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THE DESIGN IDEATION PROCESS OF A CHARACTER ANIMATION STORY

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ABSTRACT

The design ideation process of a character animation story was researched in this study. The critical design ideation process of experts' thinking was normalized. The Design Structure Matrix approach was used to analyze the ten basic elements which influences story ideation and to find the correlation between design elements regarding their independence, dependence and interaction in two senior animation experts' design ideation process. Then the experts' complex thinking was analyzed. The results showed that 1. Both senior experts repetitively mentioned the important elements in their design ideation process. These elements became critical thoughts. 2. Experts used the design pattern set into the story ideation; it made the design thinking more efficient. The two experts used the "metaphor" before conception; and then the design form of "camera language" and "body language" were taken up in the later half stage. 3. Expert A1 conceived of "story structure" as the first priority and then emphasized the logic of the whole story. Expert A2 created the "character conflict" to generate opposition in the characters to make the animation show more dramatic tension. 4. The two experts believed that the "character task" and "character personality" were important elements in the process of thinking of ideas. The results of this study provide the beginner with specific guidance and procedural aspects of the ideation process when developing an animation story.

Keywords: Story ideation, design ideation process, design structure matrix, character animation

1 PREFACE

Writing usually comes from the creators' idea in the animation design. The communication of the idea is the most important design factor to form the story. Good communication would promote the value of animation. Wells (2006) mentioned that the "Story" is the key and should be the most focus before the animating process. However, beginners often do not know how to design a good story in learning process of animation design. The beginner usually has weak ability to develop the follow-up story idea, even while having many design ideas presented. While the beginners' inspiration and imagination begins to emerge, the ideas should be better organized to communicate and promote the ability of storytelling. Therefore, conceived methods and procedures are important particularly for design a good story.

Design thinking is based on the method and on procedure of story ideation. Simon (1969) considers that "design thinking" is a creative process that produces practical solutions for problems. Therefore, exploring thinking would produce a more effective idea in the design process, and result in better design thinking methods. For this reason, understanding the expert's experience of the idea for a story would be helpful for the design of a character animation story.

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This study sought to investigate experts' development of a story idea, such that their model would be applied to teaching a student in order to promote the ability of thinking about the design of an animation story. The purpose of this study was to explore the experts' complicated process of idea development, and then summarize the critical process of story thinking. The experts' model would be applied on teaching for student to promote the ability of thinking about the design of a character animation story.

2 RELATED WORKS

2.1 DESIGN THINKING OF ANIMATED STORY

It is a very difference between beginners and experts. The experts have higher cognitive complexity and more inferences based on their rich, deep, rigorous cumulative knowledge. On the contrary, the beginners have only basic knowledge and loose structure, will only be consistent with the existing weak knowledge and information. The beginner lacks of experience and focus on the learning of animated story, can't find and apply the critical thinking in one's inspiration. This results in a less conceivable possible question (Fiske, Kinder & Larter, 1983; Stocking & Gross, 1989). A unique story cannot develop along with one's inspiration. In the other hand, the expert often uses a heuristic search strategy which produces a better solution than the beginner (Simon, 1966).

What comprises a good computer animation? Elements of animation include stories, scripts, drawing, and music among others. Lasseter (1999) pointed out it includes a clear idea, visual communication, graphic design basis, animation, drawing skills, story writing, film producer, computer-generated, and creativity. Readman (2008) considered that it should contain the story structure, movement, theme, story type, plot, characters, dialogue and scenes. Rabiger (2006) described that it needs the character, object, situation, action and themes. The element of a story is indispensable as summarized by a number of constituent elements. The key to success of an animated movie is how to use the element to tell stories, to visualize, to apply technology, and compose a movie clip animation (Wells, 2006). Good elements joining the story would further enhance the quality (Lidwell, Holden & Butler, 2003).

