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TEMPORAL TYPOGRAPHY: THE IMPACT OF ANIMATION SPEED AND INTERPOLATION ON INFORMATION TRANSMISSION EFFICIENCY

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Abstract: *This study investigates the influence of kinetic typography on information transmission efficiency within motion graphics. The focus is on the impact of two variables: word count displayed per minute and typography interpolation method.*
Type in motion plays a crucial role in conveying information and attracting viewers in new media. The speed at which text elements traverse the screen potentially impacts information perception and understanding. Similarly, the chosen interpolation method, determining transitions between states, affects readability, aesthetics, and overall message delivery.
To explore this impact, a combined quantitative and qualitative research approach was employed. Young viewers participated in the study to assess comprehension and information retention. Participants viewed motion graphic animations designed to isolate the two factors under investigation. An optimal speed range was identified, enabling comprehension at a pace that maintains viewer engagement while facilitating information retention. Additionally, the study found that the interpolation method significantly affects information transmission. Specific interpolation techniques enhanced readability, while others hindered it.

Key words: kinetic typography, interpolation, short-form video

1. INTRODUCTION

The continuous evolution of technology, combined with the high rate of production and wide availability of information, has fundamentally altered the way the public consumes media. As digital platforms proliferate and access to content becomes increasingly ubiquitous, video media has emerged as one of the dominant forms of communication and entertainment. High-speed internet, mobile devices, and social media have collectively contributed to this shift, enabling audiences to consume video content anytime and anywhere. A particularly significant trend within this space is the rise of short-form video content. Characterized by its brevity and engaging format, short-form videos typically range from a few seconds to around 90 seconds in length. Platforms like TikTok, Instagram Reels, and YouTube Shorts have capitalized on the audience's preference for fast-paced, visually stimulating content, propelling short-form videos into mainstream popularity. This makes short-form video a powerful tool in industries ranging from marketing to education. However, this shift in video media consumption habits poses a certain set of challenges for video content creators and advertisers. Beside the change in length, the change in orientation and dynamic environment of viewing video content on smartphones require a different approach in creating content. Since there are many situations in which the videos are viewed without sound (Wang et al., 2020), the video feed is often accompanied by sequenced or animated text.
In the context of using kinetic typography for promotional messages, text presented over time in a manner intended to convey or evoke a particular idea or emotion, combined with directing attention makes kinetic typography especially suitable for this purpose (Lee et al., 2002). Animation in general has shown to have a positive impact on the effectiveness and information retention of the ad content (Li & Bukovac, 1999).Advertisers have quickly adapted to this shift. Although generally the short-form video platforms allow in-feed video ad length up to 60 seconds, the recommendations are to keep the length of the ads significantly shorter. In the research of impact of 6,15 and 30 second in-feed video ad lengths to attention, emotional response, memory and attitude, Wang et al. determined that the 15 second video ad length provides the best compromise (Wang et al., 2020).
Within the broader domain of video media, motion graphics, and more specifically kinetic typography, have gained prominence. Kinetic typography refers to the animation of text in a way that enhances the communication of messages by combining dynamic movement with visual design (Lee & Park, 2023). The integration of motion and typography creates a visual experience that transcends static text, helping to emphasize important information, and boost viewer engagement. It is used in various contexts, including marketing, entertainment, education, and digital media (Schnotz & Rasch, 2005). Motion qualities, such as smoothness, acceleration, and transitions play a crucial role in how kinetic typography is perceived. Abrupt

