

# Development Of Browser-based Web Animation Tool :WATON

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**Abstract** This paper describes a new Web Animation Tool : WATON based on Firefox to support people who want to create and use animation online in a browser environment. It makes an overview of the computer animation software and the recent development situation of web animation tools, based on this we develop the idea of WATON which is a new animation. The concept, the target user and the browser Firefox supporting to make web animation tool are also discussed here. Through analyzing the existing computer animation tools and making a conclusion of their features, comes up with WATON interface design. Especially our web animation tool mockup is introduced in detail. Besides, talk about The function and the compatibility performance setting, the structure and the basic set of animation rules, as well as the future development of our web animation tool are all described in this paper.

## 1. Introduction

In the past, there are thousands of computer graphics and animation software which have to be installed on users' own computers and were run from the desktop enable users to generate complex and exquisite animations. To create these animations a user typically is required familiarity with the software packages that are used to generate the ultimate animation. These packages truly require users should have a high level familiarity before they could easily generate animations. 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. Since the promotion of the modern web program and the fast spread of the cloud computing which allows end users to run computer programs online in a web browser. 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 [1,2]. Web animation tools come up with a new method that enables users to generate the animation conveniently. For example:

### (1) Animatron Studio [3]

Animatron Studio is an easy-to-use and powerful online animated video maker that allows creating stunning animations and videos with a simple drag-and-drop. Provide a plurality of graphical integers which a user can use to generate an animation. Animatron Studio also allows users to upload their own graphical elements to make a slide or digital album and lots of social media link to share their productions. However, too many objects uploaded would burden the browser.

### (2) HTML5 MAKER [4]

HTML5 MAKER only can be used to make a slide; simple user interfaces make it could be easily understood. Provide lots of web animation effects like easy-in/out, rotate out, etc. also show the codes of animation effects as a dictionary for web designers

### (3) Animista [5]

Animista is totally an independent web animation data store which enables users to play with collections of pre-made CSS animations.

By analyzing the existing web animation tools, we can find that currently online web animation tools enable users to make a slide, a digital album as well as using them to be a data storage of web animation. We believe that web animation technology could take more possibilities for our life.

This paper will introduce the design concept and demo of our web animation tool WATON detailedly and eventually discuss the practical value and the future development of WATON. Our final goal is developing a web animation tool which could make the beginner be able to use their own graphical and musical elements to generate a 1 or 2minutes animation video and post their own productions on SNS to enjoy the process of animation making.

## 2. Design concept

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 or the like 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.

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, a user using any of the desktop client devices can interface with the animation tool that resides centrally at the server. Firefox uses the Gecko engine 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

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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 Gecko's 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 [6].

In addition, about the web technology to create the animation effect, one of the tools is Flash which is a multimedia and software platform from Adobe mainly used for creating vector graphics, animation, games and rich Internet applications (RIAs). Flash Player is a plug-in for web browsers, which may slow down the loading speed of webpage and make some security problem. Animation on the web is in 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 and JavaScript engines, Html5 is the latest iteration of HTML, it has a new element and support for multimedia contents, like audio and video [7,8]. Users can manipulate elements programmatically using JavaScript to control and create animation. Because it does not require an additional plugin to be installed and can protect the web system reduce the security problem. It is a highly competitive area, developers can look forward to more optimization and improvements to come.

Even WATON was created mainly based on Firefox browser, using the JavaScript engine as the background supporting. If we hope our tool spread widely used by lots of people, we should pay more attention to consider the compatibility problem, in order to reduce the miserable situation happened.

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 [9].

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 [10]. 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 [11,12]. 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.

### 3. Design details of WATON

#### 3.1 The interface and the feature of existing computer production tools

Through actual test and the analysis of comparing the features of computer production tools, (from the describe table 3.1-1) we can understand the basis of production tools are constituted with three features for creating an animation. They are the basic workspace, toolbar and the timeline.

In order to shorten the lead-in learning time for users requires familiarity with the interface, we tend to simplify the traditional animation making function as the base and use the similar

	Clip studio	Fire alpaca	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 brushes 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

table 3.1-1

interface of computer production tools as our web animation tool interface.

### 3.2 The basic interface and features of our web animation tool

This part will introduce the mockup and the basic feature of our web animation tool interface in details. Figure3.2-1 and figure 3.2-2 are the webpages mockup of our animation tool.