How do to arrange the elements in animated story? Onega and Landa (1996) mentioned the elements of the character, time, space, causality, order, or/ and structure strung together form a story. McKee (1997) considered the elements that affect the story development: structure, setting, character, type, idea, event, scenes, shock, footage, and action. Elements of storytelling contain character setting, plot, psychology, action and metaphor (Lidwell, Holden & Butler, 2003). Pintoff (1999) considered the constituent elements of an animated story as the character's action performance, background, footage, music and sound effects, concept, information, idea and emotion. In order to make the story a success in attracting viewers, the story has to be clear, simple, and straightforward (Jones & Oliff, 2006; Lasseter, 2001).

Scholars have different classifications of the process of story ideation. Wu, Yen & Fan (2011) summarized the impact of the idea of conceptualizing the thinking of character animation stories, including content, structure, metaphor, body language, language of the camera, the audience psychology, character task, character personality, character style and character conflict. The study was

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based on ten idea elements comprising the thinking process on character animation. This was used to analyze the design of critical thinking regarding expert's story development. The process of inherent logical thinking and decision making in solving a design problem was analyzed.

2.2 DESIGN STRUCTURE MATRIX (DSM) APPLIED IN DESIGN PROCEDURES

Design Structure Matrix is a simple matrix system and project, also called Dependency Structure Matrix, comprising a two-dimensional matrix pattern for design narrative analysis that proposed by Steward in 1965. It is a tool for proper process planning analysis (Yassine & Braha, 2003), and could represent the design structure matrix element in detail. It handles complex projects and the relationship between the design of procedures and elements (Lindemann, Maurer & Braun, 2008). Steward (1981) proposed the Partitioned Algorithm that simplified and split the design structure matrix and rearranged the matrix effectively. It identified clearly the relationship and preliminary project design activities among each element, and expressed the interaction within each element. It is helpful for confirming the correlation within jobs and for the subsequent sub-groups.

DSM assess the importance or the duplication possibility (Yassine, Whitney & Zambito, 2001), and has been widely applied to describe the project planning, project management, organizational design, product development, product design, industrial design and other fields of engineering for design activities of the planning and flow chart. But it is seldom used in the research of design ideas for an animation program.

A complex story design thinking process usually contains a number of elements regarding the project design concept with or interaction in a project design concept. Relationship exist between each idea of independence, dependence and interaction. The interesting and funny elements would be referred to repeatedly usually to enhance the thinking ability and problem solving decision for design. The design is expressed in a matrix pattern structure by the sequence of repeatedly elements to describe the expert's process of story ideation.

The expert's experience of animation story is analysed and summarized the experts' behaviour model of design concept by the DSM. The structure matrix of design recorded the relationship of each element throughout the whole design stage by array. The design process was deduced based on the relationship of defined element links. When an element was used frequently in structure matrix of design, it meant that the idea was meaningful or especially emphasized. The design process was be deduced based on the relationship of defined element links.

3 RESEARCH METHOD

In this study, according to Wu, Yen and Fan (2011), the design thinking development process of an animation story was established by analyzing and comparing two senior experts in character animation story. The structure matrix of design was used to analyze all elements by constructing a two-dimensional matrix with sequence of the critical move. The overall development process of story ideation for two individual experts would be exploring.

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The two experts, coded as A1 and A2, are male who won several animation awards in this field. Expert A1, with 10 years of experience in the animation company's creative department, specializes in creative thinking. Expert A2 is a senior animation director with more than 20 years of experience in the animation industry, and is now a Professor of animated story design at a college. The practical data was obtained orally where the expert completed an animated story design. The expert was required to carry out the Think-Aloud Protocols during the data collection to express their thought development. Many ideas emerged from an idea to trigger another idea when story designers developed their thinking. The Retrospective Protocols interview also required covering the lost thought development. Then the experts' thought development was analyzed step by step.

The critical ideas and procedures that were more interesting or especially emphasized, were found and identified as critical thinking (move). The matrix structure of design is constructed to deal with the complex idea and activity record by sequence of critical thinking throughout whole story.

In this study, the parametric structure matrix of design was used to effectively rearrange the relevant elements for clustering. It expressed the sequence of interaction, idea and their movement, in the activity of design project by matrix. The major design was inferred based on the defined relevant links between elements.

