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理事長序

本期為今年發行之第十二卷第 2 期期刊，共收錄兩篇英文研究論文、一篇英文教學報告及一篇中文研究論文。首先，英文論文部份：探討內容包括，第一篇為英文研究論文「數據美：類型學方法建構數據視覺化之美學觀」，本文指出大數據帶來開放數據環境，突顯「數據視覺化」之重要性。數據視覺化屬於新興研究議題，其概念、方法及應用等皆在發展中。因此，文中梳理與分析數據視覺化重要文獻，試圖為此新興議題補充相關內容。該研究的價值在於透過「類型學」方法，對「數據美」提出一個概念體系。第二篇為英文研究論文「玩寶可夢對於台灣人日常生活的影響」,該研究旨在探討來自台灣各地區,405 位大學生(男:165；女：240)對於寶可夢在日常生活中的影響及看法。透過網路問卷調查，以全台受測大學生與性別來看，玩家對寶可夢的看法幾乎相近或僅有些微差異，整體而言，玩寶可夢某種程度上可以增進人們身心健康、提供語言學習機會、及增進人際關係。第三篇為英文教學報告「在動畫藝術教學實踐成果」，文中提到隨著數位化時代的到來，進而成就一個蓬勃發展的數位創意時代。動畫和定格動畫的創作自然地受益於這股力量的提升。如今可以輕易獲取新進技術與知識，其民主化和易用性使創作者擁有了強大的創作工具和無限可能性。動畫或定格動畫藝術家從未如此輕鬆地表達自己的創造內容。做為指導學生動畫創作生涯的教育工作者來說，幫助動畫學生在充滿圖像和數位內容的世界中脫穎而出的過程中，可以發揮重要作用。使用數位創作與如何將其帶入新的水準，從而使它們與眾不同脫穎而出。第四篇為中文研究論文「數位媒體中的虛擬身體-以當代科技藝術為例」，論文指出當代藝術潮流透過數位媒體科技的推波助瀾下，影像創作成為藝術家參與體驗的實驗過程，不僅融合了數位媒介與科技創造，展現出多元的虛擬影像特質。文中列舉數件當代科技藝術作品，分析探討身體議題如何融入科技媒介，作為虛擬影像的概念表現，除了消彌數位時代中的虛實界限，並且構思結合跨領域技術，進而觸發影像與觀者之間的感官鏈結。然而，數位時代中影像呈現具有反身性媒體效應與被觀看特質，超越傳統攝像成果所產生的圖像序列思維。因此，科技藝術中的虛擬身體可被視為身體與科技的介入方式，延展出數位時代中獨特的視覺樣貌。最後，本期來稿 11 篇(含郵寄稿件)，作者包含台、法兩個國籍，經內審通過 5 篇論文進入雙匿名審查，審查結果 4 篇論文接受刊登。感謝各方學術先進賜稿，提升了本刊研究內涵，以及協助審查的委員們給予學術專業協助，深化本刊學術深度及內容專業。

理事長

范國光

Foreword by the Chair

This issue is the volume 12 and number 2 of this journal, which contains a total of three original research papers in English, one teaching report in English and one original research papers in Chinese. The papers in English are including (1) "Data beauty a construction of aesthetic view of data visualization with typological orientation", this paper identified that big data have brought about an open data environment and highlighted the importance of "data visualization". Data visualization is an emerging research topic, and its concept, methods, and applications are all under development. Therefore, this study sorted out and reviewed important domestic and foreign data visualization literature, and attempted to supplement relevant content for this emerging subject. This study is significant because it proposes a conceptual system for "data beauty" through the "typological" method; and (2) "The impact of Pokémon Go on Taiwanese people's daily life", The current study aimed to explore 405 Taiwanese college students' (M: 165; F: 240) attitudes toward the impact of Pokémon Go on Taiwanese people's daily life. The instrument for data collection was an anonymous 27-item six-point Likert scaled online questionnaire. The results of the current study indicated that regardless of gender, all the participants' responses to all the questionnaire items were almost the same or slightly different. Overall, playing Pokémon Go could function to some extent as therapy, (foreign) language learning, and interpersonal relationship development. One teaching report in English is (3) "On the achievements of animation Art teaching practice", This paper presents that a flourishing creative time has accompanied the advent of the digital era. Animation and stop-motion creations naturally took advantage of this rise in power. Technological advances are now accessible and their democratization and ease of use have placed into the creator's hands powerful and virtually infinite tools. Moreover, the last research paper in Chinese, which is (4) "The virtual body in digital media: Take contemporary technology arts as examples". This study lists several contemporary scientific and technological art works, analyzes and explores how physical issues can be integrated into the technological media as the conceptual expression of virtual images. In addition to eliminating the boundaries of virtual and real in the digital age, the concept combines cross-domain technologies to trigger the image and the viewer. However, the presentation of images in the digital age has reflexive media effects and characteristics of being viewed, surpassing the image sequence thinking produced by traditional photography. There were 11 manuscripts submitted to this issue of the journal, and 5 papers passed the internal review and entered the double anonymous review processes, 4 papers were accepted for publication eventually. Additionally, two nationalities of authors were involved in this issue. Thanks to the authors for their contributions. Thanks to the reviewers for their professional assistances.

