



The Impact of Hybrid Animation on the Future of Animation

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Abstract. Due to technological evolutions, animation has evolved through a diverse range of techniques, creating the conditions for hybrid animation to emerge, which has a direct impact on the production of animation. The aim of this study is to research the current state of hybrid animation among professionals, academics and students of the animation field, to hear their views, adherence and impact on their processes, as well to identify the advantages and disadvantages of hybridization as contribution to the other professionals and animation industry. This paper will be limited to the study of the main production differences between 2D and 3D animation and the result of its combination as hybrid animation, as a criteria to limit the study. To achieve this purpose, the methodological approach defined by triangulation, combines literature review, quantitative methods and qualitative methods on its analysis in order to cross some of the results to achieve deeper understanding and more credibility of results. The main contribution of this study is to position hybrid animation processes from the point of view of animation practitioners and to reveal patterns and exceptions of adherence to its technical processes in order to gather insights on the benefits and potential of its use to the industry.

Keywords: 2D Animation · 3D Animation · Hybrid Animation · Animation Production · Motivators

1 Introduction

Since its beginning, animation emerged and evolved alongside technological innovations which allowed animated films to use a combination of processes, techniques, styles and experimentations. More recently and probably due to financial constraints, emergent technological advances and consequent stylistic options in animation, recent feature films revealed a process of hybrid techniques and styles, visible in films such as Klaus (Dir.: Pablos, 2019), Spider Man: Into the Spidaverse, (Dirs.: Ramsey, Persichetti, Rothman, 2018) and Paperman (Dir.: Kahrs, 2012). The transformation into these hybrid processes can open the way to potential advantages in animation production which we

will analyze in this paper. In these films, methods and techniques led to innovative productions, financial and artistic options which impacted its final results but also a successful financial management, such as being more affordable, less time-consuming with a capacity for artistic quality and freedom of style so desired by audiences. The objective of this paper is to understand the particularities, limitations and advantages of each one of the two main methods (two-dimensional (2D) and three-dimensional (3D)) and as well, to understand the result of its combination as hybrid animation, in patterns of adherence, insights, recommendations, motivators or considerations from professionals, academics and animation students in the field, in order to help others to adopt methods of hybridization in their productions and to understand its full potential.

1.1 Research Question

In order to objectify the problem of research on how to better understand hybrid animation, three main questions were formulated as below:

- 1) What are the characteristics that define hybrid animation?
- 2) What are the advantages and disadvantages of hybrid animation?
- 3) What are the patterns of adherence, insights, recommendations, motivators or considerations made by animation professionals, scholars and students in the field that can help others to adopt successful methods of hybridization in their productions?

2 Literature Review

2.1 Two-Dimensional Traditional Animation (2D)

Two-dimensional traditional animation (2D) was the technique which gave birth to the animation film. In the beginning of the XX century in films such as *Fantasmagorie* (Dir.: Émile Cohl, 1908), *Gertie, the dinosaur* (Dir.: Winsor McCay, 1914) allowed a transformation and the expressivity of drawn lines along the screen which created unlimited worlds. In terms of definition, 2D animation can be viewed as the creation of a series of drawings on a surface according to the x and y axis [1]. These images can be juxtaposed according to the three most common standard number of frames per second: animation in ones (24 frames per second), animation in twos (12 frames per second), and animation in threes (8 frames per second, which in this case starts to be considered limited animation and not so fluid animation) to create the illusion of movement in animation [2, 3]. In 1933, the invention of the multiplane camera by Ub Iwerks, the American animator at Walt Disney Pictures, took a step forward in 2D traditional animation, with the invention of cell animation which allowed layers to be animated independently, with more depth, camera movements and much quicker than before [2, 3]. *Snow White and the Seven Dwarfs* (Produced by Walt Disney, 1937) changed the market of feature films produced with cell animation and allowed the technique to evolve. Digital animation followed the same principles that define both areas [2, 3]. As Furniss explains, “animation can be divided into two general categories, two-dimensional (e.g. drawing and painting) and three-dimensional (e.g. stop-motion). The same terms commonly are used to describe

digital animation, a digital ink and paint system like Animo, (...), assists in the creation of 2D animation, it recreates the look of traditional cel painted animation without the use of cells” [2, p. 175]. In terms of particularities 2D animation qualities are connected with the use of the expressivity of the line, the natural organicity of changeable forms such metamorphoses, the use of the gentleness and gestural movement of drawing by hand and as well as the economic stylization of forms which allows a repetition of drawing in every frame. The main 2D animation disadvantages are concerned with the long periods of production, elevated costs, the necessary complex trained education in 2D animation by professionals who can assure production and as well the reduced investment return of the film when compared with 3D films which can generate much more profit and allow sustainable future productions when compared with 2D [1–5].

