

The Effect of Combining 2D and 3D Moving Particles on Hybrid Motion Graphics

Yazan Ibrahim Alamarat ^{1*} , Hussein Mohammad Al-Omari ² 

¹Animation and Multimedia Department, Faculty of Architecture and Design, University of Petra, Amman, Jordan.

²Graphic Design Department, Faculty of Architecture and Design, Middle East University, Amman, Jordan.

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* Corresponding author:

yazan.alarat@uop.edu.jo

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Abstract

Objectives: This study aimed to evaluate the level of complexity involved in integrating 2D and 3D techniques and evaluating the utility of this approach for designers in generating innovative motion designs. It also aims to examine the design methodology employed in the creation of 2D and 3D motion graphics.

Methods: The study used the descriptive- analytical approach. It also used the quantitative approach based on understanding the effect of combining 2D and 3D moving particles in designing new and innovative designs and determining the relevant terminology and concepts to create 2D and 3D moving graphics. A questionnaire was also distributed to 200 professional and specialized motion graphic designers to test the possibility of combining contemporary designs together.

Results: The study's quantitative results showed a positive and significant reality for employing the combination of the 2D and 3D elements in motion graphics with a high likelihood of implementation by the designer. The study results also showed a high average in producing cutting-edge styles via combining 2D and 3D elements in motion graphics.

Conclusion: The study highlights the importance of conducting an accurate evaluation of the various variables to achieve the best results during the process of designing hybrid motion graphics which combine 2D and 3D particles. The study also states that the success of the combination process depends on the effectiveness of the visual style of the hybrid graphic designs and the effects, structure and motion in creating integrated images that effectively transmit the emotional story behind those designs.

Keywords: Motion Graphic; 2D design; 3D Design; Hybrid motion graphics; Graphic design.

أثر المزج بين الجزيئات ثنائية وثلاثية الأبعاد على التصميمات المتحركة الهجينة

يزن إبراهيم العمرات ^{1*}، حسين محمد العمري ²

¹ قسم التحريك والوسائط المتعددة، كلية العمارة والتصميم، جامعة البترا، عمان، الأردن.

² قسم التصميم الجرافيكي، كلية العمارة والتصميم، جامعة الشرق الأوسط، عمان، الأردن.

ملخص

الأهداف: تهدف هذه الدراسة إلى تقييم مستوى التعقيد الذي ينطوي عليه دمج التقنيات ثنائية وثلاثية الأبعاد وتقييم فائدة هذا النهج للمصممين في إنشاء تصميمات متحركة مبتكرة، كما تهدف أيضاً إلى فحص منهجية التصميم المستخدمة في إنشاء الرسومات المتحركة ثنائية وثلاثية الأبعاد.

المنهجية: اعتمدت الدراسة المنهج الوصفي التحليلي، من خلال الدراسة الكمية التي تعتمد على فهم تأثير المزج بين الجسيمات المتحركة ثنائية وثلاثية الأبعاد المستخدمة في تصميم الاتجاهات الجديدة في التصميم المتحرك، وتحديد المصطلحات والمفاهيم ذات الصلة واستكشاف استخدامها في إنشاء رسومات متحركة ثنائية وثلاثية الأبعاد. يتضمن البحث تحليل مراجعات الأدبيات المختلفة، وإجراء استبيان بين (200) من مصممي الرسوم المتحركة المحترفين والمتخصصين لدراسة إمكانية دمج هذه التصميمات المعاصرة.

النتائج: أظهرت نتائج الدراسة الكمية واقعاً إيجابياً ومهماً لاستخدام الدمج بين العناصر ثنائية وثلاثية الأبعاد في التصميم الحركي، وقدرة عالية للمصمم على تطبيقه. ومن ثم، متوسط عالٍ في إنشاء أسلوب خاص عال وإيجابي، يتم إنتاجه عن طريق مزج العناصر ثنائية وثلاثية الأبعاد في التصميمات المتحركة.