Chairman **Kuo-Kuang Fang**

2020.12.25

Data Beauty: A Construction of Aesthetic View of Data Visualization with Typological Orientation

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ABSTRACT

Big data have brought about an open data environment and highlighted the importance of "data visualization". Data visualization is an emerging research topic, and its concept, methods, and applications are all under development. Therefore, this study sorted out and reviewed important domestic and foreign data visualization literature, and attempted to supplement relevant content for this emerging subject. This study is significant because it proposes a conceptual system for "data beauty" through the "typological" method. The study first reviewed the importance of data beauty; secondly, it defined data beauty in the typology system, specifically verified and analyzed 22 "radial ring" structure types, constructed type hierarchical schemas, and finally constructed a "genealogical chart" of data beauty and discussed the practice of data beauty. In type hierarchical schemas, the radial ring structure consisted of two main hierarchical structures: the first was the intention shown in the schema layout, which was the base schema of the type hierarchical schemas; the second was to complete the operation of the aforementioned schema layout, called the operational schema, which was responsible for forming the database into rules. Basically, the base schema must undergo further interpretation before it could be prototyped, and the operational schema was a way of interpretating the base schema. In all, this study constructed seven (7) base schemas and two (2) operational schemas to enhance the understanding of data beauty knowledge.

***Keywords*:** Visualization, Data, Schemas, Aesthetic, Typology.

1. Introduction

In the era of big data, transforming massive data into images and presenting them visually to help people quickly understand information has become an important research topic. "Data visualization" is a unique academic research domain that integrates computer science, psychology, semiotics, graphics, aesthetics, and interactive interfaces (Vande & Purchase, 2011). Indeed, data calculation is one of the most important tasks in computer science. However, complex data calculated can be made more descriptive and persuasive through the use of images, thus demonstrating the need for more effective image illustrations to facilitate visual communication and interpretation. In research and teaching, data visualization has focused on generating effective interaction between abstract ideas and users through visual metaphors.

Data visualization combines aesthetics and science, and the choice of visual expression forms ultimately depends on the integration of aesthetics and data. In other words, data visualization must focus on the development of both aesthetic forms and functions in order to yield interesting outputs. However, due to the lack of design knowledge and experience in this field, designers often cannot maintain a balance between design and function. Research and development on data visualization have, so far, focused on technology, and many scholars are engaged in research on algorithms and hardware interfaces. Yet, there is a lack of research on the connotation and practice of data aesthetics. The orientation of data aesthetics has not yet achieved system construction and common consensus. Importantly, data visualization education cannot be limited to computer technology while ignoring visual design.

Based on the foregoing, to discuss what makes up data aesthetics, it is important to define what "data beauty" is, its connotations and interpretation. Therefore, we propose a conceptual system for data beauty through "typological" methods; hence, data beauty is analyzed by type. To realize this, we review the importance and possibility of data beauty; secondly, we define data beauty from the perspective of the typological system, and then the "radial ring" structure types are specifically listed, thus building the type hierarchical schemas. Finally, we construct the "genealogical chart" of data beauty, and discuss the practice of data beauty.

2. Literature Review

To discuss the aesthetic orientation of data visualization, we collected and analyzed literature on the importance of data aesthetics, the development of typology, and the schematization of types. These are explained in subsequent sub-sections:

2.1 Importance of Data Aesthetics

The famous Roman architect, Marcus Vitruvius Pollio, said in *De architectura* that buildings should have three elements: "firmness, utility, and beauty" (firmitas, utilitas, venustas). The book not only proposes the three standards of firmness, utility, and beauty and describes how to achieve these standards but also emphasizes the importance of aesthetics (Rowland & Howe, 1999). In recent years, with increasingly ease of access to Internet data, coupled with the integration of cross-disciplinary technology, such as design art and programming interface, aesthetics triggered by technology has gradually promoted data aesthetics as an emerging field in aesthetics. The term, "information aesthetics", was first proposed by Bense and Reichardt (1971) and was mainly used to quantify the aesthetic value of images based on their information content. Manovich (2001) also used the term "info-aesthetics" to describe the emerging theory of using technology interfaces to reflect the Internet society.

On the other hand, Vande (2005) believed that aesthetics in Internet art is too focused on the connotation of art, but ignores the functions that should be considered during visualization, making works too abstract and inaccessible. From another perspective, if the works place too much emphasis on practical functions, it is easy to ignore the potential impact of aesthetic elements in the works. As an independent medium, aesthetics can effectively bridge the gap between functionality and artistry in the works; this also improves the value and functionality of information. Subsequently, Lau and Vande (2007) independently proposed the information aesthetics model. Their discussion focused on aesthetics, data interpretation, and interaction experience. Based on this model, the perspective of data aesthetics is further extended as shown in Figure 1. Data aesthetics is positioned between information visualization and visualization art. Specifically, information visualization focuses on the usability and functionality of data, while visualization art focuses on art forms and is too abstract. Data aesthetics is somewhere between information visualization and visual arts as it contains both aspects.

Chaomei Chen, the editor-in-chief of the international academic journal (*Information Visualization*) which specializes in information visualization, stated the future development of the journal and proposed 10 problems to be solved in information visualization. Specifically, aesthetics, usability, and knowledge domain visualization are worth noting (Chen, 2005). The discussion above emphasizes that design is much more than functionality, as one cannot ignore the value and importance of aesthetics.

2.2 The Development of Typology

The word, "typo", which means "relief", "engraving", and "seal" emerged between the 6th and the 7th century BC in the Greek city-states of Asia Minor. In the 18th century, a continuous or unified system was adopted as a classification method for architecture, and, thus, the architectural typology was born. Typological studies, which have emerged since the 18th century, can be divided into two fields: The first is geometric analysis continued from Durand (1990); the second is the discussion of Quincy (1825) who regards "the type" as a group of essential internal structures.