2.2 Three-Dimensional Animation (3D)

In the 1960's computer evolution allowed the first three-dimensional (3D) animations to emerge in films such as the Hummingbird (created by Charles Csuri and James Shaffer, 1967), Kitty (Dir.: Nikolai Konstantinov, 1968) and Metadata (1971), which allowed the creation of images generated by computers within three dimensions, making use of three-dimensional space, depth of field, mass and volume of characters, camera movements in 360° and the use of light and shadows in more similarity with reality [3]. As Laybourne defines in *The Animation Book*, “3D animation, as the name indicates, works with one more dimension, the z axis, in addition to the x and y axis. This idea of space is fundamental to the conception of this type of technique: instead of drawing a square that moves in north, south, east and west coordinates, in a frame-by-frame manner, the square is transformed into a cube that moves around the camera, in other words, it acquires the element of depth that has a huge impact on the way 3D animation is made” [1, p. 234]. 3D animation, although not a popular technique in its beginning, had prevailed as a success of the audience, mostly since *Toy Story* (Dir.: John Lasseter, 1995) which transformed movies, television series, video games, and the internet, among others by being more emphatic than before [2, 3]. According to Williams, 3D animation can be seen as an evolution of stop motion: instead of creating tangible puppets, it employs the resources of computer graphics, i.e. CGI (Computer Generated Images) to model virtual objects and create moving images [6]. Its main difference, as explained by Au is that, “2D animations will consist of elements constructed within a 2D environment while 3D animations will consist of elements mostly constructed within a 3D environment. With this distinction made, there can now be defined differences between the two media. In 3D, all elements have some sort of volume or mass. Though lines and planes arguably have no mass or volume in the real world, it will be assumed that within 3D software packages, some volume and mass exists, though infinitesimally small” [7, p. 21].

The main 3D animation qualities are the ability to rig a character and to be able to animate it with interpolated movement, to be able to do automatic movements such as turnarounds, to move in 3D space, to move in depth, to create rotation movements in perspective, to create mass, volume, and to expose the space to light creating a world of automatic and more realistic tones of shadows, without having to redraw every drawing, shadow or pose in every frame. This advance allowed less time consuming of production radically different from drawing each drawing in every frame, not only on its creation

but also creating the possibility to correct, modify, change any sequence or any action without having to redraw everything. As well to create cinematic movements [3, 7].

The main 3D disadvantages have been more connected with the reductive style option [8], which can be less expressive in terms of language, less changeable in terms of line or forms and less attractive to audiences in aesthetical aspects, but which has conquered the world with its ability to create emphatic and humorous characters and styles with allow creativity and originality of its worlds [3, 8].

2.3 Hybrid Animation

As for the context of hybrid animation, according to Tina O’Hailey [9] it can be defined as a combination between 2D and 3D techniques, and as Kivitö [10, p. 20] mentions, “In modern animation, it is not uncommon to see both methods being used together. The combination of 2D animation and 3D animation is called hybrid animation”. Although these definitions alone exclude a wide range of animation productions that are considered hybrid by the general public such as the *World of Gumball* series (Dirs.: Graves, Perez, 2011–2019) or the *Tuca and Bertie* series (Creator: Hanawalt, 2019–2021) that use multiple animation techniques. So, if hybrid animation cannot be limited only to 2D and 3D combination animation techniques, it should also include different animation methods, even if that creates ambiguity in the categorization of some films. As an example, there has been a debate about whether to include the iconic film *Who Framed Roger Rabbit* (Dirs.: Zemeckis, Williams, 1988) under the category of hybrid animation or live action. As Harris [11] explains, “In its drawing upon a blend of media, and its integration of diverse visual approaches that extend beyond the purely photographic, animation is inherently a multi-disciplinary medium” [11, p. 17]. According to Todd [12] the first hybrid film would likely be, *The Enchanted Drawing* (Dir.: Blackton, 1900) thus indicating that since the beginning of animation creators have always had a desire to mix media. Since the appearance of CGI, artists have sought to merge these two mediums of animation, with John Lasseter’s test footage in *Where the Wild Things Are* (Dir.: Lasseter, 1983) being one of the first clear examples [3, 9]. After the introduction of CGI technology, Disney released the first 2D feature film with some CGI elements, *The Black Cauldron* (Dirs.: Berman, Rich, 1987) [3]. Over the following fifteen to twenty years, hybrid animation was focused on introducing 3D techniques into 2D films as a way to reduce production costs, as well as an innovation that allowed greater artistic freedom for animators at the time [9]. The first method in which elements were combined, was by incorporating 3D background characters and objects into 2D films. Well-known examples are: the CGI/3D chandelier in *Beauty and the Beast* (Dirs.: Trousdale, Wise, 1991), the jungle constructed entirely in 3D where 2D Tarzan is interwoven with it, and finally crowd simulation in *Lion King* (Dirs.: Allers, Minkoff, 1994) or *Mulan* (Dirs.: Cook, Bancroft, 1998) [9]. In addition to this most common method, there are other forms of merging these two media, one of them being the Warner Brothers film *Iron Giant* (Dir.: Bird, 1999), where one of the main characters, the alien robot, is one of the only elements of the production created in 3D in a 2D animated film. Alternatively, the addition of a 2D character interacting with 3D objects is also one of the manners, as are the cases of *Treasure Planet* (Dirs.: Clements, Musker, 2002), and *The Triplets of*

Belleville (Dir.: Chomet, 2003) [9]. In recent days, it is not uncommon to see two methods being used simultaneously, creating hybrid animation. This is often carried out by giving a 3D object a 2D appearance or by blending them together [8]. So common is the joined 2D and 3D methods in animation, especially in anime and television series. Due to technological advances the blending techniques are almost unnoticeable to the average person. Exemplifying this are the following anime pieces: the *Vaioretto Evāgāden* series (Dirs.: Ishidate, Fujita, 2018), the film *Kimi no Na wa* (Dir.: Shinkai, 2016), the feature film *Byōsoku Go Senchimōtoru* (Dir.: Shinkai, 2007), renowned director Hayao Miyazaki's last feature film *Kaze Tachinu* (Dir.: Miyazaki, 2013), and his short film made in CGI *Kemushi no Boro* (Dir.: Miyazaki, 2018). We can verify that it is not only in the 2D space that there is the need for hybridization. Increasing numbers of animations which are predominantly 3D witnessed the introduction of 2D animation elements with creative and expressive purposes.