الخلاصة: أثناء تصميم الرسومات المتحركة الهجينة التي تجمع بين الجسيمات ثنائية وثلاثية الأبعاد، تأتي أهمية إجراء تقييم دقيق للعديد من المتغيرات والعناصر المختلفة لتحقيق النتيجة المرجوة بكفاءة. حيث يعتمد نجاح المجموعة ثنائية وثلاثية الأبعاد على فعالية الأسلوب البصري للرسوم المتحركة الهجينة والتأثيرات والتركيب والحركة في إنشاء صورة متماسكة تنقل القصة العاطفية المطلوبة بشكل فعال.

الكلمات الدالة: التصميمات المتحركة، التصميم ثنائي الأبعاد، التصميم ثلاثي الأبعاد، التصميم المتحرك الهجين، التصميم الجرافيكي.



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Introduction

With the advent of motion graphics, traditional approaches have been supplanted by a fusion of contemporary concepts and the forces of globalization. Consequently, companies and organizations are compelled to establish fresh frameworks and guidelines that embody the core values of their brands, this is essential for effective communication with consumers through the utilization of motion graphics design in novel formats (Silva, 2021).

“A Motion Graphics (MG) is a continuous sequence of animated typography, animated 2D and 3D computer generated imagery (CGI), and live action footage that have been composited together, output to a digital film format, and displayed in mediated environment” (Barnes, 2017). The fascination with hybrid motion design, particularly its dynamic particles and technical elements mixed of 2D and 3D particles, emerged as a response to the need to align with advancements in contemporary science and the evolving space of art and design, this has significantly influenced the representation of temporal two- and three-dimensions elements within the realm of motion design, “These art-design collaborations highlight questions of authorship by virtue of the asymmetry of the relationship, whereby designers are often thought to be contaminating authentic artistic creativity” (McCartney & Tynan, 2021).

These artistic movements have had an important effect on numerous artists and designers, prompting them to move away from conventional artistic traditions and develop a passion towards contemporary art using modern technologies. This shift is evident in the design elements of the Futurism movement, which chooses static movement in favor of dynamic motion that continuously evolves and transforms, thereby, the concept of motion graphics and its accessibility has experienced significant transformation due to the advancements in digitalization and recent developments in technologies such as screen technology, mobile computing, virtual reality, and artificial intelligence (Bieberstein & Feyersinger, 2022), establishing an unusual trend in motion graphics using two- and three-dimensional elements.

Hybrid Motion Graphics design has developed the artistic awareness of the artist, their cultural understanding, and the significance importance of visual arts though the understanding of creating new trends by using new design elements such as two- and three-dimensional elements, where the objective is to reflect the concept through visual arts, thereby enhancing the connection between the designer and the recipient, both parties rely on their production, creativity, and visual discernment to effectively convey the message to the recipient (Macdonald, 2016).

Literature Review.

Motion Graphics.

Motion graphics are a pervasive and persistent phenomenon, commonly seen in background or secondary contexts, such as the motion part of brand presentations or as title sequences. However, like other types of moving images that have not been extensively researched, motion graphics have garnered considerable academic interest in the past decade (Bieberstein & Feyersinger, 2022).

"Motion graphic design is an excellent visual storytelling tool utilized more and more often. They engage viewers and communicate ideas in a brisk yet captivating manner" (Studiobinder, 2019). During the late twentieth century and early twenty-first century, a significant interest appeared in combining the concept of 2D and 3D moving particles, motion, Graphic, and creativity into contemporary hybrid motion visual art, this interest was primarily driven by attempts to examine and analyze the role of motion graphics in both historical and present artistic practices (Studiobinder, 2019).

The exploration of motion in art revealed a variety of dynamic possibilities and potentials, which eventually prompted several artists and designers to engage with these elements. As a result, they integrated innovative motion designs and forms, thereby improving the formality and aesthetic of their artistic works.

