2022-1252 IJOI
https: //www.ijoi-online.org/

International Journal of Organizational Innovation

A STUDY OF CHARACTER DESIGN METHOD

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Abstract

Characters are core components of any work, and they serve as psychological projections for viewers or readers and convoys of plots and core elements. With the rise of network publishing and Internet communications, the animation, comics, and games (ACG) industry has exploded. To create distinction in an industry with highly similar works, artists/designers focus more on character model design. In this study, we adopted product design theory to examine the processes of designing character models and develop a unique character design method (CDM) . First, we examined different character model designs and analyzed the differences between the commercial animation character modeling approaches prevalent in Europe, the United States, and Japan. We then tested several character modeling constructs and administered a questionnaire survey to collect data for statistical analysis. The findings indicated that the proposed CDM greatly improved the learning interest of inexperienced character designer.

Keywords: character design, character modeling, animation

Introduction

With the rise of network publishing and Internet communications, the development of animation and comics is becoming increasingly intertwined. Character modeling is an integral step in the conceptualization of storyline and style. The identity, status, background, and underlying personality of characters that fit the storyline can be established through character modeling and setting character features. Well-designed characters can define the outcome of the animation/comic. Therefore, character models must be unique and visually impactful to impress

viewers/readers and allow the animation/comic to stand out from other similar works in the market. Characters are differentiated by facial details, apparel and accessories, and hairstyles and hair accessories. In this study, we examined the character modeling and design processes of domestic and foreign commercial animations/comics. We then combined our findings with product design theory to develop a unique character design method (CDM) to help beginner artists quickly meet design requirements

In this study, we conducted a literature review and examined the current character design processes for commercial animation/comic works created in Europe, the United States, and Japan. We then extracted the key steps of character design and applied the procedures and methodologies of product design to develop a unique CDM. The CDM serves as a reference for beginner designers to achieve their design goals. The objectives of this study are as follows: (1) to examine existing literature on character model design and combine the findings with product design procedures to develop a unique CDM; and (2) to administer a questionnaire on character design courses to determine and validate the methodologies and applications of character design constructs

Literature Review

The term “character” originally referred to the roles reprised play actors. Character IPs came to prominence in the 19th century with the popularization of newspaper comic strips in the United States. Reader favorites were copyrighted, preventing others from using them without the publisher’s approval. During this period, creators gradually realized the immense commercial potential of character designs. In Japan, the homonym,キャラクター, is used to represent actors that appear in newspaper and magazine comic strips and animated films; robots and anthropomorphic animals and plants in movies; and entities in storybooks or fairy tales (Kazuo, 2006) .

Character Design in the Animation Processes Adopted in the United States

Arguably the most well-known animation studio globally is the Walt Disney Company, founded by Roy Oliver Disney in 1923. To cope with the rising demand in animation and film, Disney adopted a mentorship approach and created a systematic training program to commercialize its animation processes. Regardless of subject matter or production technique, Disney characters are always able to captivate audiences. The design of Disney characters begins with a model sheet of the character, and it is a visual overview of the design. In 1928, Walt Disney and Ub Iwerks jointly created an anthropomorphic mouse with large ears, red shorts, and yellow shoes. The character, Mickey Mouse, became one of the most iconic animated characters of all time and the face/mascot of Disney. Mickey Mouse embodies all the character design principles of the Disney style, including geometric modeling, silhouette identification, symbolization, and representing color. Hanna-Barbera Studios, the predecessor of Cartoon Network Studios, introduced the Flintstones in the 60s.

The prehistoric family became an instant hit. To cope with the immense production volume for weekly animated television films and create works that can be enjoyed by all ages, Cartoon Network Studios adopted a modernistic character design, the main characteristics of which are thick outlines, geometric models, and colorful. Character modeling design steps of U. S animation, like Table 1.

Table 1. Character modeling design steps of U. S animation.