The huge success of hybrid animated films such as *Spider Man: Into the Spider-Verse* (Dirs.: Ramsey, Persichetti, Rothman, 2018) and in the short film *Paperman* (Dir.: Kahrs, 2012) show that there is a market for different hybrid animation styles [10]. This has been amplified by the fact that conventional 3D animations have provided little stylistic variety, which can be seen as a lack of imagination [8]. Director of the short film *Paperman* (Dir.: Kahrs, 2012), John Kahrs expressed his reasons for using hybridization in his interview with Ciarfardini in 2012 [13]: "I think we're at a point where a lot of the CGI films that are coming out right now all have a similar goal to this stylized photographic realism that they're working with, and I really like the look of those films, but there's a part of me that believes that's not the only way that animation can be. There's something powerful about the hand-drawn line that can communicate better with people and tell a story." [13]. Similarly, Patrick Osborne, a director at Walt Disney Animation Studios who has worked on projects including *Paperman* (Dir.: Kahrs, 2012) and *Feast* (Dir.: Osborne, 2014), explained that the expressiveness of a concept filtered through a human brain is what makes an appealing illustrated style and more fascinating than creating something that looks natural, while acknowledging that 3D animation is more directional than 2D animation because changes can be made without restarting the process [14]. As Kivitō's study explains, "It is clear that both 2D and 3D methods have their advantages and disadvantages. However, there is an ocean of possibilities of what can be achieved if the pros of 3D would solve the cons of 2D, and vice versa [10, p. 19]. In addition, Osborne explains, "Hybridity possesses the capacity to enlarge both the aesthetic and socio-cultural arenas, offering new formulations" [14, p. 17]. As literature review exposes, both 2D and 3D animation techniques have particularities and limitations, but when blended can overcome the limitation of each one of them creating an hybrid stylization production which can overcome obstacles of several aspects of financial, production or style and as well to propose a new standard in the industry. To better understand this assumption an experience was made by enquiring people in the animation industry, both professionals, academics and students to hear their views about this hypothesis.

3 Methodology

The methodology uses a triangulation of methods to better understand the problem in different ways and to be able to cross results. Using this combined methodology as Muratovski [15] explains, it “can help establish a credible, valid and reliable research practice”, which can translate into more credible results because one method can confirm or by opposition minimize the impact of an answer when crossed with a result from a different method. The combined methods used were literature review, quantitative methodology (survey with closed end questions), and qualitative methodology (survey with open ended questions and small interview to some of participants in the survey). Due to the nature of the study, on how the animation techniques are being used and progressing, in its production processes and end results, the target of suitable audience for this purpose were animation professionals who work on the animation industry using some of these methods, animation academics who map, analyze and expose some of these issues in their works on recent films and their processes, and animation students who are the ones who are experimenting at the moment and who will be creating future films in the industry and experiment multiple options in their films. The criteria to choose all these three types of participants was to target someone who is currently connected with the industry in the present and who could directly expose their daily problems and directly impact this study. The survey was disseminated through digital animation professional networks such as linkedin, animation teachers at universities, producers and directors at the industry and animation students or professionals. The primary data, derived from literature review quantitative and qualitative methods, and secondary data, derived from the literature review that proved to be useful in selecting and conducting the primary information collection. The online survey consists of six sections (questions about animation in general, 2D, 3D, hybrids, in a total of 13 questions and another additional five questions on demographic aspects to better position the answers). In total there were 110 responses to the survey, but only 106 could be used for analysis and in some questions an average of 90 participants answered the question (example: on question 3 only 90 participants answered, while others did not answer). Both the template of the survey and its results can be accessed in the appendix section on Appendixes I and II. The criteria to target such a niche field was to send it to both professionals, academics and students from the animation field and industry in a balanced number so the survey could reach as many people as possible.

4 Data Collection

4.1 Quantitative Data

From the collected data, a few patterns have emerged in clear terms as listed below, which helped us to elaborate the insights from the survey (full results of the survey can be accessed in the appendix section). The demographics on the survey revealed a percentage of 61% of professionals, 22% of students and 15% of teachers in the field of animation. The age of the participants were mostly positioned between 18 years old and 44 years old (85%) and gender wise it was very balanced between female (50%) and male (43%) participants and the rest being non binary or non-specified. Globewise the

majority of answers were collected from the United Kingdom (22), Portugal (19), U.S.A (14) and Canadá (5), while less significant constant numbers from each country were collected from different 25 nationalities around the globe. Although we understand this sample is still fragile, it can, at this point, indicate a path of analysis which we will further continue to research by disseminating the survey and interviews to more participants. Due to reasons of space only some results about hybrid animation are exposed in the body of this paper although the full results can be accessed in the appendix section (Fig. 1).

Q3: Between 2d and 3d animation which one do you prefer?

Answered: 96 Ignored: 11

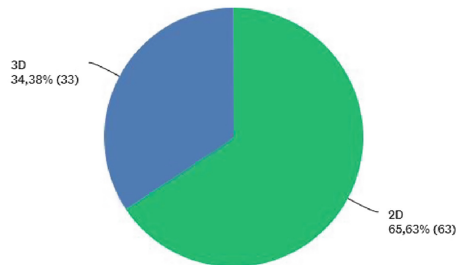


Fig. 1. Graph with the percentage results of question 3

A main result confirmed that the preference is still 2D animation among the industry. The results on the preferences between 2D (65%) and 3D Animation techniques (35%) enable us to understand the current state of preferences among the participants. It is important to highlight that this question does not tell us whether the participants work in one technique or another, only what their preferences are. These results indicate that, although clearly more expensive, 2D is still an preferable style and technique among professions, academics and students (Fig. 2).

