

**Structuring Creative Narratives: A Framework for
Enhancing Creativity in Undergraduate Animation Students
in China**

Wenchang Lin, MA, BEng.

Thesis of Professional Doctorate

Director of Studies - Dr Howard Riley

Supervisor- Dr Julia Lockheart

Supervisor - Dr Peter Spring

Doctoral College

University of Wales Trinity Saint David

2024

DECLARATION

1. that the thesis, if successful, may be made available for inter-library loan (subject to the law of copyright), and that the title and summary may be available to outside organisations;
2. that the University will store electronically, copy or translate the thesis to any approved medium or format for the purpose of future preservation and accessibility. That the thesis deposited in the digital repository will be accessible to a wide variety of people and institutions, including automated agents and search engines. That once the thesis is deposited, the item and its metadata may be incorporated into public access catalogues or services, such as national databases of electronic theses.

SignedWenchang Lin.....

Date6th December, 2024.....

ABSTRACT

This practice-based research explores how the development of a multidimensional framework, *Interaction Hyperspace*, can enhance creativity in narrative storytelling for undergraduate animation students in China. The framework is inspired by transdisciplinary insights, drawing parallels between quantum theory and the creative process, which are depicted as “a cultural symbiosis” (Galili and Zinn, 2007, p.453). In particular, the concept of quantum entanglement serves as an analogy for understanding the dynamic relationships and interactions in storytelling. The research proposes an eleven-dimensional framework that enables students to systematically construct and deconstruct narrative elements, offering structured guidance for creative exploration.

The study tests the framework through a series of case studies involving animation students and practitioners. These case studies integrate academic teaching and interactive narrative design, with data collection and analysis grounded in Activity Theory (Engestrom,1987) and Action Research (Costello, 2003). The results show that the *Interaction Hyperspace Framework* enhances students' ability to generate original story ideas, offering new possibilities for creative solutions and deeper engagement with narrative structures.

This research contributes to the fields of narrative art and animation pedagogy by providing a practical tool that bridges the gap between creative theory and hands-on application. By offering students a structured approach to storytelling, the framework helps cultivate creativity in a systematic and reproducible manner, making it a practical asset in art and design education.

Keywords:

Narrative Structure, Creativity, Art and Design Pedagogy, Animation Education, Storytelling Framework, Undergraduate Students, China

List of Contents

DECLARATION	2
ABSTRACT	i
List of Contents	ii
List of Figures	iv
Acknowledgments	vi
1. Introduction	1
1.1 Overview	1
1.2 Identifying the Problem	1
1.3 Research Questions	3
1.4 Research Background	5
1.5 Identify the Academic Gap	8
1.6 The Methodological Approach	10
1.7 Thesis Structure and Overview	15
1.8 Research Contributions	16
1.9 Chapter Summary	16
2. Literature Review	17
2.1 Overview	17
2.2 What is Interaction?	18
2.3 Quantum Theory	21
2.4 Storytelling	23
2.4.1 Story and Narrative	23
2.4.2 Storytelling	23
2.4.3 Quantum Storytelling	23
2.4.4 Narrative Theories	24
2.5 Creative Visual Construction	25
2.6 Interaction as Storytelling	26
2.7 The Existing Framework and Tools	26
2.8 Chapter Summary	28
3. Interaction Hyperspace Framework (IH Framework)	29
3.1 Overview	29
3.2 Establishing the Framework	29
3.3 The Development of the Framework Prototype	41
3.4 Examples	45
3.4.1 To Create a New Story	46
3.4.2 To Reconstruct a Story	48
3.4.3 To Deconstruct a Story	50
3.5 The Mathematical Conjecture	52
3.6 The <i>Application of Interaction Hyperspace (App IH)</i>	53
3.7 Chapter Summary	54
4. Methodology	55
4.1 Overview	55
4.2 Research Content	56

4.3 Research Method	57
4.3.1 Case Study	57
4.3.2 Activity Theory and Revised Activity Theory AT	57
4.3.3 Action Research	59
4.4 Limitations	60
4.5 Reflections	60
4.6 Chapter Summary	61
5. Case Study 1: Animation Planning	61
5.1 Overview	61
5.2 The Process	62
5.3 The Intervention	63
5.4 Data Collection	65
5.5 Data Analysis	68
5.6 Discussion	70
5.7 Chapter Summary	75
6. Case study 2: Augmented Reality Animation: <i>Door</i>	75
6.1 Overview	75
6.2 The Process	76
6.3 The Intervention	79
6.4 Data Collection	83
6.5 Data Analysis	85
6.6 Discussion	86
6.7 Chapter Summary	88
7. Case study 3: Theme Design	88
7.1 Overview	88
7.2 The Process	89
7.3 The Intervention	91
7.4 Data Collection	92
7.5 Data Analysis	94
7.6 Discussion	95
7.7 Chapter Summary	98
8. Conclusion	98
8.1 Overview	98
8.2 Original Contribution	99
8.3 Limitation	100
8.4 Future Development	100
8.5 Chapter Summary	101
References	102
Appendices	107
A1: Glossory	107
A2: Template of Research Consent Form	107
A3: A Brief about Theme Design: <i>A Piece of Sea Take-Away</i>	109
A4: Instruction of <i>App Interaction Hyperspace (App IH)</i>	110

List of Figures

(1) Figure 1.1 My Drawing Note on 2019.....	6
(2) Figure 1.2 Photograph by Jean Clottes / Chauvet Cave Scientific Team.....	7
(3) Figure 1.3 Basic Belief of Alternative Inquiry Paradigms-Updated (Denzin & Lincoln, 2018, p.111).....	10
(4) Figure 1.4: The Research Model.....	12
(5) Figure 1.5: Research Journey Timeline.....	14
(6) Figure 1.6: Engeström’s Activity Framework.....	14
(7) Figure 1.7: Revised Activity Theor.....	14
(8) Figure 2.1: My Mind Map of Literature Review.....	18
(9) Figure 2.2: Shannon–Weaver Model of Communication.....	19
(10) Figure 2.3: Flow of Information Exchange.....	20
(11) Figure 2.4: Interaction Visualization.....	21
(12) Figure 2.5: Paradigm of a Screenplay by Syd Field.....	24
(13) Figure 3.1: The Zero Dimension: Object.....	31
(14) Figure 3.2: The First Dimension: Location.....	32
(15) Figure 3.3: The Second Dimension: Action.....	33
(16) Figure 3.4: The Third Dimension: Result (State).....	34
(17) Figure 3.5: The Forth Dimension: Time.....	34
(18) Figure 3.6: The Fifth Dimension: Interaction.....	35
(19) Figure 3.7: The Visualization of Interaction Entanglement.....	36
(20) Figure 3.8: Different Time of Interaction	37
(21) Figure 3.9: The Example of Possibility of Interaction.....	38
(22) Figure 3.10: The Visualization of Interaction.....	39
(23) Figure 3.11: The Paper Hypercube.....	41
(24) Figure 3.12: The Model Made of Clay.....	41
(25) Figure 3.13: Screen Shot of Animation.....	41
(26) Figure 3.14: The Digital Model of Interaction Hypercube.....	41
(27) Figure 3.15: The Relationships in Tetrahedron.....	42
(28) Figure 3.16: The Extension of Dimensions.....	42
(29) Figure 3.17: The 3D Model of Hypercube.....	43
(30) Figure 3.18: The Interaction with Two Objects.....	44
(31) Figure 3.19: The Inter-Tension.....	45
(32) Figure 3.20: The Construction and Reconstruction Process.....	49
(33) Figure 3.21: The Visual Narrative of Harry Potter.....	51
(34) Figure 3.22: The Visualization of Interaction (2).....	52
(35) Figure 3.23: Application Screen Shot.....	53
(36) Figure 4.1 The Visualization of the AT and Revised AT.....	58
(37) Figure 5.1 The Three Imaginary Chairs.....	62
(38) Figure 5.2 Some of the Top Chairs in Selections.....	63
(39) Figure 5.3 A Reclining Chair (1 st Chair).....	63
(40) Figure 5.4 Broken Stool (2 nd Chiar).....	64
(41) Figure 5.5 Reparative Stool (3 rd Chair).....	64

(42) Figure 5.6 The Elements in Revised AT.....	68
(43) Figure 5.7 NPS Score of the Evaluation of the Effectiveness.....	71
(44) Figure 5.8 NPS Score of the Possibility of Using <i>IH Framework</i>	71
(45) Figure 5.9 The King of Chair.....	72
(46) Figure 5.10 The Preferred Chair.....	72
(47) Figure 5.11 The 1 st Chair Group.....	73
(48) Figure 5.12 The 2 nd Chair Group.....	73
(49) Figure 5.13 The 3 rd Chair Group.....	74
(50) Figure 6.1 Division of 4 Dimensions.....	76
(51) Figure 6.2 Constructing Stories by the Random Combination.....	77
(52) Figure 6.3 The Installation for AR Animation <i>Door</i>	77
(53) Figure 6.4 Stages of Action Research Process (Altrichter et al.,1993, p.6.Routledge).....	78
(54) Figure 6.5 The Working Process of Animation <i>Door</i>	79
(55) Figure 6.6 The Teaching Instructions.....	79
(56) Figure 6.7 The App IH Interface.....	79
(57) Figure 6.8 A Quick Sketch of Brainstorm.....	80
(58) Figure 6.9 Design Diary (Document).....	81
(59) Figure 6.10 The Screenshot of AR Animation <i>Door</i>	83
(60) Figure 6.11 Story Development.....	84
(61) Figure 6.12 The Storyboard of Animation <i>Door</i>	86
(62) Figure 6.13 Refined Shot List.....	86
(63) Figure 6.14 The Homepage of <i>App IH</i>	87
(64) Figure 6.15 Concept Design of <i>Door</i>	87
(65) Figure 7.1 The Inspiration Wall of Edinburgh Sculpture Workshop.....	90
(66) Figure 7.2 A Poster of Theme Design: <i>A Piece of Sea Take-Away</i>	90
(67) Figure 7.3 Procedure of the Design Task.....	91
(68) Figure 7.4 Screenshot from C.....	96
(69) Figure 7.5 Sketch by C.....	96
(70) Figure 7.6 First Sketch by L.....	97
(71) Figure 7.7 Second Sketch by L.....	97
(72) Figure 7.8 Solution for Suggestion Buttons.....	97

Acknowledgments

I would like to express my deepest gratitude to my supervisor team, Dr Howard Riley, Dr Peter Spring and Dr Julia Lockheart, for their knowledge, guidance and every supports for me in completing this research. Also, many thanks to Dr Robert Charters and Programme Manager Timi O'Neill of their lectures and academic helps over years.

I am grateful to my family who always support and love me without reserve. Especially, I started my research since my son Tianlang was 4 months old and he has given me inspirations, strengthes and belief to complete my doctorate research all the way.

I extend my gratitude to my colleagues and students of Fujian Jiangxia University for supporting me and being sympathetic to me during this research.

1. Introduction

1.1 Overview

This practice-based research develops a framework aimed at enhancing the creative narrative skills of undergraduate animation students in China. This research centers on the concept of *Interaction Hyperspace*¹, a multidimensional framework designed to systematically guide students in constructing and deconstructing narratives. By focusing on interaction as storytelling, the framework provides a structured method for narrative creation, enabling students to generate original stories that can be transformed into narrative art. As Ben Shahn (1957, p.108) noted in *The Shape of Content*, "intuition in art is actually the result of prolonged tuition." In line with this, the framework addresses the challenge students face in moving beyond familiar narrative templates by offering a clear, practical process for fostering creativity in storytelling, grounded in structured educational practices.

Although extensive literature exists on creativity and narrative structure in animation and design, a clear gap remains in their practical application in educational settings. Existing storytelling frameworks—particularly in digital and interactive media—often focus either on technical execution or high-level theory, with limited guidance for students in the early stages of creative development. This research fills that gap by introducing *Interaction Hyperspace*, which encourages creative exploration through a structured, multidimensional approach. It allows students to explore narrative possibilities while providing clear parameters for constructing their stories.

Positioned at the intersection of narrative art, animation pedagogy, and transdisciplinary creative practices, this research contributes to both academic discourse and practical pedagogy. The framework integrates theories from narrative studies, interaction tools, and creative concepts, introducing a novel approach to teaching storytelling in art and design. By applying concepts from quantum theory² to narrative construction, the *Interaction Hyperspace (IH) Framework* bridges the gap between creative theory and practical application, providing a new tool for enhancing narrative creativity within the broader context of animation education and interactive media.

1.2 Identifying the Problem

From my experience as a digital game designer for two years and later eight years of teaching in university as animation lecturer, I recognize many art practitioners and students considered that creativity is the most valuable ingredient in their work. The homogeneity of art and design is a growing issue in the creative industry while the students often find it hard to discover where innovations come from.

¹ I refer the reader to the *Glossary* for an overview of my definition in this thesis.

² I am not physics, the theories I only borrow some quantum theories for inspirations in this thesis.

When students are asked the philosophical question of what creativity entails, they often agree with Albert Einstein: "Creativity is seeing what others see and thinking what no one else ever thought" (Hargadon, 2006, p. 219). However, most of them were stuck with *where the creativity comes from*: "I would take a bath or clear my mind then let the creativity come to me" said by Xiao, a graduate student of animation who has won six national awards for his final project and is working as a senior effect artist. In teaching and supervising students, I recognize some creative minds are more remarkable than others. However, the situations about the students coming from different backgrounds are not always the same. Mary Lou Cook's perspective on creativity resonates with me: "Creativity is inventing, experimenting, growing, taking risks, breaking rules, making mistakes, and having fun" (Torronez, 2018). The majority of creative practitioners engage in similar actions to foster innovation, rather than relying on conscious thought.

Being Chinese and an educator, I believed "YouJiaoWuLei"³, the proposition from Confucius's discourse, which means making no distinctions of students in teaching. No matter what a student's talent is, one is supposed to be educated equally. Moreover, there is no end for creativity. I am always curious about how the great ideas were stimulated and keep experimenting in my own professional practice. In teaching animation students, the creative combinations occur between the stories, characters, environments, audio-visual language and editing montages. For this study, the original starting point is the students' own perceived problems of generating ideas and their desires for a formula of creativity.

In the scope of art and design, it is inevitable that the spark of an idea sometimes comes from coincidence. However, I argue that the methodical guidance might provide a more productive way to develop creativity. In the book *A Technique for Producing Ideas*, James Webb Young(2003, p.38) as a former advertising agency executive, set up an instructive paradigm and influenced the advertising industry for half a century. He asked: "Can a formula or technique be developed in answer to the question: How do you get ideas?" By answering the question he summed up the steps as:

1. Gather raw material constantly.
2. Combine old elements in new ways.
3. Go do something else for a while. (Unconscious Processing)
4. Wait for the idea to come. (The A-ha! Moment)
5. Take the idea to friends for their review. (Idea Meets Reality)

Not only the brand designers look for the recipe for creativity, every discipline of art is eager for the answers. The example of Picasso has to be raised as described in the book *The Art of Ideas: Creative Thinking for Work and Life* (Duggan et al., 2019). *Desmoiselles d'Avignon*, one of Picasso's most famous paintings of modern art was

³ A Chinese idiom from *The Analects of Confucius* - Wei Ling Gong

inspired by Matisse's *Bonheur de Vivre* and African sculpture. The secret of Picasso's creative style is 'combining two pre-existing elements into something new'. Through many stories told, the creativity comes from a process of deconstruction and reconstruction. One might be able to synthesize from raw material and design for objective-oriented purpose. When the innovation works in art and design, what could be the formula for it specifically?

David Bohm, in his book *On Creativity*, argues that true creativity involves a process of breaking through existing structures of thought to reach new possibilities (Bohm, 1998, p. 18). According to Bohm, creativity is not merely about rearranging existing elements, but about dissolving rigid patterns of thinking that constrain imaginative exploration. This insight aligns with the problem faced by students in narrative construction, where conventional narrative forms often inhibit their ability to think beyond familiar storytelling frameworks.

In my professional practices, I work with animation design mostly, but also game design, interactive design, and graphic design. In other words, they are different disciplines of narrative art. Narrative art tells a story, either as a moment in an ongoing story or as a sequence of events unfolding over time (McNamara *et al.*, 2012, p.63). From traditional Christian painting to modern experimental animation, people keep trying to discover and interpret the narratives behind the art. In my opinion, it is the instincts of humans, consciously or unconsciously, to unscramble what they see and feel. When storytelling involves the capacity for interactivity, it often means "what happens when some form of communication between two separate entities causes a story to be created" (Tearse, 2018, p.9). Especially, when storytelling works within animation, in my understanding it tends to "bring the participants into the works (stories) instead of instilling the information into the passive receivers" (Laaksolahti, 2008, p.1). This research tries to indicate that interactions between the audience and the stories are more than simply delivering background stories, but convey sympathy, value, and emotional exchange. Therefore, from the perspective of interactivity, to enhance the storytelling is the main function for art and design, which enables the source of creativity to be more methodical and practically useful.

1.3 Research Questions

In order to find opportunities for encouraging and enhancing creativity in animation and other narrative art forms, I am looking for a way to deconstruct or untangle interactions and trying to build up a framework for structuring or enabling a way of storytelling to help inform students and young practitioners.

The interactions between the art and audience, characters and environments are processes of a series of dynamic changes. In the entangled relationships, they influence the story through user interfaces, unpredictable plots and social cognition. To assess whether a structured framework can effectively outline key interactions and

inspire creativity in storytelling, this research is driven by several critical questions. These research questions guide the study, bridging both theoretical and practical dimensions, and are shaped by insights gained from the case studies:

- (1) How does interaction contribute to narrative complexity in storytelling theory?
- (2) How does the *Interaction Hyperspace (IH) Framework* support the creation of non-linear narratives with multiple outcomes?
- (3) How does the *Interaction Hyperspace (IH) Framework* enhance creativity and engagement in narrative and animation projects for undergraduate students in China?

The three research questions are designed to build upon each other, progressively moving from theory to practical application, and directly informing the methodology and case studies presented in this research.

The first question establishes the theoretical foundation by examining how "interaction" functions as a key concept in storytelling. It focuses on the complexity that interaction brings to narratives, such as how objects (characters), actions, locations and other elements within a story interact dynamically. Understanding this theoretical groundwork is crucial for framing the *IH Framework*. In the later sections of the thesis, this question informs the literature review and theoretical discussions that provide the foundation for analyzing narrative structures.

Building on the theoretical insights from the first question, the second question shifts to exploring the *IH Framework* itself. It seeks to determine how the framework facilitates non-linear storytelling, enabling students to explore multiple narrative paths and outcomes. This aligns with the methodology, where the framework is tested through case studies, allowing for an in-depth analysis of how students use the *IH Framework* in creative processes. The second research question is particularly relevant to the case studies, which analyze student outcomes in developing interactive, non-linear narratives using the framework.

This final question focuses on the practical application of the *IH Framework* in real-world educational contexts, particularly in Chinese undergraduate animation programs. It examines how the framework enhances both creativity and engagement, tying together the theoretical and practical aspects from the earlier questions. The methodology and case studies address this question by evaluating the impact of the *IH Framework* on student projects, including their creative output, engagement, and overall learning experiences.

Structuring interactions by multiple dimensions refers to *M-theory*⁴ (Schwarz, 1999, p.107), describing that there are eleven dimensions which consist of ten space dimensions and one time dimension in terms of the supersymmetric quantum

⁴ *M-theory* is a theoretical framework in physics that unifies the five different string theories and posits the existence of 11 dimensions, which are fundamental to explaining the interactions of fundamental forces in the universe (Witten, 1995).

mechanics⁵. The research will be put into the professional field of animation as a practical strategy providing solutions. As an academic researcher in the field of creative industry, I intend to explore and focus on these aspects in this practice-based research in the teaching scenarios:

- (1) Gather students' understanding of interaction, especially in the creation of narrative art.
- (2) Investigate the practical implications of interactive elements on the development of intricate and engaging narratives.
- (3) Design and prototype the *IH Framework*, ensuring it can systematically guide the creation of non-linear narratives with multiple outcomes.
- (4) Examine how the *IH Framework* enables the development of non-linear narratives by exploring different story paths and outcomes.
- (5) Evaluate the effectiveness of the *IH Framework* in enhancing creativity and engagement among undergraduate animation students in China.
- (6) Promote the use of the *IH Framework* among practitioners in the creative industry, particularly in animation and design fields.

1.4 Research Background

Over the past five years of teaching Animation Planning and Composition Design, I have been investigating how to foster creativity in design. Gradually, I have developed and incorporated lectures on creative combinations into my curriculums, aiming to enhance students' uninhibited creativity during the initial design stages.

My fascination with creative design began during my B.Eng. in Digital Media Art from 2007 to 2011. During this time, I studied script-writing for animation, graphic design, user interface design, and gained experience in game design. Following this, I pursued a career as a game designer for mobile online games for two years. Seeking further opportunities in the creative industry, I continued my education with an M.A. in Creative Arts Practice at Newcastle University from 2013, where my main practice involved exhibiting interactive installations. I have dedicated myself to studying interactive and immersive design and have been teaching and supervising Animation at the university since 2015.

As an interdisciplinary practitioner, I acknowledge that the diverse skills and techniques I have explored and applied across various art and design practices are not uniform. However, the aspect I value and admire most is the process of creative concept design. This stage typically occurs at the beginning of every design and significantly influences the entire process. In my interpretation of art and design, the most valuable aspect lies in how a work conveys specific emotions or experiences. The concept design of a piece of art may depict an era of prosperity, a tragic yet

⁵ Supersymmetric quantum mechanics is a theoretical framework that extends quantum mechanics by introducing a symmetry between bosons (particles that follow Bose-Einstein statistics) and fermions (particles that follow Fermi-Dirac statistics). It plays a crucial role in attempts to unify fundamental forces in physics, particularly in string theory (Witten, 1981).

heroic figure, or an abstract yet passionate mood. These elements are often present in narrative art, and we analyze such works through their stories. Consequently, in my professional practices, constructing and deconstructing art and design using narrative skills has always been a core focus.

In my university teaching practices, I have implemented a prototype method for brainstorming or stimulating design. This method, influenced by my years of art education and a synthesis of various creative methodologies, emphasizes divergent thinking and random potential combinations during the early concept design stage. During these initial stages, I place a key word (usually the design theme) in the center of a sheet of paper. For instance, starting with "childhood," the first level of associations might include innocence, games, snacks, songs, TV, and so forth, as illustrated in Figure 1.1. The imagination of keywords then diverges like a sun-shaped diagram through second, third, or fourth levels of associations. The next main step involves selecting two or three words from the diagram and combining them into a new setting. For example, from different branches, I might randomly choose the keywords "Planting Suns" (a song) and "Angry Bird" (a digital game). This combination leads to an imaginative story: a big bird is angry about the intense summer sun, while a team of little birds plans to breed a series of new suns to provide comfort during freezing northern nights and dark periods. In this way, a standard story's beginning and conflict emerge, appealing to the innocence of childhood and empathy for people in various situations.



Figure 1.1 My Drawing Note on 2019

My students have benefited from this method from past courses and it still remains as a rough approach to be polished in the university art classroom. These teaching experiences and wider literature reviews influenced the developing questions from *how to produce more creative design?* evolved into a deeper and more concrete exploration about *what do we see in art and design?* and *how do we approach it methodically?*

The concept of creativity in art and design has been a myth for artists and philosophers for thousands of years. A series of horses and rhinos movement drawing were discovered on the walls of caves in southern France from at least thirty-two thousand years ago (Figure 1.2⁶). This Palaeolithic art was interpreted as a creative act by presenting the animated movements like what the modern animators do. Picasso said “They’ve invented everything” (Thurman, 2008, p. 59). He was a brave pioneer in searching multiple possibilities in creativity, and amazed by this mysterious art across thousands of years.



Figure 1.2 Photograph by Jean Clottes / Chauvet Cave Scientific Team

In this thesis, I do not aim to propose the “secret” or reveal it in a philosophical approach, but attempt to start considering this question: *what hinders creativity when we design?*

In animation students’ projects, when the work is showing lower level of innovations, they tend to imitate some Hollywood-like stories, as the commercial films have a strong influence upon them. In other words, the plots or the characters are so predictable for the audience, whereas I maintain the creativity which narrative arts require is exactly the opposite. But the far more serious problem is that students sometimes are not aware of what hinders their creativity and keeps producing the similar routines. The French sociologist Pierre Bourdieu (1992) said that the *Habitus* is how a person influences the actions which responds to the social world by way of their personal habits, skills, and dispositions. The common pattern of social lives and media influences have affected the current students into making similar decisions and

⁶ Found in Chauvet Cave, date back over 30,000 years and depict horses and rhinos in motion, showcasing early humans’ advanced ability to represent dynamic figures (Jean Clottes / Chauvet Cave Scientific Team, as cited in *Smithsonian Magazine*, 2015)

exhibiting similar behaviors. Kendell Haven (2007), a professional storyteller and story consultant carefully defines a story: “A story is a character-based narration of a character’s struggle to overcome obstacle and reach an important goal”. When the students would like to deal with objective-oriented design, their inspirations come from the search engine by typing a same keyword and evoke their memories with similar life stories. In China, the ‘Millennials’ generation is growing in relatively well-off families while their main goals for the first twenty years are academic pursuits. The shared experiences of the university students show influences on their creative works based on the social habitus of this age.

Despite the availability of vast online resources and personal life stories as sources of inspiration, there remains a critical gap in how young creatives, particularly undergraduates, are supported in structuring these stories into cohesive, dynamic narratives. This study aims to explore how a structured framework can address this gap, providing students with a tool that fosters creativity while guiding them through the complexities of storytelling.

1.5 Identify the Academic Gap

The aim of this study is to address the research questions by developing a practical teaching approach for creative art that draws on diverse disciplines, such as *M-theory* and quantum theory, employing analogies and metaphors. The application of physics principles such as quantum mechanics, to the construction of art and design is an emerging field of research. For example, Galili and Zinn(2007, p.453) argue that art and science share a common goal of understanding the world and that they should be seen as complementary rather than opposing fields. They have explored this connection and suggest that physics and art can inform each other by providing insights into the essential principles of the universe.

Current approaches to narrative pedagogy, particularly in animation and design education, often emphasize linear storytelling structures and lack sufficient frameworks that encourage students to explore narratives and multiple outcomes. Frameworks such as Campbell’s (1949, pp. 28-32) *The Hero’s Journey* or Syd Field’s (1984, p.41) *Three-Act Structure* excel in providing linear storytelling structures but often fall short in supporting the complexity required for interactive or non-linear narratives. While tools like *Twine*⁷ and Lambert's (2013, pp. 199-203) *Digital Storytelling Model* enable greater flexibility and encourage multimedia integration, they primarily focus on content creation rather than equipping students with foundational skills for narrative construction. There remains a significant gap in how foundational narrative skills can be cultivated through a multidimensional approach that embraces complexity and non-linearity, particularly to the specific needs of

⁷ Twine is an open-source tool for interactive, non-linear storytelling, created by Chris Klimas in 2009. Available at: <https://twinery.org>

undergraduate animation students in China.

David Bohm, in his exploration of creativity and quantum theory, offers a relevant perspective that can strengthen this discussion. Bohm suggests that, much like particles in quantum mechanics, creative ideas exist in a state of potentiality, where multiple outcomes are possible until they are actualized through the creative process (Bohm, 1998). By integrating Bohm's insights into the creative process, one gap of this research lies in narrative pedagogy by offering a framework that not only provides structured guidance but also embraces the non-linearity and complexity that are essential to fostering true creativity.

While creativity and narrative structure are extensively discussed in the fields of animation, storytelling, and design, there remains a significant gap in how these concepts are practically applied in educational settings, particularly for undergraduate animation students in China. Current pedagogical approaches often emphasize either high-level theoretical frameworks or focus primarily on technical execution without providing students with a structured method for creative exploration in narrative development. This creates a disconnect between creativity theory and hands-on application in educational contexts, where students are often left without clear tools to systematically generate original stories.

This research is positioned to address key gaps in the intersection of narrative theory, animation pedagogy, and creativity studies. Current literature lacks sufficient exploration of how interaction functions as a core element in constructing complex narratives. While narrative complexity has been widely discussed in both literary and media studies, there is limited research examining how interaction specifically contributes to the development of intricate, multi-layered stories, particularly in an educational context.

Furthermore, the gap extends to the practical applications of narrative creation, especially regarding the facilitation of non-linear narratives with multiple outcomes. While frameworks for interactive storytelling exist, they primarily target digital media rather than foundational educational approaches for narrative development.

Finally, there is a significant gap in understanding how structured guidance can enhance creativity and engagement within educational settings, particularly for undergraduate animation students in China. While many educational models focus on fostering creativity, there is a lack of comprehensive tools that bridge theory and practice in a way that encourages creative engagement through a structured process.

To address this gap specifically, the computational framework and its display of *App Interaction Hyperspace* is designed to embody the trans-disciplinary method of narrative construction in realizing the enhancement of creativity for art students. The original contribution of knowledge of this research may offer creative design thinking

of structuring stories as well as an interactive tool in professional practical education. However, further research is always needed to explore these relationships between disciplines and improve the theoretical framework from the actual creative industry.

1.6 The Methodological Approach

The research questions lead to the core inquires of how structuring storytelling through the perspective of interaction could assist art students with their practical design. “All research is interpretive: guided by a set of beliefs and feelings about the world and how it should be understood and studied.” (Denzin & Lincoln, 2018, p.19). The researcher’s beliefs and inquiries shape the data collection and subjective interpretations during analysis. In the context of encouraging creativity, this research involves helping students to explore their own creative processes and understand how they personally generate new ideas and concepts. An Interpretivist philosophical stance is adopted to this research. In response to the research inquiries, the research is designed using qualitative methods to collect and analyze data from three case studies of different assignments with art students and practitioners.

In terms of method, there are several alternative paradigms (Figure 1.3) and methodologies that can be considered. There is a brief review of the available paradigms of my research regarding to *The SAGE Handbook of Qualitative Research* (Denzin and Lincoln, 2018).

Issue	Positivism	Postpositivism	Critical Theory et al.	Constructivism	Participatory*
Ontology	Naïve realism— “real” reality but apprehensible	Critical realism—“real” reality but only imperfectly and probabilistically apprehensible	Historical realism— virtual reality shaped by social, political, cultural, economic, ethnic, and gender values; crystallized over time	Relativism— local and specific co-constructed realities	Participative reality— subjective-objective reality, cocreated by mind and given cosmos
Epistemology	Dualist/objectivist; findings true	Modified dualist/objectivist; critical tradition/community; findings probably true	Transactional/ subjectivist; value- mediated findings	Transactional/ subjectivist; co-created findings	Critical subjectivity in participatory transaction with cosmos; extended epistemology of experiential, propositional, and practical knowing; cocreated findings
Methodology	Experimental/ manipulative; verification of hypotheses; chiefly quantitative methods	Modified experimental/ manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods	Dialogic/dialectical	Hermeneutical/ dialectical	Political participation in collaborative action inquiry; primacy of the practical; use of language grounded in shared experiential context

Figure 1.3 Basic Belief of Alternative Inquiry Paradigms- Updated (Denzin & Lincoln, 2018, p.111)

Ontology deals with the nature of reality and the fundamental essence of existence (Creswell, 2017, p.19). Within an interpretivist ontological framework, “Our individual personal reality- the way we think life is and the part we are to play in it- is self-created. We put together our own personal reality (Guba & Lincoln, 1985, p.73)”.

This coexistence aligns with multiverse concepts in quantum theory (Wallace, 2012, p.46), an analogy that informs this research across disciplines. In the Chapter 4, there is discussion about the reality of interaction. When the storytelling seen as a form of interaction, various interpretations are perceivable by the storytellers, the designers and the audiences. Thus, the first research question aligns the discovery of ontology of interaction as start of story construction.

The constructivist paradigm emphasizes the importance of understanding how individuals construct their own understanding of the world around them, which is the understanding of creating art and design in this case. Through lived experiences and interactions with other members of society, researchers must participate in the research process to produce reflective knowledge (Denzin & Lincoln, 2018, p.115). In the case studies of teaching practices, researcher as teacher plays an important role in ensuring the research process and the main interpreter of the reality.

Epistemology concerns itself with the grounds of knowledge or the 'connection between reality and research.' In the context of interpretivist epistemology, the proposition emerges that the researcher constructs comprehension through subjective knowledge acquisition. This involves seeking to comprehend a particular context and directing attention toward the distinct and tangible aspects within it (Carson *et al.*, 2001, p.16).

The critical paradigm focuses on issues of power and inequality, and encourages researchers to take a critical perspective on societal structures and systems. In the context of encouraging creativity, this could involve exploring how different societal factors (such as gender, race, or culture) impact creativity, and working to empower students who may face barriers to creative expression.

Methodology is the process of how we seek out new knowledge. The principle of our inquiry and how inquiry should proceed (Schwandt, 2007, p.190). In the interpretive approaches, interviews, observation and analysis from the interaction between the researcher and participants are applied in the case studies concerning this research mainly regard the practices in the design activities and the process of ideation.