Organization	Point of character design
The Walt Disney Company.	Geometric shape/Silhouette/Symbolic/Color Pallet.
Cartoon Network Studios	Thick outlines/Geometric shape/High-chroma

Character Design in the Animation Processes Adopted in Japan

Disney influenced the early character models of Japanese animation. Revered artist, Osamu Tezuka, conceptualized several approaches to cope with the increased production demand as animated television films popularized, including recycling backgrounds and simplifying character movements, outfits, and hairstyles to geometric shapes. These approaches can be seen in the characters of Astro Boy – one of Osamu Tezuka's most renowned works released in the 60s. As the animation market expanded and animation techniques/equipment improved, character modeling in Japan became increasingly diverse and sophisticated. The use of geometric shapes gradually shifted to more realistic proportions and more refined outfits. This shift continued into the golden age of animation in the 80s. By this time, most anime character designs were based on realism. Artists would then add exaggerated or imaginative elements to add flare, such as brightly colored hair, massive weapons, or floating accessories. It was also during this period that Japanese character models and styles became ubiquitous. Using the Department of Character Design of the Kyoto University of the Arts as an example, the core subjects for professional character design include Basic Drawing Techniques, Professional Mastery, and Communi-cation and Exchange. In the digital age, character design has evolved into an independent discipline. Hiroyoshi Tsukamoto, who has nearly 30 years of character design experience, pointed out in his work that by using the matrix method of form, clothing, and inner personality, an infinite variety of character shapes can be combined. Character modeling design steps of Japan animation, like Table 2.

Methodology

In this study, we reviewed the character design procedures of, U. S animation and anime and combined our findings with the mind mapping, form association and combination, and color planning concepts of product design theory to develop a unique CDM, comprising the following steps in Figure1.

Table 2. Character modeling design steps of Japan animation

Unit	Point of character design
Cartoon Artist- Tezuka Osamu	Observe/Add features/Unique.
80's Animated television series	realistic character/exaggerated decoration
Kyoto University of the Art	Drawing techniques. /Professional field. Communication.
character artist- Hiroyoshi Tsukamoto	Feature/matrix combination

Character background details: It means to use the real world as a base, to assume the environment in which the character lives, as a reference to create the appearance and clothing.

Head-body ratio: Based on the human head-to-body ratio, different proportions are adapted as a method to create characters. For example, a character with a big head and a very small body.

Silhouette: When drawing the character draft, blacken the whole body into a silhouette to form the overall outline, so as to ignore the details and focus on the overall shape.

Part of body: List the body parts of the whole body from head to toe, and add changes to the parts, such as changing hairstyles or adding hair accessories on the head.

Combining: Use the morphological analysis method to list the elements of the shape, and then use the free association idea to convert the abstract concepts into concrete nouns, and then draw the relevant modeling elements and concrete nouns into clothing accessories and props. Finally, the above items are integrated to complete the role. The step process is shown in Figure 1.

Figure 1. Character Design Method

Character Background Details:

Character designs cannot be fictional, they must be based on ideas of the actual world. The background of the story refers to historical culture or myths and legends, and the details refer to ancient costumes, which are adapted. Table 3 is a reference to the characters from Chinese folk tales of the Eight Immortals crossing the sea.

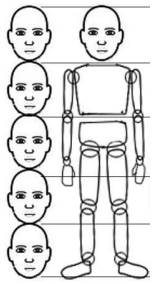
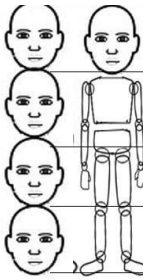
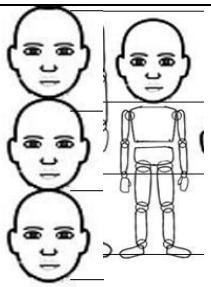
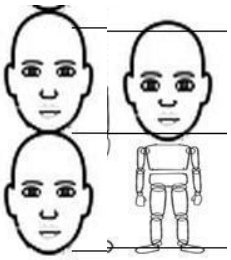
Table 3. Character background details sample

source	Character Design
	

Head-body ratio:

The head-body ratio is a measurement for drafting characters, where the head of the character is modeled in relation to its body. The head-body ratio of Asian people is typically between five and six heads, while that of European or American people is typically between six and seven heads.

Table 4. Different head-body ratio

Head-body ratio			
1 to 5	1 to 4	1 to 3	1 to 2
			
			

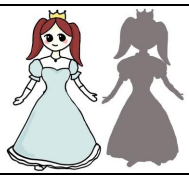
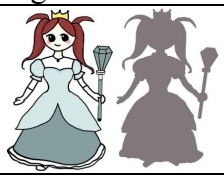
To maintain overall consistency, the head-body ratios of the protagonist and other characters are typically the same.