Q8: In your opinion hybrid movies and series are...(Please limit your answer to up to 2 choices)

Answered: 90 Ignored: 17

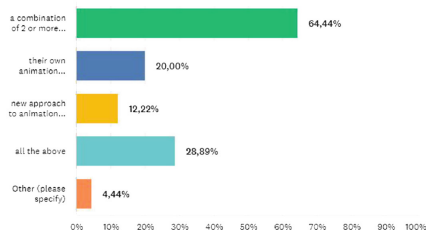


Fig. 2. Graph with the percentage results of question 8

Another clear result indicates that in terms of definition, participants identify as hybrid animation a combination of two or more techniques (64%) which contradicts some authors identified in the literature view. In second place as most chosen is the option that incorporates all of the above, i.e. “the combination of two or more techniques”, “to be its own category” and “a new approach to animation, which helps to reduce costs and labor”, with 31% of the votes.

Q9: What do you consider to be the biggest advantages of hybrid animation?
(Please choose up to 3 advantages)

Answered: 90 Ignored: 17

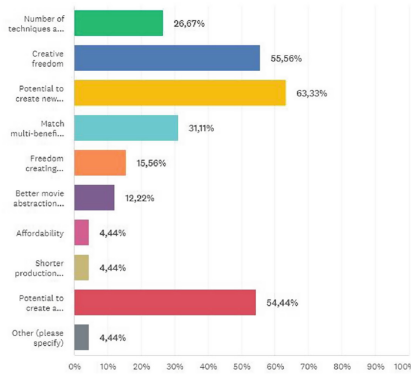


Fig. 3. Graph with the percentage results of question 9

In Fig. 3, results indicate that the participants consider that the biggest advantages of hybrid animation are the “Potential to create new approaches to visual languages” (63%), “Potential to create a unique/authorial style” (54%) and “Creative freedom” (56%). In this Fig. 3 that corresponds to question number 9 we see that the biggest advantages of hybrid animation for the target audience again demonstrate a primacy of creative choices, rather than technical options, but also demonstrate a great willingness to create a new visual language. This result also contradicts some of the literature review which views hybrid animation still as a no clear style or not having as coherent style in films.

In Fig. 4, results indicate that the participants consider the biggest disadvantage of hybrid animation to be the “Mixing techniques in a homogeneous way” (64%). This confirms the information revised in the literature review, where directors also highlight this difficulty. The second most chosen option was “Difficulty in mastering the necessary skills” (38%) and the third was “Time/cost resources” (33%). On the other hand, it is interesting to note that one of the respondents stated, in relation to the “Other” option, that in hybrid animation there are no disadvantages, as long as the team producing it is properly qualified. Moreover, participants consider that time matching to be one of the greatest difficulties in making a hybrid animation. But in any case, as question 9 highlighted previously, hybridization is also seen as an advantage the ability to create new styles. This issue will be explored in the “Discussion” section.

In Fig. 5, results indicate that there is a symmetrical distribution in relation to neutral, that is, the difference between the agreeing answers (“Strongly agree” - 9.89% and

Q 10: What do you consider to be the biggest disadvantages of hybrid animation?
(Please choose up to 3 disadvantages)

Answered: 90 Ignored: 17

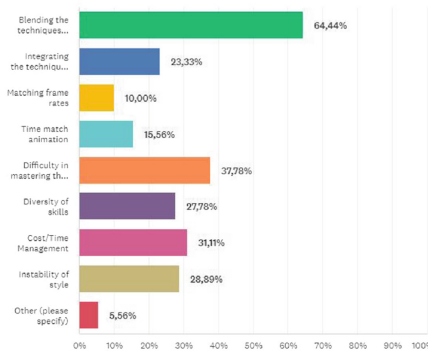


Fig. 4. Graph with the percentage results of question 10

Q 11: Do you agree with the following statement: In order for 2D animated projects to continue to be produced, it will become necessary in the future for animation studios to incorporate 3D hybridization animation techniques wether that is during the production cycle or within the movie / series itself.

Answered: 89 Ignored: 18

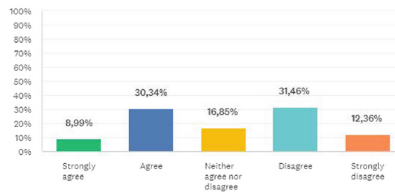


Fig. 5. Graph with the percentage results of question 11

“Agree” - 29.67%) and the disagreeing answers (“Strongly disagree” - 12.09% and “Disagree” 31.87%) is only 4.4%. This data highlights that this topic is somewhat polarizing. The increase in hybrid film animation productions is evident since the introduction of CGI, seen initially as a way to cut costs or labor. The fact that the question is phrased declaratively, i.e. as a fact that conveys the idea that hybrids will replace 2D animation, may lead to the reluctance of participants who prefer 2D to agree with this statement. But one the most relevant answers was that “that in hybrid animation there are no disadvantages, as long as the team producing it is properly qualified” which suggest that if training in hybrid techniques is promoted by studios in their productions which is already a practice of studios such as Aardman and SPA studios among others, skills can be apprehended and mastered.

In Fig. 6, results indicate that 37.36% of the participants agree with the statement and 37.36% strongly agree. In turn, 5.49% of the individuals disagree and 3.30% strongly disagree, demonstrating a high degree of consensus among the respondents. In this question, the participants highlight the hybridization as an advantage for the 3D technique,

Q 12: Do you agree with the following statement: In a 3D animation production, the use of hybridization using 2D animation techniques often times results in the project displaying a higher level of artistic expression.