Though, there are many different paradigms and methodologies that could be relevant for this research. By carefully considering the strengths and limitations of different approaches, I am attempting to develop a framework that is tailored to the unique needs and experiences of the students they work with by a framework for encouraging creativity among art students. The learner autonomy always values highly in the educational industry, thus it drives my momentum to conduct research focusing on the individual perspectives of their design according to a storytelling framework. The particular interpretations of participants involved in the design activities are valued in the data collection and analyze to this research. Therefore, it is intended to be

conducted within the interpretive paradigm to reflect the subjective meanings of the participants (Pring, 2005, p.243).

Since adopted in the Interpretivist paradigm, this research has found its consistency in Symbolic Interactionism, which is from the many approaches of Interpretivism. Gray (2009,p.21) believes that “human interaction with the world is mediated through the process of meaning-making and interpretations”. He also concludes these essential tenets of Symbolic Interactionism:

- People interpret the meaning of objects and actions in the world and then act upon those interpretations.
- Meanings arise from the process of social interaction.
- Meanings are handled in, and are modified by, an interactive process used by people in dealing with the phenomena that are encountered.

In the case of this research, “the meaning of objects and actions” means how the students construct their storytelling when “acting upon those interpretations” could symbolize the design they generate upon their stories. Especially, my understanding of storytelling could be seen as interactions, which fits the second tenet where art and design find their meanings from these interactions. Stories from *IH Framework* are easy to be “handled in and modified by”, which makes the storytelling “an interactive process” with the students’ individual experiences.

Figure 1.4 is the research model designed for this process, which indicates the relations between the theoretical framework and case studies: how each case study feeds into one another and responds and reflects on the fundamental framework. The first case is defined as the *Test* phase of a short-time classroom design assignment among animation students, which aims to deliver the idea of *IH Framework* to assist their narrative design and comparing the differences before and after the intervention. Based on the data and observations in the first case, the second case is defined as the *Adjustment* phase when the interface of the framework utilizes an interactive application to convey the *IH Framework*, which pays attention to a complete work by a group project and how the storytelling framework affects a long-term assignment and compare the different stages of animation design. The last case is defined as the *Promotion* phase, aiming to put the storytelling application to a more general use with more narrative design conditions. It explores the possibilities of different categories of design using a narrative-centered method among multiple backgrounds of more mature animation practitioners. All cases and discussions feed into the core concepts and reflect the process to improve the framework.

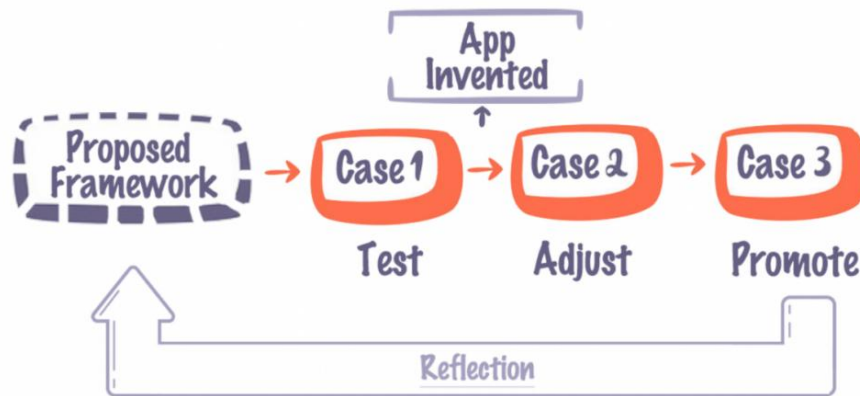


Figure 1.4: The Research Model

The research journey began with the preparation phase, where the research direction and scope were established in 2022. This was succeeded by an intensive, three-month period dedicated primarily to literature reviews, which aimed to comprehensively gather existing knowledge and identify gaps within the field. However, it is important to note that while the literature review was most concentrated during these initial three months, it remained an ongoing process throughout the entirety of the research project. This continuous engagement with the literature ensured that the research remained up-to-date with the latest developments and insights, thereby strengthening the foundation for the subsequent data collection stage and informing the overall research.

The study encompasses three case studies (Case Study 1, 2, and 3), all conducted within the year 2023. Case 1 involves a short-term training conducted within an animation class, aiming to quickly demonstrate the immediate feedback and comparison before and after using the *IH Framework*. Thus, data collection and analysis for this case were completed within one month. Case 2 is designed to document the role of the *IH Framework* throughout the entire animation creation process and the level of student participation. Consequently, this process lasted for nine months. Case 3 focuses on how more experienced designers can quickly accept and use the digital application of *IH Framework*. The design aim is to test the effectiveness of user self-learning through the app and the potential for widespread adoption of this method. Data collection and analysis for this case were also completed within one month. Each case study yielded abundant empirical data, which was promptly analyzed to reveal underlying patterns and trends. A more detailed explanation of these case studies will be presented in Chapter 4.

Finally, the research culminated in the final write-up and submission phase. A preliminary research thesis was completed and submitted in September 2023. After undergoing a review process and receiving feedback, necessary revisions and enhancements were made, leading to the final submission of the research project in

October 2024.

The research timeline depicted in the Figure 1.5 serves as a visual representation of the systematic and orderly progression of the research work, highlighting the key stages and their respective timelines. The research periods are not entirely independent of each other. The dark blue sections in the diagram represent the preparation and planning phases of each stage, during which relevant materials are accumulated and research conditions are prepared (such as the development of the app). The yellow sections in the diagram do not indicate gaps in the stages; instead, they represent periods where reviews and further organizations are conducted in relation to other stages. This methodological approach ensures a structured and rigorous investigation into the research question, ultimately contributing to the validity and reliability of the findings.

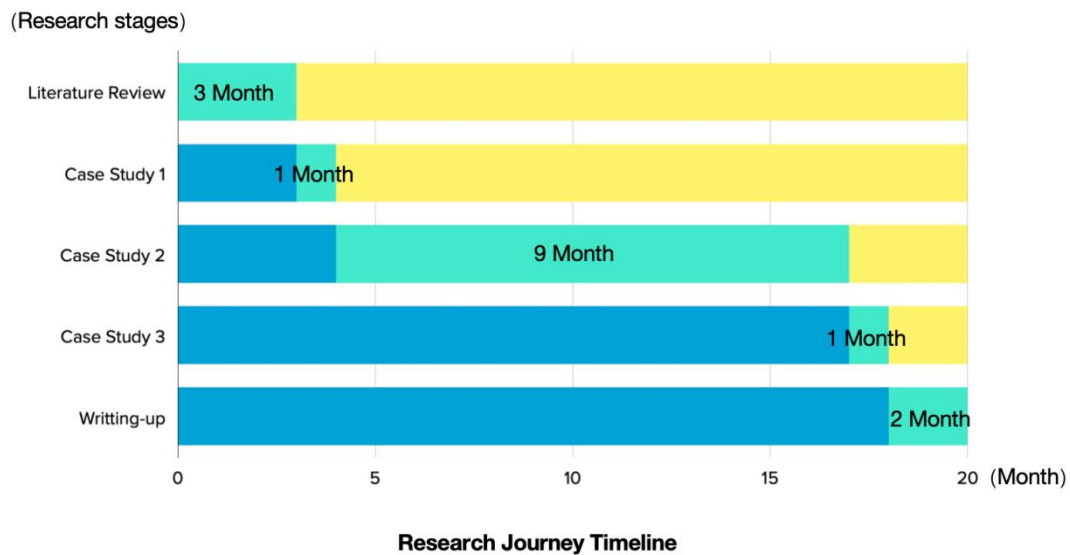


Figure 1.5: Research Journey Timeline

Research design is based on qualitative research, taking into account Activity Theory (Engeström, 2015) (Figure 1.6) and Action Research (Costello, 2003), which provide the main theoretical and conceptual framework of the research. Furthermore, I am trying to propose my own interpretation of Activity Theory regarding my working framework as Revised Activity Theory (Figure 1.7) used in one of the case studies. Activity Theory offers a systematic model to deal with multiple environments like university classrooms and the complexity of subjects. The use of Activity Theory as a method for creativity (Kinsella, 2018, p.493) enlightened me to develop a new method to apply to my research which takes into account more interaction-related aspects.

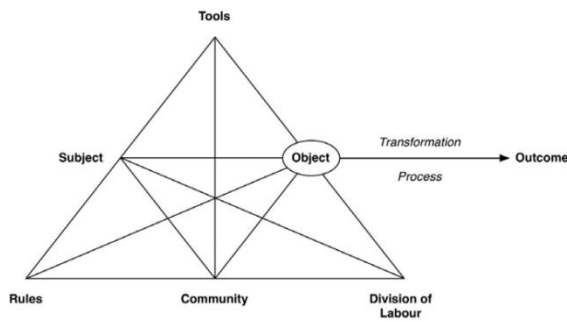


Figure 1.6: Engeström's Activity Framework

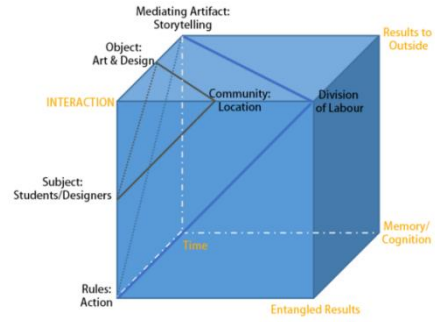


Figure 1.7: Revised Activity Theory

As my research necessarily suggests that I am an insider action researcher, I cannot be separated from the participants because it is our social interaction that created the data (Guba and Lincoln, 1991, p.158). I might be participating in most of the practices, instructing the process while I am the researcher observing and interpreting these case studies. The following is a brief description of the three case studies:

Case Study 1: Animation Planning

Content: Conceptual design practice in classroom for first-year undergraduate students.

Methods: Data will be gathered mainly using on-line questionnaires, discussion notes taken in class by the researcher and analyzed using Revised Activity Theory.

Participants: Students (sample size about 35) from animation in Fujian Jiangxia University.

Case Study 2: Augmented Reality Animation: *Door*

Content: A complete animation work from a group of students.

Methods: Data will be gathered mainly using in-depth interviews and design diaries by students, and analyzed using Action Research.

Participants: A small number of animation students collaborating on one piece of work.

Case Study 3: Theme design: A Piece of Sea Take-Away

Content: Experienced designers working on a common theme's design.

Methods: Data will be gathered mainly using online questionnaires and interviews about the design process, and analyzed using Activity Theory.

Participant: 9 Chinese designers currently residing in China or abroad.

1.7 Thesis Structure and Overview

In this chapter, the critical question about creativity and interaction is brought up from original daily experience and thinking, along with the discussion and explanations about the main methodology of this research. In the following chapter (Chapter 2),

literature reviews about visual construction of narrative and ideas inspired from quantum theory are discussed. Inspired by the hyperspace dimensions, the layers of interaction is going to be dissected into eleven aspects in the early research. As an early working framework, *Interaction Hyperspace* will be deliberated and explained how it related to and influenced by the *M-theory* in Chapter 3. In Chapter 4, there is the detailed explanations of the specific methods conducted in this research. After determining the basic framework and research methods, three case studies of teaching and practical applications of creative scenario will be described in Chapter 5, 6 and 7. In the final chapter (Chapter 8), conclusion of the present research, preview of further professional practice and proposed questions will be presented. Therefore, this thesis is trying to propose a means to stimulate innovative ideas by analyzing interaction between people and objects, where more specifically, the research is intended to feed on educational methods and creative industry as a interactive tool.

1.8 Research Contributions

The goal of the original contribution to knowledge that this research offers is to feed into the professional creative practices, while the main original product of this research is an interactive digital tool for encouraging and facilitating creative storytelling, specifically within the context of animation education. This research introduces the *IH Framework*, a tool designed to facilitate and inspire the creation of complex, creative narratives by exploring interactions between objects, audience, and environments. By doing so, it addresses the first research question, contributing to a deeper theoretical understanding of how interaction functions as a core concept in storytelling and how it enhances narrative complexity.

The *IH Framework* serves as the core product of this research, offering a practical, interactive digital tool aimed at breaking traditional narrative patterns and encouraging students to explore new creative possibilities. This contribution directly responds to the second research question by providing a structured method for enabling non-linear storytelling and multiple narrative outcomes, positioning the framework as a tool that supports innovation in narrative design.

Furthermore, this research delivers a teaching model specifically designed for undergraduate animation students in China. By integrating the *IH Framework* into educational practice, the model provides an interactive approach to art pedagogy. This outcome aligns with the third research question, demonstrating how the framework enhances creativity and engagement in practical storytelling and animation projects, thus bridging theoretical insights with real-world educational applications.

1.9 Chapter Summary

Practice as research is an ongoing process during the DProf programme and the framework considering storytelling is proposed to be critical development for the

creative art and design activities. This research will continue to discover trans-disciplinary theory and put into professional practices as main evidence and adjust the methods in helping university art students with more possibilities of creativity.

Since the researcher's perspective and interest for structuring stories is *interaction*, the case studies were collected and analyzed focused on this perspective to improve the Application *Interaction Hyperspace*, which potentiality feed into the educational environments and creative industry in the following research stage. In this first chapter, the motivation, and the evolution of research question, proposed methodology and cases' overviews have been briefly introduced. According to the research focus, more relevant literature reviews will be elaborated in the next chapter.

2. Literature Review

2.1 Overview

This literature review examines key theories and frameworks related to storytelling, narrative structure, and creativity within the context of animation and art education. It explores foundational theories such as interaction, quantum theory, and narrative construction, while also addressing more contemporary frameworks and narrative tools in digital and interactive storytelling.

This literature review supports the aim of helping to contribute to the practice of art and design and the assumption that interaction is the core element within the arts. The discussion is divided in several sections which give a general foundation for the framework of structuring stories for art and design. Firstly, in Section 2.2 the focus is on the discussion about *interaction*. In the domain of art and design, the definition of interaction responds to many interpretations and leads to more critical discourse across different disciplines. Secondly, the next section, 2.3 searches similar patterns and inspirations from the quantum theory, especially the hyperspace theory. The borrowed ideas from physics afford more insights of universal rules between science and arts to organize a structure and start setting up theoretical model. Next, Section 2.4 focuses on storytelling structures through both text and visual art. The comparison of different narrative theories reveals various characteristics and, importantly, helps to identify gaps in the research field. Section 2.5 expands on the literature and practice surrounding the construction of visual creativity, as this practice-based research aims to propose solutions for the practical creative field. A significant insight in this research, Section 2.6 provides stronger evidence to support the interpretation of interaction as storytelling. Lastly, to address the practical educational field, Section 2.7 presents existing frameworks and tools for creating narrative art, along with their comparisons and limitations. A simple mind map (Figure 2.1) is presented below to visualize the areas to be examined in the literature review and how these scopes relate

to this research. Together, these sections form a comprehensive foundation for understanding the role of interaction in art and design, while laying the groundwork for the development of the proposed framework.

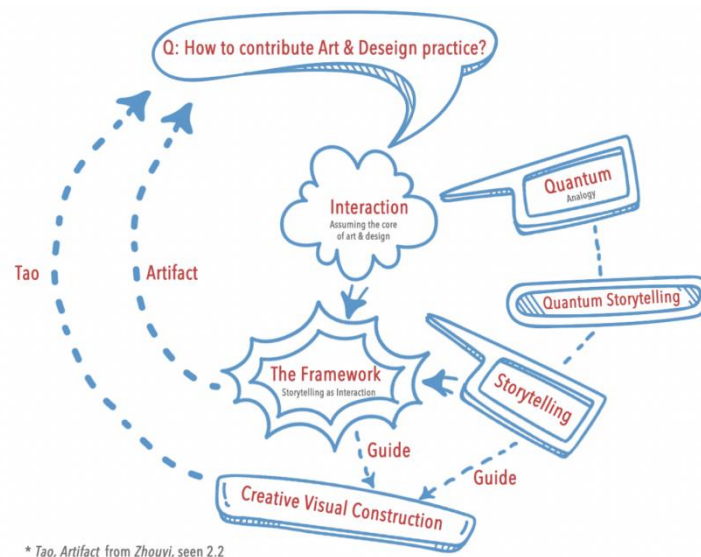


Figure 2.1: My Mind Map of Literature Review

2.2 What is Interaction?

When a piece of art is brought up in an art review, what is seen in that work? Having completed a design, what are we expecting it might communicate? When we appreciate something as creative, what is the formula that actually involves, inspires people?

These questions are not the essential research questions to answer in this thesis, but are the starting points. Many answers to the above questions would be considered appropriate and even wise, philosophically. Among them, there might be a chance that the interaction is my interpretation of these questions and it gives me motivations to look into the art and design through the entangled relationships. Coincidentally, Claire Bishop (2012, p.235) holds a similar view “the consideration of art as participative with a concept of interactivity...” while Steve Dixon (2007, p.559) announced “all art is interactive”. In agreement with them, in order to contribute original knowledge to the practical industry, I am trying to look into the topic from a perspective of interaction as a starting point.

In the search for a theory of everything, which unifies all theories, the scientists have made their efforts in finding the answers in physics. Brianna Browne’s (Harman, 2018,

p.22) claim that “physics, and string theory in particular, has limitless applicability”, which postulates the total number of dimensions was expanded to eleven rather than the four dimensional space-time from Einsteinian physics (Harman, 2018, p.23). However, Harman’s Object-Oriented Ontology (OOO) indicated “science cannot provide a theory of everything” while philosophy is a form of knowledge and aesthetics is the root of all philosophy.

The mention of aesthetics tends to bring the questions to art ontology while this thesis is in search of the ontology of interaction, which means what interaction is. When people are asking what something is, the answers are subjective to the responders, often millions of them. Generally, the answers fall into the two categories, “knowledge (what a thing is made of) and practical know-how (what a thing does)” (Harman, 2018, p.44). It is the human instincts that attempt to comprehend something by their emotional experience and physical feelings.

Technically, the *Oxford Advanced Learner's Dictionary* (Turnbull *et al.*, 2010) defines interaction as “the act of communicating with somebody, especially while you work, play or spend time with them,” particularly in the context of relationships between performers and their audience. Or “if one thing has an interaction with another, or if there is an interaction between two things, the two things have an effect on each other” .

The definition suggests that *communication* can be considered a synonym for interaction, as both involve the exchange of messages and media to create an effect. In Chinese aesthetic theories, there exists discourse about “Integration of *Tao* and *Artifact*⁸” from *Zhouyi*. *Tao* is the metaphysical, which is believed that *Tao* is the noumenon or content of *Artifact* while *Artifact*, representing the physical, is the appearance or form of *Tao* (Zhang, 2005). They are supposed to be integrated and synthesized under the laws of how the world works. In the practical field of art and design, *Tao* could be explained as the actual meaning the art is trying to express and *Artifact* is seen as the technical methods for achieving the goal. Communication could be seen as the *Artifact* of interaction in this case.

In sociology, communication means “the various methods of sending information between people and places, especially phones, computers, radio, etc.” (Turnbull *et al.*, 2010) In Shannon–Weaver model of communication (Shannon and Weaver, 1949), the transmitter exchanges information to the receiver shown in Figure 2.2. When the message is sent back, the circulation of information comes up. This model describes the legible process of message moving and participants in each module.

⁸ From the *I Ching* (or *Zhou Yi*), representing the integration of metaphysical principles and practical applications.

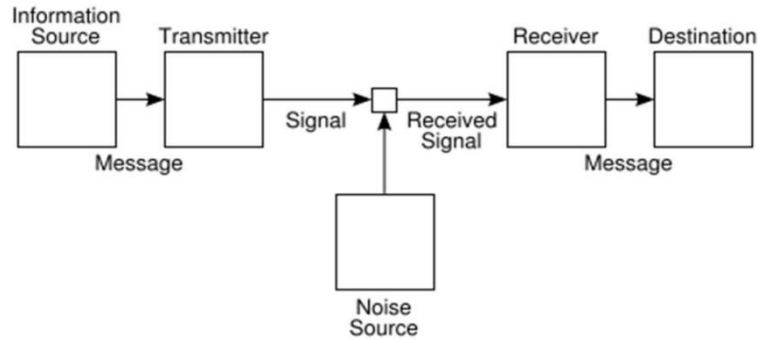


Figure 2.2: Shannon–Weaver Model of Communication

Even though this model is classic and has been iterated for many years, I have doubt about the linear model of information exchange. I would imagine the information is in a loop like the flow of water. In my opinion, the attenders switch roles and their messages become entangled.

The transmitter and the receiver are swapped every time the message is delivered so there is no need to point out the specific identification. The objects within the loop as the main attenders are affected by the impact of information. Whatever the signal or the noise, these interrupt the constituent flow of messages, creating certain effects caused by reacting to each other in this information entanglement. When there are more than two objects attending the information interchange, the information flows within them. Notably, the *information flow* is integrated with all the messages, signals and noises. That would never be one pure ingredient but create a complex mixture with all the unexpected influences caused within the entanglement we understand as communications.

As to the direction of the information flow, the situation varies from different scenarios. If the interaction is time-divided communication like instant messaging or letters writing, there is an initiator and replier. That pattern follows the Shannon–Weaver model as a linear form. But not all the scenarios all that typical and simple. In a football match, the interactions between the players are triggered in the same time. Since the whistle blowing, every body movement and every eye contact are collected into a Mobius-Strip-like information flow.

Therefore, the entangled loop of information (Figure 2.3) is my definition of *interaction*. The actual useful messages, the media used to convey, the environment and even all the unwanted noises constitute the interactions, where the objects (human or non-human) are parts of the entanglement and have effects on themselves and on others.

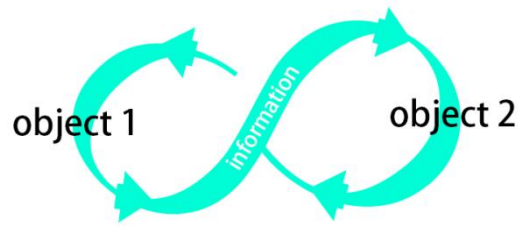


Figure 2.3: Flow of Information Exchange

2.3 Quantum Theory

It is information that is the most vital factor within the various communication modes. As shown in Figure 2.2, the primary understanding of interaction is described as an information entanglement within two or more than two objects. In my early thought, I used to imagine that the overlap of multiple human experience (or information) would be visualized as a structure of layers (Figure 2.4). Various routines of A,B and C are independent experiences in their lifespan. They would come into contact with each other, have intersection for a period of time and at last would move on separately. The yellow shadow indicates the intersection between A and C while red shadow means the intersection between A and B. Notably, the dark part with ABC is the triple overlay when A and B and C are having the interaction together.

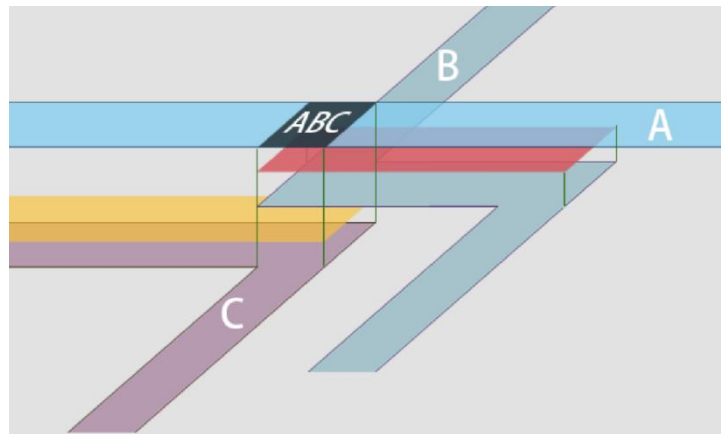


Figure 2.4: Interaction Visualization

Everyone has shared the mutual experience for a while and then continued to move on by each own track of life. The universe is conventionally described in terms of physical quantities such as mass and velocity, but a quantity at least as important as these is information. (Stone, 2016, p.17)

If I could use an analogy from physics to information theory, the mutual entangled interaction could be described as *dimensions* instead of layers. The quantum

entanglement⁹ fits the pattern and how people cognize the flow of information exchange. Especially, in the scope of art and design, most would agree that we place a high value on creativity. In quantum mechanics, the quantum leaps¹⁰ are not linear, but discontinuous, as Koyama and Niwase (2017,p.3) claimed that “the sudden appearance of idea is like the quantum leap.” Also, the latest research has discovered: “the researchers could spot when a quantum jump was about to appear, ‘catch’ it halfway through, and reverse it...” (Ball, 2019) This phenomenon parallels certain interaction processes. Certain interaction happens after a signal sent out. For example, people could pick up their phones talking to others only after they discover the incoming phone call ringing. And they are able to reverse the interaction from happening by hanging up. Also, when doing sport like tennis, people are ready to interact with their tennis ball after they swing and hit. These gestures are strong messages before the real action coming, while most people are used to read that hints to their relative chain reactions. They are necessary and sufficient conditions of pre-signals and they could be interrupted to cut off the interaction.

Based on the analogy between quantum theory and my definition of interaction, here is a comparison table to show the relativity between the quantum terms and the interaction terms (Table 1).

Table 1. Comparison of Terms

Quantum Terms	Interaction Terms
Quantum entanglement	Information loop of interaction
Quantum leaps	Interaction
Signal before quantum leaps	Signal before certain interaction
Reverse quantum leaps	Cut off interaction

That’s why I try to borrow some concepts of hyper dimension from quantum theory, or particularly M theory, as references for the later research.

Considering that we ordinarily live in a universe of (3+1) dimensional space-time, we perceive the world by relying our physical tactile sense and inferential experience. Length, width and height allow us to detect and locate three-dimension geometric volume while time is measured by different calendars or clocks. As a three-dimensional being, we might only have vision of three-dimensional objects and find it hard to perceive higher dimensional notions. From the perspective of spatial theory, the hyperspace is based on calculations by use of the mathematical-physical method that is clarified and further developed from the string theory up until the present moment.

⁹ I refer the reader to the *Glossary*.

¹⁰ I refer the reader to the *Glossary*.

At the present study claims, the eleven dimensions were introduced by *M-theory* where M could stand for magic, mystery, meta, to reflect our current state of incomplete understanding, membrane and Matrix theory for other possibilities or even mother of all theories (Schwarz, 1999, p.107). The *M-theory* describes that there are eleven dimensions which consist of ten space dimensions and one time dimension in terms of the supersymmetric quantum mechanics.

Through various thoughts on the space-time, the quantum theory and how we perceive interaction, the entangled information flow might allow us to observe, to explore and to design both physically and philosophically.

2.4 Storytelling

2.4.1 Story and Narrative

In the *Oxford Advanced Learner's Dictionary* (Turnbull *et al.*, 2011), there are two key definitions of *story* fit the purpose of this research: “A description of events and people that the writer or speaker has invented in order to entertain people”; “An account, often spoken, of what happened to somebody or of how something happened”. A similar term in the category of discussion is *narrative*, which means “a description of events” or “the part of a novel that tells the story, rather than the dialogue” (Turnbull *et al.*, 2011). In this thesis, the attention is drawn to the construction of visual arts and how we approach to them. Therefore, on my definitions, I would not make a severe distinction between *story* and *narrative*, which are both *artifacts* for guiding visual arts and providing interaction between the work and the audience.

2.4.2 Storytelling

As for storytelling, this derivative word from story means “the activity of telling or writing stories” (Turnbull *et al.*, 2011). It adds a more dynamic and action-driven state to story and enhances the interactivity between the tellers and the audience. This tension precisely describes the essential attribute this research seeks to present, which emphasize on the connectivity and relationships. Further, defined within this research, *storytelling* is the action, the influence and the bond of attenders communicating stories.

2.4.3 Quantum Storytelling

As John Polkinghorne (2002, p.26) once claimed, “Classical physics describes a world that is clear and determinate. Quantum physics describes a world that is cloudy and fitful”. When narratology meets with quantum physics, the multiple interpretations of narrativity could be seen as the possibilities within the multiverse by its readers’ or observers’ view. Boje (2014, p.201) also proposed Quantum

Storytelling “by outlining a three-part model of the storytelling process: Empiric Stories, Epistemic Narratives, and Ontological Living Stories, each as connected to one another through the antenarrative process.” He looked at the processes of turning subjective experience into narrativized understanding and brought his 11D’s approach of ontology to the surface. In Tang Li’s (2013, p.11) view, “the transdisciplinary quantum narrative brings fresh vigor to post-classical narratology and also offers a new method and cognitive pattern to the creation and explanation of literature”. The moment when the story's ending is spotted, is like the opening of the box containing Schrödinger's Cat¹¹. It is not the moment when the universe breaks apart, but the moment when the observer becomes aware of the universe in which the story is set.

2.4.4 Narrative Theories

When one is looking into the narrative theories associating with arts, there is evidence showing many structuralists contributed to art as narrative in the late twentieth century (Elkin, 2015, p.38). In art education, prominent theorists like Claude Lévi-Strauss (1963), Seymour Chatman (1978), and Paul Ricour (1984), remind us of the importance of narrative to art, along with the traditions of semiotics and phenomenology in the study of art. (Green, 2018, p.33).

Inspired from Goethean botany, Vladimir Propp was convinced that “the realms of nature and human creativity are not separated,” and that “there are laws valid equally for both, that can be investigated with similar methods” (Propp, 1984, p.68). His theory of the composition of folk tales is “not an archetype or the reconstruction of a single imaginary tale, but something altogether different: it is the compositional scheme underlying all wondertales, the skeleton” (Propp, 1984, p.74). This resonates with the idea of proposing my original framework, borrowing trans-disciplinary thinking of quantum theories and forming up a creative scheme. However, argued by Lévi-Strauss, the essence of a particular tale is not to be found through any single “archetypal tale,” but rather through “many concrete tales” (Lévi-Strauss, 1984, p.181).

The opposing opinions and debates between Propp and Lévi-Strauss were enlightening, not only the phenomena between formalism and structuralism but the methodology how text is structured. To deduce or reduce from the literature across stories, folk, tales, epic, poet, novel, and even new media in the context of digitized culture, might shift the following research and adjust the framework according to the practical case studies.

As for the narrative structure, the Three-Act structure is known as a storytelling model for narrative fictions. It divides a story into three parts termed as Beginning, Middle

¹¹ Schrödinger's Cat is a famous thought experiment in quantum mechanics, proposed by physicist Erwin Schrödinger in 1935. It illustrates the concept of superposition, where a hypothetical cat in a sealed box is both alive and dead until observed. This paradox highlights the problem of quantum measurement and the role of observation in determining outcomes.

and End by the great Greek philosopher, Aristotle (384 BCE - March 7, 322BCE) in his book *Poetics* (Ismail, 2006, p.40). Syd Field (1984, p.41) simplified the Three-Act structure, Setup, Confrontation, and Resolution, usually used in screen writing and films. He associates the Aristotle dramatic structure with the screenplay, corresponding each other as Figure 2.5 shown.

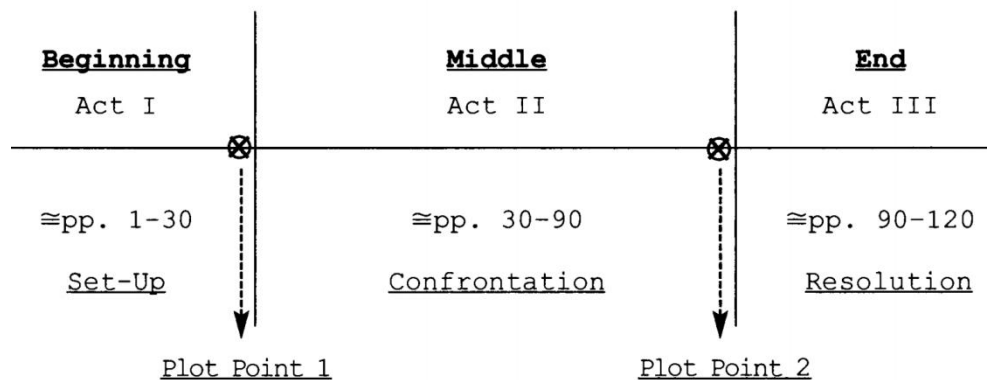


Figure 2.5 Paradigm of a Screenplay by Syd Field

In China, the narrative education from early age of students provides a four section for a story, that is the beginning, the development, the climax and the end. It is tacitly accepted as a classic model when we learn, analyze and create narratives. These theories more or less have a subtle effect on my prototype of framework. The consideration about structural composition will be deliberated in the next Chapter 3.

2.5 Creative Visual Construction

Throughout the history of research on creativity, beginning with “learning about and understanding the world around us” (Sternberg,1999, p.17), most artists agree with the view that “creativity comes from selecting and combining parts of what came before” (Duggan et al. 2019, p.11). The most innovative ideas might develop from personal experience and synthesize fragmented raw materials, a process of deconstruction and reconstruction.

The physicist “sets out to break nature down into its component parts while the artist synthesizes different features of reality” (Shlain, 1991, p.16). This deconstruction-reconstruction process is the core of structuring creative stories, which might inform the meanings of art and design and why they matter. Physics and arts could be depicted as “a cultural symbiosis, making two areas mutually dependent and attract the natural curiosity of many students” (Galili and Zinn, 2007, p.453), the two disciplines share similarities in some respects.

In trans-disciplinary thinking, Michael O’Toole (1994) also applied Michael A.K. Halliday’s linguistics to the visual arts and attempted to provide a systematic framework of tripartite functional semiotics. In this system, visual arts are analyzed

and evaluated from the representational, modal and compositional functions (O'Toole, 1994, p.24). Nonetheless, O'Toole gave examples of classic paintings, like Botticelli's *Primavera* (pp.7-23) based on his abundant knowledge of art histories but hasn't directly related these evident advantages to the art and design practices of students. Whilst appreciating the semiotic interpretations across paintings, sculptures and architecture by O'Toole, my research aspires to discover a framework of practical exercises in the narrative arts through multiple media.

