



Web Animation Techniques: User Engagement with Optimized Animations

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Abstract The animations help understand a concept intuitively without investing excessive effort. The web animations provide visitors with a more enhanced user experience. The numerous tools and modern technologies can help to add animations to websites effectively which means optimization and overall performance need not be compromised by taking significant steps. There exist certain problems like optimized outputs, compatibility with browsers, and accessibility for special users. These can be eradicated with careful consideration of necessary actions. A more effective addition of animations is possible with optimization methods like the usage of a group of animation APIs or file formats. The more dynamic animations can be created in that way. The use cases are available to understand the use of animations in the industry while taking into account the collective measures of optimized outcomes.

Keywords web animations, optimization, animation techniques, user experience, compatibility, accessibility

Introduction

The purpose of this writing is to address the effectiveness of web animations where the relation between the use of animations and user experience is first clarified. Afterwards, the tools and technologies are then discussed with their own benefits and implementation scenarios. Finally, the problems associated with the integration of animations are identified and addressed so that the developers can take necessary steps to avoid optimization and usability concerns. Overall, the target is to assist the designers and developers with useful ways to add animations to the websites.

Animation is the collection of images arranged sequentially in a slight progressive difference and these lead to create an overall illusion. This technique of visual appeal is not new but started back thousands of years ago. Specifically, the idea of web animation surrounds the motions in the web pages. This is being achieved with the help of Cascading Sheets, JavaScript, SVG, Canvas, and WebGL. Other tools like Adobe Animate, Maya, and Blender can also be used to create objects and then integrate them wherever needed in the web pages. However, each of these is associated with certain benefits based on which they become the choice for the web developers. The web animation journey started with GIFs and later with the introduction of Flash from Macromedia and the tools they later provided [1]. But now the world has evolved from these simplest animations to the complex ones where each visual can be animated and is possible to animate almost every feedback of the user. The different kinds of modern animations are, loading animations, scrolling animations, skeleton animations, navigation animations, storytelling, page motion, dynamic backgrounds, warning animations, hover animations, micro-interactions, and the list goes on. The visual feedback animations from these help the user to stay engaged in the system.

The website development art revolves around user satisfaction and can only be effective if a user can draw the required interest from the website and stay connected [2]. The objective of web animations is to increase user engagement and enhance the overall experience. It is also helpful to convey complex messages effectively and quickly without consuming extra resources. The animations also help the naïve user to navigate through the



website simply. It is therefore universal that the correct and bounded use of animations helps to create a positive impact on the target users.

Although a long list of animations is available to be used for web pages, there are some limitations due to which these cannot be added freely. The idea of integrating animations into the web is associated with complexities when it comes to practical implementations. The modern development procedures require the animations to be added in an optimized manner. Adding too many of these can lead to unwanted results like increased loading time, disintegrated display on non-targeted devices, and user distraction. The animation developer also needs to keep in mind that the integration should not divert the user's focus from an important section [3]. If not used appropriately, the animation can distract a user from useful information like a news article, an update, or a sale on a particular product.

Literature Review

The studies show the effectiveness of web animations in gaining the interest of the users and keeping them engaged. The usability of websites can be improved by properly using the animations. A complicated feature in the website can be demonstrated with the use of animations [4]. It will help the user understand easily without bombarding too much of the information.

The excessive use of animations in addition to decreased performance can lead to less visual appeal. It distracts the attention of the users and works against the idea of providing user experience. The objects of animations need to be organized properly with the appropriate usage of colors. Strong communication can only be possible if the animations are placed on the website by following the principles of animation [5].

The animations are effective only if used while considering significant factors like optimization for better user experience. The range of performance varies with the use of different tools and technologies. The performance of a website varies with the approach followed to add an animation [6]. The browser-implemented approach like GIFs takes less resources but is not always effective. The client-side programs implemented with technologies like JavaScript give more customized outputs to the users.

Web Animation Tools

CSS

Cascading Style Sheets provide the simplest way to implement animations. The components can be accessed with the Document Object Model and there is no explicit requirement of libraries when using CSS. The media queries and key frames assist in the animations can the user experience need not be compromised as these are lightweight compared to other technologies. However, CSS terms are associated with limitations and can only be used to create simple animations [7].

JavaScript

More complex animations that are difficult to handle in CSS are done with the help of JavaScript. It allows to movement of the elements of the Document Object Model with the use of libraries like anime, velocity, and ScrollMagic [8], [7].



Canvas

The 3D animations that are intensive can be created comfortably with the use of Canvas as it provides the space to draw objects. High-performance and more responsive animations can be created with the use of canvas with appealing visuals.