Based on geometry, Durand (1990) arranged structural components in the form of a diagram. Architectural forms can be combined from the types in the diagram while the restrictions and requirements of functions to forms are excluded. Quincy (1825) believed that "the type" is an a priori

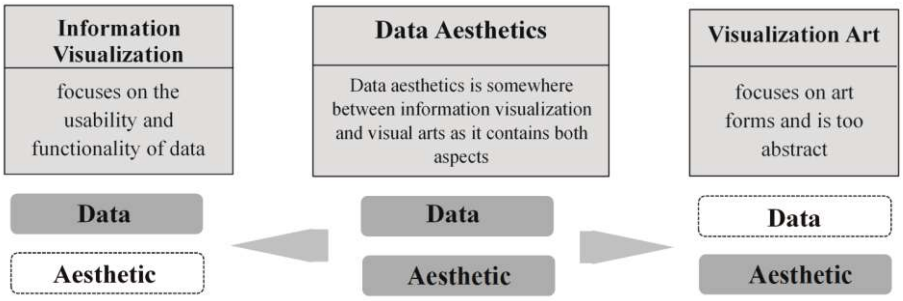


Figure 1. Characteristics of data aesthetics (Compiled in this study)

concept, and rules must be established rather than repetitions of specific forms. Until the late 19th and early 20th centuries, under the influence of linguistics and logical thought, the concept of typology was central in the ideological circle, generating very abstract and general type theories and forming systematic knowledge in many different fields.

To sum up, typology is a method of observing perpetuity and changes and aims to discover things that already exist instead of inventing new things. In other words, types are discovered, not invented. Type analysis is an inductive system that distinguishes the attributes of types. Common rules need to be discovered from a wide range of cases while differences need to be distinguished. It is believed in this study that typological studies can summarize existing types, schematize them into simple geometric forms and find their variations as well as fixed and changing elements, thus, seeking the similarity and differences in the hierarchical relationships. Therefore, we generate a variety of structural schemas with inherent similarities, and then construct a diagram to present the combinations of types.

2.3 Schematization of Types

Many relevant studies at home and abroad have made in-depth discussions on the utility performance of visualization technology. Here, the two typical types of visualization technology, radial space-filling and node-link diagram, are discussed.

(1) Radial Space-Filling

Treemap, sunburst, and hyperbolic viewer are the most commonly applied radial space-filling methods. The treemap method is a visualization technique proposed by Shneiderman (1992) which presents a hierarchical resource structure in the form of a nesting rectangle, it skillfully applies the space configuration and the size of the rectangle to represent the attribute size relationship of the information objects.

Another radial-space filling method is the use of radial distribution of trees in allocating space and dividing regions. This method was first proposed by Johnson and Shneiderman (1991) as an expansion of the treemap; it was called the polar treemap. Later, Stasko (2000) proposed a more comprehensive design, which was called the sunburst. In the sunburst, the circular center represents the root directory or the top layer of the hierarchy information and expands outwards according to the hierarchy or the depth of the directory. In addition, the circular division angle corresponds to the size relationship of the directory or file. Thus, larger the outer concentric, the number of nodes accommodated; in other words, the nodes increase with hierarchy. In addition, when the nodes of each hierarchy are distributed, the corresponding concentric circles are divided at different intervals to correspond to different nodes of the hierarchy. The entire visualized distribution is circular, which makes rational use of the space and overcomes the problem of space waste.

The hyperbolic viewer is a variation of radial treemap (Lamping, Rao & Pirolli, 1995), which is used for large-scale hierarchical structures. Specifically, the resources are displayed in a tree structure and placed on the hyperbolic plane. Through the users' interactive operations, important information will be moved to the center and magnified with fisheye views, which can clearly reveal the hierarchical relationship of the objects. In the hyperbolic space, the circumference increases geometrically with the increase of the radius. When the child nodes are placed, sufficient space can be provided by increasing the distance from their parent nodes. Mapping such a distribution back to Archimedes space can reveal that the center has a lower display density, which is convenient to display more auxiliary information, such as the detailed information of the nodes. Based on these characteristics, the nodes selected by the users will be moved to the center, and the detailed information will be magnified and displayed in real-time. The overall distribution will also be adjusted accordingly.

(2) Node-Link Diagram

The node-link in which nodes represent objects and lines represent relationships is the most natural visualization expression which is easily accessible to the users, as it helps people quickly establish the relationship between different things, and expresses the relationship between different things explicitly. The node-link diagram is mainly based on a force-directed layout and was first proposed by Eades (1984) for the purpose of reducing the distribution process and line-to-line exchange, and keeping the line length consistent. This method refers to the spring model to simulate the distribution process. The spring is used to simulate the relationship between two nodes. Under the impact of elastic force, the nodes that are too close will be bounced away, and the nodes that are too far away will be pulled closer. Through continuous iterations, the entire distribution reaches a dynamic balance and tends to be stable. Since then, the concept of force direction has been proposed and it has evolved into a force-directed distribution algorithm that is used in most network datasets. The effect of force-directed distribution algorithm is obvious in good symmetry, good local convergence, aesthetically-appealing

results, and good interaction. Through the interface, users can see how the entire picture gradually reaches a dynamic balance, helping users to more easily accept the distribution results.

3. Research Method

The framework for this study is divided into three parts: Part 1 establishes the structural hierarchy of type schemas, Part 2 introduces the background of the selected type cases and Part 3 analyzes the schemas of type cases.

3.1 Structural Hierarchy of Type Schemas

This study proposes a conceptual system for "data beauty" and defines data beauty from the perspective of the typological system. In subsequent sections, the "radial ring" structural types are specifically listed, the hierarchical schemas of types are established, and the genealogical chart of data beauty is constructed. In the radial ring types, the root system, the source, or the starting point are generally set at the center, and the scattered branches diffuse toward the circular boundary and eventually form a concentric ring, which creates a geometric sense of balance and enhance hierarchicality. In addition, the radial ring has a relatively prominent advantage that it can effectively make full use of space and perform a complete layout in the limited screen space. Therefore, this study mainly discusses ring types.

The theoretical framework of the data beauty types is shown in Figure 2. In this study, "schemas" are regarded as the composition method of types. The description of the schemas forms a genealogical chart. In this study, the schemas genealogical chart can be divided into two hierarchies: The first is the intention shown in the schema layout, which is the base schema of types; the second is the operation to complete the schemas above, which is the operational schema and derived rules. The base schema must be further interpreted before it can be prototyped, and the operational schema is the way of interpretation.