2.6 Interaction as Storytelling

Narrative art tells a story, either as a moment in an ongoing story or as a sequence of events unfolding over time (McNamara *et al.* 2012, p.63). From traditional Christian painting to modern experimental animation, people keep trying to discover and interpret the narratives behind the art. In my opinion, it is the instincts of humans, consciously or unconsciously, to unscramble what they see and feel. When storytelling involves the capacity for interactivity, it often means "what happens when some form of communication between two separate entities causes a story to be created" (Tearse, 2018, p.9). Especially, when storytelling works within animation, in my understanding, it tends to "bring the participants into the works (stories) instead of instilling the information into the passive receivers" (Laaksolahti, 2008, p.1).

Installation artist Olafur Eliasson (2019) claims "Changing the world means changing the way we experience the world" in a documentary *Abstract: The Art of Design Season 2*. That resonates with my opinion about interaction, which is capable of changing the relationships between the art and the audience; the characters and the environments; and the physical feelings and emotional cognition. In the scope of art and design which this research is targeting, every interaction is how we experience the world and everything is interaction. Thus, I define *interaction as storytelling*, in which case every art and design artefact is construed as storytelling, referring to its interactive way of constructing and engaging with audience and the environment.

2.7 The Existing Framework and Tools

Story creation and narration hold significant importance in the processes of teaching and learning. To engage in this activity, students must fulfill several tasks: gathering materials, organizing their thoughts, and structuring them into a coherent sequence of story frames. (Liu, Liu, Wang, Chen, & Su, 2012). In the digital story creation process, students engage by integrating visual and written content through research, analysis, creation, and amalgamation. (LaFrance & Blizzard, 2013).

The evolution of storytelling frameworks in art and design education has seen a shift from traditional analogue models to digital and interactive frameworks. Analogue frameworks, such as Joseph Campbell's "The Hero's Journey" (Campbell, 1949, pp.

28-32) and Vladimir Propp's structural analysis of folktales (Propp, 1968, p. 21), have historically provided step-by-step guides for constructing classical story arcs, emphasizing the importance of structure in storytelling. These frameworks are effective in breaking down complex narratives into repeatable patterns, guiding creative exploration, and helping students grasp fundamental narrative components.

With the rise of multimedia platforms and interactive media, digital storytelling frameworks have gained prominence. Lambert's Digital Storytelling Model, for instance, integrates personal narratives with multimedia elements, offering students a new way to visualize and construct narratives (Lambert, 2013, pp. 199-203). However, while it fosters multimedia storytelling, it is less focused on the structural foundations of narrative construction. In digital storytelling, individuals do not remain in the position of listeners, they shape their stories, interact with their stories and use information and communication technologies as a storytelling tool (Dorner et al., 2002, pp. 45-55)

Interactive storytelling frameworks, explored extensively since the 2010s, particularly in game design and interactive media, focus on user-driven interaction as the primary narrative device. Scholars like Marie-Laure Ryan (2001, pp. 59-72) and Janet Murray (1997, pp. 67-90) have highlighted how interactivity alters traditional narrative forms, enabling non-linear, branching storylines. Nevertheless, these frameworks are more relevant to digital media than to the foundational narrative structure addressed in this research.

A comparative analysis reveals that analogue frameworks, such as Aristotle's Poetics (Aristotle, trans. 1996, pp.43-46) and Freytag's Pyramid (Freytag, 1894, pp.114-120), provide clear, linear structures for storytelling but lack the flexibility needed for modern, non-linear storytelling. Digital frameworks, like *Twine*, offer greater flexibility and multimedia incorporation but do not focus on developing the foundational narrative structure.

To craft compelling and creative stories, students must have a clear understanding of basic story structures (Liu et al., 2011). Therefore, a key challenge in supporting students' storytelling efforts is offering effective scaffolding that enables them to comprehend and apply these narrative frameworks. For example, earlier studies like Woven Stories (Nuutinen et al., 2010), StoryMappers (Acosta et al., 2004), and visual knowledge management systems (Lukosch, Klebl, & Buttler, 2008) have introduced story structure organizers that use concept maps to help visualize narrative structures.

Graphical organizers have been shown to enhance students' awareness of story structure by visually mapping ideas, helping them to organize information and knowledge more effectively (Liu & Lee, 2013). While these tools are useful for structural visualization, they often fall short in supporting the creative process by failing to provide meaningful content suggestions to stimulate students' storytelling

(Nuutinen et al., 2010; Acosta et al., 2004; Lukosch, Klebl, & Buttler, 2008). Several studies have sought to address this gap by developing systems that incorporate pre-defined content as prompts for students to develop story frames. For instance, Antle (2003) and Tsou, Wang, and Tzeng (2006) introduced pre-defined content objects to help students shape their narratives.

Similarly, Liu et al. (2011) included story elements such as wars, battles, and rewards in their graphical interface as hints to assist in storyline development. However, while such detailed prompts can help guide students, they can also inadvertently limit the diversity of stories by offering overly specific cues (Antle, 2003; Decortis & Rizzo, 2002). These highly explicit hints restrict creative freedom, encouraging students to follow set paths rather than fostering original, diverse narratives. Moreover, these pre-defined settings offer support at a micro-level, focusing on detailed content generation rather than promoting meta-cognitive scaffolding, which could help students internalize the general principles of storytelling.

In contrast, rule-based scaffolding that offers fundamental guidelines for story development can facilitate a more flexible, meta-cognitive approach to narrative creation. For example, systems like TALE-SPIN (Magon & Zaslove, 1990) employed a set of story grammars—rules that govern episode transitions—to suggest potential storylines. These grammars guide storytellers by indicating, for instance, that after describing a story's background, an event should occur that prompts a character's action. While this method provides a structured approach, it still allows for creative freedom within those rules, enabling a more dynamic storytelling process.

However, one key limitation remains: these systems, despite their rule-based scaffolding, do not fully support the exploration of multi-dimensional storytelling and fail to engage with the complex interplay of narrative elements such as character interactions, time, and emotional arcs. This is where current frameworks, including AI-driven tools, also fall short. While AI tools can generate story elements, they often provide linear, predefined content rather than facilitating a more comprehensive exploration of non-linear narratives and creative possibilities.

2.8 Chapter Summary

This chapter starts from the consideration of contribution to art and design practices and explores the possible solutions from the perspective of *interaction*, which is assumed as the core of art and design practices. In the discussion of the ontology of interaction, some ideas from quantum theories are introduced as main analogies presenting comparable patterns with the social behavior of interaction. By structuring stories, it shows a potential methodical way of creating visual narratives, like photographs, paintings, films and animation. In the scope of this research, the *storytelling* is a dynamic and interactive process in association with concepts of quantum storytelling. Instead of looking into the aspects of physics, the borrowing of

ideas from quantum theories helps the interpretation about creative visual construction as a storytelling framework. Thus, *storytelling as interaction*, is the fundamental root guiding creative arts and design, which is *Tao*, while the proposing framework into practices is the *Artifact*. In the next chapter, there is the constituent of the *IH Framework*, corresponding to the research questions and some evidences to support its reasonability.

This literature review highlights the range of storytelling tools and frameworks relevant to narrative art pedagogy, from traditional analogue frameworks to modern digital and interactive storytelling tools. While existing frameworks provide valuable insights into narrative construction, they often focus either on technical execution or interactivity, leaving a gap in how foundational narrative skills are developed in educational contexts. This research aims to address this gap by offering a structured, multidimensional approach to narrative creation that balances creativity with structural integrity, making it a novel contribution to the fields of animation education and narrative pedagogy.

3. Interaction Hyperspace Framework (IH Framework)

3.1 Overview

From the review of literature and discussion, the appearance of *interaction as storytelling* might be seen as evocation of the creativity from art and design practices. It corresponds the first research question of *How does interaction contribute to narrative complexity in storytelling theory?* The consideration of a framework about structuring stories is the *artifact*, which is the proposed assumption to the research question: *How does the Interaction Hyperspace framework support the creation of non-linear narratives with multiple outcomes?*

The framework is established by the review of the question and refilled with inspirations found in the scientific perspective. To testify the proposed framework, there are also some ‘lab-experiment’ examples by myself to show how this framework is used for analyzing art and design and encouraging creativity for designers.

IH Framework is built upon a set of 11 dimensions, which serve as the structural foundation for guiding students through the process of narrative construction. These dimensions are designed to represent different aspects of narrative interaction, from basic spatial and temporal relationships to more complex, entangled outcomes. This chapter provides a detailed explanation of the rationale behind the selection of these dimensions, the theoretical foundations that inform them, and the geometrical models used to represent the framework.

3.2 Establishing the Framework

In the earlier chapter, referring to the quantum theory, hyperspace theory in particular

postulates the total number of dimensions as expanded to eleven (Harman, 2018, p.23). From the *Oxford Advanced Learner's Dictionary* (Turnbull *et al.*, 2010), *hyperspace* means “space that consists of more than three dimensions”. This initial inspiration, borrowed from physics, establishes eleven dimensions or layers of interaction and forms the basis for my working definition of the *Interaction Hyperspace Framework (IH Framework)*.

Creativity, according to Koestler (1964, p. 45), involves a "creative leap"—the ability to connect what is known with the unknown. This leap is essential in both scientific and artistic innovation. The *IH Framework* encourages students to make creative leaps by navigating between the known elements of traditional narrative structure and the unknown possibilities offered by interactive and non-linear storytelling.

The *IH Framework* is structured around 11 key dimensions that mirror fundamental principles from quantum mechanics, particularly those related to *M-theory* and quantum interaction. Just as quantum theory proposes that the universe is governed by multiple dimensions beyond our perception, narratives too can be understood as multi-layered, dynamic systems where various elements interact in complex ways. Each of the 11 dimensions in the *IH Framework* corresponds to a particular aspect of storytelling, drawing similar parallels to the behavior in quantum mechanics. The following table presents concise definitions of the eleven dimensions established within *IH Framework*, along with pertinent questions related to these dimensions in the context of story structure.

Dimens ions	Concepts	Question asked	Definitions
0 D	Object	What is the main target in the story?	Nominate a leading object in the interaction and the story will be told from its subjective point of view. Object could be human or non-human.
1 st D	Location	Where is the main object?	The location means where the main scenario takes place.
2 nd D	Action	What is the object doing?	The action, either dynamically or statically, indicate the original condition before interaction.
3 rd D	Result(Stat e)	What is the state/ result of the main object?	The result/ state could be an identity, or an important adjectival description about the main object.
4 th D	Time	What time is the story happening?	Indicating a specific time or a vague concept of time.
5 th D	Interaction	What interactions happen with the object?	Describing a short story, including the attender(s) and main event.
6 th D	Entangled Result(to	What is the result on the main object by the	The effects on the interacting object by this interaction.

	self)	interaction?	
7 th D	Time of Interaction	How long is the interaction?	The period of time when the interacting participants are involved.
8 th D	Possibilities of Interaction	How likely is the interaction occur?	Evaluated by the users (Likert scale), what the possibilities of the interaction are.
9 th D	Intensity of Interaction	How strongly does this interaction occur?	Evaluated by the users (Likert scale), what the intensity of the interaction is.
10 th D	Result to external participants	What is the result to those outsiders (other than the main object) by the interaction?	The effects on any ‘outsiders’ (apart from the interacting participants) or the environment by this interaction.
11 th D	Memory/Cognition	What is the most memorable or perceptible thing in the interaction?	The more psychological effects influenced by the interaction.

Table 2: The 11D of *IH Framework*

The following sections explain the 11 dimensions of the framework, each of which draws inspiration from quantum mechanical principles, emphasizing how these dimensions interact to shape complex narrative structures.

0D Object (Existence of Entities in Narrative Space):

In both quantum mechanics and storytelling, the concept of an object begins with its mere existence, before any properties, relationships, or interactions are defined. In quantum mechanics, a particle in its most fundamental form exists as a quantum entity with potential states, but without interaction or context, it remains an undefined point of potential energy and information (Bohr, 1928, pp. 580-590). Similarly, in storytelling, the object represents the core elements of the narrative—such as characters, objects, or central concepts—that exist before any roles or relationships are established. These narrative objects form the foundation of a story but are yet to be developed through interactions and narrative progression.

In geometry, a point is considered zero-dimensional (0D), signifying that it occupies no space and has no properties beyond its mere existence, as visualized in Figure 3.1. It can be thought of as a single object doing nothing, existing in a space where no information exchange occurs. In this framework, the 0D object in storytelling serves as the fundamental building block, akin to a particle in quantum space. This object could be a protagonist, a central concept, or even a non-living design element. The key principle here is object-orientation: the object itself—whether a character or a design element—becomes the focus, awaiting further development through interaction and narrative progression.



Figure 3.1: The Zero Dimension: Object

1D Location (Position in Narrative Space):

In the physical world, the first dimension is often understood as location or position, represented by a point in space. This is fundamental to how objects exist and interact. Just as a point on a map defines a specific place, in physics, an object's position is described by its coordinates in space. However, in quantum mechanics, the position of a particle is not always definite due to Heisenberg's uncertainty principle—which states that the more precisely the position of a particle is known, the less precisely its momentum can be determined (Heisenberg, 1927, pp.172-173). This uncertainty also highlights how location in quantum space affects a particle's potential interactions.

In storytelling, Location defines where the elements of the story—characters, events, or objects—exist within the narrative space. The spatial positioning of these elements influences their relationships and developments within the story, just as a particle's location in quantum space affects its behavior (Bohm, 1980). Interestingly, just like in quantum mechanics, uncertainty about location often occurs in storytelling, where settings can be vague or relative, rather than fixed points on a map.

In the framework's first dimension, Location is not just a literal coordinate but a concept that may shift or remain undefined. From a geometrical perspective, the first dimension is visualized as a point moving along a line, forming a one-dimensional space where the movement of an object can be tracked through its location (Figure 3.2). In storytelling, however, location can be more fluid and metaphorical. It may represent real places, like cities or landmarks, or abstract locations, such as wonderlands, dreams, or the mind. This reflects the flexible, multidimensional nature of how location can shape narratives.



Figure 3.2: The First Dimension: Location

2D Action (Narrative Motion):

In quantum theory, a particle's motion or momentum plays a critical role in how it

interacts with other particles and fields. The movement of a particle through space determines its trajectory and the forces it experiences, directly influencing its interactions within the quantum field. In this way, motion acts as a driving force for change, just as it pushes particles through space.

In storytelling, Action represents the dynamic force that propels the narrative forward. Just as a particle's motion leads to interactions and changes in the quantum field, actions in a story serve as catalysts that create momentum and push the plot toward resolution. Characters' decisions, movements, and interactions are what drive the story from one event to another, shaping the overall structure of the narrative.

In the framework's second dimension, Action corresponds to the movement between points, as seen in geometry where the second dimension forms a plane. In storytelling, this movement represents the transition between different narrative states or plot points. When a character or participant moves from one location or event to another, they are engaging in action, contributing to the unfolding of the narrative. This dimension captures the essence of motion, providing a richer, more dynamic understanding of how narrative elements interact. The Figure 3.3 visualizes this dimension, depicting how action carries more information and complexity than the static representation of the first dimension (Location).

By combining these ideas, Action in storytelling mirrors the principles of momentum in quantum mechanics, where both serve as the mechanisms for progress and change. The plane created by actions in a narrative space is akin to the field of influence created by a particle's movement, shaping the story's development and its ultimate direction.

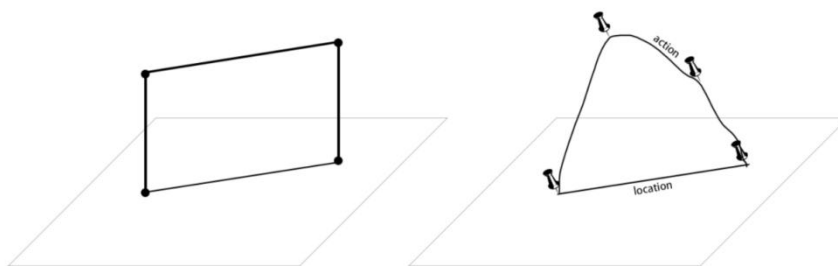


Figure 3.3: The Second Dimension: Action

3D Result (State of the Object):

In quantum mechanics, the initial state of a particle is described by its wave function, which contains all the possible information about the particle before any interaction occurs. This initial state remains undefined in terms of precise position or momentum until the particle interacts with another system or is measured (Heisenberg, 1927). The wave function represents the potential states the particle could take, but until an external force acts upon it, the particle's state remains in flux, existing only in terms

of probabilities.

Similarly, in storytelling, Result refers to the initial state of the protagonist or central object before any significant actions or events unfold. Just as a particle holds potential before interaction, the protagonist exists in a state that contains the potential for development, but their condition is static until the narrative begins. This dimension encapsulates the pre-interaction state, which defines the character's baseline traits, identity, or situation at the story's start—such as being a child, a leader, or in a state of contentment.

Geometric Representation

In geometry, the third dimension adds depth, and similarly, Result (State) is represented by a 3D shape as shown below in Figure 3.4. This shows that the character's initial state has complexity and multiple possibilities, setting the foundation for how the story develops.

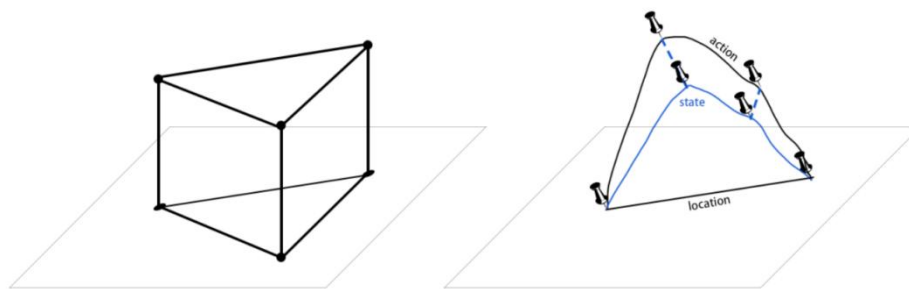


Figure 3.4: The Third Dimension: Result (State)

4D Time (Temporal Progression):

In both quantum mechanics and classical physics, time is a fundamental dimension that dictates how events unfold. In quantum theory, the passage of time¹² is entangled with a particle's state—its evolution over time is critical to understanding its behavior and interactions. Similarly, in storytelling, time drives the progression of the narrative, determining the sequence of events and how the story develops from one moment to the next.

In the framework, the fourth dimension is Time, representing the temporal flow that governs the progression of a story. Just as time in quantum mechanics influences the changes in a particle's state, time in a narrative organizes events, creating a structure for the story's unfolding. Whether expressed explicitly ("long, long ago") or left ambiguous, time plays a crucial role in how a story is experienced. Figure 3.5 illustrates the time-superposition state of an object, suggesting that, like particles in quantum theory, narrative elements can exist in multiple potential timelines until fixed by the storyteller.

¹² In quantum theory, the concept of time is more complex, but this will not be further discussed in this thesis.

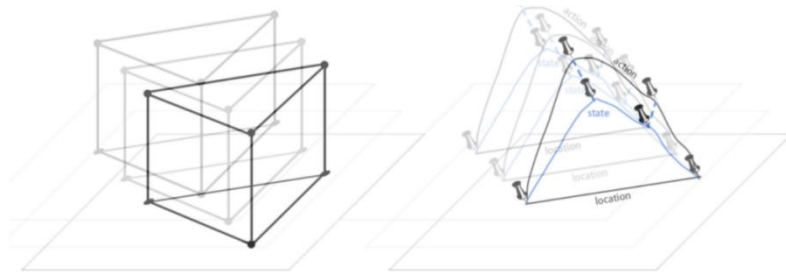


Figure 3.5: The Forth Dimension: Time

5D Interaction (Relational Dynamics):

In quantum mechanics, interactions between particles are fundamental to the behavior of quantum systems. These interactions, mediated by forces such as electromagnetism or gravity, occur across dimensions and shape the properties and dynamics of particles. Without these interactions, particles would remain in isolated states, unable to influence one another or form complex systems (Griffiths, 2018, pp.298-310).

In storytelling, Interaction represents the relational dynamics between characters, events, and settings. Just as particles influence each other through interactions, narrative elements shape each other’s development through their relationships. Characters affect one another’s decisions, events may alter the course of the story, and settings can influence the tone and progression, adding layers of complexity to the narrative.

By the time we reach the fifth dimension in the framework, the object is fully defined in terms of its location, action, state (result), and time, setting the stage for interaction to occur. This dimension represents how the protagonist or main object interacts with other entities (characters, events, or forces) in the narrative. Although interactions are mutual, the perspective in storytelling is often subjectively framed, emphasizing one side of the interaction more than the other.

In geometric terms, the fifth dimension is challenging to visualize directly. Instead, Figure 3.6 provides a diagram representing the interaction between two entities, showing how relationships and exchanges influence both the main object and its counterpart.



Figure 3.6: The Fifth Dimension: Interaction

6D Entangled Result (Interdependence of Outcomes):

In quantum mechanics, entanglement occurs when two particles become linked, such that the state of one particle directly influences the state of the other, no matter the distance between them (Einstein, Podolsky, & Rosen, 1935). This phenomenon shows the deep interconnectivity between quantum systems, where the outcome of one particle's state is contingent on the other's state, even across great distances.

In storytelling, the Entangled Result dimension reflects the interconnectedness of outcomes across different characters, events, or storylines. Just as entangled particles influence each other's states, actions in one part of a story can affect outcomes elsewhere, even if the events seem unrelated. This dimension helps to explore how seemingly independent narrative threads are actually intertwined, resulting in a more complex and layered storytelling experience. For example, a decision made by one character might indirectly cause consequences for another character in a distant part of the story, demonstrating how the outcomes of various elements are deeply interdependent.

In the sixth dimension of the framework, Entangled Results refers to how all participants are affected by an interaction, no matter how seemingly small. Whether physical or emotional, these effects ripple through the narrative, influencing how the main object (protagonist) reacts. This dimension emphasizes the mutual influence between characters, storylines, or events, even if those connections are not immediately visible. Figure 3.7 visualizes this interactive process, showing how the outcomes of one interaction can reverberate through the entire narrative, creating a web of interdependent consequences. After A and B undergo an entangled interaction, they both transform into New A and New B as a result of the interaction.

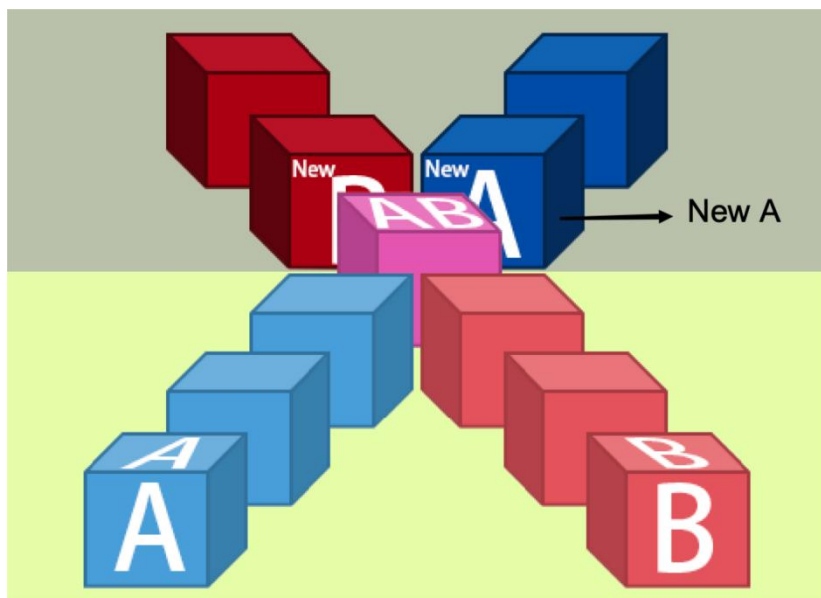


Figure 3.7: The Visualization of Interaction Entanglement

7D Time of Interaction (Temporal Context of Interaction):

In quantum mechanics, the timing and duration of interactions between particles can significantly affect the outcomes. The time an interaction takes can influence the evolution of the particle's state, and in some cases, the duration of an interaction can determine whether or not certain quantum effects, such as entanglement occurs (Schrödinger, 1935; Zurek, 2003). This idea is crucial in quantum systems where the duration of interaction directly affects the behavior and state of the system, altering how quantum particles evolve over time.

In storytelling, Time of Interaction refers to the duration of an interaction between characters or events within the narrative. Rather than focusing on when the interaction happens, this dimension examines how long the interaction lasts and how this duration influences the narrative's progression. For example, a short, intense interaction may propel the plot quickly, while a longer, drawn-out interaction may lead to more gradual character development. The time characters spend interacting can affect how relationships evolve and how much impact that interaction has on the storyline.

In the seventh dimension of the framework, Time of Interaction focuses on the duration of the exchange between the protagonist and other participants. The length of the interaction varies between participants, and their engagement may differ in intensity and time commitment. For instance, in a group conversation (see Figure 3.8), different characters may join and leave at various times, resulting in different durations of interaction. The way the protagonist perceives and interprets these interactions can also vary, influencing how the narrative describes the passage of time during the interaction.

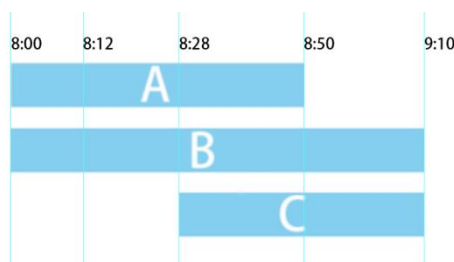


Figure 3.8: Different Time of Interaction

8D Possibilities of Interaction (Multiple Paths):

In quantum mechanics, particles can exist in a superposition¹³ of states, meaning they occupy multiple possible conditions at once until measured, at which point they collapse into a single, definite state (Schrödinger, 1935). This principle allows for multiple potential outcomes depending on how and when the particle is observed,

¹³ Quantum superposition, quantum bits can exist in multiple states simultaneously (Nielsen, M.A. and Chuang, I.L., 2010, pp. 100-110.)

leading to the idea of branching possibilities that exist simultaneously in quantum systems.

Similarly, in storytelling, the Possibilities of Interaction dimension explores how narratives can branch in different directions, much like quantum states. Each interaction within the story creates the potential for multiple future outcomes, depending on the choices made by the characters or events that occur. This dimension allows storytellers to explore multiple storylines and outcomes, encouraging flexibility and creativity in narrative design. Different interactions lead to varied scenarios, making the narrative less predictable and more dynamic.

In the eighth dimension of the framework, Possibilities of Interaction represent the various potential outcomes of interactions within the story. These possibilities are evaluated by the users or storytellers, sometimes measured through a Likert Scale (see Figure 3.9), where higher scores indicate more predictable and reasonable outcomes, and lower scores suggest unexpected, artistic, or unusual possibilities. This dimension can be likened to the multiple parallel-universe theory, where different choices or interactions lead to different narrative branches. In the realm of art and design, stories with higher possibility scores tend to align with popular tastes, while those with lower scores may offer more unique and aesthetically distinct narratives.

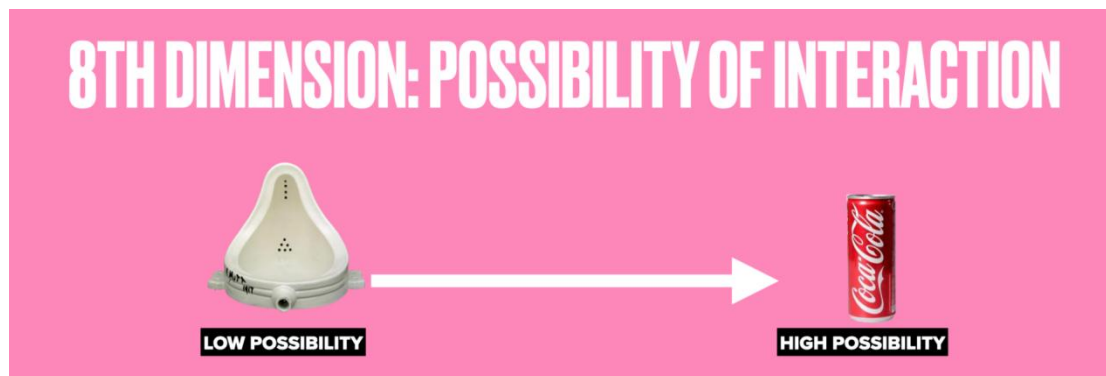


Figure 3.9: The Example of Possibility of Interaction

9D Intensity of Interaction (Strength of Influence):

In quantum mechanics, the intensity or magnitude of interaction between particles, such as the strength of a force field, determines how significantly they influence each other. Stronger interactions, like those involving electromagnetic or gravitational forces, create greater effects on the particles involved, shaping their behavior and energy levels (Griffiths, 2018, pp. 150-160). This intensity governs the dynamics of quantum systems, affecting how particles interact over space and time.

In storytelling, the Intensity of Interaction dimension measures the strength of influence that interactions between characters, events, or forces have on the narrative. Just as stronger quantum interactions lead to more significant changes, highly intense interactions in a story (such as climactic confrontations) have a profound impact on

the narrative's trajectory. These powerful moments drive the plot forward, influencing character development and the overall resolution of the story.

In the ninth dimension of the framework, Intensity of Interaction complements the eighth dimension (Possibilities of Interaction) by focusing on the depth or strength of the interaction. Evaluated using a Likert Scale, higher intensity interactions tend to lead to critical plot moments and climaxes, while lower intensity interactions may have a subtler effect on the storyline. The strength of these interactions influences how the audience perceives the importance of events and characters in shaping the narrative's outcome.

10D Result to External Participants (External Impact):

In quantum mechanics, interactions within a system can produce observable effects on external systems or observers. This is most famously demonstrated by the observer effect, where the act of observing a quantum system influences its state and behavior (Heisenberg, 1927, pp. 172-198). The interaction within a quantum system doesn't just affect the particles involved but can also impact external observers or other systems that come into contact with it, showing the ripple effects that interactions can create beyond the immediate system.

In storytelling, the Result to External Participants dimension explores how the outcomes of interactions within the narrative impact not only the central characters but also external participants—secondary characters, the environment, or even the audience. Just as external systems in quantum mechanics are influenced by internal interactions, secondary characters or external forces in a story are shaped by the results of core events. These external effects can alter public opinion, social dynamics, or other broader narrative elements, creating ripple effects that extend beyond the immediate action.

In the tenth dimension of the framework, Results to External Participants deals with how the interaction between main characters or events affects the broader environment and peripheral characters. This dimension emphasizes the idea that even small changes within an interaction can produce subtle but important shifts in the world outside the immediate participants. The environment—whether it includes non-human objects, secondary characters, or public sentiment—changes as a result of the core interaction. These changes are not abrupt, but rather occur in a gradual and dynamic process, as illustrated in Figure 3.10, highlighting how outcomes influence the world beyond the primary interaction.

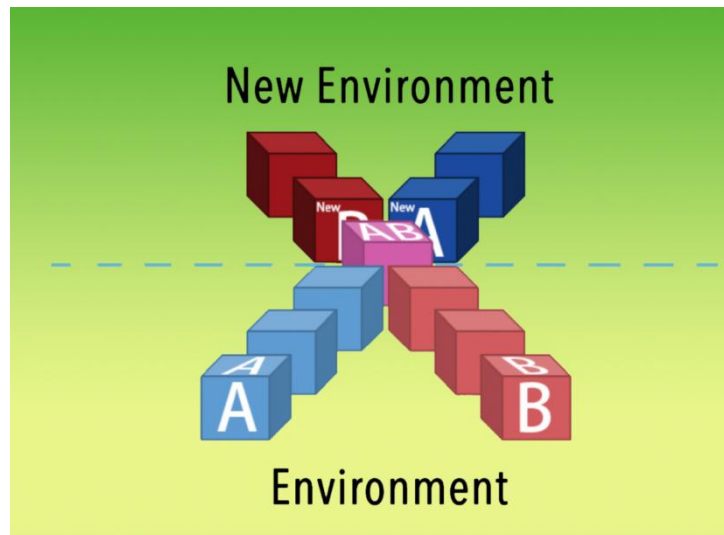


Figure 3.10: The Visualization of Interaction

11D Memory/Cognition (Narrative Reflection and Perception):

In quantum theory, the processes of measurement and memory are vital to the evolution of quantum systems. Once a quantum state is measured, its outcome is recorded, influencing the system's future interactions and developments (Zurek, 2003, pp. 715-775). Cognitive processes in quantum systems involve the retention of quantum states, ensuring that past interactions have a lasting effect on the system's trajectory. In this way, memory shapes how the system evolves over time, much like cognitive reflection shapes human decisions and understanding.

In storytelling, Memory/Cognition represents the reflective aspect of the narrative, where characters and the audience process, remember, and interpret past events. This dimension examines how memories of past interactions influence the progression of the story and its ultimate resolution. A character's ability to reflect on their experiences, or the audience's understanding of past narrative moments, can significantly shape the direction of the plot, deepening the narrative's emotional and psychological complexity.

