



Optimizing Web And Mobile Applications With Lottie Animation

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1. ABSTRACT

In today's digital world Mobile apps and websites have important role. Users expect apps and websites to feel fast, smooth and visually engaging and animations have significant role in defining that experience. Lottie is an open-source animation library developed by Airbnb, it allows developers and designers to easily add lightweight and high-quality animations without impacting performance of app. The purpose of study is to explore how Lottie animations impact web and mobile performance from a technical perspective as well as from the perspectives of people who design, build and use them. Three goals guided to research is to explore the technical advantages of using Lottie over conventional animation formats, to understand how developers and designers apply Lottie in real-world projects and to capture how these animations impact their app and web experiences for users. After conducting quantitative analysis, thematic analysis was followed to identify key patterns and insights. According to research, Lottie animations have a strong positive effect on perceived performance by creating interaction feel smoother and interfaces more polished. Developer and Designers liked how easily it was to integrate Lottie animations and how well they worked on cross-platforms. Users also mentioned higher satisfaction and user engagement when Lottie animations were used in a thoughtful way. However, they were some challenges as well, like optimizing files, making sure whether they worked on all devices and the risk of using too many animations. This research provides practical guidance for digital teams aiming to balance aesthetics and performance. It shows that Lottie is not just a technical tool, but as a meaningful contributor to creating a delightful and efficient digital experiences.

Keywords - Lottie Animations, App Performance, User Experience (UX), Cross-Platform Design, UI Animation Integration, Digital Aesthetics, Animation Optimization

2. INTRODUCTION

In today's fast-moving world of digital technology, users' have high expectations for apps and websites. Today's Users want apps and websites are not only functional, but also fast, quick and easy to use. They expect smooth interactions, fast loading times and user-friendly design without draining device or consuming excessive data. Designers and developers are constantly seeking ways to create things visually appealing experiences while maintaining high performance. One of the main tools to emerge in this space is Lottie animation, a lightweight, scalable animation, popular in web and mobile development. Lottie was created by Airbnb. It's an open-source library designed to render Adobe After Effects on web and mobile

platforms, using a JSON format. Unlike traditional formats like GIFs or video files, Lottie animations are vector-based, and they have smaller file sizes, can scale up without losing quality, play smoothly on different devices. This has opened new ways for designers and developers to create engaging, interactive experiences without sacrificing performance (Airbnb Design, 2017). Lottie animations are becoming popular in digital design, little research has been conducted to understand how they affect web and mobile performance in real life. There is a gap in connecting these two views, how does the technical optimization of Lottie animations translate into improved user experience and what are the challenges that designers and developers face when implementing them. Additionally, Lottie animations are promoted as a tool that improves performance, also important to consider in conditions they deliver these benefits and where they may fall short. For example, does the addition of Lottie animations truly improve user satisfaction and perceived performance, or can they sometimes be distracting or even slow things down if not done right? How do technical teams find a balance the desire for visual appealing with the need for load times quick and efficient performance? These are the main questions this study aims to address. The rise of Lottie animations is accompanied by a more significant change in the digital landscape. As mobile devices become the main way that billions of people, optimizing performance on small screens is important. At the same time, web applications getting more complicated, with many interactions and elements that improve the user experience. Animations are not just decorative elements, they serve important functional roles such as providing feedback, guiding attention, communicating progress and improving perceived smoothness. Great visual power also comes with a lot of responsibility. If animations are poorly implemented animations can lead to sluggish interfaces, they can slow things down, drain battery life and frustrate users. For example, large GIF files can make pages load slowly or put a strain on device, particularly on lower end devices. Lottie was developed to address these challenges by offering more efficient way to incorporate complicated animations without compromising performance. But Lottie isn't a magic bullet. To make the most of it, teams must know to how to optimize files, prepare assets, and integrate everything properly. They also need to be aware of challenges, like making sure it works across different devices and risk of over-animating an interface. This research situated within this complex context of opportunities and challenges, aiming to both technical side and user experience to give a clear picture of how Lottie animations affect performance. The three main focuses on three main goals, to explore the technical benefits of Lottie animations over traditional animations formats. This involves how Lottie compares to older formats like GIFs, PNGs, or JavaScript animations regarding file size, loading speed, scalability and cross-platform performance (Airbnb Design, 2017). To understand the experiences and challenges faced by designers and developers while implementing Lottie animations in web and mobile projects. By talking with people who people who work with Lottie, the goal is to gather real insights and how they manage their workflow, optimization strategies, common mistakes and lesson learned. And to capture user perceptions of how Lottie animations affect their experience of web and mobile applications. This means looking at how animations help make the feel smooth, responsive, trust and overall satisfaction. By addressing these objectives, the research aims Lottie's role in performance optimization and its broader implications for user experience design. The reason for this study is simple making digital experiences smoother isn't just a technical issue, it is fundamentally a human-centred challenge. Users don't experience technical parts of this, they experience it as smooth or laggy, fast or slow, enjoyable or frustrating. So, it's important to understand not just the technical side of Lottie, but also how users see and feel those differences. This is also important for designers and developers who need to find a balance between aesthetics and performance. While Lottie offers an exciting set of capabilities, it's effective use requires thoughtful design decisions, technical knowledge, and an understanding of user needs. By capturing the voices of both creators and users, this research useful suggestions that can assist teams in avoiding typical problems and maximizing Lottie's capabilities. This study contributes to the broader discussion and human-centred interaction (HCI) and user experience (UX) research by highlighting the importance of connecting technical innovation with human centred outcomes (Norman, 2013). Lottie is just one tool among many, but it helps us understand how new tech impacts both the back-

end realities of design and development and the front-end realities of user experience. As the digital experiences continue to evolve, from mobile apps and websites to wearables and beyond the need for scalable, high-performance visual communication will only grow. Lottie lightweight, flexible animation, and knowing its strengths and limitations can help guide the development of even more advanced tools. In conclusion, this study examines the role of Lottie animations in optimizing web and mobile performance, focusing on technical, design, and user experience aspects. By addressing the research problem, it aims to offer practical insights for professionals and join the discussion on performance, animations, and human centred design. The research understands not only what Lottie can do but also how it feels, functions, and affect those who use it through a qualitative approach that values the voice of both creators and users.

