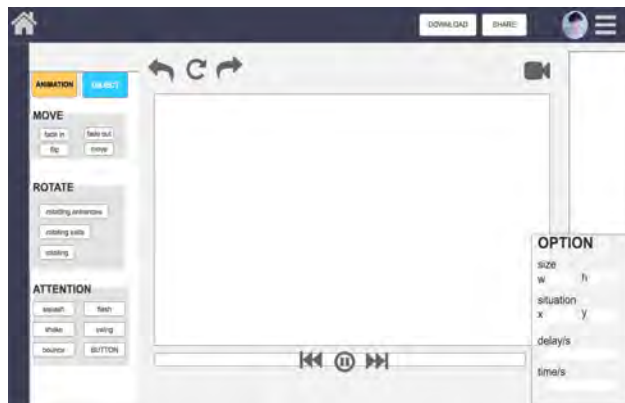


Figure 5.6: After click the animation effect button

As before design of WATON demo, When users open the web page and start a new project at first, they will see the empty workspace. As resulted in the

usability tests, the limitation of this user flow and UI design is that user may start with nothing to interact and they may be not able to upload the object in their computer to use the animation effect to edit. If them haven't put any object on the workspace, they couldn't understand the function of animation effect. Even adding a teaching video to lead them how to use the tool at the first time, because I already did that in the use test. finally, the method is setting a graphical example on the workspace to show and enable users to interact when they start to use WATON. Even users haven't set anything they also can try and understand the animation effects by interacting with the initial example. The example also can be delete. When users delete the example, a notice will appear and lead the user to recognize the object section enable them to upload their own project objects to operate.

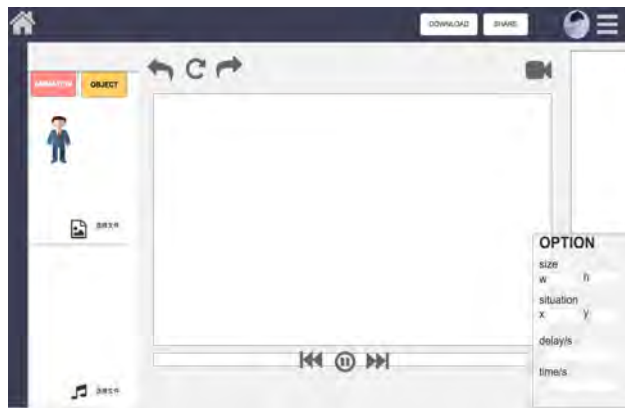


Figure 5.7: when upload the objects

As shown in the test, it is a significant usability issue that when users finish the animation setting but don't know how to play to see it. Majority of the participants try to click on the "play" icon under the workspace to see the effect, but ignore the true play button actually in the top of the workspace, the reason is the first design of the icon is too similar to the "refresh" button. Thus, in order to solve this problem and consider the user habits, I decide to change function of the former play button to a "refresh" button that allow user delete all the action and start to create a new project. Once the button is clicked, the Warning notice will appear and ask user if they agree to delete all the setting. The new "play" button will set under the workspace and add a "camera" button in the right top of workspace enable users to watch and check whole animation.



Figure 5.8: show the object on workspace

As the interview from user test two, can learn that this kind of web animation tool could be used in children workshop to help kids create a simple cartoon with their friends. Consider the target user, maybe it is new direction to change the UI style but I'm still not sure if it necessary to narrow the scope of the target users and change the function and the UI design just for kids. So this part still need test and discuss in the future work.

5.5 Summary of the user test

From user test can understand at least, WATON can be opened in different browser, and the web animation technique of HTML5 can be used to create 2D animation and this kind of animation can be play in the web page and as a web page itself directly don't need any plug-ins. This technique and the production are accept by users and help to solve the user pain-points. Also , as the back program to create WATON, we already provide a lot of code to web developers.

But there are still some problem we need to conquer in the future. One is a about using WATON to make animation, in this current situation, because of technology and finance limitation, we can't make a complete WATON for users to use. As well, we haven't design the mobile device version for users, so we can't know if it is real that web animation tool has ability to enable user to generate animation on their mobile device, and make the final goal

come true.