WebGL

Web Graphics Library is for sophisticated animations that are not possible to develop otherwise. Most of the websites incorporated with virtual reality are using WebGL to add crafted visuals to the website [9].

SVG

The vector graphics animations are efficiently handled with SVG. The animations created using Scalable Vector Graphics can produce sharp results as they focus on high pixels. It is appropriate in case there is a need for high pixelated results even if it's resized. The Synchronized Multimedia Integration Language (SMIL) can be employed to incorporate SVG animations [10].

Problems

There are certain issues that a developer has to handle like optimization of the page after adding animations, compatibility of animation with different browsers, and considering people with disabilities. So, appropriate technologies are needed to overcome these problems.

Optimization

The loading time of components and the smoothness of a website directly affect the user and therefore these concerns need to be addressed while adding animations to it. The excessive use of animations can lead to slow response and can destroy the user experience.

The solution to the presented problem is that developers need to use the simplest methods of animations with the limited use of it. The CSS animations are better for basic effects. So it needs to prefer them to other implementations. Similarly, using light JavaScript libraries and even APIs can also help. The lazy loading can be introduced to let the user wait creatively.

Compatibility

Not all browsers are compatible with every animation available and therefore the user experience is going to be ruined if an animation gets stuck in the browser under their use. This problem occurs when a developer has used a different browser and hasn't considered the outputs in the other browsers.

This can be avoided with the reset rules of CSS, cross-browser compatible libraries, and setting appropriate properties. Finally, testing the attached animations in different browsers can be helpful if carried out in the testing phase.

Accessibility

The modern world appreciates the systems with methods implemented for people with disabilities. It also helps in Search Engine Optimization when attributes are attached to the components. However, animations restrict this experience for special users.



This can be solved by removing the animations entirely or using them so that alternatives are present for disabled users. The animations should only be used where the information cannot be effectively included without making illusions.

Optimization Methods

The efficient use of web animations is required can be done with the use of APIs built for web animations and can help efficiently in the browser. Therefore, the optimization methods for web animations may include, APIs, file formats like Lottie, and CSS Houdini. More creative and eye-catching animations are possible with these technologies. These also make it possible to reduce the load and ultimately, the loading time of the web page. Also, reducing the number of animating elements will assist in reaching the goal of optimization.

CSS Houdini

More animations can be integrated with APIs as it restricts the load on the web page directly. The DOM elements can be animated with web animation APIs. This makes the synchronization possible with timing changes. It avoids the hesitation of developers to look at each frame and also reduces the load on the individual component [11].

The CSS Object Model (CSSOM) can be directly accessed through CSS Houdini which itself is a group of APIs that allows native implementation with the rendering engine of the browser. These low-level object-based APIs give access to the CSS engine with more intuitive implementations. The features in JavaScript can be added very quickly as compared to CSS. To avoid the problem of browser compatibility, CSS polyfill can be used. It is a part of JS code to provide support to browsers that are unable to support it. Its excessive use needs to be avoided due to its inefficient performance. Native CSS code is rather preferable if it's possible to get the work done with the help of that. The JavaScript Polyfill has complete access to the CSS Object Model and partial in the DOM. This can be understood in Figure 1 below which demonstrates the overall working of CSS Houdini.