In the eleventh dimension of the framework, Memory/Cognition extends beyond the previous dimensions to consider the psychological effects of interactions. Just as string theory and *M-theory* propose dimensions beyond our visible universe, the memory dimension in storytelling transcends the immediate narrative to explore how past events are stored, processed, and reflected upon by both characters and the audience. This dimension encapsulates how the protagonist's memories and reflections affect their decisions and actions, adding an intricate layer of depth to the storytelling process.

The *IH Framework* draws heavily on concepts from quantum mechanics, particularly *M-theory* and quantum entanglement, to illustrate the complex, interconnected nature of narrative structures. By using these analogies, the framework offers a multi-layered, interactive approach to storytelling, helping students understand how narratives

evolve through the interplay of memory, interaction, and reflection. Quantum principles, such as the entanglement of states and the recording of outcomes, help explain how characters' memories and cognitive processes can dynamically shape a narrative's trajectory, offering a rich space for creative exploration.

3.3 The Development of the Framework Prototype

The proposed eleven-dimensional *IH Framework* is based on the consideration of narrative structure and interactivity-related aspects, along with an analogy from eleven-dimensional hyperspace theory. Within the eleven concepts, the first four dimensions are designed to represent the more crucial elements in the structuring of stories. They are the independent variables when the other seven dimensions are the dependent variables. To show these differences and to illustrate the theoretical framework, a model of the *Interaction Hyperspace* is presented here as *Interaction Hypercube* of my definition. Figure 3.11 illustrates the first paper prototype:



Figure 3.11: The Paper Hypercube

After several trials, I designed a tetrahedron within the cube, with eleven vertices in total. In that way, the second model made of clay (Figure 3.12) might be more concise and clearer to present the relations of the eleven elements. There is also a stop-motion animation made to describe the story about the interactive process of how the framework was found (Figure 3.13).

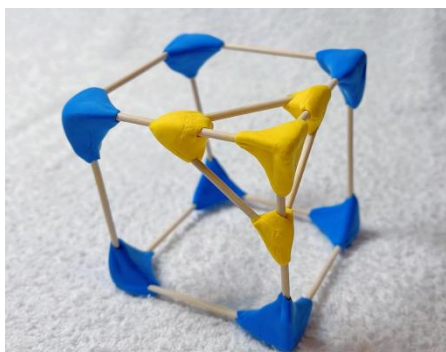


Figure 3.12: The Model Made of Clay Figure 3.13: Screen Shot of Animation

The third version of framework prototype (Figure 3.14) is designed in digital graphics. Based on my initial eleven-dimensional *Interaction Hyperspace*, the position of each

vertex of *Interaction Hypercube* shows not only the layers of relative elements, but how each elements influences the others.

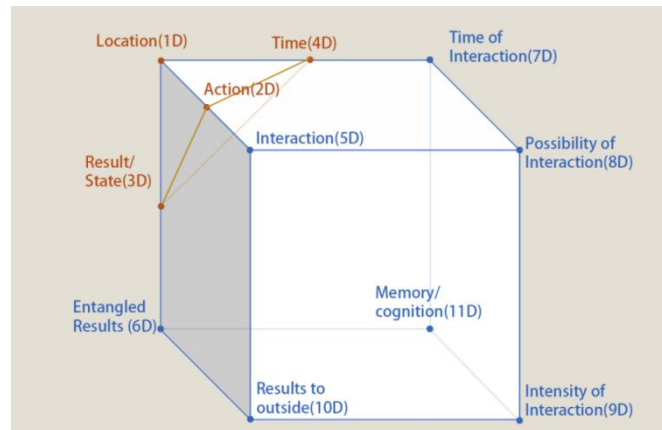


Figure 3.14: The Digital Model of Interaction Hypercube

Defined as the first relation group, the interior tetrahedron presents the basic elements in an object, starting from 1D *Location* expanding to different dimensions: 2D *Action*, 3D *Result/State*, 4D *Time* (Figure 3.15). In the latter part of this chapter, I will provide examples demonstrating how these four fundamental elements can be utilized to transform a modified narrative into a more innovative design.

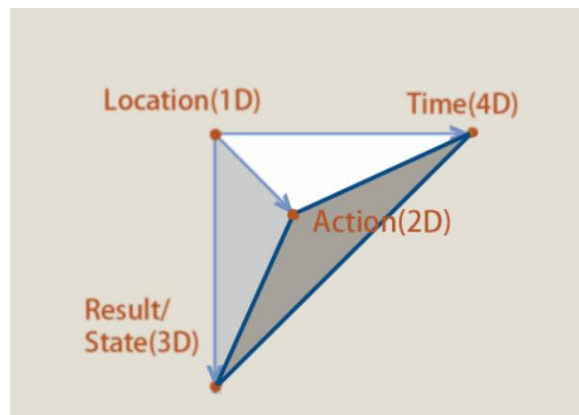


Figure 3.15: The Relationships in Tetrahedron

The interior tetrahedron is developing and following the arrows (Figure 3.16) and forming up into a cube, which the second relation group, 5D *Interaction*, 6D *Entangled Results* and 7D *Time of Interaction*, are the extension of the first group's coordinate. If an interaction happens, the 2D *Action* tends to develop into the entangled 5D *Interaction*, the 4D *Time* will shifted from a point-in-time into 7D *Time of Interaction* while the 3D *Result/State* of one object are supposed to be 6D *Entangled Result*.

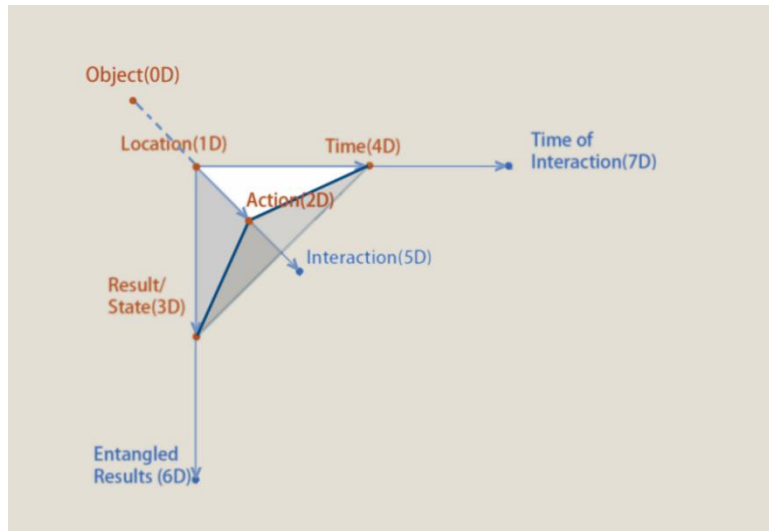


Figure 3.16: The Extension of Dimensions

And then, the elements cross with each other, coming to the point of intersection, forming the third relation group (8D *Possibility of Interaction*, 9D *Intensity of Interaction* and 10D *Result to External Participants*). The last relation group, all the information flows together to the last one vertex (11D *Memory/ Cognition*), also the farthest vertex from the starting vertex. That's the reason why the 11D *Memory/ Cognition* are argued to be higher than, and beyond other space-time dimensions. In the computer modelling software, a 3D model (Figure 3.17) was built to present the relationships and able to rotate itself as animation.

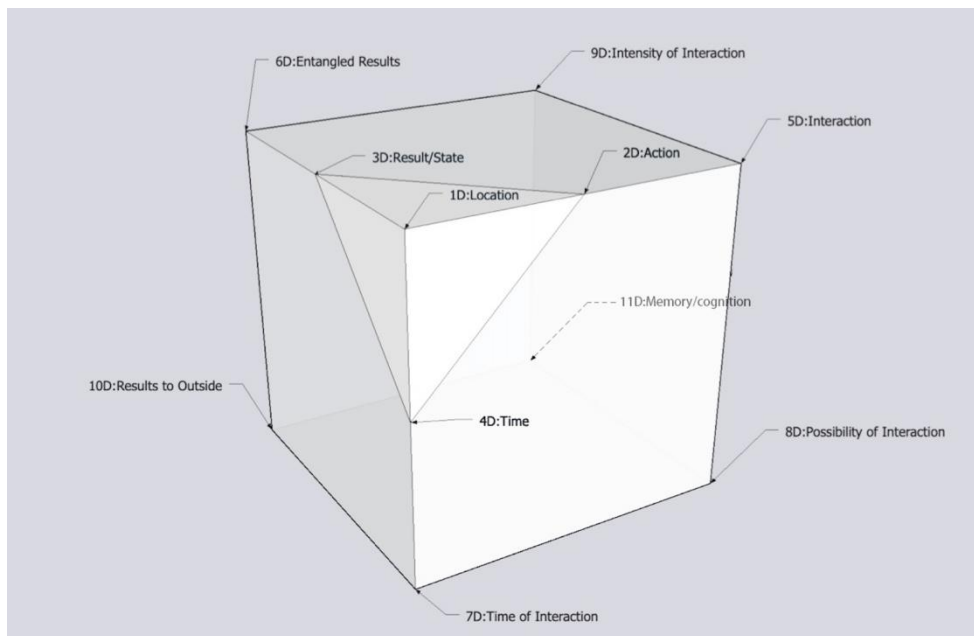


Figure 3.17: The 3D Model of Hypercube

The use of geometrical models like the cube and tetrahedron reflects the need to capture the structure, flexibility, and complexity of the 11 dimensions in the *IH Framework*. These models are essential for visualizing how different dimensions

interact within the narrative space, much like how quantum systems are represented in multi-dimensional space in quantum mechanics and string theory. These visualizations not only make abstract concepts tangible but also help students internalize the multidimensional nature of storytelling through hands-on exploration.

The Tetrahedron is selected to represent the foundational four dimensions, because of its simplicity and structural clarity. In geometry, a tetrahedron consists of four vertices, where each point is directly connected to the others, creating a solid but simple structure (Bronshtein, 2003). This shape effectively visualizes the basic narrative components, such as the location of events, the actions of characters, the results of those actions, and the time in which they unfold. The tetrahedron provides a stable, interconnected framework that can be easily understood and serves as a foundation for the more complex narrative elements.

The Cube, on the other hand, represents the more complex, interactive dimensions, such as *Interaction*, *Entangled Result*, *Intensity of Interaction*, and so on. The cube offers a more dynamic and flexible structure that can visualize the multi-layered interactions within a narrative. These dimensions reflect the interconnectedness and complexity of narrative elements, such as how actions or states influence interactions. The cube allows for a richer exploration of entangled relationships and multi-dimensional interactions, much like in quantum mechanics, where particles can exist in a superposition of states and influence one another across dimensions. It provides a visual tool to explore how entangled outcomes and interactions unfold, as each dimension (or vertex) affects the others.

The combination of the tetrahedron and cube effectively balances the foundational and complex dimensions of the framework. This approach mirrors how quantum mechanics uses multi-dimensional models to represent both simple and complex interactions between particles. In a similar way, the tetrahedron and cube visualize the layered, intertwined elements of storytelling, helping students explore how different dimensions of a narrative interact and evolve (Greene, 2000). These geometric models thus offer a powerful way to conceptualize the multi-dimensionality of storytelling and make abstract narrative concepts more tangible.

However, this process wouldn't happen when there is only one single object. The cube-framework doesn't elaborate the other participants in the interaction system. Therefore, another presentation of multiple objects' interaction might be visualized as in Figure 3.18. The point of 5D *Interaction* are the contact point. It could be seen as a shared area, a media interface, or a blurred area, where there exists some tensions in between.

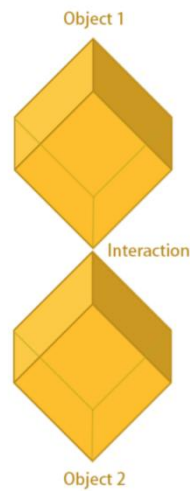


Figure 3.18: The Interaction with Two Objects

As for this tension in-between, it might be defined as *Inter-Tension* in this research. At the point of contacts or no-contacts, it could be intersection between objects but with a feathered range. For example, when people are having a conversation, the interactions are normally straightforward, bidirectional and shared simultaneously. Or, when a person is typing on a laptop, the interactions between person and computer are relying on user interface. However, some contacts are not always obvious: one individual might dream of a fictional creature where the interaction happened fictionally between one and one's mind. Even, the presence of a rock exerts an influence on the overall process of evolution through various butterfly effects. These are complicated and implicit reactions, which require a vacuum area to draw the interacting interface (Figure 3.19).



Figure 3.19: The Inter-Tension

3.4 Examples

To examine how the framework operates, there are several examples to elaborate each dimension of stories from design, to create one by construction or analyze it by deconstruction. I started to test the framework by myself as the designer and storyteller and called this process as lab-experiments.

3.4.1 To Create a New Story

When I was in the roles of script writer and director of an animation, I used to spend all nights in searching the sparks of a story. Sometimes, I dreamed about it and used my subconscious as fuel for a creative story. Talking with people and going through relative information from the internet are also helpful and insightful. However, such strategies do not work every time. To develop and innovate methodically, a system for encouraging creative combination is required at the stage of concept design.

As an example, here is a story for a suspense film, involving James, who is the main character in the story about to happen:

Table 3: The Example of Creating a New Story 1

Dimensions	Concepts	The Main Object
0 D	Object	James
1 st D	Location	On the way to school
2 nd D	Action	Whistling
3 rd D	Result (State)	With a limp for one of his legs
4 th D	Time	In the morning

There were some fields filled by providing the information according to the framework about the original condition before the interaction. Then it is allowed to introduce a participant into this interaction. When other participants join a mutual event, an actual interaction is triggered and that forms the fifth dimension.

Table 4: The Example of Creating a New Story 2

Dimensions	Concepts	The Main Object	The Second Object
0 D	Object	James	A tram
1 st D	Location	On the way to school	On the way to school
2 nd D	Action	Whistling	Running
3 rd D	Result (State)	With a limp for one of his legs	A mysterious sign was marked on the tram
4 th D	Time	In the morning	In the morning

Carrying the same first four dimensions of information, a second object encounters with the main object, and makes it possible to complete an interaction. From the fifth dimension, the interactive process is shared between the participants even the description is based on the perspective of the main object.

Table 5: The Example of Creating a New Story 3

Dimensions	Concepts	The Main Object	The Second Object
0 D	Object	James	A tram
1 st D	Location	On the way to school	On the way to school
2 nd D	Action	Whistling	Running
3 rd D	Result(Stat e)	With a limp for one of his legs	A mysterious was marked in the tram
4 th D	Time	In the morning	In the morning
5 th D	Interaction	James encounters a tram passing by	
6 th D	Entangled Result(to self)	James recognizes the tram by a mysterious sign on it and it reminds him of something.	
7 th D	Time of Interaction	For James, when he notices the tram and he perceives the time of interaction with the tram is five seconds.	
8 th D	Possibilities of Interaction	As the storyteller myself, I would score the possibility of 2.5/5 as an average number	
9 th D	Intensity of Interaction	As the storyteller myself, I would score the intensity of 4/5 for a relative higher number	
10 th D	Result to external participants	A private detective notices James with the tram and takes a photo of them.	
11 th D	Memory/Cognition	The appearance of the tram changes James's emotion when he sees it. It might influence his behaviour for years.	

With information is delivered successfully, there are entangled results to the participants in the interaction naturally. The effects are sometimes delicate but inevitable eventually. That's what sixth dimension is clarified. According to the Butterfly Effects (Lorenz,1963, pp.130-141), the environment is definitely different if this interaction between James and the tram happened. Last but not least, the eleventh dimension are memories, cognition or spirit, existing beyond all the space, time, events.

Using the framework as instructions or inspirations, the story could be told as one of the scenes in a suspense film:

In a cloudy morning, James is whistling a dismal melody on his way to school with a limp affecting one of his legs. There is a tram railway in ten meters away and a running tram is coming James's way. He notices this tram is going to pass by so he stops. Whistling an unknown tune, he stands still until he recognizes the tram by its

mysterious sign on it. It reminds him of the last time he saw it when his leg was hurt one year ago. He didn't remember a thing about the accident apart from the tram-sign. Since the sign reappears again, James hesitates for a second but makes up his mind to get on the tram to find out what happened to his leg. With nobody noticing, a private detective takes a photo of James with the tram from the dark corner.

3.4.2 To Reconstruct a Story

It is noteworthy that all the eleven dimensions are not linear and separate, but intertwined and blended with each other. Every aspect is crucial and any slight modification could make the objects interacting totally differently. As the example shown earlier, if the story is not satisfying or requires more creative combinations, the framework is able to be modified, producing new ideas, and the reconstruction of the story.

The modification could start from the basic four dimensions before interaction. The changes aim to increase mystery of the story and show unpredictable plots. Keeping some of the parts invariant, I would change slightly in the framework to see how the interaction is influenced.

Table 6: The Example of Recreating a New Story 1

Dimensions	Concepts	The Main Object	The Second Object
0 D	Object	James	A tram
1 st D	Location	On the way to school	On the way to school
2 nd D	Action	Whistling	Running backward
3 rd D	Result(Stat e)	With a limp for one of his leg	A sign was marked on the tram
4 th D	Time	In the morning	In the morning

The second dimension is amended and that change triggers a new interaction different than before. The red texts in the following Table 7 shows those changes and the theme of the story tends to be like science-fiction with suspense.

Table 7: The Example of Recreating a New Story 2

Dimensions	Concepts	The Main Object	The Second Object
0 D	Object	James	A tram
1 st D	Location	On the way to school	On the way to school
2 nd D	Action	Whistling	Running backwards
3 rd D	Result(Stat e)	With a limp for one of his legs	A sign was marked in the tram

4 th D	Time	In the morning	In the morning
5 th D	Interaction	James encounters a tram passing by and notice the abnormality about the tram.	
6 th D	Entangled Result(to self)	When James notice the tram, everything surrounded him is moving backwards	
7 th D	Time of Interaction	For James, when he notices the tram and he perceives the time of interaction with the tram is five seconds.	
8 th D	Possibilities of Interaction	As the storyteller myself, I would score the possibility of 0.5/5 presenting the unusual incident	
9 th D	Intensity of Interaction	As the storyteller myself, I would score the intensity of 4.5/5 for a relative higher number	
10 th D	Result to external participants	The people and all things around James start to moving backwards.	
11 th D	Memory/Cognition	The odd interaction changes James's value of the world. He might involved with a magical journey.	

The reconstruction of story might be described as:

In a cloudy morning, James is whistling a dismal melody on his way to school with a limp affecting one of his legs. There is a tram railway in ten meters away and a running tram is coming James's way. He thinks this tram is going to pass by so he stops. When the tram is near, he realizes something unusual about it. The tram is moving backwards quickly and there is a blurred sign on the tram that looks familiar to James. He tries to think hard but more strange things happened. The fallen coffee from his hand is returning to his hand. The passengers near him are walking backwards also. The time is twisted since the tram passed by, so James stops whistling, takes out his notebook and draws a sketch of the sign on the tram. There might be an adventure in front of James now.

The reconstructing a story does not demonstrate it as a 'better' idea, but another way of telling a story. Identifying the eleven dimensions for an interaction and then modifying the first four dimensions to make it a new interaction, the construction and reconstruction is a constantly circulated and iterative process (Figure 3.20). The *Framework IH* aims to encouraging risks and possibilities, enhancing creativity as its purpose. The decision about when to stop the cycle and achieving a satisfying solution is made by the users and the audience to judge.

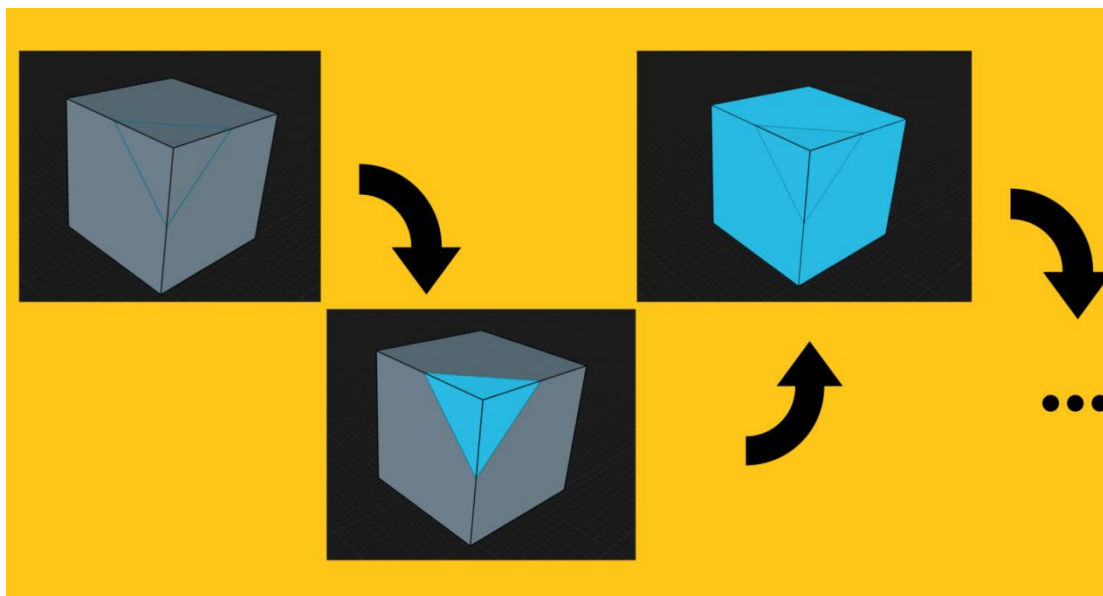


Figure 3.20: The Construction and Reconstruction Process

3.4.3 To Deconstruct a Story

To deconstruct a story is also how the framework may be used. Learning from an existing famous example of story-telling from the perspective of interaction between participants and their circumstances might feed into the pedagogy of art education.

As example, a story is described to search for the true meaning of oneself, a boy sets out on the adventures and eventually grows up as a new self. As a classic theme, it suggests many possibilities and combinations of characters. The basic storytelling structure is shown below in Table 8, which contains main characters' relations and their interactions from a famous story.

Table 8: The Example of Deconstructing of a Story

Dimensions	Concepts	The Main Object	The Second Object
0 D	Object	A gifted boy-Harry Potter	Rival-Lord Voldemort
1 st D	Location	Hogwarts-school of magic	Hogwarts and the magic world
2 nd D	Action	Go to school to learn magic	Revenge and reborn
3 rd D	Result(State)	A famous boy in the wizard world but grew up miserably as orphan in non-magic world	Coming back from 'dead'
4 th D	Time	When Harry turned 11 years old	In 1981, after attempting to kill Harry Potter
5 th D	Interaction	Harry's forehead left a scar by Voldemort instead of death, and he tried to protect himself and others from	

		Voldemort.
6 th D	Entangled Result(to self)	Harry got his own life lesson's to defeat the evil in the world and of himself.
7 th D	Time of Interaction	Eighteen years
8 th D	Possibilities of Interaction	Very surprising and unlikely (0.1/5)
9 th D	Intensity of Interaction	Strong and highly influential (4.5/5)
10 th D	Result to external participants	It is world-changing event for all the people and they have survived from the dark lord.
11 th D	Memory/Cognition	The whole experience affects many people's life and souls, they are inspired to be brave, to be selfless and to love.

The first interaction between Harry Potter and Voldemort happened when Harry was 1 year and 3 months old. The greatest dark lord Voldemort encountered his first downfall and was ripped from his body. The boy became a legend in the wizarding world but raised by his aunt's family and was brutalized as a cursed orphan. They came across each other again when Harry went to Hogwarts and was entangled with friends, tutors, enemies. Figure 3.21 below briefly indicates the track of interactions between Harry and Voldemort: the two individuals intersect from different start points and then develop tangled relations and finally are doomed in one's extermination.

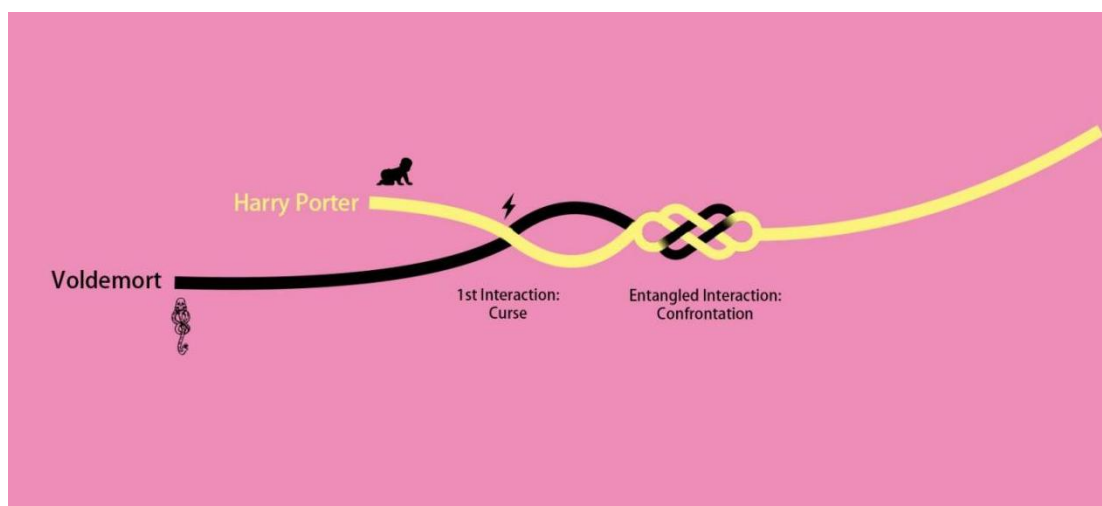


Figure 3.21: The Visual Narrative of Harry Potter

Those examples are trying to present the similar plots and theme might end up as totally different storytelling which the core idea is prominent for an unique innovation: a paradox behavior, an unexpected scenario, surprising time perspective or state

transforming. In creative writings, the interactions set the vision of the dramatic narratives while it influences the user interfaces and experience in general art and design. Hence, to deliver the appropriate information to the audience and to design the design of it are the current important tasks in this research.

3.5 The Mathematical Conjecture

Hypothetically, based on the mathematical definition of spatial dimensions, the concept of distance can be used to further quantify the potential for interaction between objects. In this context, measuring the distance between Object A and Object B across multiple dimensions (location, action, state, and time) could help to more concretely represent the likelihood or intensity of an interaction. The smaller the distance between them in these dimensions, the more likely or stronger the interaction becomes. This mathematical approach offers a more tangible way of understanding how interactions occur across multiple narrative dimensions.

To visualize interactions across dimensions, coordinates are used to position Object A and Object B within the first four dimensions: 1D Location, 2D Action, 3D Result (State), and 4D Time. Figure 3.22 illustrates an object in three-dimensional space with its location, action, and state, while time is depicted through linear progression. When Object A and Object B interact, they don't necessarily overlap in all dimensions (e.g., location or time) for the interaction to occur. For example, interactions can happen in remote meetings (different locations) or car accidents where the actions differ.

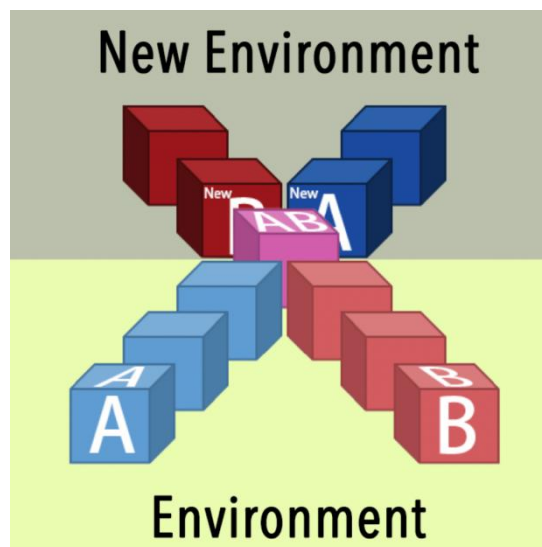


Figure 3.22: The Visualization of Interaction (2)

Assuming, Euclidean distance here is the possibility magnitude. In general, for points given by Cartesian coordinates in n-dimensional Euclidean space (Tabak,2014,p.150), the distance is

$$d(p, q) = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + \dots + (p_i - q_i)^2 + \dots + (p_n - q_n)^2}$$

In this system of *Interaction Hyperspace*, the first four dimensions are the fundamental factors of positing an object. Here I take these four dimensions as an example to calculate the distance between two objects. The position of the Object A in the coordinate system could be describe as A (p1,p2,p3,p4) while the Object B as B(q1,q2,q3,q4)

The distance is

$$d(p, q) = \sqrt{(p1 - q1)^2 + (p2 - q2)^2 + (p3 - q3)^2 + (p4 - q4)^2}$$

In this way, when the object A and Object B interact with each other, the distance could be noted as 0, then the equation would be:

$$d(p, q) = \sqrt{(p1 - q1)^2 + (p2 - q2)^2 + (p3 - q3)^2 + (p4 - q4)^2}=0$$

When an interaction happens, the location is the nearest (|p1-q1| is infinitely small), the action is the most alike (|p2-q2| is infinitely small), the state is the most alike (|p3-q3| is infinitely small), time is the most consistence (|p4-q4| is infinitely small). Of particular note is that the shorter the distance between Object A and ObjectB, the higher the possibilities, which is negative correlation. Subjectively speaking, when the location is the same, people or things are in the same space. There are great chances they come across, especially when they are conducting the same action and remaining same state simultaneously.

The possibility of interaction is higher, and therefore any surprises are less likely. If the original position of object A and object B is far away, the interaction of them is highly unusual. By challenging the variable of the equation, this system could apply in the creative industry where the minority is highly valued.

3.6 The *Application of Interaction Hyperspace (App IH)*

This practice-based research focuses on the possibilities of the development of professional practice of art and design and creative solutions through Action Research (the detailed methodology will be elaborated in Chapter 4). In the following section, the testing process will be involved with several practices of teachers' or designers' action research.

To visualize the framework and uphold my interest in interactive design, I developed a mobile application (Figure 3.23) to explain my framework and collect data from practices in case studies.

In the university teaching practice, this creative method is intended to be a teaching tool conducted by the researcher or by other lecturers with the researcher doing

observations as an outsider. It might be easier for the interaction between the lecturer and the students and the digital process of producing creativity enhances efficiency. The more detail about the application and the data collected will be elaborated in the later chapters of case studies.

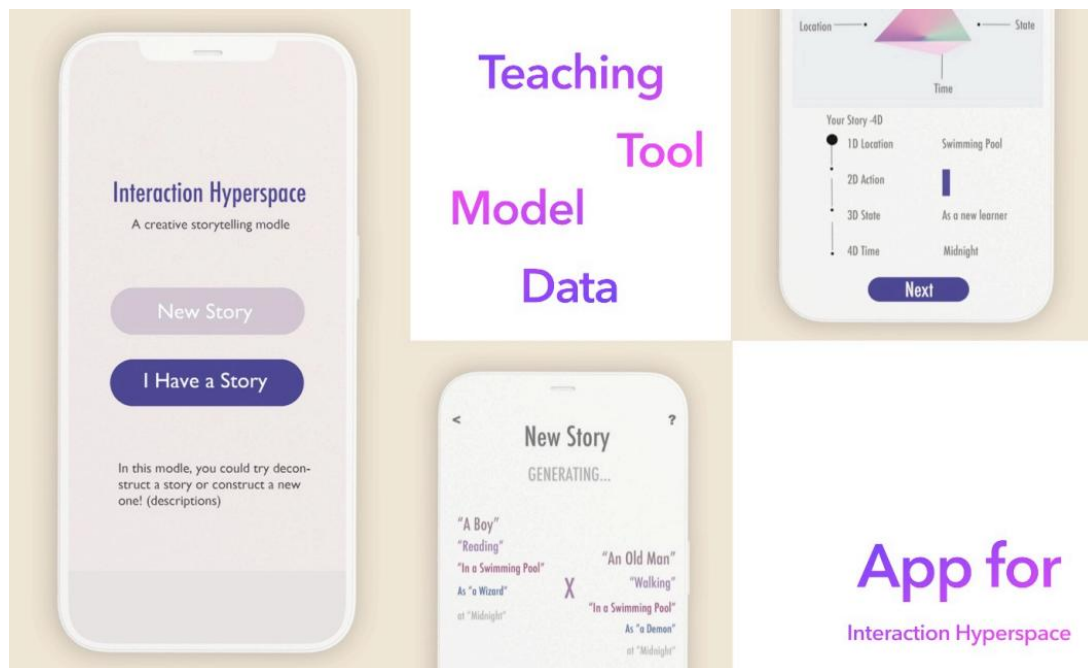


Figure 3.23: Application Screen Shot

3.7 Chapter Summary

This chapter outlines the theoretical approach and methods proposed in response to the research questions, focusing on the development of the *IH Framework*. Interaction plays a central role in the system, supporting the core structure of storytelling. By adopting the concept of *Interaction as Storytelling*, the narrative structure is deconstructed through interaction-related dimensions.

The framework was designed to serve as both a storytelling tool and an analytical model, aiming to provide systematic guidance for artistic creation. Drawing on concepts from quantum theory, the framework borrows from the objectivity and structure of physical systems, applying them to the creative process to enhance the systematization and effectiveness of storytelling in art. The use of physical analogies, such as multi-dimensional space and interaction dynamics, reinforces the framework's ability to guide innovative narrative construction in a structured manner.