or disjointed movements can disrupt the viewer's experience, creating a sense of disconnection or cognitive overload. In contrast, fluid, well-timed motions can enhance readability and make the information easier to follow. Smooth transitions, achieved through techniques such as easing - gradually speeding up or slowing down the motion - help guide the viewer's eye across the screen and keep them engaged. All this is relevant to using kinetic typography in short-form video formats, where the speed and motion qualities of kinetic typography are critical factors that can influence how well the audience engages with the text. Finding the right balance is essential: text that moves too slowly might fail to maintain the viewer's interest (de Koning et al., 2011), while text that moves too quickly may overwhelm the viewer, affecting ability to comprehend and retain the presented information(Hasler et al., 2007). However, limited research has shown that high animation speeds in advertising can result in heightened viewer arousal (Sundar & Kalyanaraman, 2004), suggesting that faster-paced kinetic typography may grab attention more effectively. The objective of this study is to explore how different motion qualities—specifically text speed and keyframe interpolation—affect viewer engagement and content retention in kinetic typography, particularly within the fast-paced context of short-form video formats. By analysing the impact of both predefined and custom interpolation techniques, this research aims to provide insights into optimizing motion design for promotional media, where capturing attention and conveying information effectively in a limited time is crucial.

2. THEORETICAL BACKGROUND

Creating comprehensive motion graphics involves a combination of design principles, animation techniques, and the technical characteristics of the format for which the motion graphics are being developed. By taking these factors into account, motion graphics designers can optimise the effectiveness of information transmission, ensuring that the target audience comprehends the intended message. Some of the key elements for information transmission in motion graphics are:

a. Clear and concise messages: Animated graphics should prioritise clarity and brevity to ensure that the audience easily understands the information. This entails using succinct language, eliminating superfluous details, and structuring content in a logical and coherent manner.
b. Legible typography: Typography in motion graphics refers to the use of text and letterforms as design elements. It encompasses the selection of appropriate fonts, sizes, styles, and other typographic properties to effectively convey messages. Ensuring sufficient contrast between typography and background is also vital for enhancing legibility. While motion can amplify the expressive aspect of type, maintaining legibility and readability ensures its functional aspect (Bachfischer et al., 2006). Establishing a clear visual hierarchy directs the viewer's focus and aids in the immediate comprehension of the most important information. This can be achieved through variations in typography, colour, size, and placement of visual elements, thereby emphasising key points and ensuring a logical flow of information.
c. Animation: Animation techniques bring static elements to life, creating motion and visual interest. These techniques include determining keyframes, easing, timing, and sequencing to create smooth transitions, dynamic effects, and engaging visual narratives. By carefully controlling these temporal elements, designers can introduce subtle variations that infuse the motion with personality (Lasseter, 1987), making the animation not only visually appealing but also more engaging on an emotional level.
d. Timing and pacing: Timing and pacing are pivotal in motion graphics. The duration and rhythm of visual elements, transitions, and effects influence the viewer's perception, comprehension, and emotional response to animated content. Viewers should be provided with sufficient time to process information without being overwhelmed or losing focus. In the contemporary context, particular attention is given to the duration and pacing of motion graphics for several reasons. The primary limiting factors are the formats for which the motion graphics are produced. Different formats, media, or applications through which motion graphics are displayed impose specific temporal constraints on content duration. For instance, motion graphics displayed on Instagram as a profile story are limited to a duration of 15 seconds.
e. Interpolations: Interpolation is a fundamental technique in motion graphics that determines the transition between two states of an animated element, such as movement, size, colour, or opacity. It involves calculating and filling in unknown data between two known values. In animation, these values are most referred to as keyframes or key states.

The concept of controlling motion in computer software by manipulating speed curves has been present for a long time (Bartels & Hardtke, 198 C.E.). Keyframe-based motion graphic software tools, such as Adobe After Effects, Blender, and other animation software, rely on different types of keyframe interpolation to control how objects move between keyframes. These tools offer various interpolation methods, ranging from simple, predefined transitions to highly customizable curves that provide designers with precise control over motion. Each type of interpolation affects the fluidity, pacing, and realism of the animation, and understanding these options is crucial for optimizing kinetic typography and motion design.