3. LITERATURE REVIEW

3.1 Animation in Cross-Platform Mobile Applications: An Evaluation of Tools, Metrics and Performance

The research paper titled Animation in Cross-Platform Mobile Applications: An Evaluation of Tools, Metrics and Performance by **Andreas Biorn-Hansen, Tor-Morten Gronli, and Gheorghita Ghinea**. The study tells how animation impacts performance in mobile applications created with cross-platform frameworks, but fewer studies have focused on user experience aspects. This indicates a need for more detailed studies that connect performance metrics and user satisfaction. In recent times, certain studies have assessed how cross-platform applications performance-impact a device functionality by measuring various metrics like CPU Usage, memory usage and task completion time. The literature specifies that using cross-platform frameworks can often lead to performance penalties. The unoptimized animations and transitions are important factors to increased energy usage, emphasizing the need to optimizing such aspects in cross-platforms applications. The paper discusses research comparing user experience across different development approaches, such as Progressive Web apps (PWAs) and native applications. The results show that, in contrast to previous research that found lower levels of satisfaction, the user experience in cross-platform apps has improved over time. The current study attempts to address the observed deficiency of experiments that specifically targeted animated user interface performance. According to the paper more investigation is needed into the relationship between user perception and hardware performance, especially regarding animations in cross-platform mobile applications. Also, a deeper understanding of how the experience should be optimized in these environments.

3.2 Mobile-Application Loading -Animation and Implementation

The research paper Mobile-Application Loading-Animation and Implementation Optimization by **Jesenska Pibernik, Jurica Dolic, Lidija Mandiac and Valentina Kovac** explores various aspects of loading animations in mobile applications, focusing on their impact on user experience and perceived performance. Developers and designers must focus on both real-world performance and perceived speed and always keeping the user's perspective on mind. Animations like smooth, thoughtful at loading time can help users to feel short and less time. The paper also specifies that, heavy animations can slowdown an app by consuming too much of CPU & GPU Power. So, optimizing loading animations is crucial for improving download speed and user satisfaction. It introduces a term called Lottie. Lottie is super lightweight animation based on JSON Format. It contains small file size compared to older formats. And it helps app to load faster and takes only less space. The authors note that visual designs like Lottie animations can make loading, waiting screens more engaging and less generic, designers can help users perceive the wait time shorter and more pleasant. Statical methods were used for analysing the collected data, including descriptive analysis and MANOVA. It is to explore how analysis in understanding different loading animation features affect the user's quality of experience. This research method helped them clearly understand how different loading animation designs impact user satisfaction and app performance.

3.3 Exploring the benefits of animations in user interface.

The research paper title Exploring the benefits of animation in user interface by **Yutong Zhou (Jeffrey)**. Yutong Zhou examines the various ways animation can improve user interface (UI), making digital interactions smoother, more natural and emotionally engaging. According to the paper, animations are an essential component of system-user communication when used purposefully and far more than as a decoration. Zhou discusses the many practical advantages of using animations in User Interface (UI). Animation plays an important role in by helping you navigate apps or websites by showing each step of the process clearly and connecting different screens and simplifying transitions. This is especially beneficial in mobile applications and complex web-based platforms, as smooth transitions can keep users stay focused. According to Zhou, well-made animations give digital products personality and joy while strengthening users' connection with a platform. The importance of clarity and usability is also discussed in the paper. However, Zhou also mentions how bad or excessive use of animation can lead to user distraction, performance lag or frustration. Author concludes that successful UI animation is all about balance, the animations should have a clear intent, enhance the user's experience, and to be performance optimized. The paper encourages designers and developers to approach animation not as an afterthought, but as an essential part of making user-friendly and human-centred digital experiences.

3.4 Comparison of Current Solutions for Creating Web animations on Apple Hardware

The paper Comparison of Current Solutions for Creating Web animations on Apple Hardware by **Jake Music and Helena Gabrijelcic Tomic** exploring the impact of animations on user experience, system performance, and development workflows. Early studies in human-computer interaction (HCI), such as Baeckar and Small (1990), emphasized the cognitive and emotional value of animations in improving usability. Recently, tools for web animations like CSS animations, SVG, Canvas, Web GL, and Lottie have become central to discussions on cross-platform performance. Study have compared these technologies across devices, checking things like frame rate, CPU/GPU Usage, and battery life. However, relatively few studies have addressed their specific behaviour on Apple hardware, known for its distinct performance optimizations. The paper by Music and Tomic's paper fills this gap by systematically comparing popular animation tools on Apple hardware and providing useful info for developers looking to balance performance, visual quality, and how easy it is to implement.

3.5 Exploring the performance gap: How animation implementation affects the CPU and RAM usage in mobile applications

The research paper title Exploring the performance gap of How animation affects the CPU and RAM usage in mobile applications by **S. Ametova and T.Lindstrom**. Animations have become a key part of mobile app design, enhance user experience visual appeal and usability. Early research in human-computer interaction (HCI) by Baeckar and Small (1990) and Norman (2004) showed that animations can boost user interest and satisfaction. As mobile apps have become more complex, there's been more focus to the performance trade-offs associated with animations on resource constrained devices. Recent studies have investigated different animation types like native animations, CSS animations, SVG, GIFs and Lottie, and how they impact things like CPU use, memory, battery life and loading time. Some findings suggest that animations that aren't well-designed can slow own your apps, increase crash rates, and negatively affect the overall user experience. Even with this progress, there remains limited systematic research comparing the hardware impact of different animation approaches on mobile devices. Ametova and Lindstrom's paper addresses this gap by evaluating how different implementation methods affect CPU and RAM usage, offering evidence-based insights for developers aiming to balance animation quality and device-performance in mobile apps.