Answered: 89 Ignored: 18

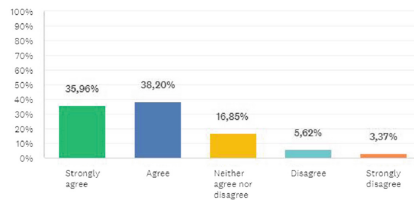


Fig. 6. Graph with the percentage results of question 12

because they mostly answered that the junction of 3D animation with 2D elements has greater artistic expression. Thus, and contrary to the previous question, the participants consider this type of intervention more favorably in the future.

Q 13: If you were given the opportunity to create your own hybrid animation project, would you?

Answered: 89 Ignored: 18

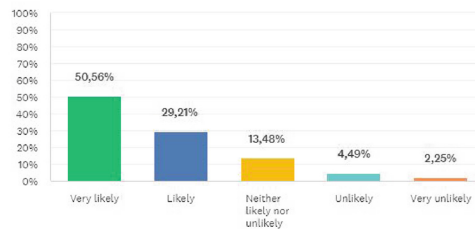


Fig. 7. Graph with the percentage results of question 13

With regard to Fig. 7, it is noteworthy that the participants consider “Very likely” (51.65%) and “Likely” (28.57%) the possibility of creating their own hybrid projects, if they had the possibility. Thus, they constitute an absolute majority (80.22%). This implies that there is interest on the part of the industry in developing this technique, even though the participants are aware of its disadvantages.

4.2 Debate of Results

Following the insights from the previous section, which are somehow clear, an analysis of the full results was conducted, by cross-referencing the sections of quantitative data, qualitative and literature review. The data indicated that there is a favorable outlook, from the participants, towards the use of hybridization which in some aspects contradicts literature review. This might occur due to the fact that literature review about this issue is still recent and not up to date or published and in another hand professionals have not been writing about the issue as they might be more concerned with finding options for

their productions. This aspect is very interesting because it shows the relevance of this study on revealing trends and technical aspects about contemporary films. This trend is revealed in question number thirteen of the survey, where participants are asked if they would be willing to create a hybrid project if they were given the opportunity. Thus, several well known animations, such as *Spider-Man: Into the Spideverse* (Dir.: Ramsey, Persichetti, Rothman, 2018) and *Paperman* (Dir.: Kahrs, 2012), have helped make this practice an artistically tempting and attainable possibility by demonstrating its innovative factor [7, 8, 13, 16]. Moreover, and as mentioned in the literature review, hybrid animation has always been perceived as progressive, in terms of cost reduction and the degree of production complexity [3, 9] but not so much in terms of style which at this point we can say that is already changing. Moreover, through the observation of the data obtained and its corroboration by the literature, it is possible to verify the existence of a relationship between technological evolution and the use of hybridization. In this way, as new instruments and tools are created with the aim of artistically improving the animation process, more use is made of the combination of diverse techniques that allow, in a less expensive way, to obtain very satisfactory results with the techniques of 2D and 3D. One of the most prominent technological developments is related with the use and development of artificial intelligence, which can be applied to any situation where the need arises to save technical labor and allocate it to the creative process [17–21].

Also in this vein, the results show a prioritization of creative rather than technical choices, which can be seen in questions, 1, 4 and 9, which oppose preferences such as “Freedom to Create,” “Potential to Create a New Visual Language,” “Potential to Create a Unique Style,” or “Expressiveness of Design” versus “Use of Metamorphosis,” “Production Shortening,” or “Accessibility.” This may indicate a greater importance given, by the target audience, to creative input during production, inseparable from the genesis of this industry being based in the artistic context and not only in the entertainment sphere [17, 19–21]. By combining 2D and 3D techniques hybridization opens up broad possibilities by allowing the advantages of both animation techniques to be leveraged and possibly minimizing the expression of their limitations. Therefore, it is referred to as one of the most beneficial alternatives to the current state of animation, its mass implementation is practically inevitable and given the technological evolution and the benefits that can be drawn from it for the industry. Nevertheless, for each production one must evaluate which technique is the most advantageous to tell a particular story, in order to achieve the desired visual appeal and style.

Despite the clear benefits associated with the implementation of hybridization, it can be perceived as costly, which often affects studio buy-in. Because, by combining the purchase of software and technological materials, as well as human labor, it has higher initial costs. Thus, it is commonly considered that the joining of 2D elements in 3D film is more costly during all stages of production. It is also important to note that the nature of trial and error that comes with new developments also increases the overall cost of a production. In opposition, the combination of 3D elements in a 2D film is already tested in the industry and does not require constant experimentation and development of new technologies [9]. However, it should be noted that this issue is intrinsically dependent on the goals and experience of the production team [9]. An example of this issue is the *Vaioretto Evāgāden* series (Dir.: Ishidate, Fujita, 2018), which, had it been produced

without the use of the hybrid technique, would have had a much longer production duration and substantially higher associated costs. Another relevant result showed that training into different approaches to hybrid films may be promoted inside studios so that each production can use the most relevant techniques.