Without a doubt, the moving particles contains numerous meanings, connotations, and aesthetic rhythms, while also playing a crucial role in effectively conveying messages and information to the recipient, several motion and animated designs have been generated and advanced as a consequence of the convergence between dynamic movement arts and static design aesthetics, This has showed the significance of investigating the creative and motion designers capabilities required for crafting 2D and 3D motion graphics. Additionally, it is essential to analyze the studies associated with the element of

movement and other pertinent philosophical phenomena or talents (Maerkele & Abbasi, 2017).

Hybrid (2D and 3D) Motion Graphics.

Hybrid motion graphics is a simple term of the mixing both 2D and 3D elements into a single motion design, this combination of different techniques allows artists and designers to take advantage of the benefits of each technique, and thus create a better animated motion design (Kozlowka, 2022).

Creating motion in two dimensions is simply a case of increasing or decreasing the values of X and Y coordinates. Each moving element must be applied to a two-dimensional space, based on a set of X and Y coordinates (Crook & Beare, 2016). The use of digital three-dimensional motion graphics technology has become known as the most common approach in the production of animated content, the evolution of technology can be seen as the representation of human creativity, and the advancement of digital motion graphics technology has emerged as the primary catalyst for the evolution of animation art (Li & Wang, 2023). On the other hand, 3D motion graphic elements are existed in three dimensions during the creation process, with the artists and designer imagination continue to grow and stretch, they need to build a virtual world that contains a 3D models and scenes according to the shape and size of the objects to be displayed and create the motion path for each element to create the final motion design. The idea creating new styles of hybrid motion designs is that contemporary art can maintain its aesthetic and symbolic estrangement from the current "reality" and act in ways that may appear socially eccentric, subversive, or antagonistic while also contributing to the imaginings of new ways of being continues to be a major source of force and appeal for the genre (Kenning, 2019).

"A motion graphic is a dynamic visual communication product that is comprised of a continuous sequence of animated typography and animated 2D and 3D computer generated imagery that have been composited together, output to digitally native file format" (Stone & Wahlin, 2018), which reflects a hybrid motion graphic by mixing 2D and 3D particles (Freeman, 2016).

Hybrid motion design includes using of time elements to simplify the transition between two-dimensional and three-dimensional elements, or a combination of them, this method gives the designers the flexibility to easily shift between compositions, enabling the manipulation of narrative dynamics from mystery to clarity, or vice versa (Shaw, 2016). Additionally, it is important to recognize that the transitions from a two-dimensional (2D) to a three-dimensional (3D) may happen multiple times within a single motion design, the combination of 2D and 3D animation is increasingly being embraced by motion designers due to its ability to enhance storytelling clarity beyond what can be achieved with simply 2D animation (Anideos, 2023).

After the designer decides to begin combining 2D and 3D particles into a single motion design, it is crucial to resolve some design-related problems in order to ensure a successful motion production, which are: Style matching, Registration, Frame rate and Image Format, Timing, Image Size, Alpha channel (O'hailey, 2015).

Style matching. During the initial stage of the design process, designers must ensure that when combining two-dimensional (2D) and three-dimensional (3D) particles, the drawing style, medium combinations, and post-processing effects are compared to determine which style will most effectively achieve the desired visual style. **Registration** refers to "when one object touches another in the scene" (O'hailey, 2015). The interaction between 2D and 3D particles is referred to as the registration line, each unique combination of these particles requires a different pipeline to achieve optimal registration, and that depends on which element will lead the movement in the motion design. Frame rate and Image format. **Timing**, to achieve synchronization when combining multiple mediums, it is necessary to carefully align the timing on a frame-by-frame basis, this entails identifying the keyframes and understanding the specific timing employed, thereby ensuring that the temporal progression of each particle is accurately matched. **Image size**, A key element that requires attention when combining 2D and 3D motion graphic design is the concept of image size, it is important to ensure that the images used the same pixel ratios, resolutions, and sizes when combined. **Alpha channel** "represents a color through which the background can be seen to some extent, a fourth channel is added to the color: the alpha channel" (Crook & Beare, 2016).

Research Questions.