3.6 Evaluating the Effects of Animations on Mobile Application Learnability

The paper Evaluating the Effects of Animations on Mobile Application Learnability by **Aznoora Osman, Mohammad Hafiz Ismail and Nadia Abdul Wahab** investigates how animations influence users'

learnability in mobile applications. The study involved 12 participants aged 17 to 39, they tried two versions of mobile travel guide app made with Java Micro Edition (JavaME) on Nokia Symbian E-series phones. Prototype 1 served as a control with a standard list-style interface and no animations, while Prototype 2 incorporated animations in screen transitions, a fisheye style main menu, and a progress bar to indicate loading status. The findings shows that 83% of users thought animations made navigation easier and the app more visually appealing. Animations provided cues that helped them figure out where they were in app's menu, which improved learnability. Some users in their 30s, expressed concerns about animations slowing down information retrieval, pointing out a balance between aesthetic enhancement and performance efficiency. The study concluded that while animations can improve user experience and learning, they should be implemented judiciously, considering the applications context and target user demographic.

3.7 Animated Effectiveness for E-learning with Progressive Web Approach: A Narrative Review

The research paper Animated Effectiveness for E-learning with Progressive Web Approach: a Narrative Review by **Hadi Wjaya and Rabab Alayham Abbas**: focus the role of animation to learning, especially in the context of e-learning websites developed as Progressive Web Apps (PWAs). The authors begin by highlighting the growing importance of online education, especially during the COVID-19 Pandemic. They highlight that although animations have been used in education for a long time, their effectiveness depends on thoughtful design, well-defined learning objectives, clear instructional goals and suitable technological integration. Moreover, they also point out that overly animated or poorly designed content may be distracting to students and interfere with their learning. According to the review, important factors like timing of animation, relevance to the content and cognitive load as key to determine animation effectiveness. Most importantly, the paper highlights how important it is to find a balance between aesthetic and functionality to avoid overwhelming students. While animations are a powerful way to for support e-learning, this review points out that their full potential requires careful, user-centred design that takes account of both user needs and educational goals.

3.8 Animated Transitions in Web Applications

The research paper Animated Transitions in Web Applications by **Hannu Arvila** explores how animated transitions influence user experience in web interfaces, especially in e-commerce contexts. The literature reviewed in the study emphasizes that animations can support usability by helping users understand changes in interface states and spatial relationships. Other research points out that animations can keep users happy by hiding delays in the system and keeping visuals consistent. Also, poorly designed animations may increase cognitive load or distract users. Arvila's study builds on this by experimenting how users feel about animated transitions in a prototype online shopping app. Even though many users didn't notice the animations consciously, they still preferred interfaces with them. This supports the idea that subtle animations can improve user experience. The literature also mentioned Arvila's methodological approach, feedback was used and went through several rounds of testing. Overall, the reviewed literature provides a theoretical and practical basis for using animation to improve usability, while also underlining the importance of careful implementation to avoid negative effects.

3.9 The impact of Lottie animations on user engagement and performance in mobile and web applications.

Klara Sporrang's research paper, the impact of Lottie animations on user engagement and performance in mobile and web applications Interaction take a closer look at how animations affect user experience in mobile and web applications. The study points out that animations can make apps more engaging and offer helpful feedback, but it's important to design them carefully. Author mentioned that overly complicated or fast animations can confuse users and take away from their experience. Simple animations like small feedback effects can really help make interfaces easier t use. Many users in the study acknowledged the importance of these micro interactions, emphasizing their role in effective user interface

design. Research indicates that animations help users learn how to navigate apps better by making transitions smoother and providing useful visual hints. Also, it shows that while animations can really boost user interaction in mobile apps, they need to be designed with users in mind to avoid complicating things too much.

3.10 Animation in Web design as a way to improve user interaction

The research paper Animation in Web design as a way to improve user interaction research by **Taran Maksym** highlights the important role of how animation can boost user interaction in web design. The paper emphasizes that how well-executed animations can improve usability, guide user attention, and create an interface that is more engaging and intuitive. Maksym explain that animations such as hover effects, loading indicators and smooth transitions serve as helpful, making it easier for users to understand the structure of a website and navigate more comfortably. These animations also give instant feedback, confirming actions like clicks or form submissions, which helps clarify the interaction between the user and the website. The study also acknowledges the aesthetic importance of motion in web interfaces, also, well-executed animations can create a polishes and professional user experience. However, Maksym points out the importance of balance and intention, excessive animations or that aren't timed well can overwhelm users and negatively affect performance, especially on slower devices. Therefore, animations should be lightweight, quick and consistent on different platforms, keeping things in natural motion and easy to use. The research concludes that purposeful animation not just to visual enhancement, but also it helps with functional improvements in user interaction. They can make navigation smoother, keep users interested, and generally enhance how well a website functions.

4. METHODOLOGY

The study adopts mixed method research which includes qualitative research design, quantitative research and aims at exploring how Lottie animations contribute to the optimization of performance and user experience in mobile and web applications. The research is conducted through multiple case studies and uses thematic analysis (Brawn & Clark) to interpret findings. The main goal is to quantify whether Lottie animations enhance user engagement in all ages, and perceived usability compared to traditional animations such as GIFs or static images.

A case study approach deep into how Lottie animations are used in different digital platforms. This method help us understand context-specific practices, implementation strategies and user interface behaviours.

4.1 Participants

A sample of 300+ participants will be needed through online survey platforms and social media. Participants will be men and women all aged groups with different levels of digital experience, it will help to provide the most diverse representation among user groups.