Silhouette:

Silhouette and geometry reinforce character recognition. The term “silhouette” derives from photography, in which a character or object is placed between the camera and a light source to remove color and dimensionality from the subject, retaining only the outline. In character modeling and design, the silhouette method reinforces character

recognition, where the effects are similar to those of symbolization. When viewing a distinct silhouette, signals are transferred from the eyes to the brain, stimulating optic nerve activity and activating parts of the brain involved in cognition, memory, and emotion, like Table 5. All well-known character models have unique silhouettes that help viewers establish association and memory in a short amount of time.

Table 5. Silhouette of character.

Level of recognition	low	medium	high
sample			

Morphological Analysis:

When designing a character, the background setting, head-to-body ratio, silhouette outline and body parts of the character are compiled into a table by morphological analysis for use in subsequent stages. Creative conceptualization: Creative conceptualization is the process of converting concepts to usable design elements. Concentration and conceptualization are crucial steps in the initial stages of product design. Fictional characters must be created based on real-world concepts. That is, known elements must be indirectly linked together. The initial stages of character modeling and design are generally abstract and ambiguous, such as establishing the concepts of being handsome, brave, beautiful, or pure. The first step is to convert these concepts into tangible elements by transforming adjectives to emotions and from emotions to nouns ,like Figure 2. the “wild” can be converted to “natural” (emotion) . From there, “natural” can be associated with “jungle” (nouns) .

Model Sheet:

Model sheets embody three graphical and creative thinking methods, namely, morphological analysis, free association, and forced relationships, to help designers incorporate representative elements into their character designs. To create a model sheet, artists first carry out a morphological analysis. Then, they form associations between the various elements. Finally, the associations are combined and transformed. Model sheets consolidate all relevant characteristics for an art project and emphasize the association aspect of the associative method of morphology (Hsieh, 2011) . In the design stage of character models, outfits, accessories, and items are combined and added to the characters, Analysis of student work in Table 8.

Figure 2. Example of Creative conceptualization “Furry”

Table 8. Student Work Sample of Character Design Method

	Creative conceptualization	Legend Wild
	Head-body ratio	1 to 5
	Silhouette	identifiable
	Part of body	head: cat ear、short hair
		body: tail
		hands: paw
		foot: boots

Survey Results and Analysis

To test the proposed CDM, we referenced existing literature and designed a classroom intervention. We then recruited 150 students studying multimedia in a technical college in New Taipei City to participate in the intervention. We also administered a questionnaire survey to measure the performance of the CDM. The pre-test and post-test questionnaires were administered between April and June 2020.

The pre-test questionnaire was administered at the beginning of the semester, the CDM intervention was carried out in the classroom throughout the semester, and the post-test questionnaire was administered at the end of the semester. Investigate gender, grade, whether you were a design major before entering university, and character design experience. Differences in "character design" among the four items

A total of 300 questionnaires were initially administered. Of which, 262 were recovered, for a recovery rate of 87%. Ultimately, there were a total of 115 valid questionnaires. This character design course is a new course. The subjects are all taking this course for the first time. They are divided into first grade and senior grade, with a total of 115 people.

In order to understand the influence of gender on character design, it is divided into male and female. There are 17 males and 35 females in the first grade. The total number of first graders is 52, with males

accounting for 32% and females accounting for 68%. There are 19 males and 44 females in the senior grades. The total number of seniors is 63, with 30% males and 70% females.

In order to understand the impact of "studying in a design-related department before entering university" on character design, the subjects were divided into two groups; One is to study a design-related department before entering the university, and the other is to study a non-design department before entering the university. Investigate differences between the two groups.

The total number of first-year students is 52, and the total number of senior students is 63. Before entering the university in the first year, the number of students in design related departments is 34, and the number of non-design departments is 18; Before entering the university, the number of seniors who were in design-related departments was 53, and the number of non-design departments was 10.

In order to know whether the subjects have previous character design experience or not. Distinguish between having and not having experience.