4 ANALYSIS AND DISCUSSION

4.1 PRINCIPLES OF CHARACTER ANIMATION STORY ELEMENTS IN THE INITIAL SEQUENCE OF THE DSM

The elements in the thinking development to arrange the initial order of the matrix is arranged before constructing the structure matrix of design was inferred. The empirical research data from Wu, Yen and Fan (2011) was used as an initial order of the matrix to analyze the individual experts' critical thinking (move) in their thought development. Ten elements impacting the story were coded as shown in Table 1.

Table 1 Axial coding of story element

NO.	AXIAL CODING OF STORY ELEMENT	CODE	NO.	AXIAL CODING OF STORY ELEMENT	CODE
1.	Story Content	SC	6.	Audience Psychology	AP
2.	Story Structure	SS	7.	Character Risk	CR
3.	Metaphor	MP	8.	Character Personality	CP
4.	Body Language	BL	9.	Character Style	CS
5.	Camera Language	CL	10.	Character Conflict	CC

The records of critical idea link are summarized sequentially in Table 2 and Table 3 for Experts A1 and A2, respectively.

4.2 ESTABLISHING EXPERT A1'S INDUCTION AND ORDER OF STORY ELEMENTS

The Expert A1's experiment took about 47 min. The retrospective interview took about 16 min. for a total of 63 min; moreover a verbatim total of 19,335 words, and a total of 51 ideas in the conceived process were provided (Wu, Yen & Fan, 2011). The critical moves of ideas were marked as "Δ", as shown in Table 2. The order of critical ideas in the whole story ideation was the following:

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Table 2 Experts A1's induction and order of story elements

NO.	TIME	INDUCTION OF ELEMENTS			CRITICAL MOVE (CM)	
1.	00'25	CS				
2.	01'18	CC				
3.	02'09	SS			Δ	
4.	02'21	CS			Δ	
5.	02'32	CP				
6.	02'58	CS				
7.	03'44	MP	AP		Δ	
8.	04'57	AP			Δ	
9.	05'16	AP				
10.	05'22	CS				
11.	06'04	SC				
12.	06'13	MP	CS	MP	Δ	
13.	06'55	AP	SC		Δ	
14.	08'37	AP			Δ	
15.	09'15	SC				
16.	10'02	CL	SS			
17.	10'34	SS			Δ	
18.	11'25	CR	CP			
19.	11'48	CR			Δ	
20.	12'01	CP	AP	BL	Δ	
21.	13'11	CC	MP	SC	MP	Δ
22.	15'38	CC	MP	AP		Δ
23.	16'50	AP				
24.	17'16	AP				
25.	17'35	AP				
26.	17'45	CS	SC			
27.	18'06	CC				
28.	18'19	MP				
29.	18'40	AP				
30.	19'04	CR				Δ
31.	20'14	SS				Δ
32.	20'33	CC	CR	BL		Δ
33.	21'36	BL				Δ
34.	22'21	BL				
35.	23'06	SC				Δ
36.	23'35	CL	BL	CC		Δ
37.	24'53	SS	SC			Δ
38.	26'08	BL	SC			
39.	29'10	SS				Δ
40.	29'45	BL				
41.	30'17	SS				
42.	30'52	AP	BL			Δ
43.	32'19	CC				
44.	32'30	SC	AP	BL		
45.	36'10	SC				
46.	37'21	SS	BL			
47.	38'24	SS	SC	BL	MP	Δ
48.	39'49	SC	CL			
49.	42'12	CL	BL			Δ
50.	44'01	SC				
51.	46'05	BL	CL	SS		Δ
Total	47'23					

4.3 ESTABLISHING EXPERT A2'S INDUCTION AND ORDER OF STORY ELEMENTS

The expert A2's experiment took about 48 min., and the retrospective interview took about 20 min. for a total of 68 min.; moreover a verbatim total of 16,817 words, and a total of 33 ideas in conceived process were provided (Wu, Yen & Fan, 2011). The critical moves of the ideas were marked as "Δ", as

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shown in Table 3. The order of critical move in the whole story ideation was the following:

Table 3 Experts A2's induction and order of story elements

NO.	TIME	INDUCTION OF ELEMENTS					CRITICAL MOVE (CM)
1.	02'00	MP					Δ
2.	02'35	CR					
3.	02'39	SC					
4.	02'46	MP					
5.	03'04	SC					Δ
6.	05'02	CP					
7.	06'20	CP	CC				
8.	06'50	CC					
9.	07'05	SS					Δ
10.	07'34	CP	CC				Δ
11.	08'48	CP					
12.	09'35	CR	CP	SC	AP	SS	Δ
13.	11'10	CR					
14.	11'48	CR					Δ
15.	12'27	AP					Δ
16.	13'51	SS					
17.	14'34	CC	AP				Δ
18.	16'14	AP					
19.	17'36	SC	AP				Δ
20.	18'49	CP	SS				
21.	20'00	SS					
22.	20'42	CR	SS				
23.	22'52	SS					
24.	24'02	SS					Δ
25.	25'41	CL	SC				
26.	26'41	CL	SS				
27.	27'55	CS	CL	SS	CL	SC	Δ
28.	37'30	SS	CC				Δ
29.	39'48	CL					
30.	39'56	AP	SS	CC			Δ
31.	33'15	CL					
32.	34'32	BL					
33.	46'56	BL	CL	SC			
Total	48'12						

Establishing expert A1's structure matrix based on A1's critical move in Table 2. The sequence of critical move was filled in from top to bottom as Ordinate, and from left to right as Abscissa to form a two-dimensional matrix for character animation story. The digit annotated the relationship of elements; the digit was "1" meant the relationship had been proposed once, "2" meant twice... etc. The relationship diagram of the Expert A1's initial diagram of structure matrix was produced after partition, as shown in Figure 1. It showed the visual diagram of causality, and the convenience for analysing the relationship of experts' conceptualized elements.

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element	SS	CS	MP	AP	SC	CR	CP	BL	CC	BL
SS	■				2	1		2	2	2
CS	1	■	1	2			1			
MP		2	■		2			1	3	
AP	1		4	■	2		1			
SC	2	2	2	2	■			4	1	
CR	1			1		■	1		1	
CP		1				2	■			
BL	2			3	3	1		■		2
CC	1	1	1		1			3	■	
CL					3			1		■

Figure 1 Expert A1's relationship diagram after partition

The Psm32 was used as a tool to construct a group, and then clustered by loop into 4 levels. The cluster of expert A1's thinking procedure is shown in Figure 2.

element	SS	CS	MP	AP	SC	CR	CP	BL	CC	BL
SS	■				2	1		2	2	2
CS	1	■	1	2			1			
MP		2	■		2			1	3	
AP	1		4	■	2		1			
SC	2	2	2	2	■			4	1	
CR	1			1		■	1		1	
CP		1				2	■			
BL	2			3	3	1		■		2
CC	1	1	1		1			3	■	
CL					3			1		■

Level 1

Level 2

Level 3

Level 4

Figure 2 Expert A1's cluster by looped

The relationship of independence, dependence and interaction in expert A1's thinking procedure resulted in the following:

1. Independence: Camera language.
2. Dependence: Story Structure→Character Style; Metaphor→Audience Psychology; Body Language→Character Conflict.
3. Interaction: Character Style↔ Metaphor; Audience Psychology↔ Story Content; Character Risk↔Character Personality.

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Expert A1’s cluster was described as follows: level 1: Story Structure, Character Style, Metaphor, Audience Psychology and Story Content; level 2: Character Risk and Character Personality; level 3: Body Language and Character Risk; and level 4: Camera Language. The structure matrix of design was used to analyze the expert’s thinking procedure level by level: analysis of level 2 by the continuation of level 1’s idea; analysis of level 3 by the continuation of level 2’s idea... etc.

Firstly, expert A1 conceived of “Story Structure;” secondly, designed “Character Style” with “Metaphor” concept in story to convey further meaning; thirdly, used “metaphor” to examine concerns with “Psychology of the Audience” and interactive thinking with “Story;” fourthly, designed the “Character Task” and “Character Personality” to highlight the character; fifthly, “Body Language” was considered in the performance of “Character Conflict” to construct a whole story; lastly, the “Camera Language” was included in the overall design considerations.