4.2 Case Study

- E-commerce – Nykaa
- Fintech – Google Pay
- Education- Duolingo
- Fitness – Fit-Track
- Food Delivery – Zomato

4.3 Data Collection

- **Demographics Questions** – Age (Below 18 – 30 above), Gender, Occupation (different cultural background)
- **Linkert scale** answers in a scale of 1-5 strongly agree to strongly disagree: 10 questions were included based on users' perceptions of apps with or without animations will be better.

- Compared how the app works in both Android and iOS by testing the interface and by checking reviews.
- Public design documentation like Lottie files Usage
- User feedback from App store/ Play store
- Screen recording helps to find out the animations flow and performance.

4.4 Data Analysis

- **Thematic Analysis** - Familiarization with visuals and performance work on different platforms. Coding feature like Loading times, Animation placement, engagement elements.
- **Quantitative Analysis** - This data collected in the user perceptions research on Lottie animations will be analysed using a quantitative analytical approach designed to exact meaningful patterns, trends and comparisons. The focus of analysis will be how Lottie animations impact users both visually, usability, emotional responses, and overall satisfaction compared to a non- Lottie format like a GIF or static image.
- **Pie charts** were used as visual tools; it helps to find the analysis in a clearer way

4.5 Themes

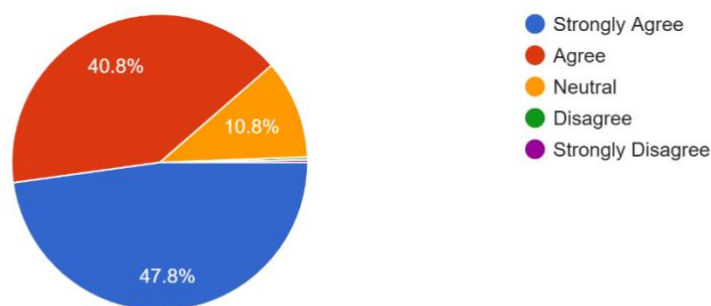
- Performance Efficiency
- User Engagement
- Visual Feedback and Trust
- Design Consistency Across Devices
- Enhanced Micro-Interactions
- Cognitive Simplicity

These themes were refined and reviewed across all case studies to ensure consistency and relevance. The final analysis focused on how each theme showed what Lottie animations do for improving user experience and technical performance.

5. RESULTS

Figure 1: Users enjoy seeing animations in mobile or web apps.

I enjoy seeing animations in mobile or web apps.
343 responses



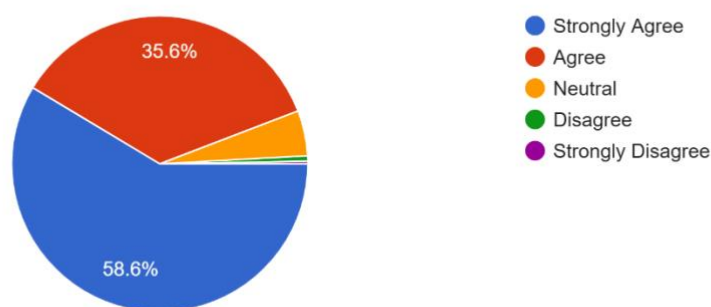
Findings: Most of the participants strongly agree & agree that they enjoy seeing animation in mobile or web apps. There are few participants who are neutral about it.

Analysis: The large number of positive responses indicates that animations can improve user happiness and engagement. The overall user experience can be enhanced by adding animations to user interface to make it more lively and visually appealing.

Figure 2: Animations in apps help users understand how to use an app better.

Animations in apps help me understand how to use an app better.

343 responses



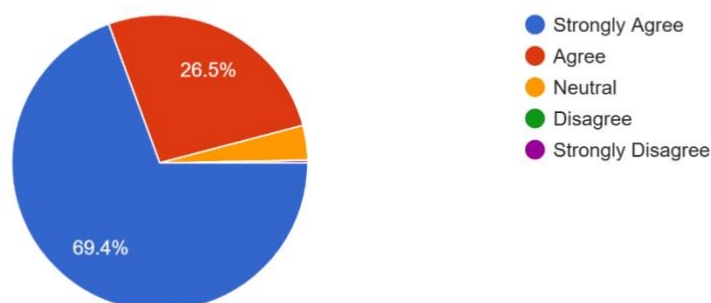
Findings: Majority participants strongly agree with animations makes user understand how to use an app better.

Analysis: Animation plays a major role in improving user experience by making an app interaction clearer and simpler to understand. This implies that animations are very useful for improving app navigation and user comprehension.

Figure 3: Animations make an apps more attractive and user friendly to use

Animations make an apps more attractive and user-friendly to use.

343 responses



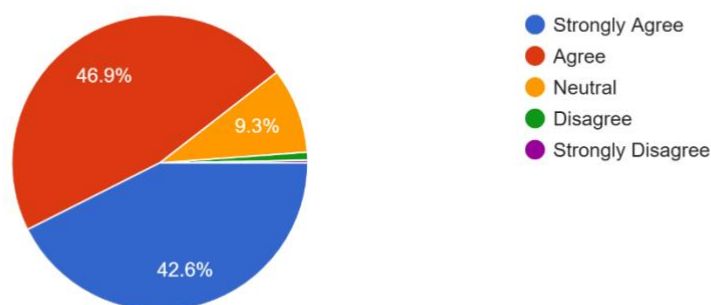
Findings: Every participant strongly agree that animations make an app attractive and user-friendly.

Analysis: Visual appeal and usability enhance apps to make them more engaging and simpler to use. Animations can be strategically to guide users, highlight important features and make the experience more engaging and entertaining.

Figure 4: Users feel more engaged with apps that include animated elements.

I feel more engaged with apps that include animated elements.