The total number of students in the first grade is 52, and the total number of senior students is 63.

In the first grade, 40 people had character design experience, and 12 people had no experience; among the senior grades, 56 people had character design experience, and 7 people had no experience.

How the experiment was performed: At the beginning of the character design course, conduct pre-tests, Introduce the character modeling design method into the mid-semester classroom teaching materials, Later in the character design course, post-tests are conducted. The questionnaires were administered before and after the classroom intervention, and the questionnaire data were analyzed using the IBM SPSS Software V22. A total of 150 pre-test questionnaires were administered, and 137 were recovered. A total of 150 post-test questionnaires were administered, and 125 were recovered. A total of 115 valid questionnaires were collected for the pre-test and post-test combined. Of the 115 valid questionnaires, 52 (45%) were completed by students in their freshman year, and 63 (55%) were completed by those in their sophomore year.

Paired-sample t-test (construct averages of the pre-test and post-test)

There are a total of 8 items, listed as follows:

(1) The differences between the first-year students using the character modeling design method before and after the test.
(2) The difference between the pre- and post-tests of the senior students using the character modeling design method.
(3) The difference between the first-year students and whether they were in the design department before entering the university.
(4) Whether the senior students were in the design department before entering the university?

(5) Before the first-year students took the character design course, the difference between the pre-test and post-test with or without character design experience.
(6) Before the senior students take the character design course, the difference between the pre-test and post-test with or without character design experience.
(7) Differences before and after the use of the character modeling design method among senior students of different genders

In the " The differences between the first-year students using the character modeling design method " questionnaire, questions 23, 24, and 32 show that after students learn the character modeling design method, there are significant differences in the post-test, as shown in Table9 and Table 10. The possible reason is that the character modeling design method is used in the classroom to help improve students' satisfaction with learning.

Table 9. The differences between the first-year students using the character modeling design method

Question number	mean	Std. D	T	sig
Q. 23	. 288	. 723	2. 87	. 006*
Q. 24	. 346	. 682	3. 65	. 001*
Q. 32	. 307	. 875	2. 53	. 014*

*P<. 05

Table 10. Differences before and after the first grade using the character modeling design method

Question number	Dimension	Question
23 (S)	satisfy	The content and presentation of the course make me feel that it is worth learning
24 (R)	Relevance	I learned something unexpected from the course.
32 (S)	satisfy	I feel a sense of achievement after completing this course.

In the “The differences between the sophomore students using the character modeling design method” scale questionnaire, questions 05, 24, and 28 show that after learning the character modeling design method, there are obvious differences between the pre-test and post-test, as shown in Table 11 and Table 12. The possible reason is that the character modeling design method is used in the classroom, which helps to improve the satisfaction level of students in learning.

Table 11. The differences between the sophomore students using the character modeling design method

Question number	mean	Std. D	T	sig
Q. 5	. 301	. 775	3. 08	. 003*
Q. 24	. 222	. 705	2. 49	. 015*
Q. 28	. 206	. 721	2. 26	. 027*

*P<. 05

Table 12. Differences before and after the sophomore students using the character modeling design method

Question number	Dimension	Question.
05 (S)	Satisfaction	When I complete the course, I feel satisfied
24I	Relevance	I learned something unexpected from the course.
28 (A)	Attention	Sentences and exercises, pictures used in the lessons help me focus.

(3) In the " First-year students tested whether they were in the design department before entering the university " project, the three dimensions of attention, association, and satisfaction were improved, as shown in Table 13. To demonstrate this, a paired sample t-test was performed. It can be seen that students who have studied design-related departments before entering the university have improved in the three dimensions of attention, association and satisfaction. There is no difference for those who are not studying design-related departments. The possible reason is that the past experience of studying design-related departments combined with the character modeling design method can focus more on character design.

(4) In the " sophomore students tested whether they were in the design department before entering the university " project, there are obvious changes in attention and satisfaction, as shown in Table. Students who have studied design-related departments before entering the university have higher attention and satisfaction items than those who have not studied design-related departments. The possible reason is that practical courses and experience in design-related departments can help students improve their satisfaction when they take character design courses in universities.