Except the result from test as above, from test also can learn something else.

The user test is a big scope project - I organize and conduct the user test, summarize the usability pain-points, produce UI, interaction and animation effects to solve the issues. During the user test, I found few important things need to be take in consideration when implementing the web animations tool:

When it comes to explaining complicated features, or showing hidden features which cannot be indicated clearly by static visual elements, using animation is a better solution than using long text-heavy user manual or any still image tutorials. Some transitions must be considered, such as subtle transitions and loading animations. The subtle transitions play an important role of keeping user in the flow by providing immediate and consistent feedback to user interactions. feedback animation let user feel that theyre in control of the system. There are many UI animation prototyping tools available in the market, such as Axure, Sketch, etc.

For this study, I have used both Axure, Sketch. Sketch were mainly used for producing UI transition prototypes. In practice, I found Sketch is a good tool for simple transition prototypes, but not the best option for complex animation prototyping. Axure are designed for prototyping in lots of different environments, so it is a viable tool that I could use.

For more complicated UI animations, After Effects is the tool I used to create quick prototypes. I produce a prototype as quickly as possible, then show it to my professor for further iterations. Actually, there is necessary to review the design and determine the different possibilities of the implementation before writing any actual code. If people work with an application and a team to maintain it, I would suggest having a set of standard transition descriptions for the ones that occur regularly in the interface, such as ease in, ease out, fade in, fade out, slide open, slide up, etc. Animation description documents the particular transition both in visual and programming way. It sets the standard for timing, speed and frames of the transition. Once the description has set, each description can be seen as an element of building up a more complicated animation. Applying consistent transitions throughout the application. Moreover, having the common terms which describe the certain transitions with defined time and speed helps the communication

between design and frontend development.

Test and test again. Testing is the best way to measure how well the new feature works. Test can be done via quantitative or qualitative method with users who fit into the product personas. Usability tests can be conducted with a small group of user in a cost-efficient way. Its beneficial to test out before the final design is completed. Test results directly show what could be improved further and what is clearly not working. When there are multiple options for production team to choose from, AB test is a good way to help make the decision. Either in the design process or after the design has been launched, testing is an essential part of the product development circle. But in this user test because the some limitation, I haven't enough chance to do lots of test even the AB test.

Chapter 6

Research summary and future work

6.1 Conclusion

This paper introduces the concept and the initial demo of web animation tool-WATON based on web browser like Firefox by using the HTML5 web animation technology. It is mainly emphasized on the theoretical part and the practical part to discuss the definition of 2D animation, the limitation of 2D animation making, and introduce a new technology of animation. Describe the web animation, Also through searching the function of HTML5 technology to discuss the feasibility of using web animation technique to make a tool for 2D animation making. After using and trying the existing computer animation tool and the web animation tool find the limitation of current situation of animation making.

In the practical part, based on the theoretical support, design the interface and the feature as well as the setting of the animation effect rules. The interface design was based on the real user experience of the computer software as a reference. Then from user tests can understand that users can't figure out the difference between the web animation and the computer 2D animation, even the frame of web animation isn't enough of 24fps, users still think it is interesting. Some of users think that the web animation tool can be used in children education, maybe in the future the tool can be used in kids animation making workshop. As well as, Based on the user test, amend some UI design to promote usability of the web animation tool.

From the research we can verify some assumptions which are mentioned in the concept chapter before.

WATON can be opened in different browser, and the web animation technique of HTML5 can be used to create 2D animation and this kind of animation can be play in the web page and as a web page itself directly, don't need other plug-ins.

This technique and the products are accepted by users and help to solve the user pain-points. Also, as the back program to create WATON, we already provide a lot of code to web developers.