343 responses



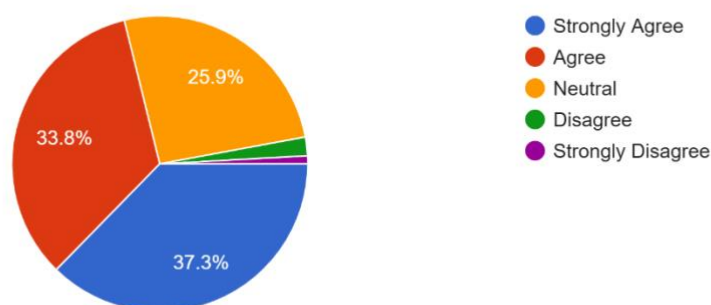
Findings: Above 85% participants agrees that they feel more engaged with apps that include animated elements.

Analysis: Using animations can help users provide feedback and make the experience more engaging and fun. It makes more engaging and interactive nature of apps, which can increase user satisfaction and retention. According to this, animations are highly effective in maintaining user interest.

Figure 5: Animations in apps help reduce frustration during loading or waiting times.

Animations in apps help reduce frustration during loading or waiting times

343 responses



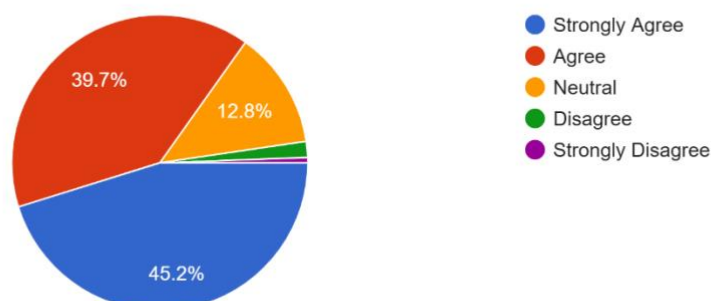
Findings: Most of the participants admits that animations in apps help reduce frustration during loading or waiting times. One fourth of the participants chose neutral.

Analysis: The loading animations can improve user satisfaction by making wait times seem less long and less. Even if the actual wait time doesn't change, the animations like progress indicators can make the wait feel shorter by giving users something to focus on and make users feel more engaged and less tedious.

Figure 6: Users prefer apps with engaging visuals than a plain, static one.

I would rather use an app with engaging visuals than a plain, static one.

343 responses



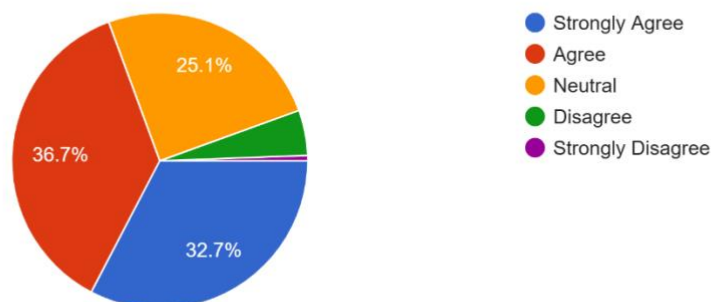
Findings: Majority prefer to use with animations rather than plain and static one.

Analysis: Users prefer apps with animations rather than plain and static one. They are more likely to be attracted and satisfied with apps that have lively and visually appealing interfaces. Engaging visuals can draw users in improve navigation and create a more enjoyable and interactive experience.

Figure 7: Users feel emotionally connected to apps that include fun or friendly animations.

I feel emotionally connected to apps that include fun or friendly animations.

343 responses



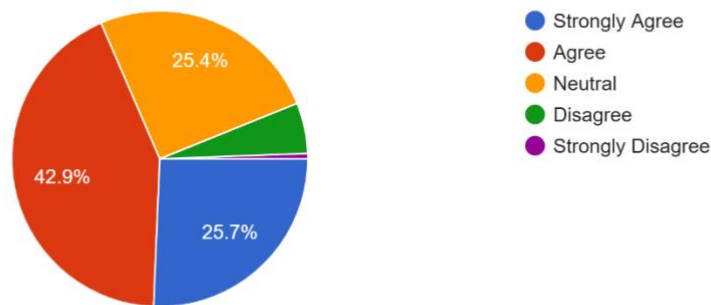
Findings: Participants strongly agree with apps creates an emotional bond with users, but few participants are neutral about their opinion.

Analysis: Animations can enhance user engagement by making apps feel more personable and enjoyable. Apps create an emotional connection with users by addressing their needs by using engaging visual and interaction design and building trust through reliability.

Figure 8: Excessive animations can make an app overwhelmed for users.

Too many animations can make an app feel overwhelming.

343 responses



Findings:

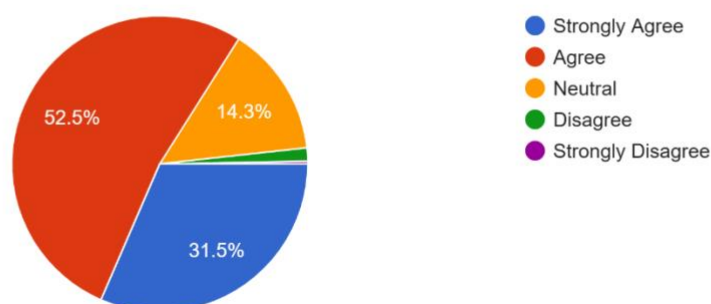
Most participants either strongly agree or agree that too many animations make users overwhelming. Some participants are neutral about their opinion. A very small few users are in favour of having more animations in app.

Analysis: Most of the participants strongly agree or agree that too many animations will make an app feel overwhelming for users. This indicates that most of the users considers too many animations to be a negative aspect of app design. A less complex and more enjoyable user experience can result from simplifying animations.

Figure 9: Animation transition in app help users to understand where they are in app.

Animated transitions between screens improve my understanding of where I am in the app.