5 Conclusion, Contributions and Further Studies

The conducted experience and data collection, indicates that hybridization, even with its drawbacks, is received by the target audience as a new and interesting proposal and as a valid approach to visual language in animation, allowing 3D greater accessibility to the artistic side and 2D a greater ability to create more detailed and ambitious animations. From the analysis of the approximately 90–100 responses to the survey and the conducted interviews the following insights can be identified as:

1. An attitude mostly in favor of hybridization;
2. A greater importance given to creative expression skills than to the ability to imitate reality;
3. A greater artistic capacity of 3D films with 2D intervention;
4. The same cannot be said for 3D intervention in 2D animations, given the discrepancy in the responses obtained;
5. Hybrid implementation is usually perceived as expensive, which in some cases leads to hesitations in its use, but the literature review and the data collected indicates that this is highly dependent on the goals and qualifications of the production team;
6. The evolution of technology facilitates the increasing use of hybridization in animation productions, such as with artificial intelligence;
7. The evolution of technology reduces the differences in terms of production, being the determining factors for the choice of media (2D, 3D or hybrid) the narrative and the artistic vision of the studio;
8. It is estimated that the use of multiple techniques in the development path of the animation industry is increasing and even inevitable;
9. Throughout the study it became evident that, recurrently, the most chosen options were always linked to the animator's ability to put more of his creative input into the production and, consequently, hybridization being one of the most desirable tools for this purpose.
10. Proper training in the industry in hybrid techniques might overcome the problem of qualification on broader techniques or on the other hand be able to employ a more diverse range of animators with different skills.

In summary, it can be observed that the conducted experience contributes to a more contemporary state of art on this issue. Hybrid animation might be more present and further developed in the coming years, since for an artist or studio, the ability to create an unique and exclusive visual language is a great temptation and advantage in the current market saturated with stylistically consistent 3D animation. In the face of pressure for reinventing itself, hybridization appears to be a very appealing approach, since, in addition to its great creative variety, it is inseparable from the evolution of technology,

such as artificial intelligence and as well reducing costs and consequently improving profit strategies choices. The main contribution of this research was to understand the contemporary state of hybrid animation and to collect insights about its processes and adherence in order to help others to use it. It is also intended to give voice to the creatives of the animation field so that they can express their interests and desires related to the topic which can contribute to a more contemporary view on the issue which literature review alone cannot expose because of the absence of recent or contemporary studies. Also to understand in more depth the particularities, limitations and advantages of each one of the two main methods (2D, 3D) and as well to understand the result of its combination, in patterns of adherence, insights, recommendations, motivators or considerations made by professionals and animation students in the field that can help others to adopt methods of hybridization in their productions. One of the main contributions is the need of studios or schools to promote training in broader techniques to students so they can apply such knowledge in the professional environment.

As for potential lines of research, the interest is to investigate the limits of hybrid animation and to enlarge the sample of this survey in order to gain more insights and as well as to analyze it crossing more of the variables in more depth. Furthermore, the discussion between hybrid animation still has many aspects to be considered, namely the expression of movement, form and narrative.

Acknowledgment. This study was supported by UNIDCOM under a Grant by the Portuguese Fundação para a Ciência e Tecnologia (FCT) no. UIDB/DES/00711/2020 attributed to UNIDCOM/IADE – Universidade Europeia, Lisbon, Portugal.

Appendix I

Template of the survey with the total of 18 questions.

Hybrid Animation Questionnaire

Section 1 - Animation: The Art in Motion

* 1. Which of the following qualities/attributes of an animation are the **4 most important** to you?

- | | |
|---|---|
| <input type="checkbox"/> Imitation of real life | <input type="checkbox"/> Need for plot/story |
| <input type="checkbox"/> Expressiveness of the drawing | <input type="checkbox"/> Illusion of life and magic |
| <input type="checkbox"/> Abstract representation | <input type="checkbox"/> Full authorship productions |
| <input type="checkbox"/> Creating characters or worlds that are not anatomically or physically possible | <input type="checkbox"/> Use multiple styles in one animation |
| <input type="checkbox"/> Use of metamorphosis | <input type="checkbox"/> More affordable |
| <input type="checkbox"/> Other (please specify) | |

* 2. Which of the following animation techniques do you prefer?
(Please choose **up to 3**)

- | | |
|---|---|
| <input type="checkbox"/> 2d Animation (Traditional and digital) | <input type="checkbox"/> Puppetry animation |
| <input type="checkbox"/> 3d Animation | <input type="checkbox"/> Paint on glass animation |
| <input type="checkbox"/> Stop-motion | <input type="checkbox"/> Drawn on film animation |
| <input type="checkbox"/> Cut-out | <input type="checkbox"/> Erasure animation |
| <input type="checkbox"/> Claymotion | <input type="checkbox"/> Pinscreen animation |
| <input type="checkbox"/> Sand animation | <input type="checkbox"/> Experimental animation |
| <input type="checkbox"/> Flip book animation | <input type="checkbox"/> Chuckimation |
| <input type="checkbox"/> Other | |

3. Between 2d and 3d animation which one do you prefer?

- 2D
 3D

Hybrid Animation Questionnaire

Section 2 - 2D Animation

4. Which do you consider to be the biggest advantages of 2D techniques?
(Please choose up to 3 advantages)

- | | |
|---|--|
| <input type="checkbox"/> Affordability | <input type="checkbox"/> Mix of materials and artistic techniques |
| <input type="checkbox"/> Freedom to create form | <input type="checkbox"/> Simplicity of creative expression (graphic) |
| <input type="checkbox"/> Ease of metamorphosis | <input type="checkbox"/> Using the line for movement |
| <input type="checkbox"/> Ease of abstraction | <input type="checkbox"/> Shorter production duration |
| <input type="checkbox"/> Other (please specify) | |

Hybrid Animation Questionnaire

Section 3 - 3D Animation

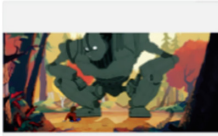
5. Which do you consider to be the biggest advantages of 3D techniques?
(Please choose up to 3 advantages)