1. Linear Interpolation: Linear interpolation maintains a constant speed between keyframes, resulting in uniform motion that can feel mechanical or rigid. While straightforward, it often lacks the natural flow required for engaging animations.
2. Easing Interpolations: Motion graphics tools provide predefined easing interpolations, such as ease-in, ease-out, and easy ease, to create smoother, more natural transitions between keyframes. These are simplified, preset versions of Bézier curves, designed to make motion feel more fluid by introducing gradual acceleration or deceleration. Ease-In slows at the beginning of the motion and accelerates toward the end. Ease-Out starts quickly and decelerates toward the end, providing a smoother stop. Easy Ease combines ease-in and ease-out, creating both a slow start and stop, offering a more natural motion effect.
3. Bézier Interpolation: For designers seeking full control, Bézier interpolation allows manual adjustment of the motion curve. By manipulating the Bézier handles, designers can gradually tune the acceleration, deceleration, and motion trajectory, creating more complex and dynamic animations. This type of interpolation is suitable for tailoring motion to specific creative needs.
4. Hold Interpolation: Hold interpolation offers no transition between keyframes, resulting in abrupt changes in motion or position. This method is often used for stylistic effects where immediate shifts are desired.

Predefined easing interpolations provide users with an easy way of achieving more natural motion compared to simple linear interpolations. In programming environments, these easing functions are often based on the notable work of Robert Penner, who formulated a set of mathematical easing equations (Penner, 2002). However, in keyframe-based animation production software, easing interpolations are usually implemented using Bézier curves, providing a limited number of presets. While these predefined options provide an easy way to create the impression of more natural movement compared to linear interpolation (Krasner, 2013), they may not always suit specific animation needs, especially when unique timing or pacing is required. Custom easing allows animators to have finer control over the speed curves, enabling them to create more fitting and dynamic motion.

3. METHODS

The study was conducted in two phases. The first phase focused on evaluating participants' retention of content and their preferences regarding different text sequence speeds in a kinetic typography motion graphic. The second phase involved a comparative analysis of motion graphics using predefined interpolation curves for easing versus custom speed curves applied to the animation. All participants in this study were aged between 18 and 30 years old, as this demographic represents the primary users of digital platforms where short-form video and motion graphics are most consumed (The State of Video for Tech 2024).

For the text presentation speed evaluation, a multivariate experimental design was employed to assess the effects of varying text speeds on content retention. A total of 60 participants took part in this evaluation. Participants were randomly assigned to one of four experimental groups, with each group viewing a kinetic typography video where the text was presented at one of four distinct speeds: 40, 60, 90, or 120 words per minute (Table 1). The stimuli were created using After Effects and consisted of a simple text sequence containing information about a design studio and its work. Given that animated motion graphics content is designed to not contain sentences or longer text paragraphs, the typography had to have a prominent and visually attractive appearance. According to all factors, the sans serif display fonts Now and sans serif fonts Helvetica were selected. Each word was presented individually on the screen, with every word having the same duration within the test sequence. Following the viewing, participants were administered a questionnaire designed to measure how effectively they retained the information conveyed during the video. The questionnaire comprised 9 questions that required participants to recall specific information from the text presented in the motion graphics. The answers to the questions were simple and more

complex from one term to a whole sentence that the respondents were asked to recall. Also, the questions asked the participants to memorize two types of data, words and numbers.

Table 1: Stimuli specifications and links to videos

animation	Words/min	Words altered every	format	Link to video
S40WPM	40	45 frames	30 frames/sec	https://youtu.be/0xGiwqwdQ4
S60WPM	60	30 frames	30 frames/sec	https://youtu.be/pK0rzEyFft0
S90WPM	90	20 frames	30 frames/sec	https://youtu.be/lRGGixLHQTQ
S120WPM	120	15 frames	30 frames/sec	https://youtu.be/fRiLajzXEH8

A separate evaluation was conducted to assess the subjective attractiveness of the four different speeds. A total of 40 participants viewed each of the four test samples and rated the attractiveness of each on a Likert scale from 1 (not attractive) to 5 (very attractive). The order in which the samples were viewed was randomized to minimize potential bias.