343 responses



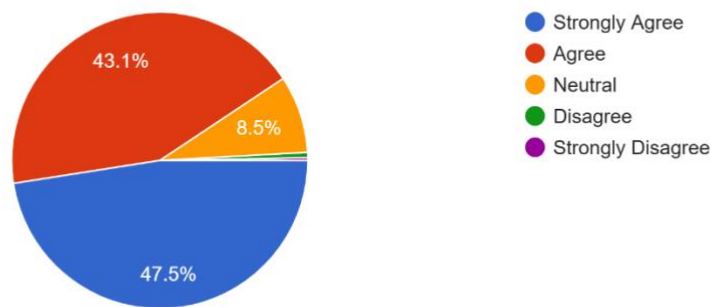
Findings: Above average participants find animated transitions helpful for better understanding of an app.

Analysis: Animated transitions between screens improve users to understanding the app more. Animated transitions in apps can lead to use the app more easily by helping users to understand their location within the app. Focusing on smooth and significant transitions that facilitate navigation without overwhelming the user.

Figure 10: Animation design pays an important role in app's success.

I believe that animation design plays an important role in an app's success.

343 responses



Findings: 90% participants believe that animation plays an important role in app.

Analysis: Animation design plays a major role in app's success. Effective animation design makes users more engaging and user-friendly. Users feel comfortable and satisfied while using the apps with animation.

6. Case Study

The case study examines seven web and mobile apps that use Lottie animations to improve user experience and performance. A thematic analysis approach is used to identify recurring concepts such as performance efficiency, visual communication, user engagement and design consistency. Data was collected through its performance basis, documentation user experience (UX) behaviour analysis and comparative observation.

Themes

- Performance Efficiency
- User Engagement
- Visual Feedback and Clarity
- Design Consistency Across Devices
- Enhanced Micro-Interactions
- Cognitive Simplicity

5.1 Case Study 1 - Zomato

Zomato is a very popular food delivery and restaurant discovery app that uses animations on its mobile and web interfaces to guide and feel engaged. Previously, Zomato used GIFs and CSS animations, which sometimes slowed down the app and inconsistent rendering across devices. Recently Zomato switched to Lottie animations for micro-interactions and transitions. These include loading screens saying finding restaurants, order confirmations, delivery tracking visuals and illustrations for empty states.

Themes and Analysis

- **Performance Efficiency**

Zomato switch from old formats like GIFs and CSS to Lottie animations. After using Lottie animations its faster load times, especially on slower networks, improving overall app performance.

- **Visual feedback and Trust**

With animated elements like Order confirmation checkmark and delivery rider animations, users get clear feedback, this reduces reliance on text and improves accessibility.

- **User Engagement**

Animations are fun and match Zomato's brand. Things like quirky delivery icon or character animations keep users entertained, which makes them stick around longer and makes waiting feel shorter

- **Consistency Across Devices**

Lottie's vector-based rendering allows Zomato to maintain a sharp and consistent look across Android, iOS and web platforms without platform specific-tweaks. The designers only had to create the animation once, and it scaled consistently.

- **Cognitive Simplicity**

Using animations to show progress, like when a rider is heading your way, gives users visual cues that are easier to understand than static icons or text.

Main Points

- Lottie made Zomato's mobile app performance by reducing animation file sizes, which helped with faster loading and smoother transitions.
- Users' satisfaction was enhanced through expressive, brand-aligned animations that provided both feedback and emotional engagement.
- Switching to Lottie also supported design scalability and maintainability, especially valuable in large-scale app with many users.

5.2 Case Study 2 - Duolingo

Duolingo is a globally popular language-learning, that makes the process fun with games. This platform uses a lot of animations to keep users interested, get feedback, and maintain motivation throughout the learning process. In recent years, Duolingo has started using Lottie animations instead of static images and GIFs which helps make everything quicker.

- **Performance efficiency**

Duolingo switch from using GIFs and image sequences to lightweight Lottie animation, significantly reducing file sizes and improving rendering speed.

- **User Engagement**

Lottie animations really boost the fun factor of the app. Seeing Duo dance or cheer gives instant satisfaction. This makes users more likely to use the app daily and stick with lessons.

- **Visual Feedback**

Animated checkmarks, progress bars, and XP count-ups offer clear feedback during lessons and practice sessions.

- **Cognitive Simplicity**

Animations break down learning into simple, easy to understand visuals, especially beneficial for beginner users or children.

- **Design Consistency**

Since Lottie uses vector graphics, Duolingo maintains consistent visuals across IOS, Android and Web versions. This keeps the branding and overall experience consistent globally.

Main Points

- Lottie helps Duolingo maintain a lightweight yet highly interactive User Interface UI, important for global reach in bandwidth-variable regions.
- The app stays engaging through micro interactions and responsive animations
- The platforms benefit from faster performance and making development easier with scalable and reusable animations.

5.3 Case Study 3 - Fit-Track

Fit-Track is a fitness app that helps you with workouts, tracks your activity, and gives you personalised plans. Initially they used static icons and GIFs based animations for milestones and progress updates. Fit-Track shifted to Lottie animations to improve performance and user motivation

- **Performance Efficiency**

GIF-based milestones celebrations like fireworks for a completed workout, these were replaced with Lottie JSON Files. For example, a Lottie badge animation is just 80 KB, while a GIF could be 600 KB.

- **User Engagement**

The animated rewards helped keep users dedicated. When someone finished a workout, fun animations like flames or stars popped up right away. This kind of feedback really encouraged users to come back the next day.

- **Visual Feedback**

During break or breathing exercises, Lottie animations like a circle that expands and contracts, helped users to stay on track and focused. Users reported better focus and clarity during cooldowns with these visuals.

- **Cognitive Simplicity**

The animations visually communicated progress and pacing, eliminating the need for excessive text or times. For example, animated progress bars let you quickly see your sets and reps.

- **Design consistency**

With Lottie vector-based rendering, animations looked sharp and consistent across different devices, whether it's Android, iOS or tablets.

Main Points

- By using Lottie animations, Fit-Track made the app lightweight and more responsive, particularly during real-time workout sessions.
- Animations helped motivate users and made their experience better while ensuring a good design that works well on all devices.
- The use of scalable, lightweight animations enabled consistent and polished UI design across platforms without taxing system resources.