4.4 ESTABLISHING EXPERT A2’S STRUCTURE MATRIX BY IDEA DEVELOPMENT

Expert A2’s initial diagram of structure matrix was established based on Table 3. The relationship diagram was produced after partition, as shown in Figure 3.

element	CC	MP	SC	SS	CP	CR	AP	CS	CL	BL
CC	1			3	2					
MP		1								
SC		1	1		1	1	1		3	
SS	1		1	1	1	1	3		2	
CP	1		1	1	1	1				
CR		1		2	1	1				
AP	1		2			1	1		1	
CS				1				1		
CL	1		1	3				1	1	
BL									1	1

Figure 3 Expert A2’s relationship diagram after partition

The Psm32 was used as a tool to construct a group, and then clustered by loop into 3 levels. The cluster of expert A2’s thinking procedure is shown in Figure 4.

element	CC	MP	SC	SS	CP	CR	AP	CS	CL	BL
CC	1			3	2					
MP		1								
SC		1	1		1	1	1		3	
SS	1		1	1	1	1	3		2	
CP	1		1	1	1	1				
CR		1		2	1	1				
AP	1		2			1	1		1	
CS				1				1		
CL	1		1	3				1	1	
BL									1	1

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Figure 4 Expert A2's cluster by loop

The relationship of independence, dependence and interaction in expert A2's thinking procedure resulted in the following:

1. Independence: Character Conflict.
2. Dependence: Metaphor, Story Content, Story Structure, Character Personality, Character Risk, and Audience Psychology.
3. Interaction: Metaphor↔ Story Content; Story Structure↔ Character Personality; Character Personality↔ Character Risk; Camera Language↔ Body Language.

The structure matrix of design was used to analyze the expert's thinking procedure level by level: analysis of level 2 by the continuation of level 1's idea; analysis of Level 3 by the continuation of level 2's idea. Expert A2's cluster was described as follows: Level 1: Character Conflict; Level 2: Character Risk and Character Personality; Level 3: Character Style, Camera Language and Body Language.

Firstly, Expert A2 conceived of "Character Conflict" to make the animation story have more dramatic tension to attract the audience; secondly, used the "Story" and "Metaphor" to express further meaning within story; thirdly, laid out the "Story Structure" and designed "Character Personality" simultaneously; fourthly, planned "Character Task" and designed "Audience Psychology"; lastly, focused on performance to develop continuously "Character Style," "Camera Language" and "Body Language" to finish a complete story.

Comparing the relationship diagram of experts A1 and A2, it was found that expert A1 owned more critical ideas than expert A2. Experts A1's consideration was more than expert A2 in the thinking process of story design. On the other hand, expert A2 was more experienced, some of the usual design process was used to develop the story. Expert A2 was more accurate which resulted in higher efficiency in story design.

5 CONCLUSION

Both senior experts repetitively mentioned the important elements in their design ideation process. These represented the elements the experts would use frequently. Expert A1 developed his story with fewer limits in the design ideation process, and resulted in more critical moves than expert A2; expert A2 developed his story with a pattern set into the story design resulting in higher effectiveness in the ideation process. Both experts included "Metaphor" in the initial stage of ideation to establish the meaning of a story and included the form of "Camera Language" and "Body Language" in the later stage of ideation. They thought of the "Story" first, and then thought of the "Form" of animation. On the other hand, expert A1 emphasized "Story Structure" more than the "Logic of Whole Story;" Expert A2 emphasized the "Character Conflict" to make the animated story have higher dramatic tension. The independent, dependent and interaction were different in the ideation process for the two experts, however, they both considered that the "Character Task" and "Character Personality" would be elements strongly impacting the ideation.

It is understood that a unique, diversified complexity in the ideation process of story design resulted from this study. Nonetheless, the experts' thinking elements were conceptualized to propose a thinking process mode of story ideation. It would be particularly helpful for beginners to learn a systemized

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ideation process of story design, and this could be a reference for further study of animation design.

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