In Fig. 2, Type (Type X) is a function composed of the base schema, f{Base schema}, and the functions of one type may contain more than two base schemas. The operational schema responsible for deriving rules is used as the distribution method to complete the base schema, which represents the two most typical types of the type schema technology earlier discussed: radial space-filling method and node-link diagram. Type is a function for the data to complete the base schema through the operational schema and can be expressed as Eq. (a), where the operation of the base schema in the formula is represented by {}, and the operation of the operational schema is represented by (). Therefore, the form of data beauty can be expressed as Eq. (b), and the base schema and the operational schema constitute the type schema of data beauty.

Type (Type X) = f{Base schema} (a)

Data beauty = Base schema of radial ring types {Operational schema (Data)} (b)

3.2 Background of Type Cases

In this study, 22 data visualization cases in which the radial ring structures connote the data beauty type system were cited (Table 1). There are two sources of the selected cases: The first are the prize-winning works of British Kantar Information is Beautiful Awards in recent years, and the other is the case platform website, visualcomplexity.com (Lima, 2005), founded by Lima (2011), which is an influential data visualization case library today. The main goal of this website is to collect and use different visual design methods to gain a reflective and critical understanding of various disciplines and social contexts. The website covers architectural cities, art, design, fashion, technology, religion, biology and physics, and hopes to inspire and encourage people to engage in research in this aspect.

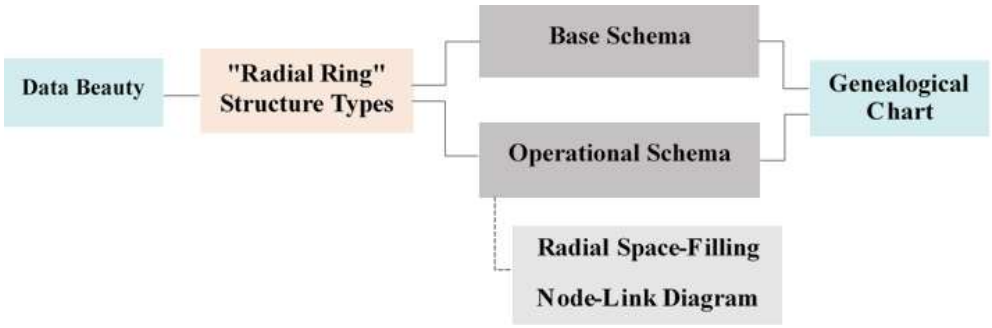


Figure 2. Theoretical framework of the data beauty types

Table 1. Case Background

No.	Works	Author	Year	Summary
TA1	Simulated Dendrochronology of U.S. Immigration	Molly Callahan	2016	Illustrate immigration paths to the United States for centuries through the growth texture of the annual ring and explore where the immigrants to the United States come from.
TA2	Time Tree of Life	Blair Hedges & Sudhir Kumar	2015	It is a public knowledge base used to provide information about the evolution process and time scale of life.
TA3	EE-Digital City Portraits	Brendan Dawes	2012	Gather residents living in major cities in the UK, and discuss topics on the Twitter social platform for three days
TB1	Coral Cities: An Ito Design Lab Concept	Craig Taylor	2018	Use coral structure to draw maps and analyze livable cities in Europe and Asia
TB2	Chriming	Sook go, Sejong University	2014	Integrate the logic of operations (Mandala) with the sound of birds, the concepts of branches and forests, and present invisible and abstract subconsciousness. The Mandala visually represents healing and meditation.
TB3	Visualization work <Writing without words> Original work <On the Road>	Visualization author, Stefanie Posavec Original author, Keroauc	Visualization work 2008 Original work 1957	Explore the relationship between specific sentences and vocabulary in a book through Internet visualization, and understand the cross-references between different documents on the same topic, or the relationship between different books. These functions can help to extract the narrative structure and style of literary works.
TC1	The Rhythm of Food	Moritz Stefaner	2004-2016	The Google Trends website analyzes hundreds of ingredients, recipes, and other food-related search terms. The weekly trend data accumulated through 12 years provides a rich dataset, and people can explore food trends over the years to know which foods are getting more and more popular.
TC2	The Healthiest Year of My Life	Doug Kanter	2012	The author summarizes all the physiological data related to diabetes in 2012, this yielded the best blood sugar control effect for the 28-year diabetes patient.
TC3	Olympic Feather	Nadieh Bremer	2016	Use the image developed from badminton as the visual feature of the number of medals in the Olympics over the years
TD1	Sunlight, Fatness, and Happiness	Siori Kitajima & Ravi Prasad	2012	Put forward some assumptions on visualization, such as what factors make a place a happy place to live