The second phase of the research was to investigate the influence of keyframe interpolation on the retention and subjective preferences. Tested were two samples with different approach to keyframe interpolation. Both kinetic typography motion graphics featured the same elements, general motion paths, number of scenes and transitions and the overall duration which was 18 seconds. However, in the first sample (I1) all movements and transitions were done by applying simple easing interpolations (easy ease in, easy ease out, easy ease). The movement of elements and transitions for the second sample (I2) were done by applying more elaborate Bézier curves for interpolations. The stimuli were created in Adobe After Effects. The topic of the text was promotional information about a concert.

For the retention test, a multivariate experimental design was employed. A total of 40 participants were randomly assigned to one of the two experimental groups. After viewing the assigned sample, the viewers had to answer 5 questions to test retention of the content presented through the kinetic typography.

4. RESULTS AND DISCUSSION

For the retention test across different sequence speeds, descriptive statistics, including the number and average of correct answers per participant group, were calculated. A Chi-square test was conducted to assess the association between video speed and response accuracy, determining whether significant differences in comprehension levels existed between different presentation speeds (Table 2).

Table 2: Answer counts per question for different sequence speeds

Video speed	Response Type	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	TOTAL
S40WPM	Correct	14	4	9	9	5	2	8	4	1	**56**
S40WPM	Partially Correct	0	5	0	0	0	4	0	2	1	**12**
S40WPM	Incorrect	1	6	6	6	10	9	7	9	13	**67**
S60WPM	Correct	13	7	10	10	4	2	11	4	0	**61**
S60WPM	Partially Correct	0	2	0	0	0	0	0	0	0	**2**
S60WPM	Incorrect	2	6	5	5	11	13	4	11	15	**72**
S90WPM	Correct	13	7	9	9	4	3	9	6	1	**61**
S90WPM	Partially Correct	0	3	0	0	0	0	0	2	2	**7**
S90WPM	Incorrect	2	5	5	6	11	12	6	7	13	**67**
S120WPM	Correct	12	4	8	8	4	2	6	5	0	**49**
S120WPM	Partially Correct	0	2	0	0	0	3	0	1	0	**6**
S120WPM	Incorrect	3	9	7	7	11	10	9	9	15	**80**

Regardless of sequence speed (Figure 1), most respondents correctly answered basic information questions, but struggled with harder ones (e.g., recalling the last three words in Q9). Performance across groups was comparable, with 120 WPM yielding the fewest correct answers, though the difference was not statistically significant ($p = 0{,}095$).

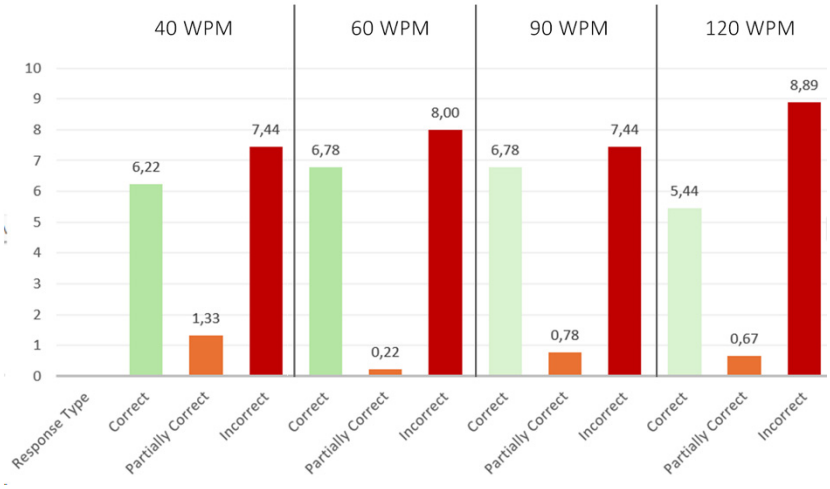

Figure 1: Average number of correct, partially correct, and incorrect answers per sequence speed

For subjective evaluations results (Figure 2), a Kruskal-Wallis test, followed by Mann-Whitney post-hoc analysis, showed a significant preference for faster sequence speeds, with 90 WPM rated most attractive. Significant differences ($p \leq 0{,}001$) were found between all pairs, except 60WPM -120WPM and 90WPM -120WPM.