1. How practical is it for hybrid motion designers to combine two- and three-dimensional elements, and how capable are they in doing so?
2. Is there a special style to be produced by mixing the two- and three-dimensional elements in motion designs?
3. How does the effective use of the time element (Timing) improve harmony, creativity, and the quality of motion design?

Research Problem.

The two- and three-dimensional nature of Motion Graphic Design has been characterized by the recent publication of designs, including the integration of two- and three-dimensional motion particles.

The problem of this research is how to integrate both two- and three-dimensional particles into a hybrid motion graphic design, and the possibilities be applied by designers and the extent to which integration can be used to produce motion design of a creative nature .However, this research aims to reveal how the two- and three-dimensional particles are integrated into the motion graphic designs.

Research Objective.

This study aims to assess the level of complexity involved in integrating 2D and 3D techniques in motion graphics, as well as evaluate the utility of this approach for designers in generating innovative designs. On the other hand, this study aims to examine the design methodology employed in the creation of 2D and 3D motion graphic designs with an emphasis on their artistic and creative aspects.

The primary objective of this study is to conduct a technical and creative analysis of the samples utilizing the proposed methodology.

Methodology.

The purpose of this quantitative study is based on understanding the effect of mixing 2D and 3D moving particles which used in designing new trends in Motion Graphics. Moreover, this research will be based on the identification of terminologies and concepts for motion graphics, and how it can be used in the process of creating 2D and 3D motion graphics, based on analysis of several literature reviews, author's experience, a questionnaire conducted to professional and specialized motion graphic designers to study the possibilities of implementing this type of modern designs.

Hybrid motion graphic design analysis.**Study sample**

The sample study was made up of 200 individuals who were randomly selected from the study community, and table 1 shows the distribution of the sample according to personal and functional variables.

Table (1): Distribution of sample members according to personal and functional variables.

Variables	Category	Repetition	Percentage
Sex	Male	108	54.0
	Female	92	46.0
	Total	200	100.0
Age	Under 25 years	71	35.5
	From 25 to 35 years of age	46	23.0
	From 35 to 45 years of age	49	24.5
	From 45 to 55 years of age	22	11.0
	55 years and over	12	6.0
	Total	200	100.0

Variables	Category	Repetition	Percentage
Educational Level	Bachelor	113	56.5
	Masters	83	41.5
	Ph.D.	4	2.0
	Total	200	100.0
Years of Experience	Less than 1 year	26	13.0
	Less than 5 years	68	34.0
	Less than 10 years	37	18.5
	From 10 to 20 years	43	21.5
	20 years and over	26	13.0
	Total	200	100.0

Table 1 shows the following:

- For the sex variable, the highest (male) is (108 per cent) (54.0 per cent), while the lowest (female) is (92 per cent) (46.0 per cent).
- For the age variable, the highest (under 25 years of age) is the most frequent (71 per cent) (35.5 per cent), while the lowest (55 years of age and over) is 12 per cent (6.0 per cent).
- For the variable of the educational level, the highest number of bachelors (B.A.) is (113 per cent) (56.5 per cent), while the lowest number (Ph.D.) is (4 per cent) (2.0 per cent).
- For the variable years of experience, the highest (less than 5 years) is the most frequent (68 per cent (34.0 per cent), while the lowest (less than 1 year) and 20 years (less than 26 per cent) are the lowest (13.0%).

Steady study tool:

With a view to extracting the stability of the study tool, it was applied twice by a two-week time difference to a survey sample of 25 members of the study community, and to calculate the correlation factor - Pearson, between the two applications for the recovery of the stability of return (Test. R-test), the application of the internal consistency equation (Kronbach Alpha) to all areas of study and the tool as a whole for the survey sample, and table 2 shows this.

Table 2: Kronbach Alpha coefficients for study areas and tool as a whole.