TD2	Braindance	ČrtomirJust & Matej Koncan	2014	Attempt to bridge the gap between science and art; find and visualize people's reactions and differences to the music tracks they first heard, explain how brain waves flow, and the corresponding relationship between hearing and brain waves
TD3	The Education Flower	Andera Codolo & Giacomo Covacih	2012	Study the education-population ratio, enrollment rate, graduation rate, unemployment rate, education investment status, and student-teacher ratio in various countries, and present them in a visual form to facilitate reading and mastering the current education status in various countries
TD4	Weather Chart 2012	Thomas Clever, Gert Franke & Jonas Groot Kormelink	2012	Use weather data to create a chart, use social media data to draw a weather map, display daily temperature, humidity, rainfall, wind speed, and sunshine changes throughout the year.
TD5	Weather Radials	Timm Kekeritz, JanaKühl, Karen Hentschel, Tobias Ottenweller, Frank Rausch	2014	Present 35 cities around the world in a unique visualization form to highlight the story behind the original weather data, nearly a hundred weather events are selected, such as extreme weather conditions, high-temperature records, and other meteorological anecdotes.
TE1	Foam Tree VORONOI	FT500 explorer	2015	Classify FT500 companies according to different industries. Visualize world-renowned large companies based on the ranking results in the report of the Financial Times
TE2	The Entire History of Kickstarter Projects, Broken Down by City	Nicole Jekich	2016	Allow readers to re-understand the identity of each state in the United States and the creativity of the cities through the bubble chart
TF1	Eigenfactor.org (Visualizing Information Flow in Science)	Maritz Stefaner	2009	Create a network diagram of the books cited in the Thomson Reuter's 2007 Journal Citation Reports to study the connection between books and research papers
TF2	Connectogram	John Van Horn	2012	The visualization system can read the overall structure of the brain and its connections at a glance.
TG1	OrgOrgChart	Justin Matejka	2007-2011	The ANIC organization notes that the company's structure will change over time, and takes a snapshot of the Autodesk organizational hierarchy every day across a time span of 1,498 days.
TG2	Map of Science	Los Alamos National Laboratory	2009	Based on electronic data search, readers move from one journal to another, process the data through the so-called clickstream model, and establish the association between them.

TG3	Co-authorship network map of physicians publishing on hepatitis C	Andrew Lamb	2013	Display the collaborative network of research papers on the subject of the hepatitis C virus
TG4	Visual Poetry	Boris Muller	2006	Based on a very old concept of coded text, the author assigns a value to each letter in the alphabet. Using this system, the entire poem is arranged in a radial ring path.

3.3 Schema Analysis of Type Cases

In this section, a schematic analysis is performed on the 22 radial ring type cases based on the two operational schema methods. First, the five base schemas of radial space-filling methods are discussed, including circling, branching, grating, undulating, and fragmentation. Then, the two base schemas of the node-link diagram method, including association and link, are discussed, and the database functions and characteristics of the cases are explained.

(1) Radial Space-Filling

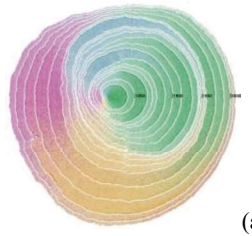
1. Base schema: Circling

The structural characteristics of the circling schema: The time sequence is arranged along the circumference, and radial concentric rings or spiral diagrams are used to display the time axis, which can also represent the event structure within a certain time period. A ring represents a cycle, and the entire visualization distribution is ring-shaped, which makes reasonable use of the space.

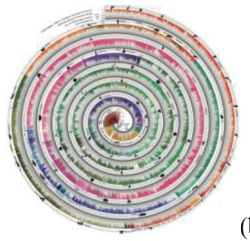
The database of Case TA1 illustrates immigration paths to the United States for centuries through the growth texture of the annual rings as shown in Figure 3(a). Each ring represents a year, and each dot on the image represents 100 persons, while each color indicates the regions of the world where they originate. The colors are used to distinguish where the immigrants come from while the number of dots is used to record the number of immigrants.

The database of the Time Tree case TA2 comes from the data of thousands of published studies and is arranged into an explorable life tree in a chronological order as shown in Figure 3(b). The Time Tree has three exploration modes: (1) Node time: to find different time points of two species or higher ethnic groups; (2) one species group, display the geological time and the timetable of astronomical historical events, and provide readers with a comparative analysis of the time axis and time period.

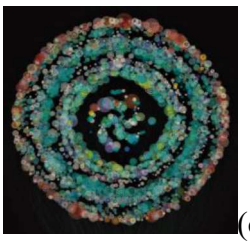
In Case TA3, as shown in Figure 3(c), in the portrait database of British cities, one ring represents one minute, and there are a total of 4,320 minutes. The ring in the middle represents earlier time points, and different colors represent different topics. The Twitter data in 11 major cities in the UK within 72 hours was searched with different keywords such as entertainment, weather, and wealth.



(a)



(b)



(c)

Figure 3. Base Schema: Circling

2. Base schema: Branching

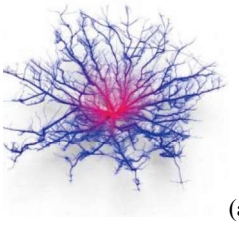
The structural characteristics of the branching schema: Radial tree recursively adopts the

radial distribution of each subtree to form a ring structure, which makes the subtree structure more intuitive. The characteristic of this radial ring tree is that as the number of hierarchies increases, the space occupied by the subnodes gradually becomes smaller.

The database of Coral City Case TB1 presents subway traffic routes and displays transportation data based on the bifurcation growth of coral, and uses this indicator to calculate the distance accessible within 30 minutes of driving in major first-tier cities as shown in Figure 4(a). This result is applied to the living quality ranking of cities to illustrate the assessments of European cities.

The database of Case TB2 captures the sounds of birds and adopts a program simulation that uses sound waves to convert the sounds into an image that is similar to snowflakes as shown in Figure 4(b). Under this logic, the logic of operations (Mandala) is combined with the concept of branches and forests, thus, presenting the invisible and abstract subconsciousness. Centered on the mandala, the number of the first branch represents the frequency of the bird sounds. Finally, the tuner software is used to distribute the scale range.

In recent years, literary works have become important in Internet visualization. Case TB3 uses hierarchical relationships to visualize them. The rules of the database are firstly based on chapters. Blue-green represents an independent chapter, and gray represents each paragraph in the chapter, and the paragraphs are divided into blue sentences, which are finally divided into brown words as shown in Figure 4(c). The rules of view branching represent chapters, paragraphs, sentences, and words, and the colors used correspond to the 11 topic categories set in the book (such as travel, work, social events, and local life).