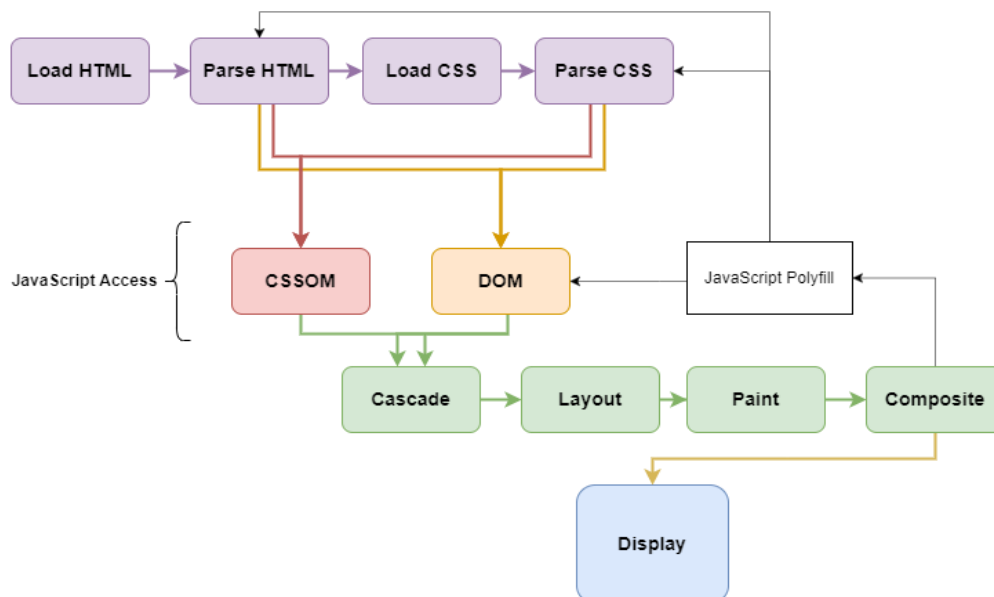


Figure 1: Demonstration of CSS Houdini



File Formats

The file formats of JSON like Lottie can help avoid the extra weight on the page. The Lottie animations are easy to implement as they can easily be transformed from the design team to the development team with their built-in functionalities. The file formats allow the developers to integrate small vector graphic animations effortlessly as if they are integrating static assets in the website.

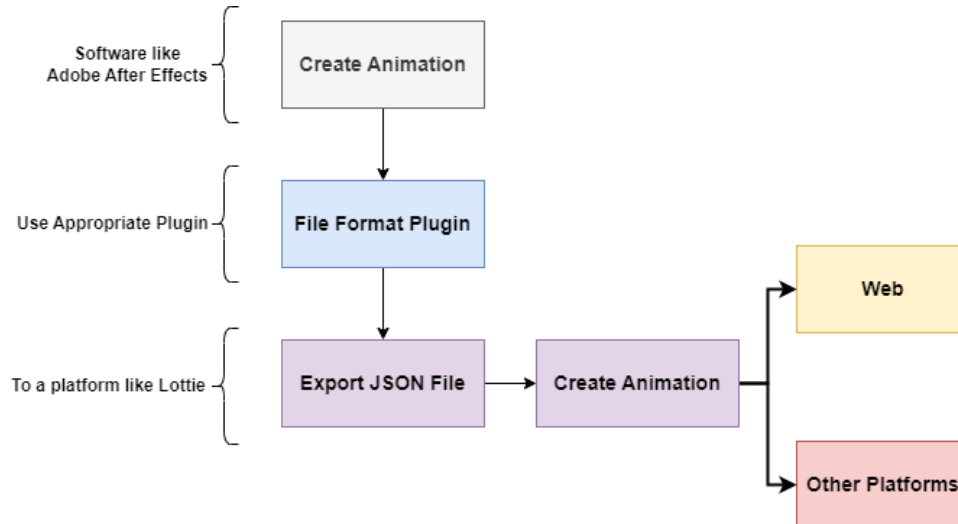


Figure 2: Workflow of File Format

Use Cases

Multiple industries are currently taking advantage of the availability of web animations as they give a short way of attracting users and enhancing user experience. The engagement of targeted users increases from data visualization in the user interface. One of the prominent examples can be Google's Data Visualization. The notable industries with advantages of web animations are:

- The product selling is easy when users can experience the product in a 3D environment. Specifically, an example can be the automobile industry where products can be displayed in a 3D space.
- The education sector withdraws a large part of incentives from web animations as teaching concepts with the help of web animations are intuitive and help the students to understand faster [12], [13].
- The entertainment industry uses animations to provide a feel of 3D space when a user visits their platform to search for any content.

There are other industries as well where the animations are creating impact on businesses with user engagement. The conversion rates increase when appropriate animations are used and thus business statistics become favorable.

Research Impact

The presented solutions in this article will allow the developers to use suitable methodologies for web animations to create impactful animations without losing the response time. The user experience can be enhanced with effective measures of optimization, compatibility, and accessibility. The use of state-of-the-art technologies can take the animations to the next level and allow user satisfaction.



Future Developments

The digital world has come a long way in progressive development and iteratively proceeding towards more optimized solutions to the given problems. In the future, web animations are going to be more optimized with modern technologies of the time. The evolution of machine learning is also directly connected with the sublimation of web animations as the algorithms in the future would allow the developers to build more personalized solutions. Therefore, personalized feedback animations would be possible with the use of these algorithms. The integration of Virtual Reality and Augmented Reality would also step up the experience of users with their effective usage without increasing the loading time of the platforms.

Conclusion

The web animations are helpful for user engagement, better user experience, and providing guided tutorials to the user. But these are accompanied by a few challenges for the developers. They need to consider the factors associated with the use of animations to get effective results. The methods for the optimized outcome without increasing the loading time are available for the developers and the solutions to the common problems have been addressed for them. The latest technologies including, APIs and CSS Houdini can assist the developers in avoiding unwanted consequences. Other than that, web animations are going to evolve in the future with the use of modern technologies like state-of-the-art machine learning algorithms.

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