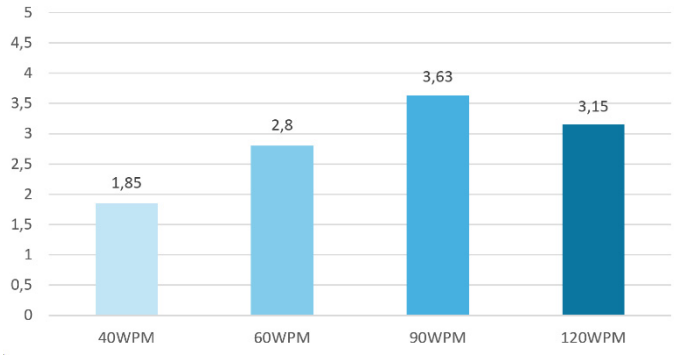

Figure 2: Average attractiveness scores for the sequence speed test samples

For the information retention evaluation related to different keyframe interpolations (Table 3), we employed the same statistical analysis as with the sequence speed test. The results showed comparable or improved retention across all questions, suggesting that the qualities of movement shaped by complex keyframe interpolations influence recall in viewers (Figure 3). The results were statistically significant ($p \leq 0.05$).

Table 3: Answer counts per question for different interpolation types

Sample	Response Type	Q1	Q2	Q3	Q4	Q5	TOTAL
I1	Correct	8	8	10	18	11	55
I1	Incorrect	12	12	10	2	9	45
I2	Correct	16	14	14	20	11	75
I2	Incorrect	4	6	6	0	9	25

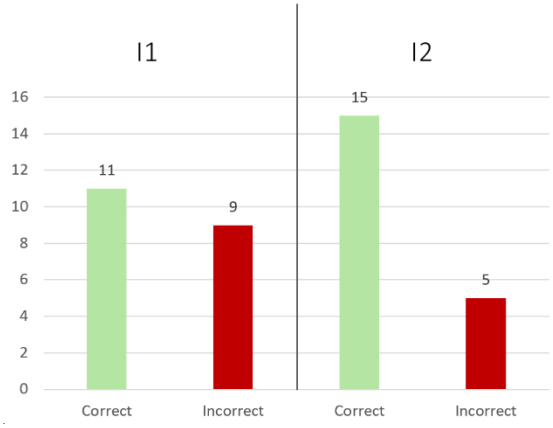

Figure 3: Average number of correct, and incorrect answers per sequence speed

5. CONCLUSION

Kinetic typography is one of the tools that content creators and advertisers can use to gather attention and effectively convey information in the era of short-format videos. However, crafting a quality kinetic typography is a complex endeavour and the designer should consider multiple factors that can have significant impact on the product. Speed and movement qualities are amongst those factors. While the results of our research don't feature statistically significant differences for the retention of information of the tested sequence speed, there is a clear subjective preference towards the faster sequence speeds, with 90 words per minute being scored as the most attractive one.

As for the keyframe interpolation, although predefined easing curves are readily available for use in keyframe-based animation software, the results show better information retention if more elaborate Bézier curves are used for keyframe interpolation. Such a result coincides with the practices and rules of movement in animation. It is more difficult for the human eye to understand simpler forms of interpolated movement because such movements are rarely encountered in nature. In addition, for simple forms of interpolation, sometimes it takes longer time for the change to fully occur, which disrupts the flow of the plot. To successfully animate changes in motion graphics, more complex interpolation methods give much more control in modifying the amount of change in a particular property in each time interval. Although such interpolations may seem quick and too complex, they effectively give the viewer more time to see the content moving in the time interval that is set for each change.

This study has limitations. The participants were exclusively between 18 and 30 years old, which may not fully reflect the preferences and retention patterns of other age groups. Additionally, a simple text sequence as stimuli may not capture the complexity of real-world kinetic typography applications, limiting the scope of the findings. Future research could broaden the participant demographic and explore the impact of keyframe interpolation on other types of video content, as this study primarily focused on promotional messages.

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