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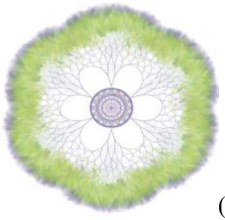

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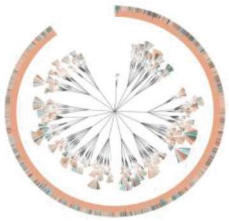


(c)

Figure 4. Base Schema: Branching

3. Base schema: Grating

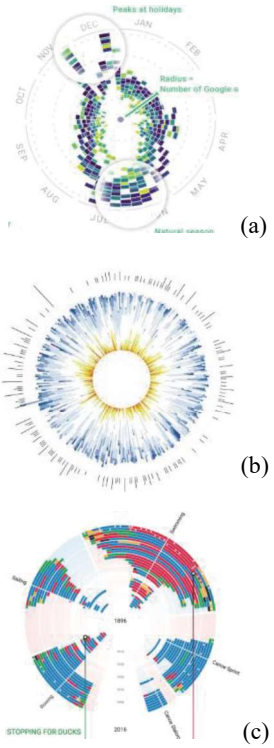
The structural characteristics of grating schema: Radial grid lines are adopted to diffuse outwards from the root of a center or the highest level, and the hierarchies decrease from the inside to the outside; these adopt the ring segmented parallel arrangement sequence. Each segmented area usually corresponds to a specific data or attribute, and the color reflects other attributes of the segmented area. Since the structure is radial, it can be well laid out with the symmetrical area, but the irregularity resulting from the radial arrangement makes the distinction between the hierarchies less obvious.

In order to study seasonal patterns in food search, Case TC1 developed a new radial annual clock chart to reveal the seasonal trends of food. Each segment of the database represents people's search interest in a certain week in the past 12 years. The distance from the center indicates relative search interests, and the color indicates year-by-year trends, which can reveal repeated rhythm and changing trends every year as shown in Figure 5(a).

The database of Case TC2 includes medical data and exercise data of insulin and blood glucose monitors as shown in Figure 5(b). Higher blood glucose readings are represented by cooler colors while lower blood glucose readings are represented by warmer colors. The outermost black line along the image represents the distance covered during exercise, which can reveal the impact of changes in diet and exercise on the body. For example, after an individual participates in marathon training, the detection rate of insulin is reduced by 40%. The effects of low-carbohydrate diets and high-carbohydrate diets are also displayed.

More than 5,000 champions have emerged in the Olympic Games since inception. The database of Case TC3 displays different competition events and the historical records of the Olympics as shown in Figure 5(c). The time sequence is arranged along the ring and a ring represents a cycle to distribute the time axis, which can show the visualization effect of

the time-varying sequence of the dataset. It can help readers explore how the medals in 56 different sports in the Olympic Games are won and understand the patterns in certain sports. For example, during the recent Olympic Games, most of the European medals have been awarded to Asian countries. Alternatively, it can help people know the total number of each sporting activity and when women's events are added to each sporting activity, thereby showing the entire history of the Olympics.



(a) (b) (c)

Figure 5. Base Schema: Grating

4. Basic schema: Undulating

The structural characteristics of undulating schema: We can express the direct visual effects of quantified numbers through traditional bar charts, area charts, or line charts. However, when the data table is very lengthy, data presentation in a limited screen space will bore people and they may miss the key point. The radial undulation layout is used to explain the value of the vertical dimension and compare it with the standard horizontal bar chart; it shows that the traditional pie chart has spatial capabilities at different hierarchies.

The data from the database of Case TD1 covers 60 countries in the world as shown in Figure 6(a). Based on changes in national GDP, sunshine rate, murder rate, obesity rate, and population density, Case TD1 discusses the correlation between sunshine and happiness. Does a country have to be rich to be happy? Is there a correlation between murder rate and obesity rate? Are the people in countries with larger populations happier? Based on these indicators, the 60 countries are ranked in terms of people's changes in happiness.

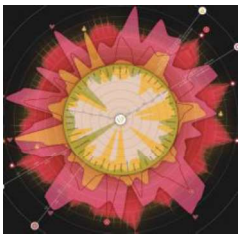
In the database of the Braindance case TD2, 20 volunteers listen to music that they have never heard and the brain wave changes of these 20 volunteers when listening to music are presented as a view. Then, neuroscience and medical instruments, such as the EEG instrument, are applied to collect the weak biological waves generated by the human brain at the scalp, which are then enlarged into curves and used to explain how the brain waves flow and the corresponding relationship between hearing and brain waves. The figure depicts two specific types of measurement data: blue-green is the focus while red-orange is the relaxation as shown in Figure 6(b).

The database of Case TD3 compares the education statistics of 34 countries in the world based on the 2012 Education Overview: OECD (Organization for Economic Co-operation and Development) Indicator. The results include rich colors and produce the annual reports on the education level as shown in Figure 6 (c). The indicators include the students' annual expenses, percentage of education expenses in public expenses, percentage of educational institutions' expenses in GDP, and percentages of 15-29 year olds, 25-34 year olds, 35-44 year olds, 45-54 year olds, and 55-64 year olds. In addition, it is hypothesized that if specific data can be obtained, a huge association graph can be established to find similarities between different fields.

Discussing the impact of weather on people's lives is also a popular topic in the field of data visualization. The database of Case TD4 originates from the 714,843 data samples related to weather posted on social media in 2011 as shown in Figure 6(d). For example, in Florida, the rainfall for one consecutive day has resulted in an average reduction of 4.1% in fatal car accidents, which happens to be the wettest week in a year. Also, as the weather gets hotter, the number of crimes in Los Angeles has increased.