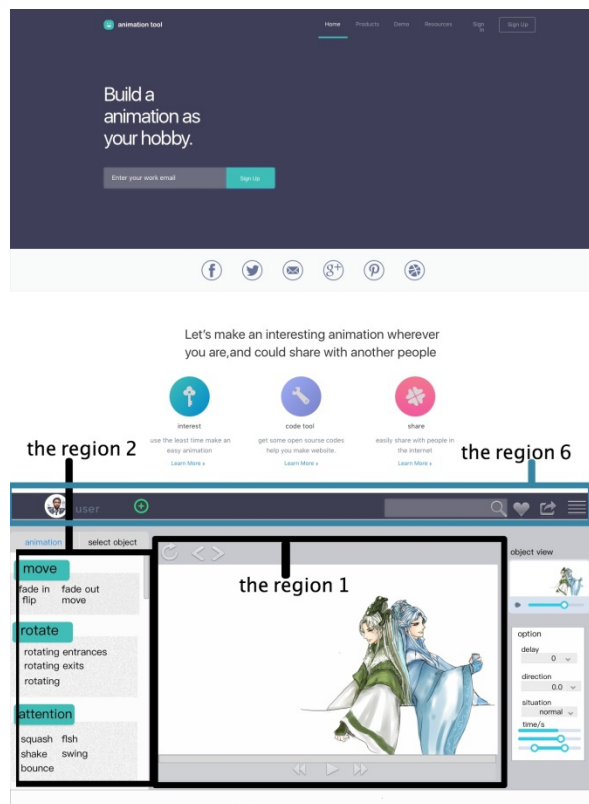


figure 3.2-1

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 workspace. 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 effect 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 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.

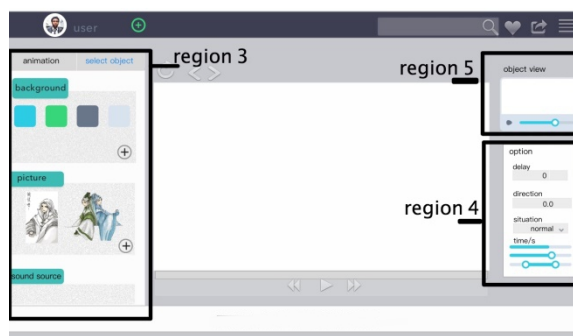


figure 3.2-2

#### 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 element 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 the 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.

Though checking the menu user can learn the JavaScript program of each animation effect and get the free copy codes.

### 3.3 The performance of WATON displays on different size of browsers

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 1366\*768px, 1920\*1080px, 1440\*900px, 1280\*800px and 1600\*900px are the current top5 desktop screen resolutions worldwide as recorded recently [13].

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.

According to table3.3-1 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 [14].

screen	viewable area (unit: px)							
	1	2	3	4	5	6	7	8
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

table3.3-1

According to the list, it could easily figure out that the widescreen 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 [15]. 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 website design and using a liquid layout that stretches to the current user's window size can solve this problem. 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 z the different viewports of handheld devices and smaller screens that people use [16,17].

The figure3.3-1 and 3.3-2 are different performances of WATON under 1366\*768px and 1024\*768px on Firefox. there

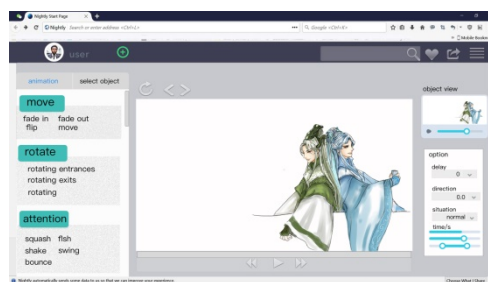


figure3.3-1

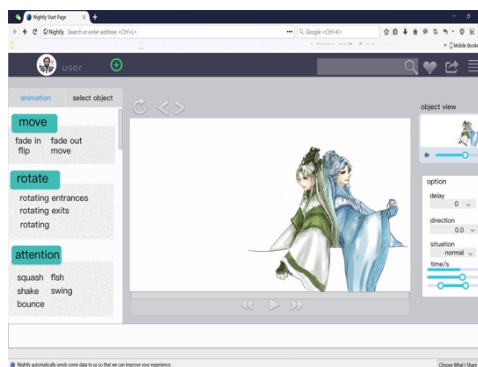


figure3.3-2

is some white space when the resolution is 1366\*768px.