Throughout this chapter, the definitions and components of the framework were presented, along with examples of how it can be used to structure stories and encourage creative innovation. While the examples discussed were based on self-testing and experimental scenarios, the framework demonstrates its potential as a tool for analyzing and fostering creativity.

In the following chapter, a more rigorous exploration of the methodology and academic approaches will be provided, offering further validation of the framework beyond initial experimental testing.

4. Methodology

4.1 Overview

This chapter outlines the research methodology employed in developing and testing the *IH Framework*. The research adopts a practice-based qualitative approach, incorporating Action Research, Activity Theory and case study methodologies. The aim is to provide a structured process for evaluating how the *IH framework* can enhance creative narrative development among undergraduate animation students in China. Throughout the research process, various roles were adopted, including researcher, teacher, and facilitator, each of which played a pivotal role in the evolution of the framework.

With respect to creative storytelling, it is essentially based on the designers' own perceptions and understandings of arts and design. The framework is applied to the practitioners who might connect their individual lived experiences and perspectives and form these ideas into a synthesized embodiment. As the data of this research are collected from personal interpretations of participants in their constructing narrative art, the research study falls into the Interpretative Research Paradigm. Ontology deals with reality and the nature of being, Interpretivist ontology suggests that many realities can exist at once, and that there is no direct access to the real world (Carson et al., 2001, Hudson and Ozanne, 1988)

As my main interest starts from the exploration of interaction and interactivity, the elements of storytelling and how they are associated with art and design are established in the discussions and reflections about interaction. In Chapter 2 in Section 2.2, there is a discussion about *What is Interaction?* This is the main motivation and leading inspiration regarding the framework proposed in Chapter 3. To test the theoretical method in the professional field of teaching and learning narrative arts, there will be more discussion towards *Interaction* from participants' interviews and questionnaires.

As general definitions from many scientific fields like physics, chemistry, and biology, interactions emphasize the behaviors of systems between entities. They tend to focus on the properties of matter and the interior linkages. In the context of arts and humanities, interaction can be defined as the process of two or more entities engaging in entangled communication or behavior with one another. Moreover, process

ontology, especially from the perspective of Zhuangzi¹⁴, which claims that everything is in a state of constant change and transformation (Damyanova, p.177), suggests that all entities are engaged in a process of interaction with their environment and with other entities. That responds to the earlier discussion, which proposed that everything could be seen as interactions. Therefore, while the concept of interaction may have different understandings and interpretations depending on the context and field of study, my research tries to deconstruct it and synthesize it to apply to the creative process of art and design.

From ontology to methodology, it fuels the power from the internal to the external process, and furthermore influences the research approaches and data analysis. It gives my momentum to the ontology of interaction, which construes the notion of the reality of interaction. Moreover, the methodology ensure the researcher and those whom they interact collaborating construct a meaningful reality (Angen, 2000, p.385).

Since the consideration and discussion about methodologies has been introduced in Chapter 1, this chapter emphasizes on the specific academic methods applied in each cases. In Section 1.5, the academic gap of this research is deliberated as attempting to make analogies and metaphors across different disciplines from physics to the practices of art and design. In the latter section of this chapter, the limitations of qualitative approaches of this research are described and explained according to the specific situations to complete this chapter.

4.2 Research Content

This research focuses on developing and applying the *IH Framework* to structure storytelling and enhance creativity in artistic creation, specifically targeting undergraduate students in China. The aim is to bridge theory and practice by utilizing the *IH Framework* to organize narrative elements and explore interaction's role in shaping creative outcomes.

Theoretical Foundation: The study integrates quantum theory, narrative theory, and educational pedagogy to develop the *IH Framework*, a multi-dimensional model for creating and analyzing complex narratives to encourage students' innovations in art and design.

Methodology Design: To assess the framework's efficacy, the research will conduct three case studies, each varying in duration and context. These case studies will utilize the *IH Framework* to analyze and generate narratives, providing insights into its adaptability and performance in different creative scenarios. Specifically:

Case Study 1: Short-term session in an animation classroom with undergraduate students, focusing on the immediate impact of the *IH Framework* on storytelling and

¹⁴ Zhuangzi was a Daoist philosopher, born in Warring States period (around 369 BCE).

creative engagement while working on independent concept designs.

Case Study 2: Long-term project-based collaboration, exploring the influence of the framework on narrative complexity and artistic expression over an extended period among a group of students working on a shared animation project.

Case Study 3: A focused short-term theme design project, assessing the practical application and sustained impact of the *IH Framework's* benefits on creative development among mature students and practitioners.

Analysis and Reflection: The research will evaluate the framework's application outcomes, emphasizing its ability to enhance narrative complexity, foster creative engagement, and provide practical benefits to art and design students. This assessment will validate the framework's effectiveness and identify areas for improvement.

4.3 Research Method

4.3.1 Case Study

In terms of considering the possible research method, Gray (2004, p.125) introduced a different strategy as Yin (1994) made the Table 9 for determining them.

Table 9: Determining Research Strategy

STRATEGY	FORM OF RESEARCH QUESTION	REQUIRES CONTROL OVER BEHAVIOURAL EVENTS	FOCUSES ON CONTEMPORARY EVENTS
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Unobtrusive measures	Who, what, where, how many, how much	No	Yes/No
Case Study	How, why	No	Yes

In section 4.1, the review of research questions focus on how structuring storytelling through the perspective of interaction could assist the art students with their practical design, which makes the form of research question is “How”. The “requires control over behavioral events” are not necessary in the context of this research activity as the storytelling-based art and design are encouraged to be imaginative and unlimited. Nevertheless, the focuses on contemporary events are highly valued in the research activities of a qualitative study. After considering the above factors, Case study is the appropriate research method for data collection in this research. The specific techniques of each case study will be deliberated in the Chapter 5, 6 & 7.

4.3.2 Activity Theory and Revised Activity Theory AT

The idea of using Activity Theory (AT) as the methodology for developing creativity in art and design was inspired by Kinsella (2018, p.493). As an analytical approach, the second generation of AT proposed by (Engeström *et al.*,1999) focuses on understanding human activity in social and cultural contexts, where interactions are highly valued. It can help the researcher to analyze the underlying and dynamic process during teaching activities by identifying the different elements of AT system, such as the goal of teaching, the tools used to encourage design and the environment associated. Relatively speaking, AT is also a complex and nuanced framework, the data collection and analysis are required to be ensured the validity and reliability of the research. Researcher as teacher was therefore encouraged to reflect on practice through questionnaires, lesson reflections and observations.

A revised Activity Theory is mentioned briefly in Chapter 1 in Section 1.5. In this system, the analysis parameters expand from the original six elements into eleven elements, which is defined as Revised Activity Theory (Revised AT) by the researcher for considering more aspects with interactions. To visualize the relationship between the AT and Revised AT, the second generation of AT could be seen as a top view from the tetrahedron in the *Hypercube* (Figure 4.2). It might offer a new spacial relationships within the Activity Theory, and explain that the point in the center of AT triangle is the perspective of *Interaction*. As the main research questions aim to help the students improve their creative art and design, the central topic is about how the students deal with their work. Thus, the *Interaction* in this case specifically means students interacting with their own creations.

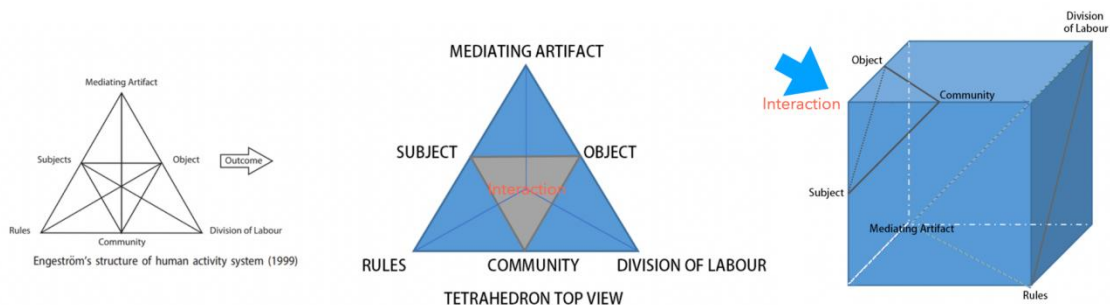


Figure 4.1 The Visualization of the AT and Revised AT

Therefore, this Revised AT is adapted in the first case study and it shows certain differences to the original AT in this particular classroom activity. Table 10 present these factors and the specific research contents in comparison. The more detailed parameters and analysis are explained in Chapter 5 in Section 5.5.

Table 10: Comparison of AT and Revised AT

Activity Theory	Revised Activity Theory	Specific meaning in the case
Object	Object	Art & Design
Subject	Subject	Students as Designers
Tools	Tools	Storytelling Framework IH
Rules	Rules	Requirements of Assignments

Community	Community	The class in university and the Chinese cultural background
Division of Labour	Division of Labour	Teacher instructing students and students completing design tasks
/	Interaction	Between the students and their design works as the focus of the whole activity
/	Time	The duration of the teaching, learning and practices
/	Entangled Results	Impacts on students from this activity
/	Results to the external participants	Influences on the researcher as teacher from this activity
/	Memory/Cognition	The following developments for students

4.3.3 Action Research

Action research (Costello, 2003) is a particularly useful methodology for a case study in regard to developing creative projects for university art students. One of the reasons is that Action Research involves highly participatory (Costello, 2003) working between researcher and participants, which fits into the scenario of a university design practice. Another reason for selecting Action Research in the case study is the potential of solving practical problems and generating knowledge, which can be applied to improve practices for the following cases. In encouraging creative storytelling skills, the collaboration of the researcher as instructor and students can lead to more effective interventions and solutions to the identified problems within the process. At last, Action Research is an iterative process involving cyclic planning, action, observation and reflection (Costello, 2003). These iterations may provide more improvement and refinement to the original theoretical framework than other methods, resulting in a more effective impact on the creative design development of art students.

However, there are some limitations and flaws in Action Research. As an iterative approach, Action Research can be time-consuming and resource-intensive. It may require long-term and continuous observations and collaborations between the research and participants. In the university system, the students are committed to diverse courses and projects. It may lead to some inevitable distractions and interference with this research. Most importantly, Action Research is highly participatory and the perspectives on the enhancement of creativity vary among the students in the case. It may be challenging to find out a consensus in the context of university teaching.

In comparison to these analytical approaches, Activity Theory concentrates on

understanding the patterns and dynamics of classroom teaching while Action Research focuses on problem-solving and generating practical knowledge through a series of activities. Both methodologies have their strengths and limitations. To consider all these factors, the strategy is balanced by introducing mixed approach into this research and fitting into each case study specifically.

4.4 Limitations

This research is framed within the Interpretivist paradigm, where the researcher's subjective perceptions heavily influence the understanding and interpretations of the findings. One key limitation is that the researcher's personal biases, knowledge, and experiences play a significant role in shaping the conclusions drawn. While this approach allows for in-depth, context-specific insights, it also creates a dependency on the researcher's competency. Readers must, therefore, critically evaluate the researcher's methodology and interpretative process, which inherently introduces a level of subjectivity (Carson et al., 2001; Hudson and Ozanne, 1988).

Another limitation stems from the storytelling nature of the research. In creating narratives around the studied cases, the research is not purely objective. The storytelling approach inevitably introduces personal perspectives, which can lead to different interpretations of the results depending on the researcher's or reader's background. This variability highlights that the effectiveness of the framework being studied may be perceived differently by different individuals. Since the research relies on individual interpretations of specific case studies, the findings and conclusions are contextually bound to those particular cases. As such, generalization beyond the specific situations discussed may be limited, reducing the broader applicability of the results.

Each case study is unique, and therefore, the conclusions drawn may only be valid within the specific contexts examined. This underscores the importance of critical engagement by the reader in assessing the relevance and applicability of the findings to other settings.

4.5 Reflections

As part of the research process, I assumed multiple roles throughout the study: researcher, teacher, and facilitator of the *IH Framework*. These roles evolved as the research progressed, each offering unique insights and challenges that influenced the development of the framework.

As a researcher, my primary role was to design the study, collect and analyze data, and ensure that the research methods aligned with the study's goals. Throughout the research process, I maintained a reflective journal, documenting my observations and decisions. These reflections provided valuable insights into the evolving relationship

between the framework and student outcomes. For example, in the early stages, I noted that students struggled with understanding how to apply the abstract concepts from the *IH Framework* to their narrative creation, prompting a revision of the digital application which enables a straightforward and interactive tool to use by students themselves.

In my role as a teacher, I worked closely with students, guiding them through the narrative creation process while allowing space for independent exploration of the *IH Framework*. One of the key challenges I encountered was balancing structured guidance with creative freedom. The documentary of teaching includes entries on how students responded to different teaching strategies, particularly the balance between open-ended tasks and framework-driven exercises. This role allowed me to adapt my teaching approach as the research progressed, ensuring that students could fully engage with the framework without feeling constrained.

As a facilitator, I introduced the *IH Framework* to students and provided ongoing support as they applied it to their narrative projects. This role involved technical issues students encountered when using the framework and making iterative adjustments based on their feedback. My facilitation of peer review sessions and feedback loops also played a critical role in ensuring that students could engage with the framework on a deeper level. Entries in my reflective journal detail the challenges of explaining complex concepts from the *IH Framework*, such as quantum storytelling and entangled results, in a way that was accessible to students. These reflections provide a deeper understanding of how my roles influenced the research process and contributed to the iterative development of the *IH Framework*.

4.6 Chapter Summary

In summary, this chapter explains the main philosophical stance of Interpretivist with ontology perspectives. Also, the research activities fit with Symbolic Interactionism as principle. To explore how structuring stories may inspire creative art and design for students, different qualitative research methods and approaches are employed for gathering data and analyzing. Multiple case studies are designed to collect data on the professional practices of art students when systematic Activity Theory and Action Research methods are established to provide more participatory and iterative perspectives of this research. The case study and corresponding methods are explained in the following chapters.

5. Case Study 1: Animation Planning

5.1 Overview

Animation Planning is a four-week starter program for animation students to use

professional strategy to have a comprehensive plan for an original animation. It is set up for second year undergraduate students at Fujian Jiangxia University. In this case study, the researcher selects the first week of Animation Planning as inspiration for animation and encourages more creative thinking in the early stage of the scheme. Specifically, this case is designed for the first stage of the verification of the proposed research theory, which enables 35 students to create their primary concept design and reflect on the intervention of *IH Framework* to have an impact on their design.

China's undergraduate education system, grounded in a rich cultural and educational traditions, has undergone significant transformations in recent decades. As the country strives to cultivate a new generation of innovative talents capable of meeting the challenges of globalization, undergraduate education has increasingly emphasized the importance of critical thinking, creativity, and practical skills. This context sets the stage for exploring novel teaching methodologies that can effectively engage students and foster an environment conducive to learning and innovation.

This case as the first study in my research holds seminal significance. It serves as a pioneering exploration into whether and how the concept of "*Interaction as Storytelling*" can be integrated into China's undergraduate educational landscape. This approach posits that through interactive narratives, students are not merely passive recipients of information but active participants in the construction of knowledge, thereby enhancing their engagement, comprehension, and retention of educational content. By doing so, I aim to gain a clearer understanding of if the *IH Framework* can approach to students and impact traditional teaching methods in animation concept and make undergraduate education in China more interactive and effective for students.

5.2 The Process

The activity was conducted in 3 sessions of Animation Planning, aiming to foster the abilities of planning animation projects and generating the initial idea for animations. Each session lasted 45 minutes and conveyed different topics:

1. The discussion about different understandings of interaction, creativity, art and design from students;
2. The introduction to using storytelling tool *IH Framework* to help design;
3. The feedback after using *IH Framework*.

The process of practical assignments was designed to produce three primary designs of imaginary chairs: the first design is with no instructions at all; the second design comes after the introduction of the storytelling *Framework IH*; the last design is encouraged to alter some key elements of *Framework IH* to improve from the earlier design. The visualization process of this classroom-practice is shown in Figure 5.1 below.

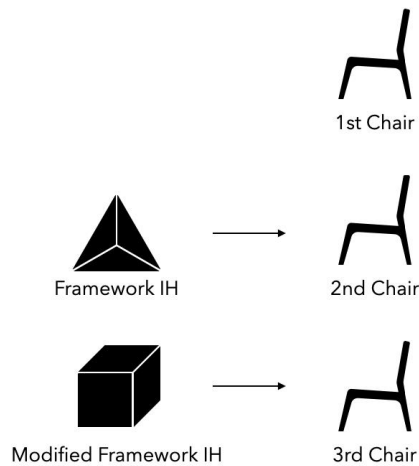


Figure 5.1 The Three Imaginary Chairs

The criteria of the case were measured in two ways, group discussion and voting for *the King of Chair* (Figure 5.2) during class from the students and a more systematic online questionnaire from individual perspectives. Although this case study was based on a short-term classroom practice, the students showed high engagement and concentration in these sessions. Along with the observation of the researcher as the teacher in this case, the data also included the audio recording retrieved from the classes.

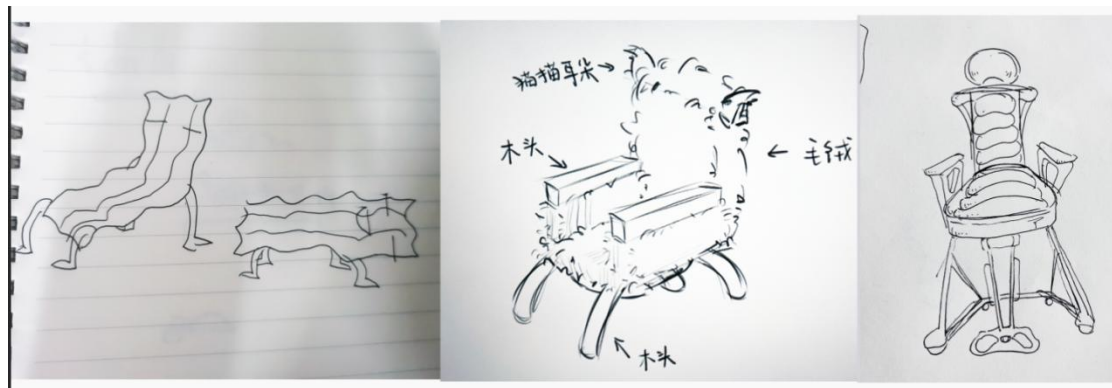


Figure 5.2 Some of the Top Chairs in Selections

Particularly, this is an important phase of experimenting with the theoretical framework in an early stage of research, as it has the potential for widespread usage among young students and allows for the adjustment of the research method for subsequent research.

5.3 The Intervention

This case is intended to use three design assignments to present the differences before and after the intervention, *IH Framework*, which is using the storytelling structure to help narrative design.

The first design assignment is a relatively broad and open-ended task, guided simply by the prompt "Imagine a chair" (see Q9 in 5.4 Data Collection, p.65). As chairs are one of the most common objects in daily life, this design requires minimal explanation, allowing students to swiftly employ familiar methods for creation and minimize unnecessary distractions (Exemplified in Figure 5.3). The design task for the first chair is completed based on the students' design intuition prior to any intervention. This serves as a clear control group, indirectly reflecting the current design patterns and thought processes of undergraduate animation students.



Figure 5.3 A Reclining Chair (1st Chair)

The introduction of *IH Framework* was displayed and presented to the students right after the first free-design mission. The intervention in this case was straightforward and immediate, when the design approach was applied in the classroom. Notably, the narrative tool *IH Framework* used in the classroom was in the form of the teacher's explanation and questionnaires (in this stage, the mobile *App IH* hasn't fully developed). But the core framework worked in the same way to explain the theoretical system for inspiring more concept designs.

The designs of the second and third chairs, serving as the after-intervention group, create a stark contrast with the first chair. In an animation class, the design of an imaginary chair was not assessed by its ergonomic functions but the characteristics and storytelling potential for later animation design. These chairs may have personalities, habits, background stories along with humanized expressions. In Figure 5.4 (the same student who created the 1st chair in Figure 5.3), the object is described as a small upholstered stool with a broken back and a chair leg covered in strips. In this design, the student uses the narrative elements to describe a short story: "After the extinction of humans, a small broken upholstered stool in the garbage dump, the heart is confused. But after discovering the elevator that goes straight to the sky and the mechanical halo that surrounds it, there is hope in the stool's heart." The intervention of *IH Framework* provides a structured scenario where a simple chair might interact with other objects, which leads to more possibilities for narrative arts. Subsequently, the student utilized the modified framework to alter the condition of "human extinction" and proceeded with the third revision and creation of the chair design.

(Figure 5.5).

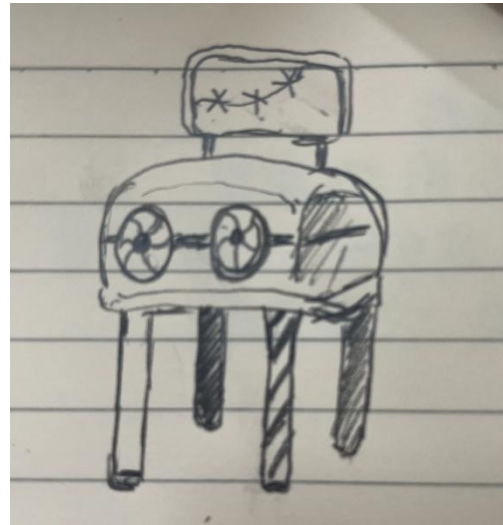
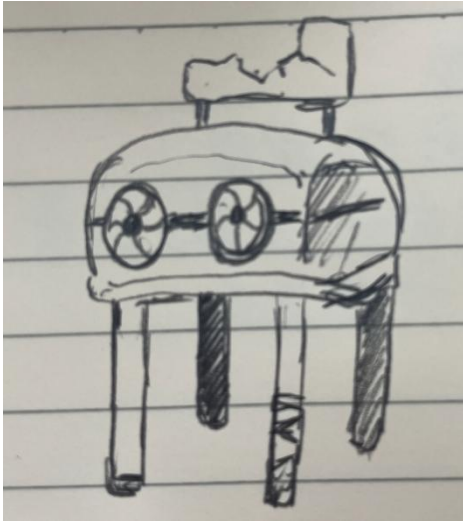


Figure 5.4 Broken Stool (2nd Chair) Figure 5.5 Reparative Stool (3rd Chair)

Under such intervention, a shift in the student's creative thinking can be observed, along with the significance of a character (the creative subject) in narrative arts. Subsequently, the collection and analysis of data will be clarified in the latter sections, and reflections on the implications of this case will be in the discussion section.

5.4 Data Collection

Data from this case study was collected through online questionnaires, including the views towards art and design from students; the design concepts and sketches; and the feedback about how the students reflect on the storytelling framework for their design. Moreover, the process is monitored by the researcher who kept their answers anonymous. In the framework of Activity Theory, teachers are there for supporting students' active participation, encouraging collaboration in the particular environment as classrooms, and moreover, prompting the learning process through necessary guidance. Therefore, the monitor not only guaranteed the students' commission to their assignments, but also help with the reservation of the classroom activity as a role of insider researcher.

The collection of the online questionnaire will be shown in the Appendices A5 (pp.115-117). The specific approach during the classroom activity followed the Revised Activity Theory to designate the subject and object, tools, rules, community, division of labor, interaction, time, entangled results, results to the external participant and memory/cognition.

As the main approaches of data collection were mainly retrieved from online questionnaires, the design of questions was fundamental to the research. As Boje(2014) developed his quantum storytelling in epistemic, empiric, and ontological ways, the primary questions before intervention discussed the native

views of students. They were targeted to reflect three main categories in the practice of arts and design:

1. The ontological perspective: what are arts and design?
2. The epistemic perspective: how are the most important ingredient of arts and design?
3. The empiric perspective: what is the challenge in creating art and design?

The specific questionnaire is designed as below:

Q1: What do you think is art?

Q2: What do you think is design?

Q3: What do you think is the relationship between art and design?

Q4: What do you look for most when creating your art/design work?

Q5: Where do you think the creativity comes from?

Q6: What challenges do you face in creating your work?

Q7: What do you think interaction is?

Q8: What do you think is the relationship between interaction and art/design?

Q9: Now imagine a chair in your head and describe what it looks like and what inspired you to create it.

Q10: Maybe you can sketch it out. (Voluntarily choose whether or not to upload pictures)

When the storytelling approach intervened, the second questionnaire collected the specific response about how they use the *Framework IH* as a tool in design.

Question designed (the *IH Framework* embodied as questionnaires):

1. 1D: Where is the protagonist?
2. 2D: What is the protagonist doing?
3. 3D: What state is the protagonist?
4. 4D: When does the story take place?
5. 5D: What interaction does the protagonist have?
6. 6D: What effect does it have on the protagonist?
7. 7D: How long is the interaction?
8. 8D: How possible does the interaction happen?
9. 9D: How strong is the interaction?
10. 10D: What effect does the interaction to the others/environment?
11. 11D: What's the most impressive memory/cognition from the interaction?
12. Please give your description of your design (chair).
13. Maybe you could sketch it out. (Voluntarily choose whether or not to upload pictures)
14. If you could create a different design by changing the first 4Ds (Location/Action/State/Time), what would you change?
15. Please give your description of your new design (chair).
16. Maybe you could sketch it out again. (Voluntarily choose whether or not to

upload pictures)

At last, the final questionnaire targeted at the feedback about the method of Interaction Hyperspace as an inspiration for arts and design with open questions and Likert Scale. These data were reflective and meaningful to prove how my theoretical approach is effective for art students in professional teaching practices and useful for instructing the later cases and improving them for the research.

Question designed:

1. Can you understand the method (Hyperspace of Interaction¹⁵) as a way of design through the researcher's explanation or written materials?
2. Before learning about this method (Hyperspace of Interaction), how did you conceive the inspiration for your chair design?
3. How do you evaluate the first chair designed in the preliminary survey?
4. How do you evaluate the chair design after understanding this method (Hyperspace of Interaction)?
5. How do you evaluate the design of the chair after changing the 4Ds of the Hyperspace of Interaction?
6. Which design do you think is your favorite?
7. Where do you think this method (Hyperspace of Interaction) can be applied?
8. Evaluation of the effectiveness of this method (Hyperspace of Interaction) for creative improvement (Score from 1 to 10).
The possibility of using this method (Hyperspace of Interaction) for your design in the future (Score from 1 to 10).
9. What are the weaknesses of this method (Hyperspace of Interaction)?
10. How do you suggest this method be improved?

The data collection process encompassed both online questionnaires and in-class observation notes recorded by the researcher. The questionnaires, distributed through an online platform, allowed for a broad and diverse range of responses from students, providing quantitative insights into their experiences and challenges. Complementing this, the detailed observation notes captured during class offered a rich qualitative dimension, revealing nuanced aspects of students' behaviors, reactions, and interactions.

During these sessions, particular comments from students emerged as significant, offering deep insights into their creative processes and needs. One student remarked, "一下子想太多反而会失去最开始想到的东西" (translated as "Thinking too much at once can lead to losing sight of the initial idea"), highlighting the delicate balance between contemplation and spontaneity in the creative process. Another concern raised was "缺少交互" (lack of interaction), indicating a desire for more collaborative and engaging learning environments. Students also expressed that "形容不够细致"

¹⁵ In the early stage of research, the *IH Framework* is introduced as Hyperspace of Interaction, but their contents remain same.

(descriptions were not detailed enough) and "希望有更细致的描述" (hoping for more elaborate descriptions), underscoring their need for in-depth, descriptive feedback to enhance their understanding to *IH Framework*. See Appendix A5-Questionnaire 3 (p.117) for the original data.

These comments serve as authentic reflections of the students' mental states and requirements during their creative endeavors. They reveal areas where current practices may be falling short and suggest avenues for improvement. Building upon the comprehensive data collection mentioned earlier, the next phase of this study involves a systematic analysis and in-depth discussion of the data gathered from the case study.

5.5 Data Analysis

To explore how the art students embrace the *IH Framework* as a working protocol for their practical design mission in the first case study, the data collected from online questionnaires and observation from the researcher will be archived and analyzed systematically by Revised Activity Theory. As explained in earlier Chapter 4 in Section 4.3.2, Revised AT is applied in this case, in which activities are carried out from the subjective perspective of students' interaction with their works. Along with the view of design activity as interaction, the other elements such as time, entangled results, results to the external participants and memory/cognition are added into qualitative analysis (see Figure 5.6).

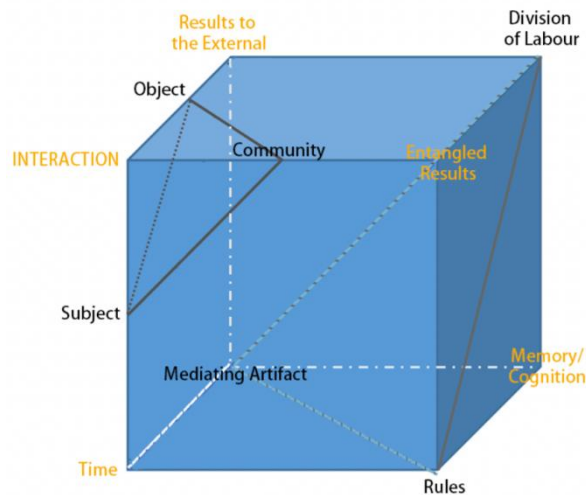


Figure 5.6 The Elements in Revised AT

Object: Engeström *et al.* (1999) believed that the object of activity shapes and determines the action. In this case, the object refers to the goal or outcome of the creative design. Seen as the production of creative thinking, it reflects the students' learning outcomes and the application of the storytelling *IH Framework*. The object plays a crucial role in determining this design activity, leading to other factors involving subject, community and cultural historical interactions in this system. In the case, the goal of the design tasks was producing innovative chairs in class. The

animation students focused on these objects, utilized the "Hyperspace of Interaction" method for creation, and presented works at multiple stages, including preliminary designs, designs after understanding the method, and designs after changing the 4Ds¹⁶.

Subject: The subject in this context of teaching activity usually refers to the individual or group of students who are the primary actors of the assignments in class. In this case, the students are the primary subjects, as they are the ones responding to the learning process and producing the design by applying the storytelling framework. In the meantime, they are also the interviewees who participated in the questionnaire and in-depth interviews. The 35 students are around 20 - 22 years old with a primary experience of animation, equipped with basic drawing and script writing skills. They shared their understanding, application, and feedback on the design method *IH Framework* through questionnaires and interviews.

Tools: The tools in this context refer to the different mediating artifacts, either the physical materials or the medium of mind used by the students in their creative work. In this case, in particular, it emphasizes the impacts on the design from the usage of *IH Framework*. As the main observation target for this research, the tool is introduced by lecture and examples by the researcher as teacher in the class. Students used this tool to conceive, design, and improve their works, while also evaluating its effectiveness.

Rules: The rules in this context refer to the expectations, norms, and conventions that govern the students' work in university animation teaching practices. These rules can include the guidelines for the use of specific techniques and the criteria for assessing the quality of the artwork. The procedure of producing three imaginary chair designs and the introduction of storytelling *IH Framework* are the specific rules for this case. There were specific instructions to conduct these assignments and the design outcomes were assessed by the students' voting and teacher's comments. In the questionnaires and interviews of this case, students also followed certain rules, such as honestly answering questions and sharing their true design processes and feedback. At the same time, the *IH Framework* method itself also provides a set of rules to guide students in their creations.

Community: The community in this context refers to the social and cultural context in which the students' activity and design assignment takes place. Although the questionnaires and interviews were conducted individually, all participating designers constituted a community. They share a passion for design, a pursuit of innovation, and curiosity and exploration of the *IH Framework*. This community can include the students in the class, the instructor, other faculty members, and also the broader art community outside of the university. This case takes into account the university environment and the Chinese cultural influences on the students' design concepts. It

¹⁶ 4Ds refer to the story element in IH Framework, which are location, action, result (state) and time.

reflects the collective consciousness and aesthetic evaluation of the current university students through their designing and reviewing the assignments.

Division of labor: The division of labor in this context refers to the distribution of tasks and responsibilities among the different members of the community involved in creative work. For this case, the researcher as teacher has the responsibility of introducing the storytelling method to help design and provide feedback to the students, while the students have the responsibility of producing the artwork and applying the storytelling framework. Also students shared their design inspirations and processes, evaluated the effectiveness of the *IH Framework*, and provided suggestions for improvement.

Interaction: This research parameter is considered in this particular case to pay attention to the interaction between the students and their design works. The relationships target on reflecting the teaching method and the effectiveness of the *IH Framework*. They improve their designs by understanding and applying this method, while also influencing the further improvement of the method through feedback and evaluations. Also, the interaction associates with how they evaluate their own and peers' work.

Time: Time is taken into account in this case as the activity is limited within the class schedule and the reflections on the efficiency of framework as a design tool from students are monitored and controlled by the researcher. The data are documents of the duration of the design assignments and the time students react to the framework, which can be an assessment of the app development for *IH Framework*.

Entangled Results: Entangled Results are usually defined subjectively involving both participants in the interactions. In this case, the main consideration is the acceptance and understanding of the teaching method from students.

Results to the external participants: As the interaction is limited between the students and their works in this case, it makes the researcher to be the external participant. The researcher observes this activity and analyzes the results from the data collected and reflects on the next stage of research.

Memory/ Cognition: In this particular case, memory and cognition refer to how the students perceive the teaching method and if they may use *IH Framework* voluntarily in the future.