Weather is more than just numbers. It defines our lives. The database of Case TD5 consists of 365 radial lines as shown in Figure 6(e). The closer to the center, the lower the daily minimum temperature. The farther away from the center, the higher the daily maximum temperature. Rainfall or snow is represented as

a blue circle, which also represents the quantity. There are 365 days in a year, and thus there are 365 radial lines distributed clockwise from the 12 o'clock point. Each radial view shows the climate characteristics of a place and its specific weather events, such as the long heatwave in Washington DC, the unusually humid spring in Berlin, the high-temperature records in Sydney, and the monsoon season in Mumbai.



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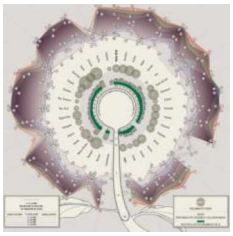

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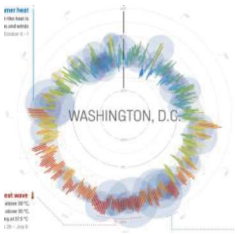


(e)

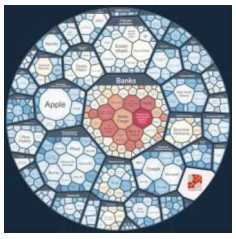
Figure 6. Base Schema: Undulating

5. Base schema: Fragmentation

The structural characteristics of fragmentation schema: Each branch or component is represented by a geometric shape, and the secondary branch or component is represented by a smaller geometric shape. In a ring tree, the area of each individual geometric shape reflects the number or data attributes of the area, such as the value; and the color of the area represents other characteristics or attributes. In the ring tree diagram, the hierarchical structure is very clear, but because there are too many empty spaces between different geometric areas, this is not a very effective structure in terms of functionality.

The Foam Tree database of Case TE1 is a Voronoi visualization tree diagram as shown in Figure 7(a). Through interactive, efficient, and interesting browsing of hierarchically-distributed data, triangles, hexagons or circles can be placed into any Voronoi. Based on the report of the Financial Times, Foam Tree classifies world-renowned large companies according to different industries and visualizes the ranking results in a Voronoi view.

Viewing the local through the whole can be used to visualize the creativity and identity of the city. Case TE2 identifies the creative industry model of each state in the United States based on the 100,000 Kickstarter projects divided by city and category and then describes the creative features of each major city through the types between the projects. The database comes from Kickstarter and is broken down into 15 categories, as shown in Figure 7(b), including music, video, publishing, art, games, design, theater, dining, comics, technology, fashion, photography, dance, and journalism. Each Kickstarter project is depicted as a small circle, the size of which is determined by the number of its supporters.



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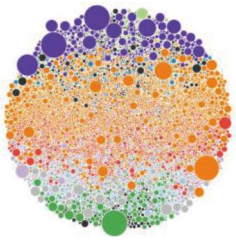


(b)

Figure 7. Base Schema: Fragmentation

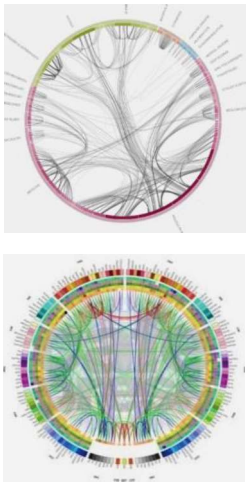
(2) Node-Link Diagram

1. Base schema: Association

The structural characteristics of association schema: When the data table is very lengthy, the relationship between data can be represented by the strength of the association. The densely distributed curve area is the easiest to visually notice, while lines with different colors and thicknesses can represent the strength of the association (or numerical association). Since the chart is a ring, the space available in the innermost part of the ring is smaller while the space available in the outermost part of the ring is larger. Therefore, data that covers a large scope and can represent relationships or needs are clustered and placed in the center of the ring; while detailed data or data with low association with other data is placed on the outside. In addition to the line colors and positions, the tension of the association lines can also show different aspects of the association between the data. When the line tension is smaller, it is easier to see the density of different data; when the line tension is higher, the lines are denser, and people can clearly see the association classification of each data item, such as which group of data items has a strong association with another group of data items.

Book citations are common in academic literature and are an important indicator to measure the reputation and credibility of scholars' articles. From book citations, we can also understand the association between one article (book) and other articles (books). If two articles (or two books) are cited by a third party at the same time, the two articles (books) are indirectly associated. The database of Case TF1 comes from Thomson Reuter's 1997-2007 Journal Citation Reports as shown in Figure 8(a) which includes 634,926 book citations in 6,218 scientific papers. The segments on the ring represent different disciplines (such as molecular and cell biology, medicinal chemistry, and earth sciences), and connection represents citations between academic papers.

In Case TF2, the brains of 110 volunteers were scanned, all of whom are 25 year olds and right-handed. Diffusion-weighted magnetic resonance imaging was used to identify neuronal connectivity. As modern instruments have powerful image resolution and post-processing capabilities, they can create detailed associations and display the main pathways of neuronal fibers in the human brains as shown in Figure 8(b). The database association diagram is a schematic diagram of the brain connections in a circular form and represents the cerebral cortex which is distinguished as the left and right hemispheres. When observing the outer side of the ring, we can find the frontal lobe, temporal lobe, parietal lobe, and other important structures. For example, the cortical area represented by the cerebellum has its own color. Through the inside of the circle, a series of colorful lines indicate which areas are associated. The lighter-color areas contain the most associated lines while the thin line areas contain fewer associated lines.



(a)

(b)

Figure 8. Base Schema: Association

2. Base schema: Link

The structural characteristics of link schema: Recent multi-directional link diagrams generated by computer operations combine advanced methods such as force direction and genetic algorithms. Through flexible manipulation of spatial boundaries, they can effectively display high hierarchical structure, which has become an efficient node-link structure. Multi-directional link diagrams are not limited to horizontal or vertical extensions. Instead, the diagrams allow free structural layout, and thus can flexibly display hierarchical structure. In terms of the layout, multi-directional link diagrams generally consist of an initial root system or the starting point which extends in all directions. Besides, the link diagrams in each direction follow their own specific direction and are bifurcated regularly, extending to the edge of the diagrams. Although the overall layout seems unconstrained, it is not confusing or disordered.