1, When a user changes the width of the browser (like figure 3.3-3), 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 haven't hidden elements. So the user can see it without scrolling.

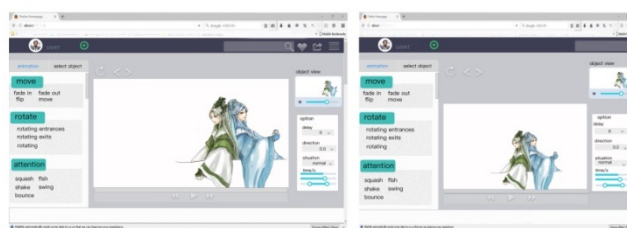


figure3.3-3

(compare with the full screen size between the width reduced)

2, Another situation is when a user changing the height of the browser (like figure3.3-4), 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, user need to scroll the scrolly 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 land2 as much as possible avoid to use scrollX in webpage.

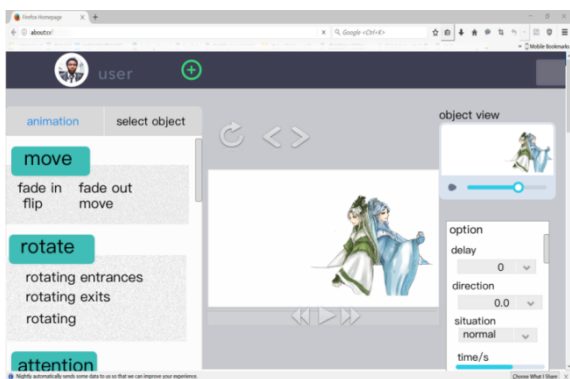


figure3-3-4

(reduce the height of the browser window, the button parts will be hidden)

This paper hasn't mentioned the resolution design on mobile device like tablet and smartphone, 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.

#### 4. Rule set for web Animation Tool

In order to let user can understand how to make a web animation quickly, we found 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 play tribute to how objects move in their real worlds. According to the The 12 Basic Principles of Animation from the "Illusion Of Life" by Frank Thomas & Ollie Johnston [18] and combine with the features of web animation effects, we selected 5 rules as our basic animation rules. But it is not the final setting of our web animation tool. In the future we need do a lot of user testing to improve and perfect the rules.

- 1, The move means the elements can do the most basic moving in the screen
- 2, Ease parameter that is the mathematical functions that define how fast or slow animation occur in different parts of animation's total duration. An easing type of "ease-out" is the converse of this: the animation starts 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, produce the stars, runs, and ends of an animation more variable.
- 3, Fade which 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.
- 4, Squash, flash, shake swing, bounce

These animation effect 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.

5, Rotate when an object is moving, it not always maintain a same orientation, with a rotation. This is especially true of the human figure and the action of animals. Rotation is used extensively in animation, since they create motion [19,20].

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

For example, like the figure4-1, move to right, fadeout, rotate, by using this kind of words at least user can realize what the action the object will move.

```
<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 4-1

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, 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 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 figure4-2 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 4-2



Refer to the time setting of our web animation tool, because the feature of JavaScript program, our web animation tool was used the time option instead of the traditional timeline to generate the animation which means providing the duration time and delay time option. 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(1/1000<sup>th</sup> 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.

By using this kind of JavaScript programming rule user can upload their own picture to our web browser and then can make an animation effect like the figure 4-3



figure 4-3

(this is a simple animation, the Sakura jump between the different two color flowers)

and if users have interests in learning JavaScript, we also provide the free codes to help them to do self-education.

## 5. Conclusion and future work

This paper introduces the concept and the initial demo of web animation tool-WATON based on Firefox by using the HTML5 and JavaScript. It is mainly emphasized on the interface and the feature as well as the setting of the animation effect rules. The interface design was based on the real using experience of the computer software as a reference. Because of the given space limitations, this paper didn't fully explore the programming of our web animation tool. Until now the interface design and the background programming are not totally completed, it is still required a lot of user testing to make further modification. We hope our web animation tool can help the beginners who are interested in animation making but don't have 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 JavaScript codes from the 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 users to try the tool and receive their feedbacks to make some 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 smartphone content like “Tateanime” [21] in japan. 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.

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