Table 13. Paired sample t-test of first-year students tested whether they were in the design department before entering the university

Dimension	mean	Std. D	T	sig (2-tail)
Attention	. 102	. 437	2. 18	. 031*
Relevance	. 112	. 442	2. 36	. 020*
Satisfaction	. 174	. 512	3. 17	. 002*

*P<. 05

Table 14. Paired sample t-test of sophomore students tested whether they were in the design department before entering the university

Dimension	average	Std. D	T	sig (2-tail)
Attention	. 139	. 377	2. 70	. 009*
Satisfaction	. 176	. 489	2. 61	. 012*

*P<. 05

(5) In the " whether the first-year students have character design experience " project, those with character design experience had no change in the pre- and post-test; those without character design experience had significantly improved post-test satisfaction, as shown in Table 15. The possible reason is that the character modeling design method of this study allows inexperienced people to understand the complete design steps and improve their satisfaction.

Table 15. Paired sample t-test of whether the first-year students have character design experience.

Dimension	mean	Std. D	T	sig (2-tail)
Satisfaction	. 201	. 275	3. 19	. 005*

*P<. 05

(6) In the " whether the sophomore students have character design experience " project, those with character design experience had no change in the pre- and post-test; those without character design experience had significantly improved post-test satisfaction, as shown in Table 16. The possible reason is that the character modeling design method of this study allows inexperienced people to understand the complete design steps and improve their satisfaction.

The instructional materials motivation survey in independent sample t-test.

List 6 items:

(1) Investigate the differences in responses of different genders in the first-year students.

(2) Investigating differences among first-year students who study design departments before entering university

(3) Investigate the differences between first-year students with and without character design experience

(4) Investigate the differences in responses of different genders in the sophomore students.

(5) Investigating differences among sophomore students who study design departments before entering university
(6) Investigate the differences between sophomore students with and without character design experience analyse as below:

Table 16. Paired sample t-test of whether the sophomore students have character design experience.

Dimension	mean	Std. D	T	sig (2-tail)
Attention	. 273	. 262	2. 76	. 033*
Satisfaction	. 261	. 251	2. 75	. 033*

*P<. 05

(1) There are 52 first-year students, including 17 males and 35 females. Compared with women, men had lower values on the attention and association dimensions of the pretest. as in Table 17.

Table 17. Summary table of independent sample t-tests of different genders in the first grade

Dimension	gender	n	mean	Std. D	df	T	(p)
Attention	male	17	3. 38	. 432	43. 6	2. 24	. 030*
	female	35	3. 72	. 624			
Relevance	male	17	3. 40	. 538	50	2. 17	. 035
	female	35	3. 81	. 681			

*P<. 05

(2) There are 52 first-year students, 34 of whom studied design-related departments before entering the university, and 18 who studied in non-related departments. Compared with those in non-related departments, the mean values of attention, association, confidence, and satisfaction in the post-test were significantly different for those who studied in design-related departments. as Table 18.

(3) There are 52 students in the first grade. Before the character design course, there were 40 people who had character design experience and 12 people who had no character design experience. There are obvious differences between the experienced and the inexperienced. The experienced people's confidence in the pre-test, the satisfaction dimension and the post-test confidence dimension are all higher for the experienced. See Table 19.

Table 18. Summary table of independent sample t test for design department in the past (first-year)

Dimension	Design-related departments in the past	n	mean	Std. D	df	T	(p)
Attention	Yes	34	3. 7181	. 53419	50	2. 113	. 040*
	No	18	3. 37	. 599			
Relevance	Yes	34	3. 83	. 573	50	2. 66	. 010*
	No	18	3. 38	. 578			
confidence	Yes	34	3. 48	. 505	50	3. 71	. 001*
	No	18	2. 92	. 544			
Satisfaction	Yes	34	3. 84	. 633	50	2. 24	. 029*
	No	18	3. 42	. 669			

*P<. 05

Table 19. First grade character design experience independent sample t-test summary table

Dimension	Pre or post test	Character Design Experience	n	mean	Std. D	df	T	(p)
confidence	pre-test	Yes	40	3. 46	. 588	50	3. 06	. 004*
		No	12	2. 91	. 314			
confidence	post test	Yes	40	3. 40	. 584	50	2. 71	. 009*
		No	12	2. 91	. 385			
Satisfaction	pre-test	Yes	40	3. 75	. 693	50	2. 05	. 045*
		No	12	3. 27	. 736			

*P<. 05

(4) There are 63 senior classmates, 19 males and 44 females. There was a clear difference between males and females, and the confidence of the pre-test was higher for females. and Table 20.