#	Area	Number of sections	Stability of return (Test. R-test)	Internal consistency equation (Kronbach Alpha)
1	The reality of using the combination of the two- and three-dimensional elements in Motion design and the ability of the designer to design it.	5	0.88	0.82
2	Mixing of the two- and three-dimensional elements into Motion designs.	5	0.87	0.84
3	The extent to which the effective use of the time element (Timing) can improve harmony, creativity, and the quality of Motion design.	4	0.87	0.80
Tool as whole.		14	0.94	0.88

Table 2 shows the following:

- That constant re-entry factors (Test. R-test) ranged from (0.80-0.84) to a constant return factor for the whole tool (0.88). The Kronbach Alpha transactions ranged from (0.87-0.88) to the tool as a whole. (0.94).

Resolution correction:

The final resolution was made up of 14 paragraphs, where the researcher used a liker scale for the pentagram to measure the opinions of the study sample members, and strong approval was given (5), okay (4), medium (3), non-consensual (2) not so much as to indicate ($\sqrt{}$) to the answer reflecting the degree of their consent, and the following classification was relied upon to judge the calculation averages as $(5-1) / 3 = 1.33$ length of the one category, so the range of the three levels is as follows:

- Less than a few 2.33.
- From 2.34-3.66 medium.
- From 3.67 to 5.00 large.

To answer the survey questions, the following statistical treatments have been used through the SPSS program:

- Repeaters and percentages of personal and functional variables of study sample members.
- Statistical averages and standard deviations of survey sample members and responses to all paragraph's outcomes

Results.

The findings of a study that aimed to determine how combining 2D and 3D designs affected hybrid motion graphics are presented in this section, the questions posed in the study will inform how the findings are presented areas of the study tool.

Study Questions.

Question 1: What is the reality of using the Mixing of two- and three-dimensional elements in hybrid motion design and the ability of the designer to apply it?

To answer this question, the computational averages of the usage of the combination of the two- and three-dimensional elements in the hybrid motion design and the ability of the designer to apply them have been calculated, and table 3 shows this.

Table 3: Statistical averages and standard deviations of the domain paragraphs "The reality of using the combination of the two- and three-dimensional elements in hybrid motion design and the ability of the designer to apply them" and total (N=200).

#	Section	Average	Deviation	Level	Grade
1	2D and 3D elements can be effectively integrated into Motion designs	4.33	0.68	1	High
2	It's easy to maintain a good balance between 2D and 3D elements without the design looking cluttered.	3.79	0.91	5	High
3	Mixing 2D and 3D elements enhances the quality of the Motion design.	4.26	0.63	2	High
4	The programs used in the design process that Mixing 2D and 3D elements differ from the programs used in the design process for traditional Motion designs.	4.09	0.75	3	High
5	Mixing 2D and 3D elements enhances the viewer's experience of animated designs.	4.08	0.85	4	High
Area as whole.		4.11	0.51	-	High

Table 3 shows that the calculation averages ranged from 3.79-4.33, all of which are high, paragraph 1, which states that "2D and 3D elements can be effectively integrated into Motion designs" in the first order with an average of 4.33 and to a high degree, and paragraph 2, which states that "It's easy to maintain a good balance between 2D and 3D elements without the design looking cluttered." in first place with an average of 3.79 and to a high degree. The calculation average of the area was "The reality of using the combination of the two- and three-dimensional elements in hybrid motion design and the ability of the designer to apply them" as a whole and to a high degree.

Question 2: Is there a special style to be produced by mixing the two- and three-dimensional elements in motion designs?

To answer this question, the calculation averages of a special stamp are calculated by mixing the two- and three-dimensional elements in motion designs, and table 4 shows this.

Table 4: Statistical averages and standard deviations of the field paragraphs "Specialty produced through the mixing of the two- and three-dimensional elements in motion designs" and total (N=200)

#	Section	Average	Deviation	Level	Grade
1	In following up on motion designs, I see that there is a special design style that integrates the two- and three-dimensional elements in the definition of the artistic style.	4.31	0.88	2	High
2	The time element is an effective tool in balancing the technical and technical vision of motion design.	4.24	0.73	3	High
3	The mixing of the two- and three-dimensional elements affects the creativity of motion design.	4.38	0.68	1	High
4	There must be a dynamic time compatibility of the two- and three-dimensional elements used in motion designs.	4.21	0.67	4	High
5	The mixing of the two- and three-dimensional elements produces innovative and creative design styles.	4.09	0.69	5	High
Area as whole.		4.24	0.49	-	High