Understanding these elements of Activity Theory in the context of the university classroom of an animation class can help identify the various factors that influence creativity and inform the development of more effective and inclusive art education practices.

5.6 Discussion

The results were discussed and reflected immediately after the class to document direct feedback from students. The effectiveness of *IH Framework* was assessed in multiple dimensions.

One of the measurements is Net Promoter Score (NPS) system. It borrows the idea from a market research metric that is based on a single survey question asking respondents to rate the likelihood that they would recommend a company, product, or a service to a friend or colleague (2021). Scores range from 0 to 10, with the NPS calculated by subtracting the percentage of detractors (scores 0-6) from the percentage of promoters (scores 9-10), resulting in a score between -100 and 100. This score reflects overall customer satisfaction and loyalty.

Regarding the question "Evaluation of the effectiveness of this method (Hyperspace of Interaction) for creative improvement" (see Figure 5.7), an NPS score of 10.5 indicates a positive sentiment among respondents. This score suggests that a significant portion of the surveyed individuals are enthusiastic about the method's effectiveness in enhancing creativity, and their positive evaluations far outweigh the negative ones. Such a score implies that the majority perceive the "Hyperspace of Interaction" method as highly effective in fostering creative improvement, and they are willing to recommend it to others. This positive reception may stem from the method's innovative approach to stimulating and integrating creative ideas, leading to tangible results in practical applications.

Q16.Evaluation of the effectiveness of this method (Hype...

NPS题 / 回答人数 35 / 净推荐分数 10.5%



Figure 5.7 NPS Score of the Evaluation of the Effectiveness

As for the question "The possibility of using this method (Hyperspace of Interaction) for your design in the future" (see Figure 5.8), the NPS score of 10.5 again conveys a positive message. It indicates that respondents are optimistic about the potential of incorporating the *IH Framework* into their future design processes. They believe that this method can help them achieve better creative outputs in their design work. This confidence may be rooted in the method's proven effectiveness in previous creative improvement projects or its ability to offer a fresh, innovative perspective and tools different from traditional design methods.

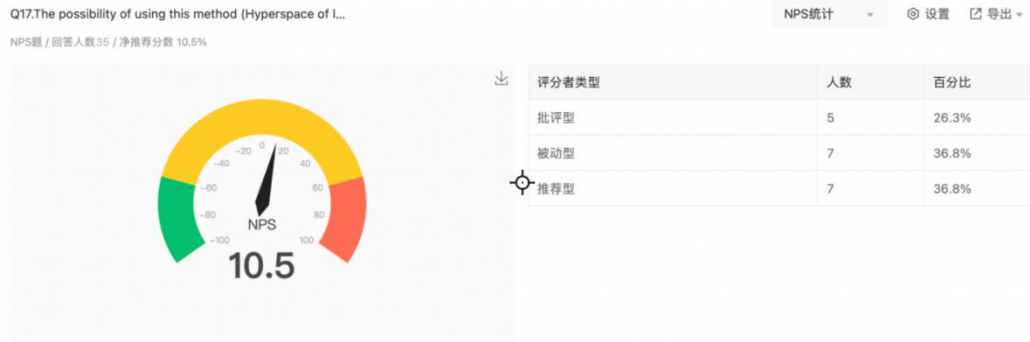


Figure 5.8 NPS Score of The Possibility of Using *IH Framework*

The other dimension is the subjective assessment of the design of chairs. The discussion around the best chair was through a voting called the *King of Chair* from selections of all 3 assignments of design. The result was surprising but inspiring when a simple sketch won out. The story was about a curved nori-shaped chair with four hands crawling on the floor (see Figure 5.9). The class burst out laughing when I show them this sketch at once. As they soon associated this chair with *Lying flat*, a network buzzword in China means the people are mentally relaxed, satisfied with the current living conditions, have no anxiety, no extravagant expectations, no expectation and hope for the future and lay down without pressure. This sketch was rough, simple, and even did not point to *Lying flat* as a veiled meaning by the original designer. However, in the current social environment and cultural context, this interpretation was quickly grasped by fellow students in the classroom, evoking an unspoken resonance among them. Their recognition of the "King of Chairs" extended beyond mere appreciation for its design creativity; it was, to some extent, an affirmation of shared values.

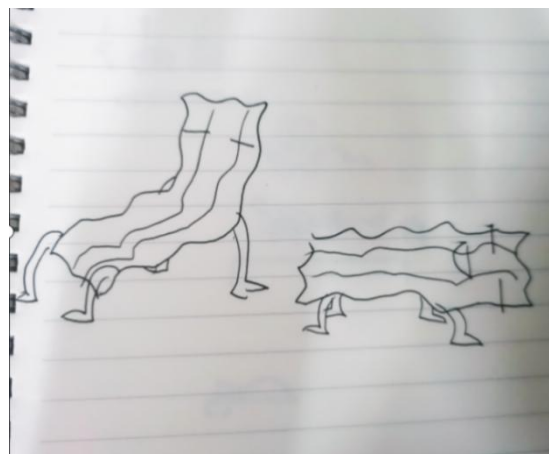


Figure 5.9 The King of Chair

Another interesting fact is that more than 50% of students chose the second chair as their favorite chair out of their own three designs (See Figure 5.10). The second chair was designed after using the *IH Framework* to construct a new story, while the third

chair was designed to encourage students to modify one of the story elements and alter their design. The original questionnaire designed by the researcher was meant to stimulate more creative perspectives for improving design. However, the last assignment on the third chair design was less engaged with students and the approaches to explain the necessity of modifying the elements were less convincing within a relative short time. Thus, the proper methods of constructing, deconstructing and reconstructing stories for Chinese animation students were considered to conduct respectively in the next case.



Figure 5.10 The Preferred Chair

In addition to obtaining student evaluations of their own and their peers' chair designs through data collection, it is can also be vertical comparison in the entire group's transformation in chair design (particularly the changes before and after the intervention) from the researcher's perspective as a teacher. The designs of the first chair group (see Figure 5.11) were primarily based on the functionality of the chair itself. It was evident that the students' creative inspiration and expression tended towards their own everyday needs and aesthetic pursuits for chairs. The chairs maintained a "sittable" design concept, and they also annotated the materials and some usage methods.

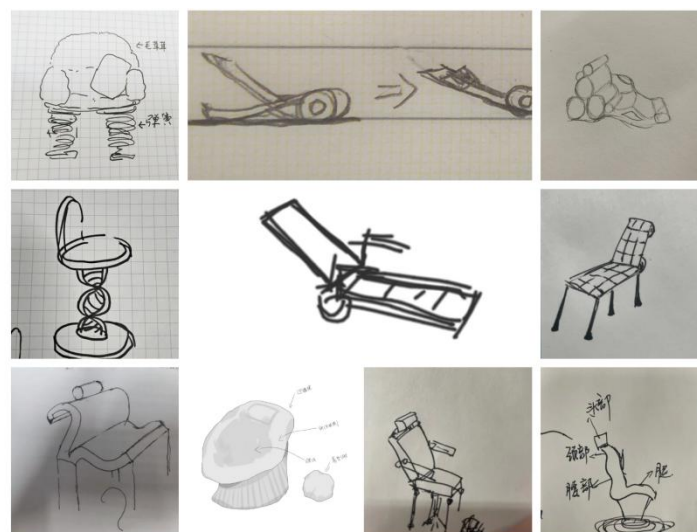


Figure 5.11: The 1st Chair Group

The designs of the second chair group (see Figure 5.12) exhibited a strong tendency towards personification, with many chairs possessing expressions and movements. The narratives presented by the students were also rich in scenarios, enabling viewers to quickly resonate emotionally with the designs. Furthermore, these chairs possessed significant narrative expansiveness, making them well-suited to serve as characters in subsequent animation designs.



Figure 5.12: The 2nd Chair Group

Many of the chair designs in the third group (see Figure 5.13) inherited the design concept of the second chair, bearing a resemblance in terms of styling. The primary distinction from the second chair lies in the adjustments made by the students in their narrative presentations. Additionally, some students, due to the relatively tight time constraints, did not fully grasp the significance of this design iteration, which consequently diluted the emotional impact of their designs.



Figure 5.13: The 3rd Chair Group

Through the Activity Theory analysis, students have varying degrees of understanding and application of the *IH Framework*. Some students can better understand and apply this method for creation, while others have difficulties in understanding or improper application. The *IH Framework* has a positive effect on improving undergraduate animation students' creativity. Most students believe that this method helps stimulate inspiration, expand thinking, and improve design works. In the meantime, they have suggestions for improving the *IH Framework*. They hope that the method can be more intuitive and easy to use, provide more reference cases or materials, and increase interactivity. Lastly, students constitute a community that shares the pursuit of design and the desire for innovation. They learn from each other, exchange experiences, and express their sense of identity with current society and mindset through design, within a shared cultural and historical context.

5.7 Chapter Summary

In summary of the first case study, the prototype of *IH Framework* was applied to practical university teaching with animation students in order to provide an opportunity to encourage creativity for narrative design. Overall, the class was highly engaged with this method and produced concept designs that benefited from it. Data were retrieved from online questionnaires completed in the class and the observations of the researcher as teacher in this case. Analyzed by Revised Activity Theory, the results present the relationships of designers and their work in the interactions of creation and the impacts reflected on the design by the social-cultural community. Through educational practices, the limitations and flaws of the framework reveal themselves to help the improvement of this research. Particularly, in a short-term design assignment, the effectiveness and applicability of the *IH Framework* are not typical. As the Test phase of research, this case study still provides valuable insights and directions for adjustment for the next case.

6. Case study 2: Augmented Reality Animation: *Door*

6.1 Overview

The second case study, "Augmented Reality Animation: *Door*," is a relatively long-term project undertaken by a group of three undergraduate students from Fujian Jiangxia University over a span of nine months, from September 2023 to May 2024. This AR animation project encompasses a complete storyline and utilizes Unity technology to create an interactive animation accessible via mobile phones. The focus of this case study is on the entire development process, from the initial concept to the interactive narrative. In this research phase, a storytelling tool in the form of a mobile app is introduced to assist students in recording and designing, while also documenting the series of changes throughout the animation's development. Given the project's extended duration, an iterative and collaborative Action Research method is employed for data analysis.

Within the context of this project, the students express their desire to explore new technology and innovation through their designs, while they name their project as *Door*. They are not merely creating an animation; they are also experiencing and understanding how innovative thinking can be applied in a real-world project.

This case study not only demonstrates how students utilize *IH Framework* as a team but also reveals the subtle influence *IH Framework* has on a project's various stages. This project also employed an iterative approach of Action Research, transforming students from mere research subjects into active co-participants in the study, thereby contributing to the refinement of the *IH Framework*. In this project, the iterative method of action research was adopted, which not only enhanced the students' practical abilities but also empowered them to take an active role in the research process. By participating in various stages of the project, such as problem identification, data collection, analysis, and reflection, students gained a deeper understanding of the research topic and became valuable contributors to the study. Their insights and feedback were crucial in refining and improving the *IH Framework*, making it more effective and relevant to the needs of students and educators alike. This collaborative approach fostered a sense of ownership and responsibility among the students, encouraging them to actively engage in the research process and contribute to the advancement of knowledge in their field.

6.2 The Process

This case is a graduation project supervised by the researcher as instructor, the *IH Framework* is intervened from the early stage of Animation *Door* for providing more options for storylines, especially for a interactive animation.

At first, there was only an abstract concept about doors by the group members without clear ideas of stories, protagonists or scenarios. In need of more narrative features, the virtual environment for animation expanded with the conceptual theme *Door*.

That was the time the group members asked for inspiration with more creative stories when the *IH Framework* was introduced. As a theoretical model, *IH Framework* was capable to provide a collaboration method for groups. Each group member including the researcher produced 10 random terms towards the first 4 dimensions of *IH Framework* separately (exampled in Figure 6.1). Randomly combined by the 4 dimensions, every member create 5 short stories as potential concepts for animation (see Figure 6.2). The group then discussed together to find out the most appealing and innovative stories as their initial idea to develop from.

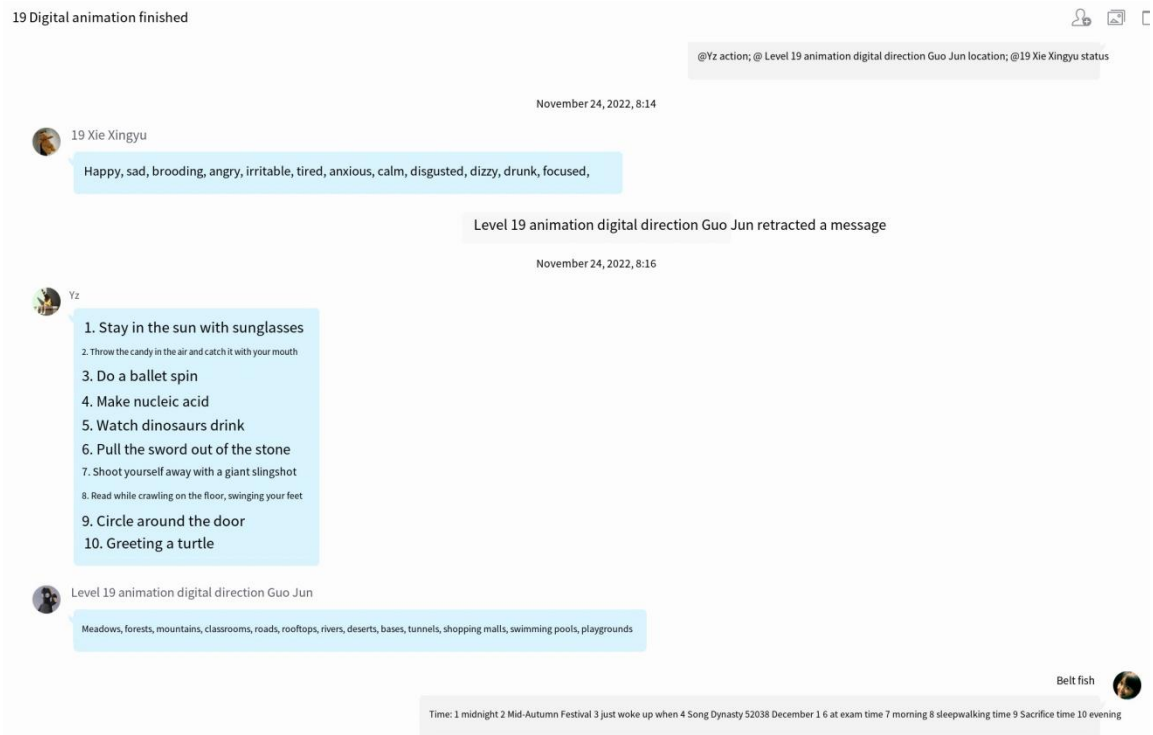


Figure 6.1 Division of 4 Dimensions

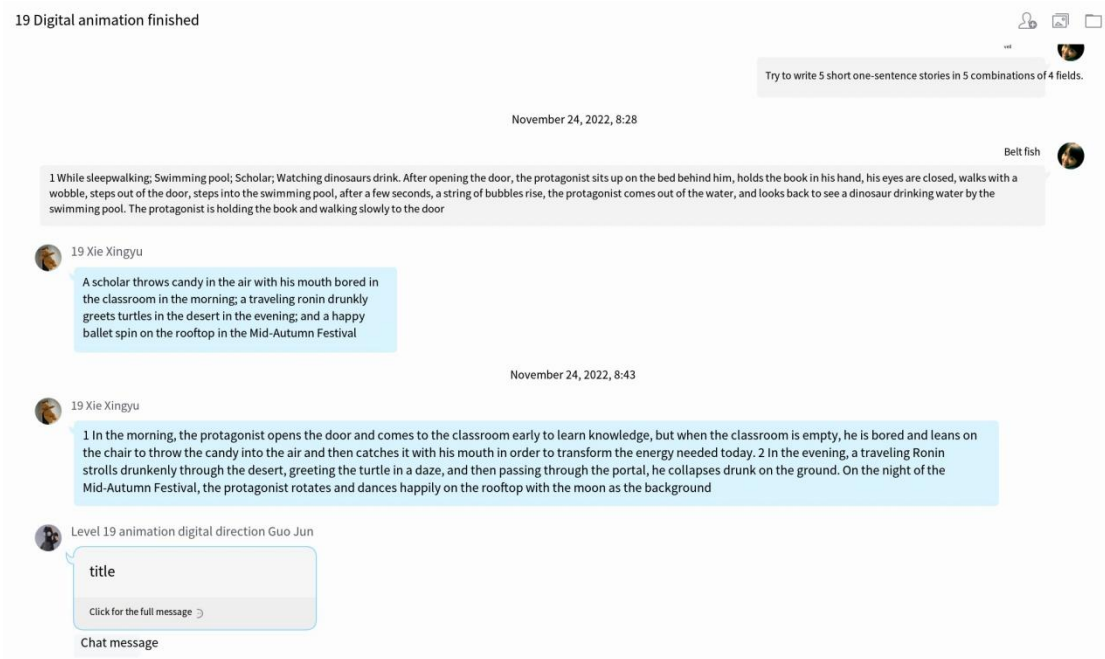


Figure 6.2 Constructing Stories by the Random Combination

As a participatory practice, the group member helped to provide some suggestions and reflected on the *IH Framework*. When the initial idea was settled for a few days, *Application Interaction Hyperspace (App IH)* came to use individually to help the group members to develop more stories. The animation aimed to be interactive through a physical door installation when the main story was set to be segmented by

entering and getting out of the door (See Figure 6.3). *App IH* assisted the group member to produce 3 different short stories and eventually unify them into a complete animated experience via Augmented Reality technique.

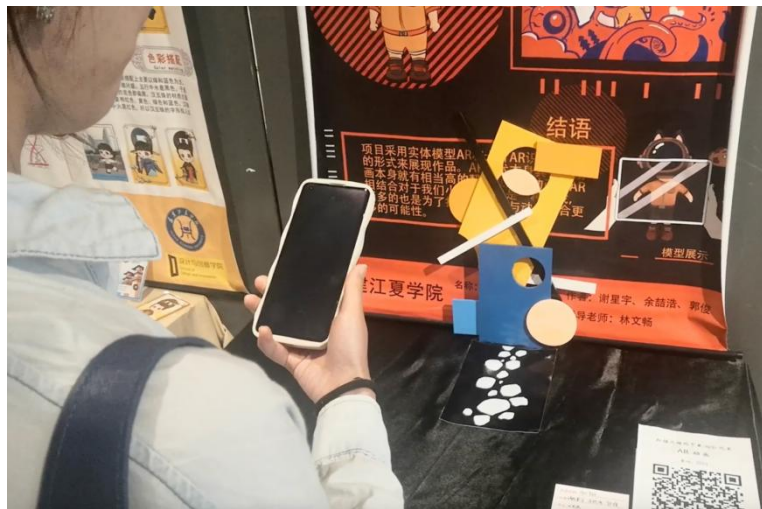


Figure 6.3 The Installation for AR Animation *Door*

The planning, action, observation, and reflection were throughout the whole design process, but could be seen as division into 2 stages of cycles. By engaging in the spiral of Action Research, researchers are able to actively improve their practice and gather evidence to evaluate how the practice has improved (McNiff & Whitehead, 2010).

Altrichter *et al.* (2005) explain the different stages (Figure 6.4), and state that the researcher should begin their Action Research study by identifying a practice that could be developed further, acting as the researcher's starting point. In this case, the Action Research spiral began with the planning for a new animation with the collaboration with students, adapting a storytelling tool of narrative art in order to stimulate more creativity.

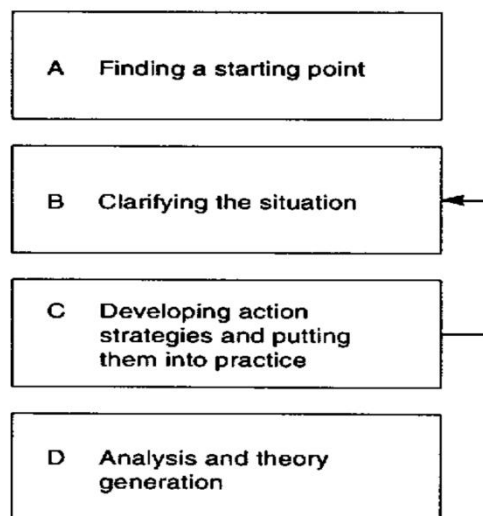


Figure 6.4 Stages of Action Research Process. (Altrichter et al., 1993, p.6. Routledge)

Identifying the challenges by interviewing students, the planned tutorial was executed and data was generated and collected during this process. After the first intervention, a review and analysis of feedback from students help to reflect on the core *IH Framework*. It led to the second cycle of planning, action, observation and reflection on the theory. In this case, the digital tool of *App IH* was introduced and used for the development of animation stories.

The working process of *Animation Door* showed the interventions and different approaches involved in this case (Figure 6.5). The detailed interview and design diary are deliberated in the next sections and in Appendix A6 (p.120).

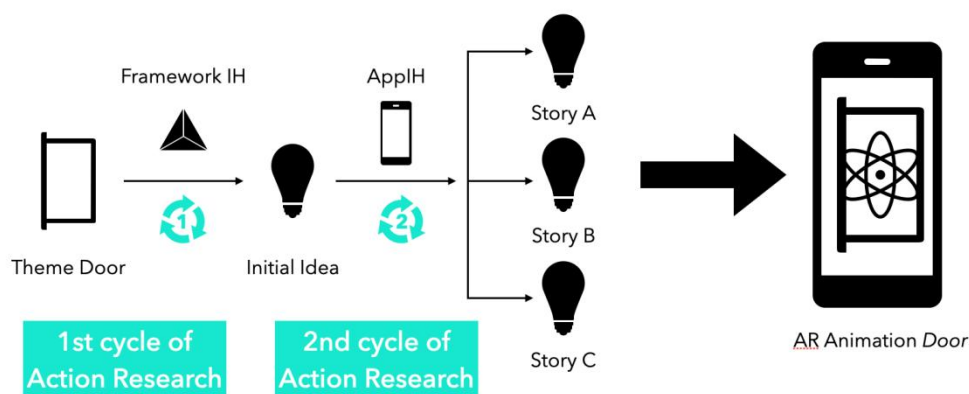


Figure 6.5 The Working Process of *Animation Door*

6.3 The Intervention

The intervention of *IH Framework* influenced this case in two different methods. One was traditional teaching instructions (Figure 6.6) and the other one was a digital user-friendly mobile *App IH* (Figure 6.7). The second case worked as the Adjustment phase of the research plan, the different methods of approaching student participants provided valuable insights into the improvements of the teaching artifact. The cyclic Action Research also revealed the different stages of reflection on the intervention.

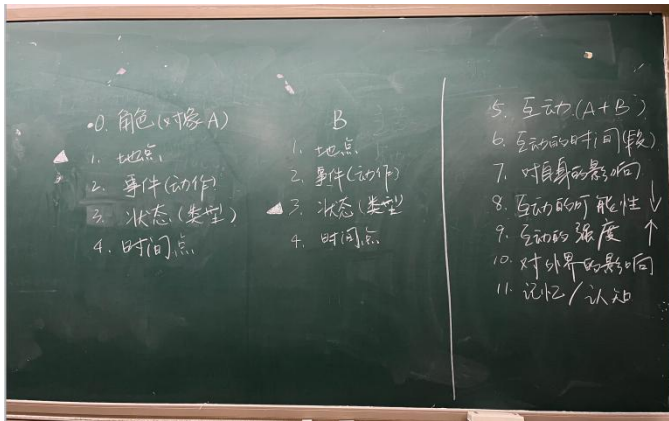


Figure 6.6 The Teaching Instructions

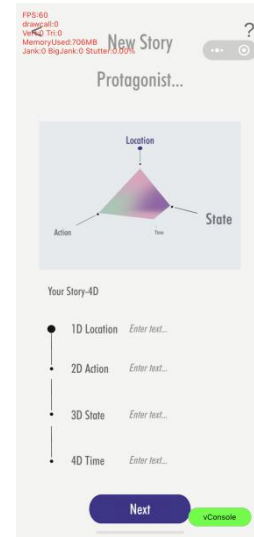


Figure 6.7 The App IH Interface

During the initial creative stage, the students in our group had a relatively broad understanding of the themes and concepts for the animation. In order to find a starting point, we conducted a team brainstorming session, using randomly listed 4D keywords as a catalyst to create some quick animation sketches. All three students in this group swiftly completed the *IH Framework* and created corresponding sketches (please refer to Appendix A6, pp.124-126). Subsequently, the students also engaged in reflective descriptions. There is an example made by this group of student to show the quick design and its elements in *IH Framework* (see Table 11 and Figure 6.8):

Table 11: A Brainstorm Story

The Interaction Hyperspace Framework		A Door in Hospital
0D	Object(People)	An old beggar
1D	Location	Hospital
2D	Action	Crying
3D	Result(State)	Paralysis sitting
4D	Time	Daytime
5D	Interaction	Interact with a bully and a doctor
6D	Entangled Result(to selfs)	Got hurt and hungry
7D	Time of Interaction	A period of time
8D	Possibilities of Interaction	Likely (the old beggar got bullied in the street and went to the hospital)
9D	Intensity of Interaction	Ordinary
10D	Result to the outside	The old beggar ends up in the street and happy only for a bit food
11D	Memory/Cognition	Not very dramatic but thought-provoking

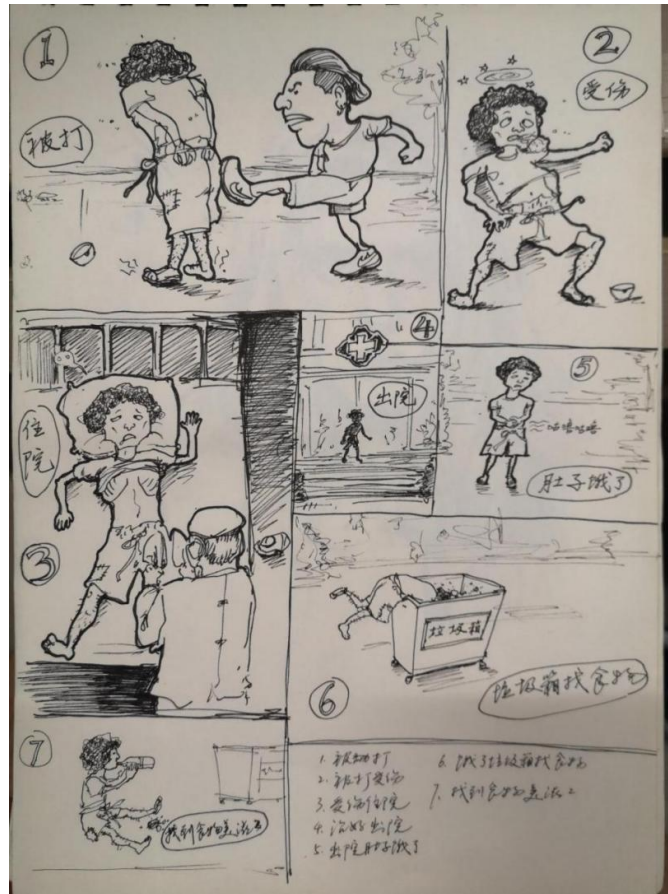


Figure 6.8 A Quick Sketch of Brainstorm

After the initial burst of creativity, the students spent some time independently discussing the script and presenting corresponding synopses. They then identified several logical issues within the script and decided to revisit the *IH Framework* to deconstruct the plot, seeking further refinement of their story ideas. This led to a second round of intervention and strategic adjustments. They kept a design diary (see Figure 6.9) to record these changes (more design diary see Appendix A6, p.120).

2. Plot script

After determining the art style, we began to decide on the plot content. In the early stage, we repeatedly revised the script, but in the process, we found that after revising one part of the plot, there was another logical problem. To this end, combined with teacher Lin Wenchang's suggestions, we carried out a line brainstorming (Figure 1 below), a 4-dimensional shuffling, writing, and re-writing a new script outline. Finally, the first draft of the animated short film "Door" was finalized (Figure 2 below).



Figure 14 Dimensional brainstorming



Figure 2 First draft of the animation script

Figure 6.9 Design Diary (Document)

As a 3D fiction AR animation, *Door* was required for more imaginary and novel plots and scenarios. The original conceptual theme has nominated a main object but lacks of storytelling elements. The optional and changeable *IH Framework* was capable to offer more possibilities for stories from targeting a protagonist to interactions. Animation *Door* eventually developed three segmented plots through different interactions between the character and a magic door (Figure 6.10).

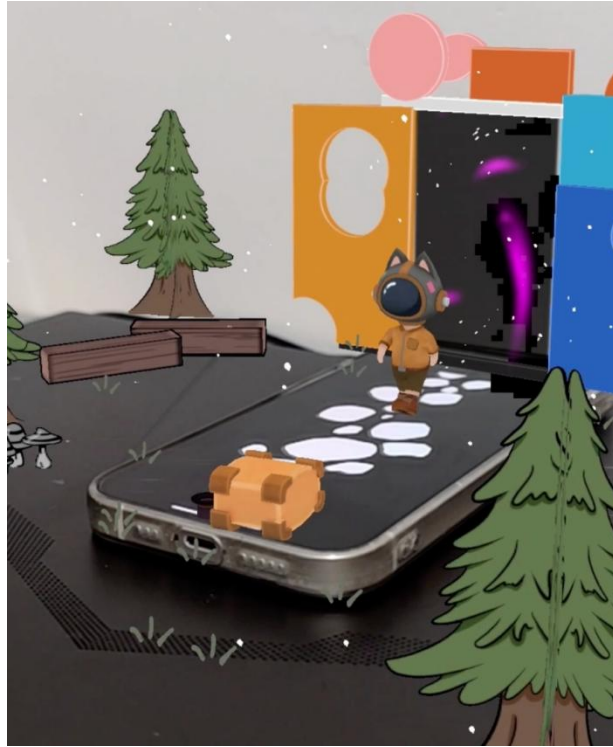


Figure 6.10 The Screenshot of AR Animation *Door*

6.4 Data Collection

In this case, there was a digital log to record the design diary which collaborating between the students and the researcher. It included the instruction from the perspective of the teacher, feedback from students and the discussion between themselves. The primary data also involved interviews with the group member in this case. It documented how these teaching methods approach the students, which method they preferred, and if they are efficient for guiding future design work. In the context of cultural social relations, the background introduction will be provided for each of the interview participants in this case, detailing information about their roles and division of labor in this animation project and the type of previous work they are good at. For confidentiality reasons, every participant has been given a pseudonym with one letter.

Interview participants:

X: 23 years old, Fujian Province. He was responsible for the design of the door, the scene and the animation editing. Before this project, he has 2-year experience of 3D modeling and is good at constructing virtual environments and architectures.

G: 24 years old, Jiangxi Province. He was in charge of the character design and the 3D animation in this project. G specializes in character modeling in 3D software and team management.

Y: 23 years old, Fujian Province. He was responsible for the Unity programming and the 3D movement of the character in the animation. Also, he is capable of script writing, interactive design, and action binding of the animation characters.

The general process of producing an animation story follows the development from story element, story script, storyboard to animation (Figure 6.11). The design diary and interviews were taken place when the stories of animation evolved.

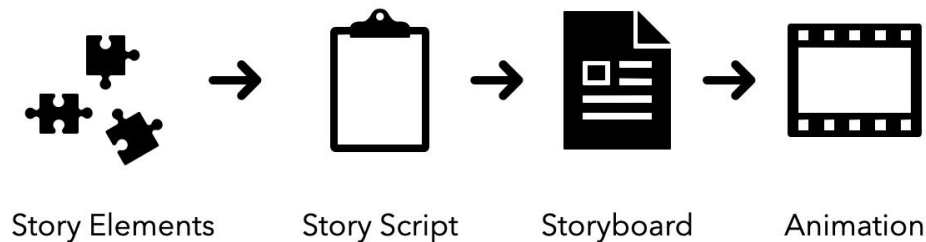


Figure 6.11 Story Development

The first interview happened when the story elements were created through group discussion and creation using *IH Framework*. The feedback from students was gathered through group interviews conducted in Chinese, then translated and transcribed by the researcher. Each group member was asked a series of questions that focused on their experience of the storytelling *IH Framework*, which are presented below:

1. What are the biggest challenges when you start to create an animation?
2. How do you feel when using the *IH Framework* to help create stories?
3. Did the short story develop since the group creation based on the *IH Framework*?

After the second intervention *App IH* was used among the group members, the second interview documented the differences in the tutorial approaches and reflections from the perspective of students. The key points of the interview were noted down and transcribed digitally, of which the questions are asked below:

1. How do you feel when using *App IH* to help create stories?
2. Is this app different than other methods in helping design? If so, what are the differences?
3. What are the differences between the *IH Framework* and *App IH*?
4. How is your story developed through these methods?

The last interview was conducted after the completion of *Animation Door* as a final review and reflection. It helped the research to reevaluate the whole process and lead to theoretical conclusions. The interview questions were:

1. Is the final story concept for the *Animation Door* different from the last story utilizing the *App IH*?
2. If so, what changed your mind?
3. Review the animation-producing process, what do you think is the most important element?
4. Would you use the *IH Framework* or *App IH* in your future work?

The researcher recorded concise written notes to comprehensively document all responses, utilizing keywords and composing full sentences for particularly noteworthy comments.