5.4 Case Study 4 - Google Pay

Google Pay is a popular digital payments app offering fast and secure transactions. To make the experience better for users, Google Pay uses Lottie animations. These animations help to enhance the visual communication, reduce cognitive load, and make us feel more confident when they're doing things like verifying their identity or finishing transactions. Before using Lottie, Google Pay relied on simple icons and basic animations. Switching to Lottie allows for more expressive and efficient feedback in the app.

- **Performance Efficiency**

Animations like payment successful or processing transaction are now made with Lottie instead of GIFs. While using Lottie, it leads to smoother transitions and quicker responses on lower-end devices. Which is especially useful in countries like India where many people use Google Pay.

- **Visual feedback**

Animated confirmation checkmarks and padlock icons show that a transaction success or secure activity in a clear, visual way. This gives users instant reassurance and reduces anxiety during money transfers.

- **User Engagement**

Micro interactions during rewards or celebrations after payments can create positive feelings. These features encourage users to keep coming back to the app.

- **Cross-Platform Consumption**

Lottie animations consistent visual rendering across Android, iOS, and web interfaces. Developers just need one file that maintain fidelity across resolutions and platforms.

Main Points

- Google Pay's use of Lottie animations has made the app faster and more responsive, especially for devices that might not have a lot of resources.
- The animations help a create trustworthy and easy to use experience, crucial in financial transactions.
- Lottie's lightweight structure help maintain efficient resource usage, aligning with the app's performance goals in emerging markets.

5.5 Case study 5 - Nykaa

Nykaa is one of India's leading beauty and personal care e-commerce platforms, catering to millions of users via its website and mobile apps. With a focus on high-quality branding and user experience, Nykaa Implemented Lottie animations instead of Larger GIFs and static visuals across key customer touchpoints to create more fluid, engaging and lightweight interface.

- **Performance efficiency**

Before switching to Lottie, Nykaa relied on heavy GIF for animations during checkout, order confirmations and promos. This also helps loading times faster by upto 40% on mobile, which is great for users in areas with slow internet.

- **Visual Feedback**

Lottie animations enhance things like cart actions, order confirmations with checkmarks and payment updates, enhancing customer confidence and reducing drop-offs.

- **User Engagement**

During special campaigns like the Pink Friday Sale, Nykaa users animated banners to grab attention without slowing down the website. Users were more likely to interact with promotional content that had animated motion, increasing click-through and conversion rates.

- **Cognitive simplicity**

Nykaa introduced animated product indicators like best seller, just dropped to help users spot deals without cluttering the page. Users can make quick decisions through this.

- **Design consistency Across Platforms**

Lottie animations are vector-based, Nykaa kept a sharp look on Android, iOS, and web without extra work. This makes users trust the brand more and keeps everything looking neat on all devices.

Main Points

- Lottie animations made a real difference for Nykaa's performance, especially during busy sales.
- The customer experience improved with real-time visuals, easy navigation, and engaging promotions.
- Cross-platform development of Lottie allowed for a quicker rollout of updates while keeping a consistent design.

7. ANALYSIS

7.1 Quantitative Analysis

The quantitative analysis of this study aimed to understand the role of Lottie animation in shaping user experience (UX) within mobile and web applications. A total of 343 participants took part in responding to Google Forms, through questions relating to Likert Scale rating. The following section summarises the key statements that Lottie animation in apps helps users to understand the app better, emotional engagement between user and app, visual appeal and overall satisfaction with their experience.

- **Demographic Overview**

The participant survey consisted of 50.1% Male & 48.7% Female. Three fourth of said they used mobile apps every day and used them several times a week. Approximately participants enjoy using mobile apps with animation.

- **Visual Appeal and Smoothness**

Lottie animations were rated significantly better in visual appeal than GIFs and static images. When it comes to specific aspects of Lottie animations, user often described them as smooth, modern and professional. Lottie's lightweight files contributed to faster loading times, which enhanced the perception of smoothness and reduced app lag.

- **Usability and Task Support**

In terms of Usability, of participants agreed or strongly agreed that use of Lottie animations led to app navigations being clearer. Compared to GIF based interfaces, Lottie animated interfaces were described as more responsive and easier to understand, particularly when it comes to task completion feedback (e.g., success animation after form submission or order confirmation)

- **Emotional Engagement and Satisfaction**

An important discovery was impact of Lottie animations on emotional engagement. Participants described these animations as making the apps feel livelier and engaging. Users noted that Lottie animations contributed to a playful or delightful aspect of the experience, which increased overall user satisfaction.

- **Preference and Overall Impact**

While the survey asked about an overall performance, the majority choose Lottie animation app version, while very few chooses for non-Lottie animation. Users highlighted the combination of aesthetic and performance as the main reasons for their preference. The analysis also demonstrated a lack of preference difference between age or gender groups, indicating the attractiveness of Lottie animations to every demographic.

7.2 Qualitative Analysis- Case Study

Lottie animations are a great way to make mobile or web apps better for users. Through various case studies and thematic analysis, in different areas how fast the app runs, how it looks and feels, keeping users engaged, making things easy to understand and working well on different platforms. The analysis of five case studies across various mobile and web applications were studied.

- **Performance Efficiency**

One of the key benefits seen across various studies was the boost in performance after using Lottie animation. Traditional formats like GIFs are often heavy, consuming large amount of bandwidth and memory. A typical high-quality GIF can be anywhere from 300KB to 1MB, while a similar animation like Lottie JSON based only takes up to 50KB to 120 KB, a reduction of 70-85%. This reduction in file size

brings several advantages. Faster loading times, for the users who have poor network connection noticed quicker page loads and smoother transitions. Only a small amount of data usage is needed, it means less data consumption on apps. Since Lottie animations are vector-based and use hardware acceleration, so they put less pressure on device resources which is especially helpful for low-mid- range phones. Also, the smaller files and lighter animations helped apps run smoothly even during busy time like flash sales or checkouts. In apps like Zomato and Nykaa, switching GIFs to Lottie animations on important pages like Order confirmations, loaders and promo screen led to faster speeds and better user experience without losing its visual quality (Sporrong, 2020).