- | | |
|--|--|
| <input type="checkbox"/> Ease of changing plans a.k.a camera | <input type="checkbox"/> Ease of change (ex: editing) |
| <input type="checkbox"/> Close-to-real lighting | <input type="checkbox"/> Capacity of reusing previous production |
| <input type="checkbox"/> Ability to create details | <input type="checkbox"/> Affordability |
| <input type="checkbox"/> Potential for perspective and 360° rotation | <input type="checkbox"/> Shorter production duration |
| <input type="checkbox"/> Ability to imitate the real world | |
| <input type="checkbox"/> Other (please specify) | |

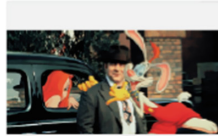
Hybrid Animation Questionnaire

Section 4 - Hybrid Animation

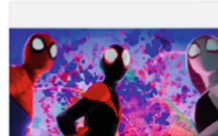
6. Which of the following movies use hybrid techniques?
(more than one can be selected)



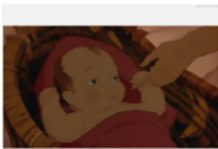
The Iron Giant



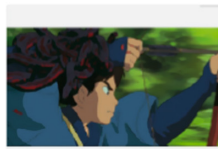
Who Framed Roger Rabbit



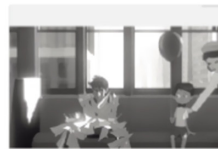
Spider-Man: Into the Spider-Verse



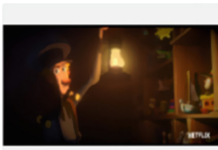
The Prince of Egypt



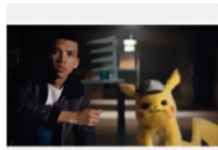
Princess Mononoke



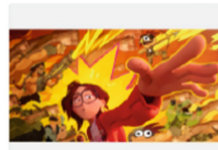
Paperman



Klaus



POKÉMON Detective Pikachu



The Mitchells vs. the Machines

7. If you remember more hybrid movies/series, feel free to include them in the box below. If not you can skip this question

8. In your opinion hybrid movies and series are...
(Please limit your answer to up to 2 choices)

- a combination of 2 or more techniques
- their own animation category technique
- new approach to animation production that helps reduce costs and labor
- all the above
- Other (please specify)

9. What do you consider to be the biggest advantages of hybrid animation?
(Please choose up to 3 advantages)

- | | |
|---|--|
| <input type="checkbox"/> Number of techniques at your disposal | <input type="checkbox"/> Better movie abstraction capability than 3d |
| <input type="checkbox"/> Creative freedom | <input type="checkbox"/> Affordability |
| <input type="checkbox"/> Potential to create new approaches to visual languages | <input type="checkbox"/> Shorter production duration |
| <input type="checkbox"/> Match multi-benefits of different techniques | <input type="checkbox"/> Potential to create a unique/authorial styles |
| <input type="checkbox"/> Freedom creating movement | |
| <input type="checkbox"/> Other (please specify) | |

10. What do you consider to be the biggest disadvantages of hybrid animation?
(Please choose up to 3 disadvantages)

- | | |
|--|---|
| <input type="checkbox"/> Blending the techniques seamlessly | <input type="checkbox"/> Difficulty in mastering the skills necessary |
| <input type="checkbox"/> Integrating the techniques technologies | <input type="checkbox"/> Diversity of skills |
| <input type="checkbox"/> Matching frame rates | <input type="checkbox"/> Cost/Time Management |
| <input type="checkbox"/> Time match animation | <input type="checkbox"/> Instability of style |
| <input type="checkbox"/> Other (please specify) | |

Hybrid Animation Questionnaire

Section 5 - The Finish Line

11. Do you agree with the following statement:

In order for 2D animated projects to continue to be produced, it will become necessary in the future for animation studios to incorporate 3D hybridization animation techniques whether that is during the production cycle or within the movie / series itself.

- Strongly agree Disagree
 Agree Strongly disagree
 Neither agree nor disagree

12. Do you agree with the following statement:

In a 3D animation production, the use of hybridization using 2D animation techniques often times results in the project displaying a higher level of artistic expression.

- Strongly agree Disagree
 Agree Strongly disagree
 Neither agree nor disagree

13. If you were given the opportunity to create your own hybrid animation project, would you?

- Very likely Unlikely
 Likely Very unlikely
 Neither likely nor unlikely

Hybrid Animation Questionnaire

Getting to know you!

The Classic Demographic Questions :)

14. What is your gender?

- Female
- Male
- Non-Binary
- Prefer to Self-describe

15. What is your age?

- 18 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 or older

16. In what country are you based in?

17. What is your current status in the field within the of animation?
(Can choose more than 1 option)

- Professional
- Professor / Scholar
- Student
- Other (please specify)

Hybrid Animation Questionnaire

18. As a professional, what role do you play in the production of an animated project?

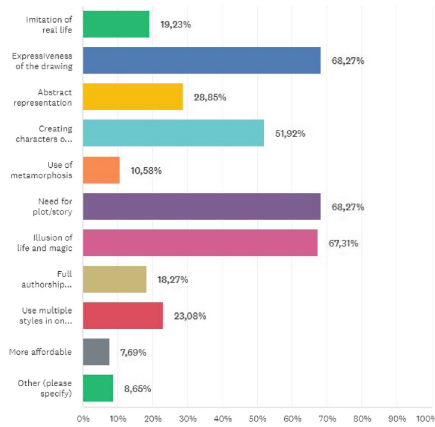
Appendix II

Graphical representation of the full results of the survey.