6.5 Data Analysis

After collecting data from the student interviews and design diaries, a thematic analysis was conducted to analyze and categorize the notes. The categories were not predetermined but emerged organically based on the topics discussed in the data. The categories were analyzed to identify patterns and recurring themes within the data. These common themes were synthesized to provide an overview of the feedback, which informed improvements for the second stage of Action Research.

Thematic analysis is a qualitative analysis technique that was used to analyze the notes collected from the student interviews and teacher observations (Braun & Clarke, 2006). The flexible approach of thematic analysis allows for a variety of epistemologies and research questions to be addressed (Braun & Clarke, 2006)

The collected data from a group of three animation students' interviews and design diaries pertains to the construction and development of the *IH Framework*. Through analysis of this data, valuable insights can be obtained regarding the efficacy of the storytelling framework in facilitating narrative art practices.

The first student interviews are presented first, providing direct feedback regarding the user experience of *IH Framework* working as a creative tool for brainstorming. This result is relevant for review and adjustment of the development of *App IH* which was implemented in the second period of the Action Research. Furthermore, this data served as valuable references to students' engagement and perception of the teaching methods in professional art practices.

The researcher used several methods for data analysis, including comparing design diaries, and drawing conclusions from student interviews. Combining suggestions from the students from the perspective of important participants and reflections on the first cycle of Action Research, it is crucial for the preparation of the second process of planning, action, observation and reflection. The final evaluation of this case considered all the analysis of interviews, design diaries and reflective writings.

6.6 Discussion

This case marked an important development in the *IH Framework*, transitioning it from a purely theoretical construct to an interactive application. The data collected revealed distinct user experiences when employing two different methods to structure stories for *Animation Door*.

Following the initial cycle of action research, the case's group members randomly selected key elements for their stories, integrating them into experimental mini script writings. This phase underscored the *IH Framework's* capacity to construct compelling stories. As the animation production process unfolded, the intervention of the *IH Framework* proved influential. It adeptly deconstructed existing stories into 11 dimensions, modifying the first four to reconstruct narratives that stimulated more inventive combinations.

In the subsequent cycle of action research, the animation stories underwent refinement, with careful consideration given to creativity and technical constraints. These polished stories were then translated into storyboards for animation production (illustrated in Figure 6.12). At this juncture, the team further honed the storyboard, guided by the narrative tool within the *App IH*, and curated a visually expressive shot list (showcased in Figure 6.13). Upon finalizing the script, they harnessed the "I have a story" feature of the *IH Framework* to dissect the existing storyline, thereby elucidating the interactive relationships within the story's structure (see Figure 6.14). This feature enabled the creation of nonlinear narratives and imparted a sense of expansiveness to the interactive animations.

ID	Accumulated time	content	duration
1	0	The door starts to activate the polygon on the door starts to move	4 s
2	4 s	The protagonist walks out of the door	2 s
3	6 s	The protagonist scans his surroundings and finds the hat	1
4	7 s	The protagonist goes to pick up the hat	2 s
5	9世纪	The protagonist dances with joy	1
6	十年代	The main character wears a hat and walks back through the door (the light on the door changes from green to red)	3 s
7	13世纪	The protagonist walks through the door, is scared by the tentacle inside the door runs out, falls the hat also falls on the ground, the tentacle retracts, the door The light turns green again	2 s
8	15	Out flew a butterfly	2 s
9	17	The protagonist finds the butterfly and starts chasing it	3 s
10	20	The butterfly flew around and back to the door	2 s
11	22	The protagonist picks up his hat and follows him through the door (the light on the door changes from green to red).	4 s
12	26	A group of butterflies chase the protagonist out again, and the protagonist knocks his hat down and drops it where it started (the light on the door starts flashing), The protagonist gets up and runs.	5 s
13	31	At last a butterfly flew out of the door and round the door The butterfly turned and flew away.	5 s
15	39	The eyes return to the door, light on the door gradually goes out and turns green, and the door begins to change and gradually close	5 s
	44岁的年代	The closed door and the lost hat	

Figure 6.12 The Storyboard of *Animation Door*

剧情脚本确定后，开始了对片段的分镜绘制，为了使镜头结合交互形式，更容易理解，做了许多的调整，包括分镜绘制，从开始的整版说明到最后的片段版说明，便于组员更好的理解镜头的偏移、景别等（如下图5、6、7、8）。

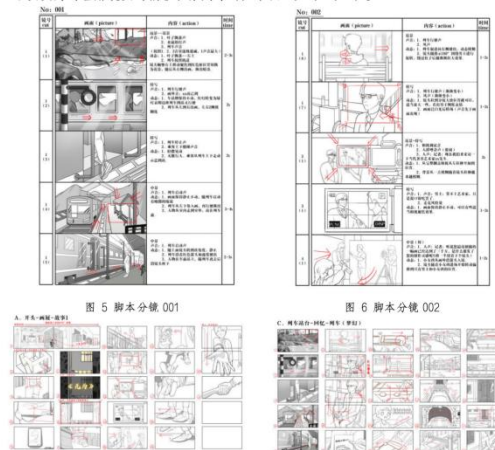
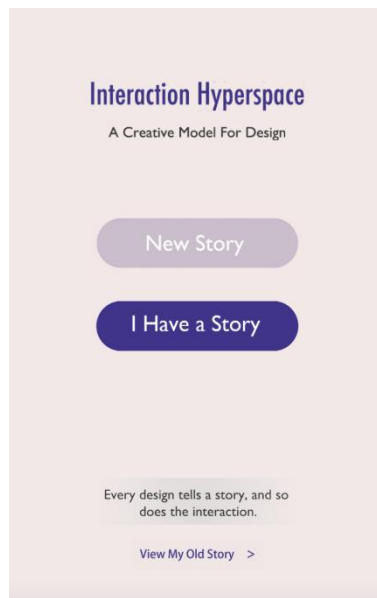


图 5 脚本分镜-A段

图 8 脚本分镜-C段

Figure 6.13 Refined Shot List

Building on the creative narrative, the students then crafted conceptual design sketches centered around the theme of doors (Figure 6.15).



6.14 The Homepage of *App IH* Figure 6.15 Concept Design of *Door*

The interviews conducted with the group and the insights gleaned from the design diaries offered a revealing glimpse into the early stages of animation planning. The student participants were pleasantly surprised by the *IH Framework* and *App IH*, expressing enthusiasm and a passion for crafting diverse story combinations. One student, G, who was an avid online mobile game player, remarked, "It was interesting and interactive, like a game." (see Appendix A6, p.127) They also demonstrated the ability to collaborate effectively as a team, creating absurd stories that they kept to themselves.

However, as the animation production process neared its conclusion, the team found themselves unable to fully realize all their ideal stories due to the limitations of certain 3D technologies they struggled to master. This challenge is, in fact, a common occurrence in animation production, as evidenced by my eight years of experience as an animation teacher. This realization underscores the importance of incorporating remedial planning as an extension of the *IH Framework*, addressing more practical concerns when utilized in broader contexts.

In conclusion, the *IH Framework* and *App IH* have demonstrated their potential to enhance the creative process in animation production. By refining the storyboard and shot list, and enabling the creation of non-linear narratives, these tools have empowered students to bring their stories to life. However, the team's experience also highlights the need for ongoing adaptation and problem-solving to overcome technical challenges and fulfill creative visions.

6.7 Chapter Summary

To conclude, the *IH Framework* and *App IH* was introduced to a group of students as participants in Action Research to help improve the bottleneck of lack of inspiration in the early stage of design. Working in an iterative and participatory project, the interviews and reflective discussion benefit this research. This case study was able to yield insights regarding effectiveness of the storytelling *IH Framework* providing more possibilities of students' abilities of narrative design. However, the outcomes may not simply rely on the storytelling skills, but many technical issues. The findings presented in this study imply that *IH Framework* can be utilized as a tool in improving the motivation and inspirations for students. In the next stage of research, it will also consider the learner autonomy and universality of application among the different practitioners of art and design.

7. Case study 3: Theme Design

7.1 Overview

This case study is specifically designed to showcase the versatility and efficacy of the *App IH* in a wide array of scenarios, ultimately aiming to boost creative capabilities among art and design practitioners. The chosen theme for this experimental design case, "A Piece of Sea Take-Away," serves as a catalyst, guiding participants to swiftly produce targeted art or design works. This theme not only challenges traditional thought patterns but also encourages innovative thinking and expression.

The study involves nine participants, all of whom are relatively mature Chinese designers or practitioners in the creative industry, possessing a wealth of experience and expertise. These individuals have great potential to serve as future advocates and facilitators for the *IH Framework*. From their perspectives as educators or disseminators of this methodology, they can assess whether the research has a positive impact on fostering creativity among Chinese undergraduate animation students. By targeting this professional demographic, the research seeks to gather diverse insights and evaluations, enriching the understanding of how the *App IH* can be applied in real-world settings. This aligns with the third phase of the research promotion, which focuses on expanding the user base and encouraging more individuals to adopt and assess the *IH Framework* and *App IH* in their daily routines or specific educational practices.

In the context of animation undergraduates in China, this case study holds significant relevance. The creative stimulation education methods (tools) for these students often require innovative approaches to foster their imagination and design skills. The *App IH*, with its ability to facilitate narrative design and enhance creativity, can serve as a valuable addition to their educational toolkit. By exposing animation undergraduates

to this tool, educators can encourage them to think outside the box, experiment with various mediums, and develop unique narratives that reflect their personal vision and creativity.

Furthermore, the researcher's role as an outsider in this case study ensures an unbiased approach, allowing participants to freely express their ideas and creativity without external influence or evaluation. This autonomous environment fosters a more open and explorative mindset, which is crucial for nurturing creative talent in the field of animation and design.

In summary, this case study not only demonstrates the versatility of the *App IH* in various scenarios but also highlights its potential as a creative stimulation tool for animation undergraduates in China. By incorporating this tool into their educational practices, educators can help students unlock their creative potential and develop into skilled and innovative animators and designers.

7.2 The Process

Motivations: the interaction between humans and technology has consistently captivated activity theory, a focus that aligns naturally with the theory's emphasis on mediation and tools (Kaptelinin and Nardi, 2018, p.3). This case relies highly on the technology, *App IH*, as an artifact in the design activities, which might inform the future research paradigm. How to combine a social activity involving artistic creation with a methodology that helps create is my original intention in designing this case.

I have been to many art workshops and held a few by myself. These activities mostly faced to the public and attract those who study or are interested in art and design. However, when visiting these workshops, people are told to 'make something' as the beginning. I was in the Boat-making event in Edinburgh Sculpture Workshop (see Figure 7.1). The procedure was simple and friendly as people dropped-in, grabbed some materials provided, and built their own boats. The inspirations were some examples printed on the wall. My friend told me: "If I had more ideas at the beginning, it would help me to build the boat, the Me boat." The formalism of the boat is typical and symbolic, and the general image consists of a functional boat bottom to carry on the water and maybe a striking flag above. To 'make something' in a workshop is easier than 'creating something' for art students. The motivation for this case is to attempt to encourage art practitioners to conduct a concept design under an unifying theme.



Figure 7.1 The Inspiration Wall of Edinburgh Sculpture Workshop

The design experiment or task is embedded within a gamified scenario, designed to inspire boundless creativity and imagination. The theme, embodying the concept of "taking away a piece of the sea," is intentionally surreal and challenges rational thinking. Participants are encouraged to explore various mediums for their expressions, including but not limited to drawings, photographs, videos, collages, writings, poems, sculptures, or sounds. Each participant might begin with an initial design, showcased on the "*A Piece of Sea Take-Away*" poster (Figure 7.2 and for a detailed overview of the theme design, please refer to Appendix A3, p.108).

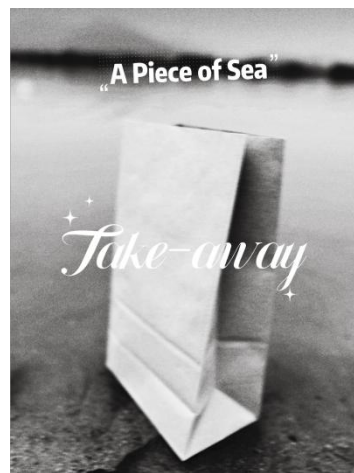


Figure 7.2 A Poster of Theme Design: *A Piece of Sea Take-Away*

The entire procedure, from the perspective of the participants, is outlined in Figure 7.3. Following their first attempt design, the *App IH* is introduced and briefly explained, guiding participants in its application for their narrative design. Encouraged to produce a second design immediately after, this approach aims to highlight the differences in creative output before and after the intervention. It is noteworthy that, according to the flow guidance outlined in Figure 7.3 "Procedure of the Design Task", if a designer does not have an initial idea for the theme design at the outset, they will

proceed directly to use the *App IH*, ultimately resulting in only one design sketch. Conversely, if the theme design resonates with the designer from the beginning, they will end up with two design sketches: one created before using the app and another after.

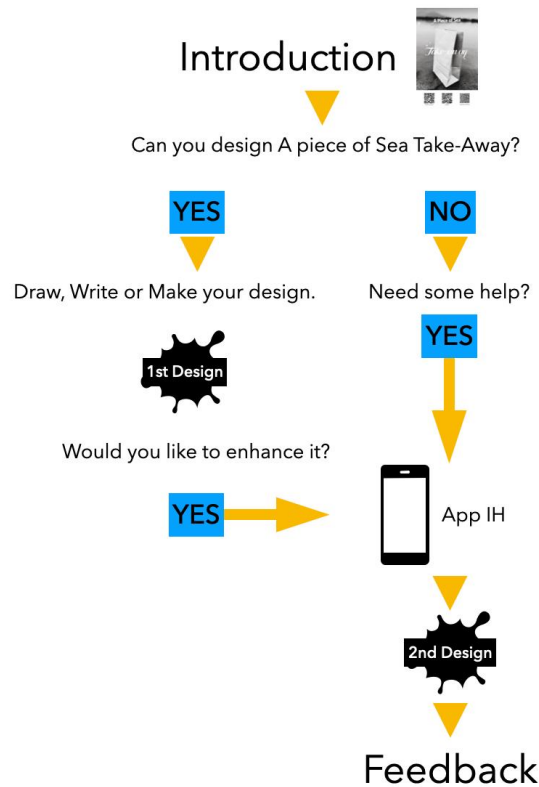


Figure 7.3 Procedure of the Design Task

To gather participants' responses and feedback, a combination of interviews and questionnaires is employed. The collected data is then analyzed through Action Research, providing insights into the creative process and the impact of the intervention. Ultimately, the suggestions derived from this study aim to inform and enhance the storytelling process in art and design, whether during the initial creation or the reconstruction of narratives.

7.3 The Intervention

In this case, the intervention is centered around a user-friendly mobile application, *App IH*, which serves as a tool for structuring narrative design. The participants, who are relatively mature designers, are tasked with exploring two distinct design approaches: the first based on their instincts and lived experiences, and the second involving a storytelling-oriented redesign.

The intervention aims to empower and enhance creativity by offering a narrative structure within the design process. To facilitate this, several key components have been integrated:

(1) Prior to the intervention, participants receive concise instruction and tutorials on navigating *App IH* (refer Appendix A4, p.109), ensuring they are well-versed in its functionalities. Ongoing technical support from the researcher is also provided to address any questions or issues that may arise during the design process.

(2) If required by the participants, inspiring case studies and examples showcasing how other designers have successfully utilized *App IH* to enhance their narrative design capabilities are shared with participants. These examples serve as a source of inspiration and provide practical guidance on applying the app's features to their own projects.

Even so, the intervention operates as a self-guided tool, allowing participants to explore and utilize it independently, thereby minimizing the researcher's subjective influence and guidance. Throughout this specific theme design task, the researcher has deliberately reduced direct intervention, adopting an outsider role to ensure that the participants' creative processes remain as unbiased as possible.

At the conclusion of the intervention, an evaluation and reflection session is conducted. Participants are encouraged to reflect on their design processes, assess the effectiveness of *App IH*, and share their experiences and lessons learned. This promotes consolidation of knowledge and provides valuable feedback for future research and improvement.

Additionally, to foster a more dynamic and innovative environment, the intervention incorporates interdisciplinary collaboration. Participants are encouraged to collaborate with other fields, such as literature, filmmaking, or user experience design. This cross-disciplinary approach brings new perspectives and ideas, enriching the narrative design process and expanding the possibilities for creative expression.

By providing these comprehensive resources and support, the intervention enables designers to navigate and experiment with *App IH* on their own terms, exploring various paths to improve their designs by either constructing new stories or modifying existing ones.

7.4 Data Collection

In this case study, I delved into the application of Activity Theory to explore the creative process and outcomes of an experimental design activity centered around the theme "*A Piece of Sea Take-Away*." The objective is to investigate how the *App IH*, a digital tool designed to enhance creative capabilities, facilitates innovative thinking and expression among art and design practitioners. This section outlines the data collection methods utilized to capture the complexities and nuances of this creative endeavor.

Data are collected from questionnaires and semi-structured interviews, along with the

sketch design practices as a visually supported material. The questionnaire is designed to minimize the researcher's tendentious questions and subjective guidance. It contains the background of each participant, the process of creating ideas, and the general challenges when they conduct designs. These questions reflect that these senior designers experience years of design thinking and generate relatively familiar design patterns by themselves. The following questions are proposed to them by evaluating the *App IH* and the suggestions for this specific method from their perspectives. They respond to the two designs and the differences between the design process by the intervention and it will feed into the future study for this research. The questions are designed along the process of design as follows:

1. Can you understand the method (Hyperspace of Interaction) as a way of design through the researcher's explanation or App?
2. Before learning about this method (Hyperspace of Interaction), how did you conceive the inspiration for your design?
3. How do you evaluate the first design in the preliminary survey?
4. How do you evaluate the second design after understanding this method (App Hyperspace of Interaction)?
5. Evaluation of the effectiveness of this method (Hyperspace of Interaction) for creative improvement.
6. The possibility of using this method (Hyperspace of Interaction) for your design in the future.
7. How do you suggest this method be improved?

With more in-depth inquiries, the semi-structure interviews expand from these questions with more associations with the individuals:

1. Where are you from? (Your Hometown)
2. When you were creating an oriented theme design before, how did you start thinking about it?
3. What do you think is the most difficult part of a design?
4. Do you think creativity can be cultivated/trained?
5. Please talk about the influence of today's design experiment on you or what you want to talk about. (Any aspects, such as your previous experience, or what you think can be used for reference, or what are the weaknesses of using this method?)

The data collection methods outlined in this section are designed to provide a comprehensive understanding of how Activity Theory and the *App IH* influence the creative process and outcomes in an experimental design activity centered around the theme "A Piece of Sea Take-Away." By employing a range of qualitative approaches, this case study aims to generate insights that can inform practice, enhance creative capabilities, and further research in the field of art and design.

The full semi-structured interviews and visual design outcomes from the participants are in Appendix A7 (p.129).

7.5 Data Analysis

The retrieved data is analyzed by Activity Theory, as it provides a framework for understanding how individuals, tools, goals, and cultural factors interact to shape design activities and outcomes. It emphasizes the interplay between individual actions and the broader social context, making it a valuable approach for studying the case study in a complex and dynamic system in design practices.

According to the Activity Theory, this case applied the classic Activity Theory model by Engeström *et al.*(1999) as more and more technology-related cases focus on the production of human-technique collaborative outcomes in activities.

Table12: Activity Theory Applied in Case Study 3

Activity Theory	Specific meaning in the case
Object	Theme Design: <i>A Piece of Sea Take-Away</i>
Subject	Participants as Designers
Tools	Storytelling tool: <i>App IH</i>
Rules	Follow the instructions to design 1-2 pieces of work
Community	The design environments of different individuals
Division of Labour	Researcher launched the instructions and participants completed design works

Object: The Object is the goal or outcome targeted by the activity. In this case, the object is a conceptual theme design using *A Piece of Sea Take-Away* as inspiration. To attempt to embody the sea, it is ultimately encouraging associations and imaginations about the sea. The other level of object of this case is the goal for this process, which is using the technique app to improve design for art practitioners.

Subject:

The Subject refers to the individual or group participating in the activity. In Case Study 3, the Subject is the group of designers who participated in the survey and responded to the questionnaire. The participants conduct this design experiment are from China, but they are currently living in different cities in and outside of China. They generally have more than three years of design experience in college or the creative industry. Relatively, they are defined as senior designers compared to the other two case studies.

Tools: The Tools are the mediators used by the Subject to achieve the goal. The main tool in this case is the *App IH* providing a digital and interactive structural story framework for helping design. The *Promotion* phase of the research focuses on the potential development and user acceptance of the application.

Rules: The Rules are the norms or guidelines that constrain the activity. In this case, the Rules include the voluntary participation of the designers, the anonymous

handling of the research results, and the ethical guidelines followed during the research process. More specifically in the study, the rules applied refer to the design instructions of the process. After showing the poster image, the instruction was simple and straightforward: Make a preliminary design sketch (concept design) based on the theme. Any design form can be used (video, graphic, industrial design, poetry, etc.).

Community: The Community represents the social relationships among the multiple Subjects participating in the activity. In Case Study 3, the Community can be viewed as the group of all participating designers who shared their experiences and suggestions through the questionnaire. These senior designers are influenced by the major Chinese cultural social environment as a common background, which keeps in consistent with the other case studies of the research. Though the theme design is conducted individually, they work for a common concept in the scenario of the sea.

Division of Labor: The Division of Labor refers to the task allocation among different members of the activity system. In Case Study 3, the Division of Labor is evident in the designers each completing the questionnaire independently while sharing their experiences and suggestions. The researcher takes responsibility for launching these design tasks and monitoring the design procedures and the participants are the primary users of *App IH* and designers in this case.

Around these elements, the data consists of subjective descriptions and NPS scores. The application as a storytelling method is accepted by 100% of participants while they value the effectiveness and possibilities of future usage are 33.3 and 44.4 respectively, shown as Recommended.

Activity Theory also emphasizes the dynamic nature of activity systems, referring to the interactions and changes among the elements. In Case Study 3, interaction between subject and tools is that the designers used the researcher's explanations and the *App IH* to understand the *IH Framework* and apply it to their theme designs.

Through the Activity Theory analysis of Case Study 3, it can be concluded that the case presents an activity system centered on designers, who use the *App IH* as a Tool to design more creative and interactive design. In this process, the designers shared their experiences and suggestions through the questionnaire, promoting knowledge exchange and experience for this research. At the same time, contradictions and challenges also exist within the activity system, such as the limitations of the method and areas for improvement. These feedbacks provide valuable references for future research and practice.

7.6 Discussion

According to the feedback, one of the most inspiring points is that the storytelling method offers more angles at the start of the design. For example, “the aspects of time,

and state are not usually the elements to be considered in my old habitat of design” said Z, “but they did offer me more perspectives to design”. Similarly, C claimed that she did not have a clear impression in her first design but doodles, but she sorted out the whole picture using the app providing a story structure for her design (See Appendix A7).

One point of view appeared as Participant C stated: In the past, she has recognized the importance of telling a compelling story in design as many designs rely on human narration to achieve a more comprehensive expression. Narration can enhance the design through a secondary enrichment, sometimes even exerting a greater influence than the design itself. However, this theme design has made her consider from another perspective, “Why not reverse the process, starting with a story and then proceeding with the creative design?” This approach provides positive momentum for the completion of the design and, at the same time, offers significant assistance to the creator. Figure 7.4 is the screenshot from *App IH* generated by C and she developed her sketch (Figure 7.5) from the narrative as what she described “Reversed process”.

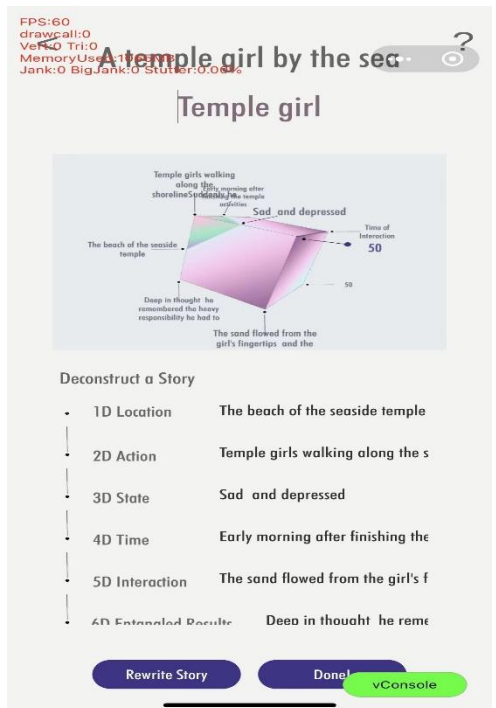


Figure 7.4 Screenshot from C



Figure 7.5 Sketch by C

Similarly, as Participant L mentioned, he came up with many ideas when he first got the theme. However, after he started to draw a sea snail (Figure 7.6), he lost the other images in his mind. Even though this method might not be the one he was looking for, it was capable of offering a clear structure to remind him of the other aspects to consider and the relationships he was after. Figure 7.7 is an after-intervention sketch, he pointed out more elements and colors into consideration.

These reflections also inspired me, not solely due to their illustration of the method's

effectiveness to some extent, but rather because of their potential to encourage independent thinking among students. This research might extend its significance from framework construction to a mode of reflection.

草图1

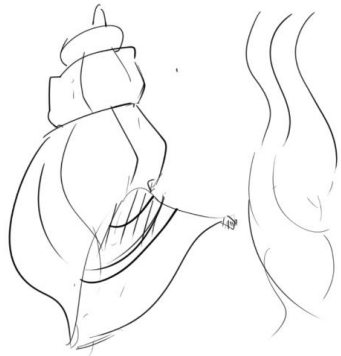
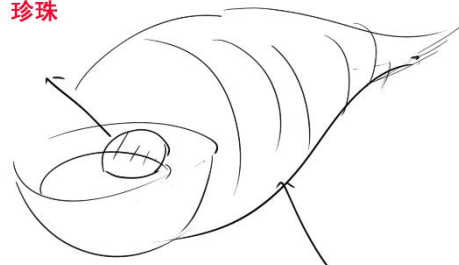


Figure 7.6 First Sketch by L

珍珠



整体是五彩斑斓的颜色

Figure 7.7 Second Sketch by L

On the other hand, from an improvement perspective, one of the suggestions is that the users expect more explanations or definitions of different dimensions in the application. When the researcher stepped back and the students took control of comprehending and using *App IH*, the users would like to be offered more examples or options under each dimension. But it is a dilemma, ‘options’ mean the imagination is selective and bounded while the creativity is encouraged to be unlimited and fearless. A potential compromise solution could be to add a button after each option, providing some reference values (Figure 7.8). More consideration of these issues will be discussed in the later research.

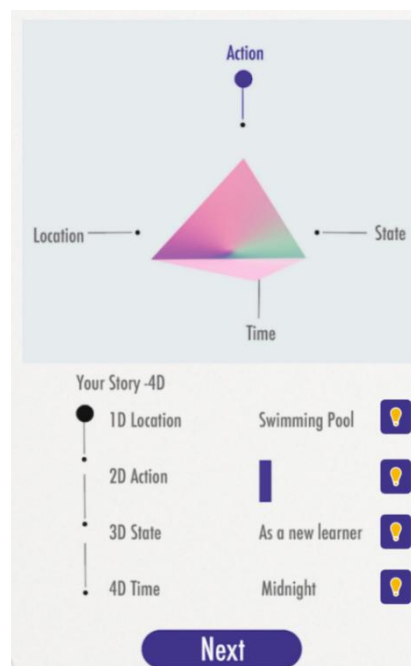


Figure 7.8 Solution for Suggestion Buttons

Another promising suggestion is to “design multiple sub-story lines to allow creators to explore more possibilities”. This might bring more interactive stories into the narrative design as the interaction not just between the designer and the work, but within the audience and the work. In the future literature, the interactivity of narrative artwork is emerging and the audience require more and more immersive experiences. Since *App IH* as a storytelling aid program is always challenged by the development of techniques and requirements of society, there will be some consideration towards Artificial Intelligence (AI) technology in the next chapter.

7.7 Chapter Summary

In conclusion, the exploration into the theme design of *A Piece of Sea Take-Away*, featuring two distinct design phases before and after the intervention, highlights a nuanced perspective. The experienced practitioners demonstrated how *App IH* becomes a pivotal tool in organizing structures, weaving narratives, and examining design paradigms, even within the context of pre-existing user design preferences. The responses from the participants predominantly shows a favorable reception of the outcomes, though it's important to acknowledge the inherent subjectivity in qualitative interpretations. Activity Theory analyzed in this case emphasizes the creation environment and tendency have some impacts in producing creative work. This study might shed light on the potential of leveraging intervention to reshape design approaches and suggest adaptable methodologies of interplay between design, user habits, and creative imaginations.

8. Conclusion

8.1 Overview

In this chapter, the conclusion is drawn from the analysis of case studies and contributes original knowledge into professional practices of art and design.

To review the research questions, the first inquiry is based on literature review and primary discourse with the participants of this research. In exploring “*How does interaction contribute to narrative complexity in storytelling theory?*”, the interpretations vary and the researcher dissects it with an ontological explanation. Defined in the context of this research, interaction is seen as storytelling, a narrative structure within events, between people and environments. The second question built upon the first one, interaction as storytelling might be able to inform narrative art in constructing interrelationships from different layers. This study explores how the *Interactive Hyperspace Framework* supports the creation of nonlinear narratives with multiple outcomes and validates its validity. This leads to the third research question, which tests how the *Interaction Hyperspace Framework* enhance creativity and

engagement in narrative and animation projects for undergraduate students in China. The researcher proposes the *IH Framework* deconstructing interaction into 11 dimensions and tests its practicability and effectiveness through case studies, Activity Theory and Action Research as methodologies applied. From Chapter 5 to Chapter 7, practical cases have been conducted to help *IH Framework* improve in the professional domain of design activities, especially in the context of Chinese undergraduate scenario. The narrative structure is proven to be beneficial to guide design and enhance creativity for art students, thus the *App IH* is supported as an interactive technique for constructing stories in these teaching practices.

8.2 Original Contribution

As previously mentioned, this research study presents its original contribution to knowledge in multiple ways. Firstly, the pivotal discoveries provide a framework describing narrative structure that can enhance and empower creativity in design. Secondly, the originality lies in the insights with respect to the interaction and the analogy with quantum theories. Lastly, to put this framework into the practical field, a mobile *Application IH* along with a teaching model consistent with the theoretical *IH Framework* is developed to feed into university animation practices in China.

As established in the introduction of this research study (in Section 1.5) there is a gap in knowledge with respect to trans-disciplinary thinking from physics to art and design by constructing narratives and setting up a storytelling framework of interaction in this context. There is little evidence that associate physics with art, but this research field is emerging and provides more creative insights for both disciplines. In terms of pedagogical practices, the *IH Framework* appears to be an innovative and methodical teaching model in assisting narrative arts for students.

The framework could be interpreted from the ontological aspect of interaction. By deconstructing a story in a way of interaction, the multiple dimensions offer more perspectives in art and design. Some of the key findings in practicing the framework are shown below:

1. A relatively comprehensive structure works for a story for the purpose of creating art and design, especially in the early design concepts for animation.
2. The relationships are considered thoroughly between the plots, between design and audiences, and between the environment and the work.
3. The new creative combinations that emerged from the interaction may enhance and empower an existing work.

By focusing on an interaction perspective within narrative design, the framework has shed light on the pivotal role that storytelling plays in the design process. Simultaneously, it has facilitated the comprehension of the intricate connection between designers and design in terms of their mutual influence. Consequently, the

App IH has been promoted as a means to structure narrative design, thereby fostering diverse methodologies and providing instructional guidance in pedagogy.

8.3 Limitation

Since adopted in the Interpretivist paradigm, the observations and narration analysis through the lens of the researcher is inevitable to remove subjective elements. Within Activity Theory and Action Research, the participants are highly involved in the research process and provide individuals' insights and evaluations, which might be considered valid only in the particular cases.

Another limitation of this research might be the different definitions of *IH Framework*. Some dimensions are less explicit than others when the students use the *App IH* alone to conduct the design process. As a digital tool in the practical field, the functionality and programming of an application usually require many tests and iterations of development. Due to the duration of this research, the *App IH* remains a test version and primary tool in testing the theory instead of a complete product in the market.

8.4 Future Development

In addition to tackling the study's limitations, more professional practices in the domain of art and design will be implemented in the future. Insights and feedback were gathered not from the view of students, but more from teachers and experts with mature experiences.

Suggestions of *App IH* gathered from case studies also present an opportunity for future work. Although this is a storytelling aid program, the drawing board function is not perfect and convenient for users on a mobile device. There might be an option that add a picture upload into the app to assist the users to keep records of their instant sketches. Hence, future development will involve software upgrading and testing.

One of the undeniable impacts is that the rapid development of Conversational Artificial Intelligence (CAI) systems has permeated into various creative industries and replaced some traditional work. The recent arrival of generative AI tools like Stable Diffusion, Midjourney, and Chat GPT enables individuals to create imaginative narratives, images, videos, and animations by using these AI platforms. In particular, AI text-to-image programs afford easier and faster ways of producing creative content (e.g., music, animation, story, and visual arts), which can be effective in the creative processes for creators (Vincent, 2022). It might be the biggest challenge to the current research and the future development of the creative industries. My current strategy involves reframing this as an opportunity rather than a confrontation and utilizing its strengths for the purpose of this study. AI systems are based on a large amount of database and generate new content aligning with most general logic. However, the core value of creativity lies precisely in its continual disruption of these 'universal

values' and its creation of new possibilities. Hence, future work might take into account more AI-based data as inspirations and train creative thinking to reverse AI. This will be a lengthy and challenging exploratory research, yet it also carries immense potential and improvements simultaneously.