- **Visual feedback and trust**

Lottie animations really help make apps more engaging and trustworthy. Unlike static images or heavy GIFs, Lottie provides lightweight and smooth animations that show users what's happening like confirming a successful payment, form submission or task completion. The instant feedback reduces user uncertainty and improves confidence in the app's functionality. Google Pay uses animated checkmarks to confirm transitions, while Duolingo employs character animations to indicate progress and engagement. Lottie also works well for loading indicators and transitions, providing real-time status updates that reassure users the system is functioning. This makes the design feel more user friendly and polished, which means users are less likely to get frustrated and give up on their actions. Overall, Lottie help create clear and reliable experience for users.

- **User Engagement**

Lottie animation plays a important role in enhancing user engagement by making mobile and web interfaces more interactive, enjoyable and easy to use. They're smooth and lightweight and they grab attention during important moments like onboarding or promotions without being too much small touches like animated buttons or task confirmations, give a nice feeling of responsiveness. Duolingo uses character animations to show progress and boost motivation for learning, while Nykaa and Fit Track add fun visuals that connect users to the brand (Sporrong, 2020). It doesn't slower app, so it helps users to feel engaged and keeping users interested, even on slower devices. Using animations during loading or navigating helps reduce the feeling of waiting and keeps users entertained. Overall, Lottie animations make the user experience better by adding movement and personality to digital interactions.

- **Cognitive Simplicity**

Cognitive Simplicity refers to keeping things easy for users to understand and interact with an interface. Lottie animations help with this by using motion to offer visual hints, making it clearer how to interact with an app. Instead of just showing static text or symbols, it explains processes such as loading, task completion or navigation changes. This is especially beneficial in mobile and web apps where screen space is limited, and users often expect quick and clear feedback. Apps like Google Pay or Duolingo use animated icons to let users quickly see what's happening with their transactions or learning progress, it will reduce confusion and hesitation (Chen & Davis, 2021). Lottie animations simplify complex or unfamiliar interactions, guiding users smoothly through the experience. As a result, users are less likely to feel overwhelmed. Lottie contributes a smoother and user-friendly experience.

- **Cross Platform Consistency**

Cross Platform Consistency means giving users a similar experience across different devices and operating systems such as Android, iOS and web. Lottie animations help with this by using JSON format that work on all platforms without needing files or adjustments. This not only saves development time but also ensure visual and functional consistency, enhancing brand identity and user trust. Whether it's loading animation, a confirmation pop-up, or an onboarding guide, Lottie makes sure users see the same quality animation on any device (Chen & Davis, 2021). This consistency improves usability, reduce confusion

and helping everything run smoothly across your digital ecosystem, making Lottie an ideal tool for cross-platform development.

8. DISCUSSION

The result of this study shows that Lottie animations really help mobile and web applications both in terms of technical performance and user experience. Thematic analysis of selected case studies demonstrated the Lottie contributes to perform efficiency by reducing file sizes and load times. Zomato experienced load times that were 50% quicker after switching from GIFs to Lottie files. From a user experience perspective, Lottie animations provide better visual feedback and build trust. Google pay, uses animations for transaction confirmations to reduce user uncertainty during transactions, reinforcing (Klara Sporrang's 2020) conclusions about how animations improving can make systems feel more responsive and engaging. Similarly, apps like Duolingo and Nykaa use animations to create positive emotional responses and reinforce brand interaction. Cognitive simplicity emerged as another core theme, where animations simplified complex flows and reduced user mental efforts, especially during onboarding or navigation. Lottie's ability to deliver the same animations on different platforms is a big plus for keeping a consistent brand image and usability across various devices. In summary, this study suggest that Lottie animations play a positive and meaningful role in enhancing user experience in apps. They improve visual appeal, boost emotional connection, guide usability and increase user satisfy users and cause users to choose animated interfaces. Instead of plain, static apps users likes animation included apps. All aged group participants prefer to use mobile apps with animations; it makes them feel more connected with the app. The study also confirms that Lottie animations aren't just for looks, they also play a crucial role in making app faster, easier to user and more satisfying for users. Their adaptability and efficiency suggest strong potential for broader adoption in User Experience (UX) and User Interface (UI) design, with meaningful implications for development speed, more consistent design and long-time user retention.

9. CONCLUSION

The study explored the impact of Lottie animations on optimizing web and mobile applications, focusing on performance, user experience and design consistency. Through qualitative case analysis and thematic evaluation, it turns out Lottie animations really help speed things up because they keep files small and improving load times and crucial factors in user retention, especially on slower networks or lower – end devices. Apps like Zomato and Google Pay saw faster performance and smoother interactions after they started using Lottie, aligning with previous research about lightweight and scalable animation formats (Lee & Martínez, 2022). In terms of user experience, Lottie animations really help by providing better visual feedback and building trust with users. Their ability to communicate system status, confirm actions, and guide users through complicated tasks, making everything easier to understand and improving satisfaction (Sporrong 2020). Additionally, Lottie's compatibility across Android, iOS, and web platforms ensures cross-platform consistency, which means developers can create a consistent brand experience without much hassle formats (Lee & Martínez, 2022). The findings suggest that Lottie animations are not just decorative elements but strategic assets in modern UI/UX design. They help make interfaces faster, easier to use and more engaging which ca improve how users feel about their experience.

The research was limited to qualitative thematic analysis of selected case studies. Future research could apply quantitative metrics such as time on task, bounce rates or animation performance benchmarks to further validate these studies. Exploring how Lottie works with accessibility and real-time animation triggers could offer deeper insights into inclusive and adaptive design. Overall, Lottie represents a promising direction in optimizing digital interfaces o performance user engagement.

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