(note: due to space limit all the results are below in exception of the questions used on the body of the paper)

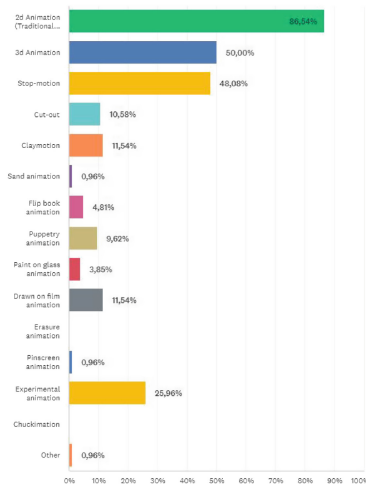
Q1: Which of the following qualities/attributes of an animation are the 4 most important to you?

Answered: 104 Ignored: 3



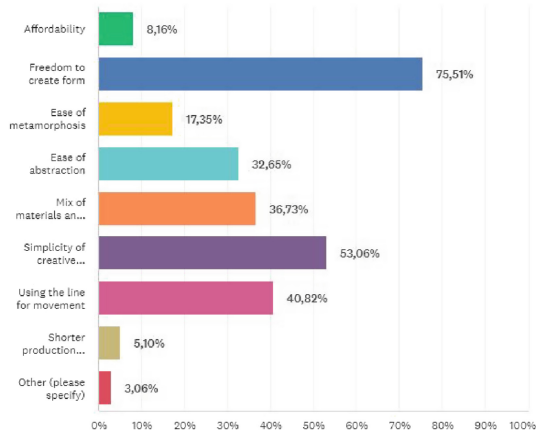
Q2: Which of the following animation techniques do you prefer? (Please choose up to 3)

Answered: 104 Ignored: 3



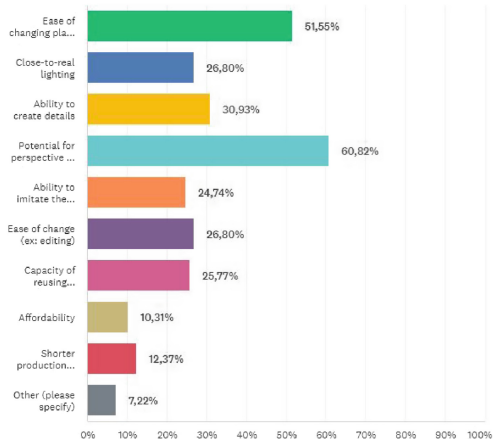
Q 4: Which do you consider to be the biggest advantages of 2D techniques?
(Please choose up to 3 advantages)

Answered: 98 Ignored: 9



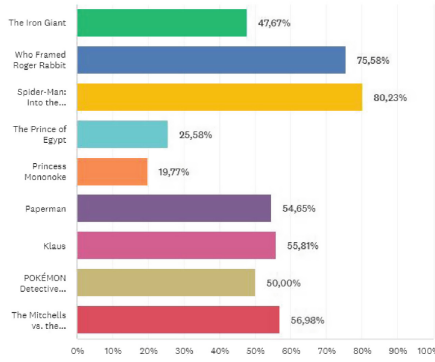
Q 5: Which do you consider to be the biggest advantages of 3D techniques?
(Please choose up to 3 advantages)

Responderam: 97 Ignoraram: 10



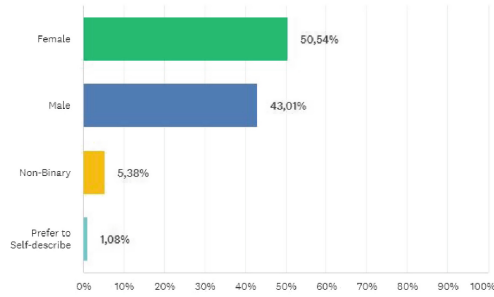
Q6: Which of the following movies use hybrid techniques? (more than one can be selected)

Answered: 86 Ignored: 21



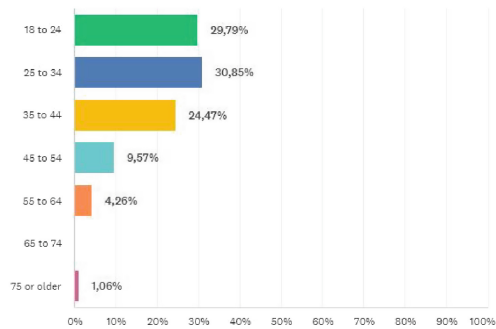
Q 14: What is your gender?

Answered: 93 Ignored: 14



Q 15: What is your age?

Answered: 94 Ignored: 13

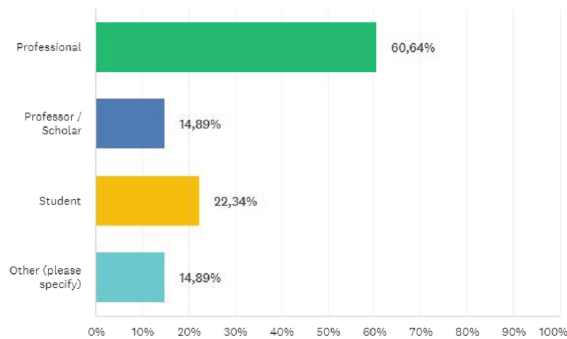


Q 16: Answers table from the 16° question

Countries	Nr	Countries	Nr
Alegeria	1	New Zealand	1
Australia	2	Poland	2
Belgium	1	Portugal	19
Brazil	1	Russia	1
Canada	5	South Africa	1
Colombia	1	Spain	1
France	2	Sweden	1
Germany	3	Switzerland	1
Italy	3	Turkey	1
Japan	1	UK	22
Malaysia	1	USA	14
Greece	2	India	3
Mexico	1	Ignored Question	15
Total	106		

Q 17: What is your current status in the field within the of animation? (Can choose more than 1 option)

Answered: 94 Ignored: 13



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