Table 4 shows that the calculation averages ranged from 4.09-4.38, all of which are high, with paragraph 4, which states that " There must be a dynamic time compatibility of the two- and three-dimensional elements used in motion designs." In the first place, with an average of 4.38 and a high degree, and in the last place, paragraph 5, which states that " The mixing of the two- and three-dimensional elements produces innovative and creative design styles" with an average of 4.09 and a high degree, the calculation average for the whole area was "special in style, resulting through the mixing of the two- and three-dimensional elements in the motion designs" and a high degree.

Question 3: How does the effective use of the time element (Timing) improve harmony, creativity, and the quality of motion design?

To answer this question, calculation averages have been calculated of the extent to which the effective use of the time element (Timing) has improved harmony, creativity and the quality of motion design, and table 5 shows this.

Table 5: Statistical averages and standard deviations of the area paragraphs " How does the effective use of the time element (Timing) improve harmony, creativity, and the quality of motion design" and total (N=200)

#	Section	Average	Deviation	Level	Grade
1	The effective use of the time element (Timing) improves the harmony between the two- and three-dimensional elements?	4.43	0.64	1	High
2	The speed of motion affects the experience of viewing designs that mixed two-dimensional and three-dimensional elements?	4.39	0.63	2	High
3	The configurations used in the type of rate enhance the quality of the design.	4.05	0.85	4	High
4	The design speed of motion varies in terms of the number of footage (24 fps / 30 fps) when both two- and three-dimensional elements are mixed in motion designs.	4.34	0.80	3	High
Area as whole.		4.30	0.49	-	High

Table 5 shows that the calculation averages ranged from 4.05-4.43 to a high degree, with paragraph (1) stating that " The effective use of the time element (Timing) improves the harmony between the two- and three-dimensional elements?" In the first place, with an average of 4.43 and a high degree, and in the last place, paragraph 3, which states that " The configurations used in the type of rate enhance the quality of the design" in my average calculation (4.05) and to a high degree, the calculated average of the area was " How does the effective use of the time element (Timing) improve harmony, creativity, and the quality of motion design?" as a whole (4.30) and to a high degree.

Findings & Conclusion.

By answering the questions of the study, it was concluded that:

- The computational averages of the use of the mixing of the two- and three-dimensional elements in the motion design and the ability of the designer's ability to apply them ranged from 3.79-4.33, all of which were high, to the calculation average of the area as a whole (4.11) and to a high degree, hence a positive and significant reality of the use of the combination of the two- and three-dimensional elements in the motion design and a high capacity of the designer to apply it.

- The calculation averages of a special domain are produced by mixing the two- and three-dimensional elements in motion designs, ranging from 4.09-4.38 all of which are high, and the calculation average of the area was 4.24 and high, thus creating a high and positive special style, which is produced by mixing the two- and the three-dimensional elements in motion designs.

- The calculation averages of the extent to which the effective use of the time element (Timing) has improved harmony, creativity and the quality of motion design ranged from 4.05-4.43 all at a high level, to an average of 4.30 for the entire area and to a high degree. The use of the time element (Timing) thus has a significant impact on the improvement of harmony, creativity, and the quality of motion design.

When integrating 2D and 3D particles within the framework of motion graphics, a variety of variables requires careful consideration, designers and artists must consider multiple elements such as style matching, registration, timing, image size, and alpha channel to effectively produce hybrid motion graphics. However, an essential measure to determine the success of the 2D/3D combination is based on the effectiveness of the hybrid motion graphic visual style, effects, composition, and motion to effectively create an integrated image that effectively communicates the desired emotional story.

The registration process has been effectively implemented, ensuring that timing and motion are precisely conveyed throughout the scene without any interruptions. Additionally, the integration of 2D and 3D particles was completed with successful outcomes.

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