(5) There are 63 sophomore students, 53 of whom studied design-related departments before entering the university, and 10 who studied in non-related departments. Compared with those in non-related departments, the mean values of attention, association, and satisfaction in the post-test were significantly different for those who studied in design-related departments. as Table 21.

Table 20. Summary table of independent samples t-test for gender differences in senior grades

Dimension	gender	n	mean	Std. D	df	T	(p)
confidence	male	19	3. 34	. 672	61	2. 12	0. 38*
	female	44	3. 69	. 573			

*P<. 05

Table 21. Summary table of independent sample t test for design department in the past (sophomore)

Dimension	Pre or post test	Design-related departments in the past	n	mean	Std. D	df	T	(p)
Relevance	pre-test	Yes	53	3. 93	. 595	37. 2	2. 61	. 013*
		No	10	3. 65	. 224			
Relevance	post test	Yes	53	4. 04	. 605	61	2. 83	. 006*
		No	10	3. 47	. 425			
Satisfaction	post test	Yes	53	4. 12	. 628	61	2. 22	. 030*
		No	10	3. 65	. 605			

*P<. 05

(6) There are 63 students in the sophomore grade. Before the character design course, there were 56 people who had character design experience and 7 people who had no character design experience. There are obvious differences between the experienced and the inexperienced. The experienced people's confidence in the pre-test, the satisfaction dimension and the post-test confidence dimension are all higher for the experienced. See Table 22.

Table 22. sophomore grade character design experience independent sample t-test summary table

Dimension	Character Design Experience	n	mean	Std. D	df	T	(p)
confidence	Yes	56	3. 62	. 646	17. 2	2. 12	. 042*
	No	7	3. 33	. 264			

*P<. 05

Prospects

The results show that the proposed CDM effectively enhanced the satisfaction, confidence, and character design interest of the participants without experience in design. Virtual YouTubers (VTuber) exploded in popularity in Japan in 2018 and have continued to rise ever since. The main source of income for VTubers is showing ads on their channels or through memberships.

According to the statistics released by Playboard, VTuber Kiryu Coco received JPY ¥150 million in sponsorships in 2020. Originally a

model for large companies, many amateur or enthusiast YouTubers have emerged in recent years. These new trends show the increasing demand for character design, which was originally only limited to animation, comic, or gaming industries. Today, character design has become a major position in many industries. We hope that the proposed CDM will help expand the design of VTubers and assist artists in creating online model sheets.

Research methods: The character modeling design method is used in the character design course, and students are asked to conduct a questionnaire survey in the early and late stages of the course. It is hoped that through the character modeling design method, we can understand the impact of the above projects on learners in different grades, different genders, previous studies in design-related departments, and whether they have character design experience. conclusion as below:

1. Differences between pre- and post-test results using character design method regardless of grade level. There are significant differences between the first grade and the senior grade after the character design method, and the conclusion is that the character modeling design method constructed in this study can effectively assist in character design.

2. Differences in the pre- and post-test results of students of different genders using character design method. After students of different genders used the character modeling design method, there was no significant difference in the pre- and post-test. The confidence of male students was lower, the attention and association of females in the upper grades were improved, and there was no significant change in males. Conclusion The character modeling design method constructed in this study does not differ by gender.

3. Differences in studying design departments before entering university. Students who have studied in design-related departments in the past have significantly improved their attention, relationship, and satisfaction after implementing the character design method. The conclusion is that the character design method constructed in this study combined with design-related practical courses can effectively improve the attention and satisfaction of character design learners.

4. Difference between the pre- and post-test results after the character design experience for students using the character design method.

The confidence and satisfaction of those who had experience in character design in the pre-test were higher in the pre-test, and there was no significant change in the post-test. Learners without character design experience have improved significantly on average. Conclusion The character modeling design method constructed in this study has clear steps and good process sequence, which can help inexperienced people to improve their confidence and satisfaction.

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