8.5 Chapter Summary

In this chapter, the research questions are reviewed and responded to in the beginning in terms of the the purpose of this research. Subsequently, the focal points of this study, the original contributions to the practical research, have been elaborated and concluded. As demonstrated by the case study of this research, and through indicating further ways in which this research could continue and develop in this final section, it is evident that a framework of narrative construction can inform the creativity in art and design for undergraduate students in China.

References

- Acosta, C., Collazos, C., Guerrero, L., Pino, J., Neyem, H., & Moteletm, O. 2004. StoryMapper: A multimedia tool to externalize knowledge. Proceedings of the 24th International Conference of the Chilean, pp. 133–140.
- Altrichter, H., Posch, P., & Somekh, B. 1993. *Teachers Investigate Their Work: An Introduction to the Methods of Action Research*. Routledge.
- Angen, M. 2000. Evaluating Interpretive Inquiry: Reviewing the Validity Debate and Opening the Dialogue. *Qualitative Health Research*, 10, pp.378-395.
- Antle, A. 2003. Case study: The design of CBC4Kids' StoryBuilder. Proceedings of the 2003 Conference on Interaction Design and Children, pp. 59–68.
- Aristotle.1996. *Poetics*. Translated by M. Heath. London: Penguin Classics.
- Ball, P. 2019. *Quantum Leaps, Long Assumed to Be Instantaneous, Take Time*. Available at:
<https://www.quantomagazine.org/quantum-leaps-long-assumed-to-be-instantaneous-take-time-20190605/> (Accessed: 8 August 2021).
- Bishop, C. 2012. *Artificial Hells: Participatory Art and Politics of Spectatorship*, London; New York: Verso Books.
- Bohm, D. 1998. *On Creativity*. New York: Routledge.
- Bohr, N. 1928. The Quantum Postulate and the Recent Development of Atomic Theory. *Nature*, 121, pp. 580-590.
- Boje, D. M., & Saylor, R. 2014. An Ontological Perspective on Process. *Language and Communication at work: Discourse, Narrativity, and Organizing*, pp.197-218.
- Bourdieu, Pierre. 1977. *Outline of a Theory of Practice*. Cambridge University Press.
- Bourdieu, Pierre and Loïc J.D. Wacquant. 1992. *An Invitation to Reflexive Sociology*. The University of Chicago Press.
- Braun, V., & Clarke, V. 2006. Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3(2), pp. 77–101.
Available at: <https://doi.org/10.1191/1478088706qp063oa>
- Bronstein, I.N., Semendyayev, K.A., Musiol, G. and Muehlig, H. 2003. *Handbook of Mathematics*. 5th edn. Berlin: Springer-Verlag.
- Campbell, J. 1949. *The Hero with a Thousand Faces*. Princeton, NJ: Princeton University Press.
- Carson, D., Gilmore, A., Perry, C. & Gronhaug, K. 2001. *Qualitative Marketing Research*, London: Sage Publications.
- Costello, P. J. M. 2003. *Action Research*. New York: Continuum.
- Creswell, J. W. 2017. *Qualitative Inquiry and Research Design (International Student Edition) : Choosing Among Five Approaches*. Fourth Edition. SAGE Inc.
- Damyanova, D. 2016. Process Ontology in An Eastern Perspective, with Special References to Zhuangzi. *Balkan Journal of Philosophy*, 8(2), pp.175-181.
- Decortis, F., & Rizzo, A. 2002. New active tools for supporting narrative structures. *Personal and Ubiquitous Computing*, 6(5), pp.416 – 429.
- Denzin, N. and Lincoln, Y. (eds.) 2018. *The Sage Handbook of Qualitative Research*.

- 5th ed. London: Sage.
- Dixon, S. 2007. *Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation*, Cambridge, Mass., MIT Press.
- Dorner, R., Grimm, P., & Abawi, D. F. 2002. Synergies between interactive training simulations and digital storytelling: a component-based framework. *Computers & Graphics*, 26(1), pp.45-55. Available at:[https://doi.org/10.1016/S0097-8493\(01\)00177-7](https://doi.org/10.1016/S0097-8493(01)00177-7)
- Duggan, W. et al. 2019. *The Art of Ideas : Creative Thinking for Work and Life*. New York: NY: Columbia University Press,. Available at: <https://doi.org/10.7312/dugg17940>.
- Elkins, J., Valiavicharska, Z., & Kim, A. (Eds.). 2015. *Art and Globalization*. Penn State Press.
- Engeström, Y. 2015. *Learning by Expanding*. Cambridge: Cambridge University Press.
- Engeström, Y., & Miettinen, R. 1999. *Activity Theory: A Well-kept Secret*. Cambridge: Cambridge University Press.
- Engeström, Y. Miettinen, & Punamaki, R.-L. 1999. *Perspectives on Activity Theory*. Cambridge: Cambridge University Press.
- Field, S. 1984. *The Screenwriter's Workbook*. New York: Dell.
- Freytag, G. 1894. *Freytag's Technique of the Drama: An Exposition of Dramatic Composition and Art*. Translated by E.J. MacEwan. Chicago: Scott, Foresman and Company.
- Galili, I., & Zinn, B. 2007. Physics and Art—A Cultural Symbiosis in Physics Education, *Science & Education*, 16(3), pp.441- 460.
- Gray, D. E. 2004. *Doing Research in the Real World*, London: SAGE.
- Greene, B. 2000. *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. New York: W.W. Norton & Company.
- Green, P. 2018. *A Framework for the Consideration of Narrative in Creative Arts Practice* (Doctoral Dissertation, University of Plymouth).
- Griffiths, D.J. 2018. *Introduction to Electrodynamics*. 4th edn. Cambridge: Cambridge University Press.
- Griffiths, D.J. 2018. *Introduction to Quantum Mechanics*. 3rd edn. Cambridge: Cambridge University Press.
- Guba, E. G., and Lincoln, Y. S. 1991. What is a Constructivist Paradigm? In D. S. Anderson & B. J. Biddle (Eds.), *Knowledge for Policy. Improving Education through Research*, pp. 158-170. London: The Falmer Press.
- Hargadon, A. B. 2006. Bridging Old Worlds and Building New Ones: Toward a Microsociology of Creativity. *Creativity and Innovation in Organizational Teams*. Psychology Press, pp. 219-236.
- Harman, G. 2018. *Object-Oriented Ontology: A New Theory of Everything*. Penguin UK.
- Haven, K. 2007. *Story Proof: The Science behind the Startling Power of Story*. Greenwood Publishing Group.
- Heisenberg, W. 1927. Über den anschaulichen Inhalt der quantentheoretischen

- Kinematik und Mechanik [On the Perceptual Content of Quantum Theoretical Kinematics and Mechanics]. *Zeitschrift für Physik*, 43(3-4), pp. 172–198.
- Ismail, N. 2006. Emotional Engagement in Feature Film Storytelling: Reframing the Classical Three-act Structure. *Jurnal Skrin Malaysia*, 3, pp.35-54.
- Kaptelinin, V. and Nardi, B. 2018. Activity Theory as a Framework for Human-Technology Interaction Research, *Mind, Culture and Activity*, 25(1), pp. 3–5. Available at: <https://doi.org/10.1080/10749039.2017.1393089>.
- Kinsella, V. 2018. The Use of Activity Theory as a Methodology for Developing Creativity within the Art and Design Classroom, *The International Journal of Art & Design Education*. Oxford: Wiley Subscription Services, Inc, 37(3), pp. 493–506. Available at: <https://doi.org/10.1111/jade.12147>.
- Koyama, K. and Niwase, K. 2017. A Linear Approximate Model of Creativity in Quantum and Chaos Theory, *Neuro Quantology*, 15(4). Available at: <https://doi.org/10.14704/nq.2017.15.4.1038>.
- Laaksoaho, J. 2008. *Plot, Spectacle, and Experience: Contributions to the Design and Evaluation of Interactive Storytelling*. Stockholm: USAB.
- LaFrance, J., & Blizzard, J. 2013. Student perceptions of digital story telling as a learning-tool for educational leaders. *NCPEA International Journal of Educational Leadership Preparation*, 8(2), pp.25-43.
- Lambert, J. 2013. *Digital Storytelling: Capturing Lives, Creating Community*. 4th edn. New York: Routledge.
- Lévi-Strauss, C. 1984. Structure and Form: Reflections on a Work by Vladimir Propp. *Theory and History of Folklore*, edited by Anatoly Liberman, translated by Ariadna Y. Martin and Richard P. Martin, U of Minnesota P, pp. 167–188.
- Li, T. 2013. Quantum Narratives: A New Narrative Model. *Foreign Literature*, 4, pp. 11-18.
- Liu, C. C., Chen, S. L., Shih, J. L., Huang, G. T., & Liu, B. J. 2011. An enhanced concept map approach to improving children's storytelling ability. *Computers and Education*, 56, 873–884.
- Liu, C. C., Liu, K. P., Wang, B. H., Chen, G. D., & Su, M. C. 2012. Applying tangible story avatars to enhance children's collaborative storytelling. *British Journal of Educational Technology*, 43(1), pp.39–51.
- Liu, S. H., & Lee, G. G. 2013. Using a concept map knowledge management system to enhance the learning of biology. *Computers and Education*, 68, pp.105–116.
- Lorenz, Edward N. 1963. Deterministic Nonperiodic Flow, *Journal of the Atmospheric Sciences*. 20 (2), pp.130-141.
- Lukosch, S., Klebl, M., & Buttler, T. 2008. Facilitating audio-based collaborative storytelling for informal knowledge management. *Lecture Notes in Computer Science*, 5411, pp.289–304.
- Magon, J., & Zaslove, M. 1990. TALE-SPIN. *Animated Series*, USA.
- McNamara, A. et al. 2012. Directing Gaze in Narrative Art. In Proceedings of the ACM Symposium on Applied Perception (SAP '12). *Association for Computing Machinery*, New York, NY, USA, pp.63–70. Available at: <https://doi.org/10.1145/2338676.2338689>.

- McNiff, J., and Whitehead, J. 2010. *Action Research: Principles and Practice*. Routledge.
- Murray, J. H. 1997. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge, MA: MIT Press.
- Nielsen, M.A. and Chuang, I.L. 2010. *Quantum Computation and Quantum Information*. 10th edn. Cambridge: Cambridge University Press.
- Nuutinen, J., Sutinen, E., Botha, A., & Kommers, P. 2010. From mindtools to social mindtools: Collaborative writing with woven stories. *British Journal of Educational Technology*, 41(5), 753–775.
- O'Toole, M. 1994. *The Language of Displayed Art*. Fairleigh Dickinson Univ Press.
- Polkinghorne, J. 2002. *Quantum Theory: A Very Short Introduction*. New York: Oxford University Press Inc.
- Pring, R. 2005. *Philosophy of Education: Aims, Theory, Common Sense and Research*. London: Continuum.
- Project Management Institute. 2021. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)-and The Standard for Project Management*. Project Management Institute.
- Propp, V. 1984. The Structural and Historical Study of the Wondertale. *Theory and History of Folklore*, 5, pp.67-81.
- Propp, V. 1968. *Morphology of the Folktale*. 2nd edn. Translated by L. Scott. Austin: University of Texas Press.
- Ryan, M.-L. 2001. *Narrative as Virtual Reality: Immersion and Interactivity in Literature and Electronic Media*. Baltimore: Johns Hopkins University Press.
- Schrödinger, E. 1935. Die gegenwärtige Situation in der Quantenmechanik [The Present Situation in Quantum Mechanics]. *Naturwissenschaften*, 23, pp. 807-812.
- Schwandt, T. A. 2007. *The SAGE Dictionary of Qualitative Inquiry*. Third edition. Los Angeles, Calif: Sage Publications.
- Schwarz, John H. 1999. From Superstrings to M Theory, *Physics Reports*, 1999, 315 (1), pp.107-121.
- Shahn, B. 1957. *The Shape of Content*. Harvard University Press.
- Shannon, Claude E. 1948. A Mathematical Theory of Communication. *Bell System Technical Journal*. 27 (3): 379–423. Available at: <https://doi:10.1002/j.1538-7305.1948.tb01338.x>. hdl:10338.dmlcz/101429
- Shlain, L. 1991. *Art and Physics: Parallel Visions in Space, Time and Light*. New York: Quill William Morrow.
- Smithsonian Magazine. 2015. *A Journey to the Oldest Cave Paintings in the World*. Available at: <https://www.smithsonianmag.com>
- Sternberg, R. J. 1999. *Handbook of Creativity*. Edited by R.J. Sternberg. Cambridge: Cambridge University Press.
- Stone, J. V. 2016. *Information Theory: A Tutorial Introduction*. Sebtel Press.
- Tabak, J. 2011. *Geometry: The Language of Space and Form (History of Mathematics)*. Revised ed. Facts on File.
- Tearse, B. R. 2018. *Skald: Exploring Story Generation and Interactive Storytelling by*

- Reconstructing Minstrel*. eScholarship, University of California.
- Thurman, J. 2008. First Impressions: Letter From Southern France. *The New Yorker*, 84(18), pp. 59-69.
- Torronez, A. 2018. How Creativity Leads to a More Successful Life. Available at: <https://addicted2success.com/success-advice/how-creativity-leads-to-a-more-successful-life/>
- Tsou, W., Wang, W., & Tzeng, Y. 2006. Applying a multi-media storytelling website in foreign language learning. *Computers and Education*, 47(1), pp.17–28.
- Turnbull, J., Lea, D., Parkinson, D., Phillips, P., Francis, B., Webb, S., ... & Ashby, M. 2010. *Oxford Advanced Learner's Dictionary*. International Student's Edition.
- Vincent, J. 2022. Anyone Can Use This AI Art Generator - That's the Risk. *The Verge*. Available at: <https://www.theverge.com/2022/9/15/23340673/ai-image-generationstable-diffusion-explained-ethics-copyright-data>.
- Wallace, D. 2012. *The Emergent Multiverse Quantum Theory According to the Everett Interpretation*. Oxford: Oxford University Press.
- Witten, E. 1995. String Theory Dynamics in Various Dimensions. *Nuclear Physics B*, 443(1-2), pp. 85–126.
- Witten, E. 1981. Dynamical Breaking of Supersymmetry. *Nuclear Physics B*, 188(3), pp. 513–554.
- YIN, R. K. 1994. *Case Study Research: Design and Methods*, London: Sage Publications Ltd.
- Young, J. W. 2003. *A Technique for Producing Ideas (Advertising Age Classics Library)*. The McGraw-Hill Companies, Inc.
- Zurek, W.H. 2003. Decoherence, Einselection, and the Quantum Origins of the Classical. *Reviews of Modern Physics*, 75(3), pp. 715-775.
- Zhang, D. 2005. *The Unity of Dao and Qi in Chinese Philosophy*. Beijing: Peking University Press.

Appendices

A1: Glossory

Interaction Hyperspace: I define this term as my working title for my framework in this thesis, which I combine the inspiration from hyperspace theory of science and my personal inclination to explore interactivity in art.

Quantum Entanglement: Quantum entanglement is a phenomenon in quantum mechanics where two or more particles become interlinked in such a way that the quantum state of each particle cannot be described independently of the state of the others, even when the particles are separated by large distances. In this thesis, I compare this phenomenon to the entanglement of relationships in the humanistic context.

Quantum Leap: Quantum leap is a term used metaphorically to describe a sudden, large, or significant advance or increase, often in a technological, scientific, or personal context. In this thesis, I use this term to draw an analogy to a sudden change in state.

A2: Template of Research Consent Form

Academic Research Consent Form 学术研究许可书

Introduction:

This document serves as a consent form for your participation in a research titled "Structuring Stories: A Framework for Considering Storytelling to Encourage Creativity for Art Students".

We want to find out what you think about art and design practices. We are trying to find out what would be beneficial to generate more creative art works and design.

简介：本文件作为一份研究同意书，邀您参与一项名为“构建故事：鼓励艺术学生创造力的一种叙述框架模型”的研究。我们想知道你是如何看待艺术和创作实践的。我们正在试图找出是什么有助于产生更多有创意的艺术作品和设计。

You are being invited to take part in a research study that is being run by the University of Wales Trinity Saint David. Before you decide, it is important to understand the research is about student's opinion towards creative ideas and design. It will involve with your feedback about art and design and how you deal with design practice. Please take time to read this information carefully and discuss it with others if you wish. If there is anything that you are not clear about, or if you would like further information, please ask.

你被邀请参加一项由威尔士三一圣大卫大学进行的研究。在你做决定之前，重要的是要了解这项研究是关于学生们对待创意灵感和设计的看法，并且它将涉及到

你们对于艺术设计的反馈和如何进行设计实践的。如果您愿意，请花时间仔细阅读此信息并与他人讨论。如果你有什么不清楚的地方，或者如果你想了解更多的信息，请随时提问。

***1. I confirm that the above study has been explained to me and I have had the opportunity to ask questions.** 我确认上述研究已经向我解释过，我也有机会提问。

YES

NO

***2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.** 我明白我的参与是自愿的，我可以在任何时候自由退出，而不提供任何理由。

YES

NO

***3. I agree to the note-taking or audio recording of the discussion.** 我同意对讨论进行笔记或者录音记录。

YES

NO

***4. I agree to take part in the discussion group.** 我同意参加集体讨论或分组讨论。

YES

NO

***5. I am aware that the results from the study may be published but I will not be identified in the research findings.** 我知道这项研究的结果可能会发表，但我的身份信息不会在研究结果中体现。

YES

NO

***6. What is your name?**

你的名字是？

***7. Name of Participant** 请手写签名确认你的同意书。

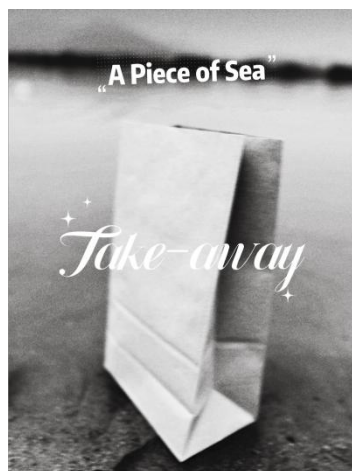
A3: A Brief about Theme Design: *A Piece of Sea Take-Away*

This theme generated from the idea of the researcher, fascinated in light installations and the relationships between human and the sea. I use the storytelling framework IH by myself when I have the initial interest about this topic. It leads me with a story of turning sea water into light, which assembles a video installation. I used a chemical mediator to powering the light through the electrolytic properties of seawater. It enabled me to consider the transformation from liquid sea water into untouchable light. Moreover, the interaction not only happened between the designer and the sea, between the light and the water, between the take-away paper bag and different locations, but exist with time.



The Screenshot of Video Footage: *Sea Light_By Wenchang Lin*

This project works as a theme-oriented design discussed and experimented among students in the third case study, also it is assembled by myself as an insider designer in a video installation. The footages and trails were taken in these locations: Fuzhou (China), Edinburgh (UK) and Swansea (UK). It involves with Psychogeography thinking and interactive techniques, which expecting interactive storytelling in the story of my design.



A Poster of Theme design: *A Piece of Sea Take-Away*

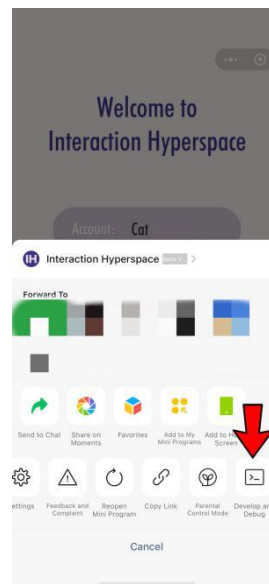
A4: Instruction of *App Interaction Hyperspace (App IH)*

This is a step-by-step instruction about App Interaction Hyperspace, which can access through different platforms.

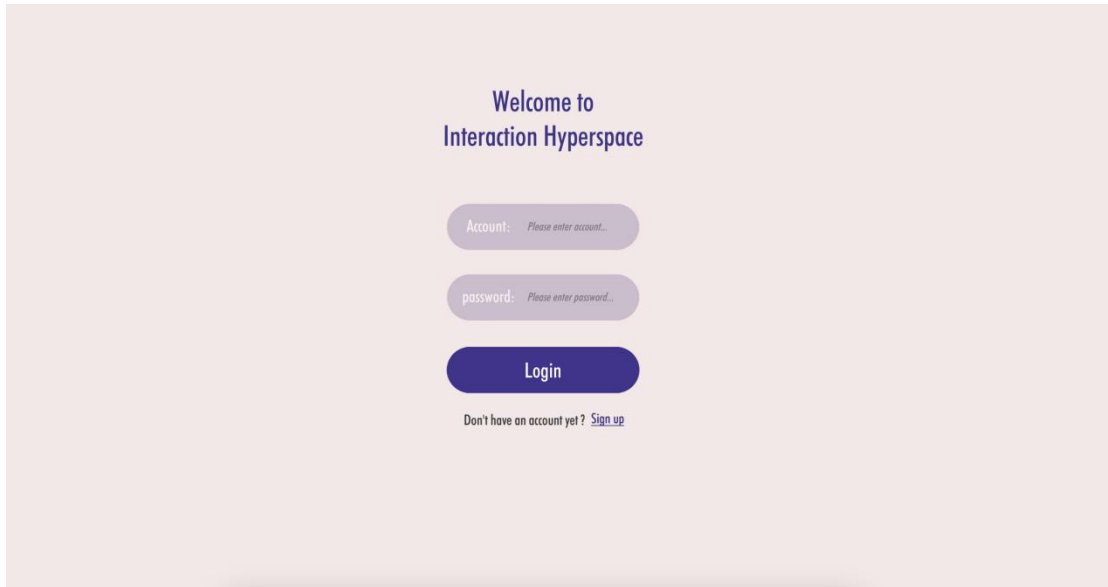
Video Guidance: <https://youtu.be/tIQGhiHaQw4>

● Installation

1. The web version app through browser on computers :
<http://test.interactionhyperspace.com>
2. The Android version downloaded from:
<https://pan.baidu.com/s/1IPNkHG53A6qWg7FRDWilDA?pwd=xsiw>
(Password: xsiw)
3. A test version via mobile software Wechat by scanning QR code:
*Wechat app need to start **Develop and Debug** as it is a test version.

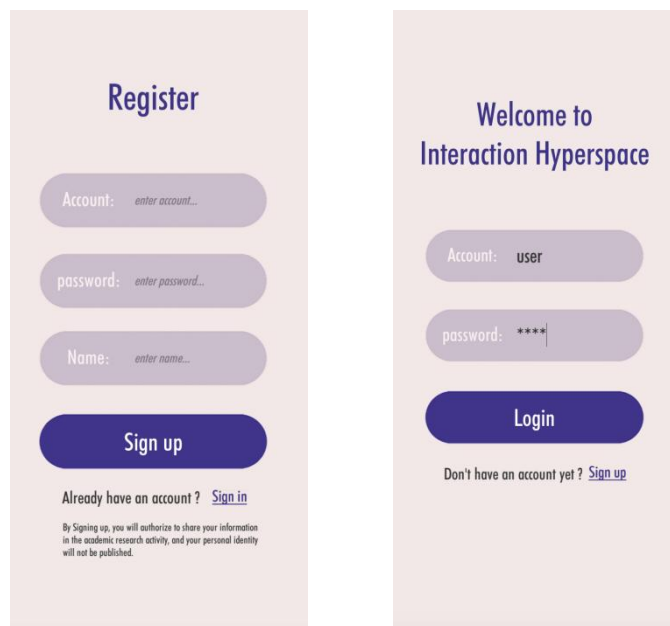


Once the app is downloaded and installed properly, this will be shown on your device:



- **Sign up/ Login**

By registering, the users could set up their own accounts and use them in the login process. The future stories the users created are also able to review through the personal account. After signing up, the users are able to use the account and password to login.

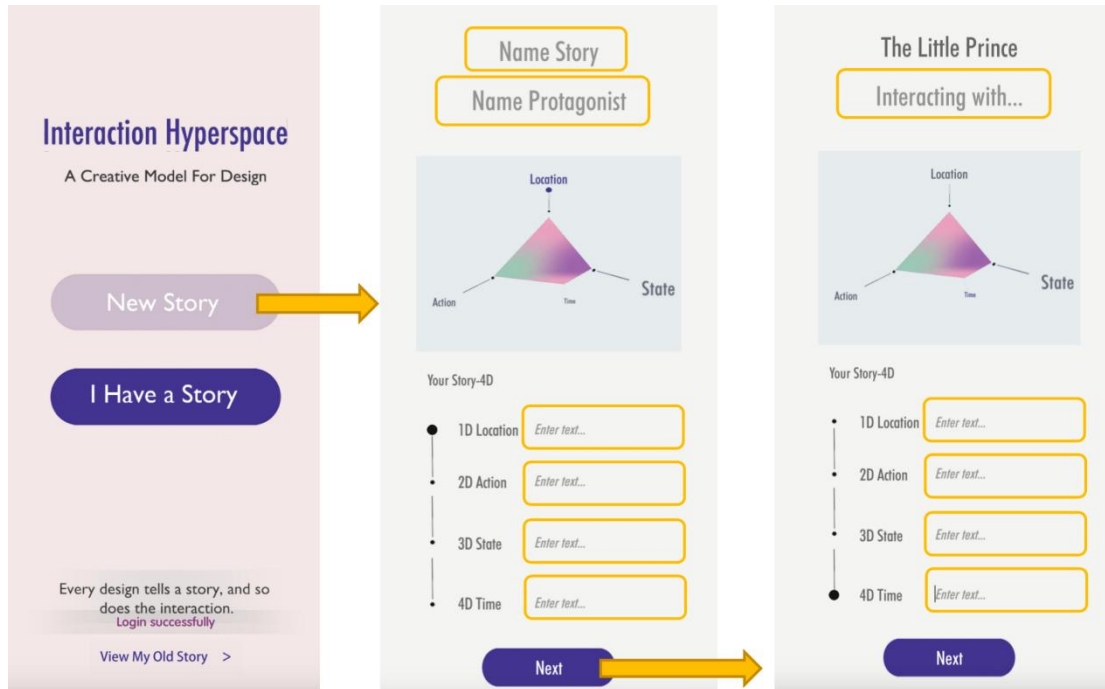


- **New Story**

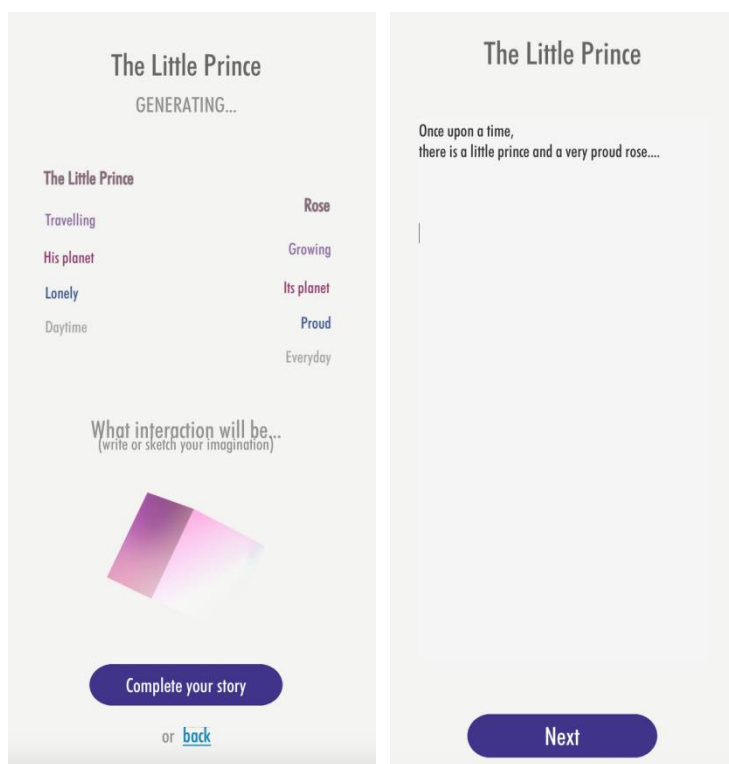
When users want to create a new story or design, they can go to *New Story* process. By filling in *Name Story*, give a title to the story which is about to create, as well as nominating protagonist by *Name Protagonist*, which is the main object the users want to target in this design.

Follow with the four aspects about the protagonist, *1D Location*, *2D Action*, *3D State* and *4D Time*, the users need to fill in all these 6 areas to continue by clicking *Next*.

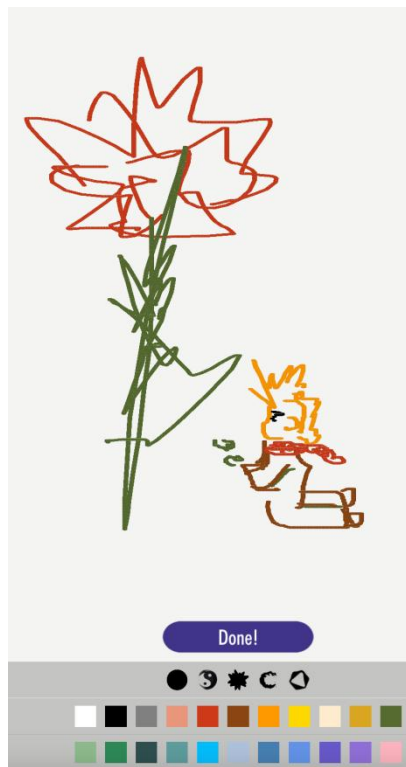
It will lead to a second object that the protagonist going to interact. By filling in to *Interacting with..* along with its *Location, Action, State* and *Time*, that complete the main interaction in the story.



The next step will show a brief chart displaying the key words for both objects in the interaction. The users can review their contents to continue to *Complete Your Story* for future design or go *back* to the last step.



Lastly, when completing the story writing, it leads to a drawing board that users can sketch based on their story and produce a visual image if they want.



Clicking **Done**, the data will be updates to the server and the creation is finished at this step.

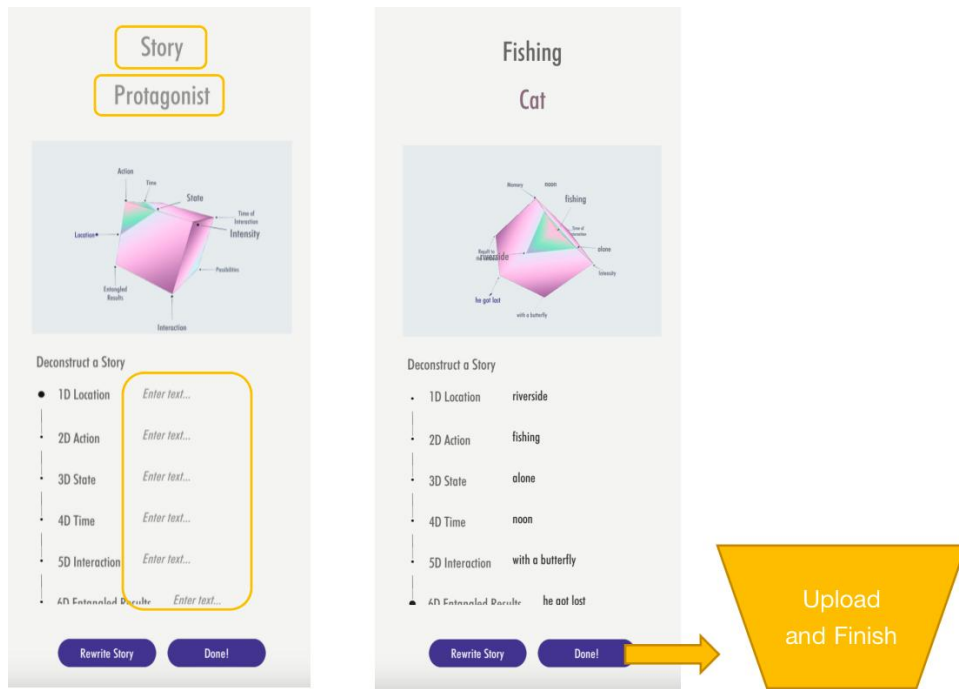
● **I Have a Story**

When the users select ***I Have a Story*** in the homepage, it will show an 11-dimensional framework for analyze a story. The users will identify the name of the ***Story*** and analyze it for one of the ***Protagonist***. From the protagonist's perspective, the interaction exists in 1D Location, 2D Action, 3D State, 4D Time, 5D Interaction, 6D Entangled Results, 7D Time of Interaction, 8D Possibilities, 9D Intensity, 10D Results to the outside, 11D Memory.

- * 8D Possibilites and 9D Intensity require to be filled in numerically.
- * The 11 dimensions are able to scroll up and down.
- * The cube displayed above is able to rotate.

Done:

When completing the 11 dimensions, clicking ***Done*** allows the data to be uploaded into server and finish this process.



Rewrite Story:

The page will show the 4D about the protagonist was created before, and able to be modified in the page.

Next, it will start to create a new object that protagonist **Interacting with...**, following the 4D to fill in. This process is the same as setting up **New Story**. The last process will be the sketch board.