6.2 Future work

But there are still some problems we need to conquer in the future. The first one is because of the original limitation of HTML5 technique, it hasn't been supported by all of browsers. Some functions couldn't be achieved in some old browsers because of the different standards. And, because of lacking uniform standards in different browsers we need to create several beta websites to explore the adaptability. The second problem is about using WATON to make animation, in this current situation, because of technology limitation, we can't make a complete WATON for users to test, so some of the advantage functions mentioned in this thesis can't be verified practically. Like, if this tool can be used by a lot of people in the same time and save the production files in real time. But these functions already have the technology and application supporting, therefore we can realize these functions in the future. Using web animation effects to control the motion of each object is simpler than drawing each frame to create animation, but considering the layout problem, this kind of animation tool still can't create very complicated animation or video. According to users' feedback, creating this kind of simple animation is fun for them. As well, I haven't designed the mobile device version for users in this search, the first step is to try to create a tool for PC browser, but HTML5 technique has utility advantages on mobile devices. In the future work it is important to create the mobile version to enable users to generate animations on their mobile devices, and make the animation making more convenient.

Because of the given space limitations, this paper didn't fully explore the programming of our web animation tool. Until the interface design and the background programming are not totally completed, it is still required a lot of user testing to make further modifications. We hope our web animation tool can help the beginners who are interested in animation making but haven't enough time and technological skills to use the computer animation software, for instance, children generate simple animations to do some animation workshop. Furthermore, we also hope the codes from WATON could be used as a dictionary to help developers package the same code into their own web design.

This study will keep focusing on the development of our WATON and design

the completed system which can generate more complex animations. Later, we will ask some front-end engineer to discuss how to finish the whole work of WATON, still need invite some users to try the tool and receive their feedbacks to make more updates. We also would like to develop a full animation by using our own tool to compare with the old one which is made by existing computer animation software like Adobe animate cc. We can use our web animation tool to generate some short animation video as a smart phone content like "Tateanime"¹a comic application in Japan which is provided on a mobile device. Besides, it is also necessary for us to upgrade user experience across multiple devices for the reason that the mobile devices are much popular now. Also, the limitation of our web animation tool and technologies for complex animation will be deeply researched in the future.

Notes

1 <https://www.tateanime.com/>

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Appendix

A Example Codes

```
<!DOCTYPE html>
<html>

<head>

  <meta charset="UTF-8">

  <title>shaking head demo</title>

  <link rel="stylesheet" href="css/style.css" media="screen" type="text/css" />

</head>

<body>

  <body>
  <div style="text-align:center;clear:both;">
<script src="/gg_bd_ad_720x90.js" type="text/javascript"></script>
<script src="/follow.js" type="text/javascript"></script>
</div>
  <div class="wrapper">
    <div class="border-circle" id="one"></div>
    <div class="border-circle" id="two"></div>
    <div class="background-circle">
      <div class="triangle-light"></div>
      <div class="body"></div>
      <span class="shirt-text">I</span>
      <span class="shirt-text"></span>
      <span class="shirt-text">C</span>
    </div>
  </div>
</body>
</html>
```

```

    <span class="shirt-text">S</span>
    <span class="shirt-text">S</span>
    <div class="triangle-dark"></div>
</div>
<div class="head">
  <div class="ear" id="left"></div>
  <div class="ear" id="right"></div>
  <div class="hair-main">
    <div class="sideburn" id="left"></div>
    <div class="sideburn" id="right"></div>
    <div class="hair-top"></div>
  </div>
  <div class="face">
    <div class="hair-bottom"></div>
    <div class="nose"></div>
    <div class="eye-shadow" id="left">
      <div class="eyebrow"></div>
      <div class="eye"></div>
    </div>
    <div class="eye-shadow" id="right">
      <div class="eyebrow"></div>
      <div class="eye"></div>
    </div>
    <div class="mouth"></div>
    <div class="shadow-wrapper">
      <div class="shadow"></div>
    </div>
  </div>
</div>
<span class="music-note" id="one">&#9835;</span>
<span class="music-note" id="two">&#9834;</span>
</div>
</body>
</html>
</body>
</html>

```

CSS style haven' provide, because It is too long to write in here.