The database of OrgOrgChart case TG1 establishes the company's entire hierarchical structure into a tree. From May 2007 to June 2011, the snapshots of the Autodesk organizational hierarchy were taken everyday. Each employee is represented by one ring, and a line connects each employee to his or her

manager. Then, force-directed algorithms are used to distribute the whole. The view has three types of changing functions every day: Employees join the company, employees leave the company, and employees change their managers as shown in Figure 9 (a).

In order to show the relationship between different disciplines in the scientific field, according to the pipelines of people reading scientific papers on the Internet, the interactions of nearly 1 billion users are analyzed, and a relationship diagram is drawn. The database of Case TG2 processes the data through the clickstream model and searches the users who transfer from one journal to another, thereby establishing their association. As shown in Figure 9(b), the view places the sciences and humanities in a multi-directional link layout. It is centered on humanities and sciences are arranged around humanities. Each ring represents one journal, and the color coding is as follows: light purple for Physics; blue for Chemistry; green for Biology; red for Pharmacy; yellow for Social Science; white for Humanities; purple for Mathematics, and pink for Engineering. The association lines reflect the users' navigation lines from one journal to another.

Visualizing a collaborative network of papers on specific scientific topics to model scientific collaboration can be used to analyze a series of powerful technologies. Case TG3 authors have collected a free and detailed database to visualize the scientific collaborative network in the field of visualized medicine and healthcare, which contains more than 20 million scientific papers on biological sciences. Based on the strength of the association, the position of each author and the number of publications on certain topics reveal the collaborative network of research papers on the topic of the hepatitis C virus as shown in Figure 9(c). Each point represents a single author, and there are a total of 8,500 points. The boundaries between the points represent the co-authors of the scientific papers.

In the database of Case TG4, a red ring on a circular path represents a number. As many different words can share the same number, for example, the number 99 represents the word "poetry", while "poetry" can share the number 99 with "ideas", "letters", and other words. Most rings represent different words. The thickness of the ring depends on the number of words sharing the same number. The diameter of the ring is based on the length of the poem, and thus, short poems are closer to the center while longer poems are farther away from the center. Finally, the gray line connects the words of the poem in the original sequence. Therefore, the solid line represents the repeating pattern in the poem as shown in Figure 9(d).

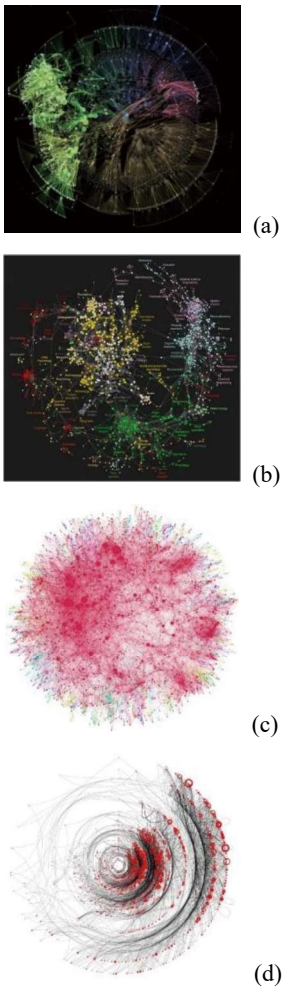


Figure 9. Base Schema: Link

4. Research Results

On the premise of the exqamined literature, this study undertakes the construction and systematic thinking of data beauty from a typological perspective and completes the evaluation of radial ring structures. Based on base schemas and operational schemas, 22 excellent data visualization works from the last ten years are summarized and seven base schemas are extracted. Radial space-filling includes five base schemas, including circling, branching, grating, undulating, and fragmentation. The circling schemas include Case TA1, TA2, and TA3; the branching schemas include Case TB1, TB2, and TB3; the grating schemas include Case TC1, TC2, and TC3; the undulating schemas include Case TD1, TD2, TD3, TD4, and TD5; the fragmentation schemas include Case TE1 and TE2. There are 16 cases in total. Two base

schemas are found by the node-link diagram: association and link. The association schemas include Case TF1 and TF2; the link schemas include Case TG1, TG2, TG3, and TG4. There are six (6) cases in total. The overall genealogical chart of the radial ring types of data beauty is shown in Figure 10.

The node-link diagram and the radial space-filling have their own advantages and disadvantages. Based on the dynamic description, the node-link diagram escapes the derivative rules centered on the technical description. The radial space-filling can clearly and intuitively display the hierarchical structure, effectively utilize the space, and support large-scale hierarchical data. If the two can be combined, their advantages can be combined. The analysis of type maps helps to understand the complexity of types from another perspective. For example, although Case TG4 is classified as a link schema of the node-link diagram, this case implies a circling schema apart from the dominant link schema. A similar phenomenon can be found in Case TG1 which implies the branching schema of the radial space-filling apart from the dominant link schema.

The node-link diagram draws single individuals as nodes, and the link between the nodes represents the hierarchical relationship between individuals. This intuitive and clear method is particularly suitable for expressing hierarchical relationship.

However, when there are too many individuals, especially when the breadth and the depth are greatly different, the readability of the node-link diagram is poor, and a large number of data points are gathered in the local area of the screen, making it difficult to efficiently use the limited screen space. Such spatial problem arises in Case TG1 and TG3 also found such spatial problem. The radial space-filling uses segmented regions in the space to represent individuals in the data and represents the hierarchical relationship between the data with the concept of the outer region and the inner region. Compared with the node-link diagram, this method is more suitable for displaying subordinate relationships and it efficiently utilizes the screen space, hence, can present more data.

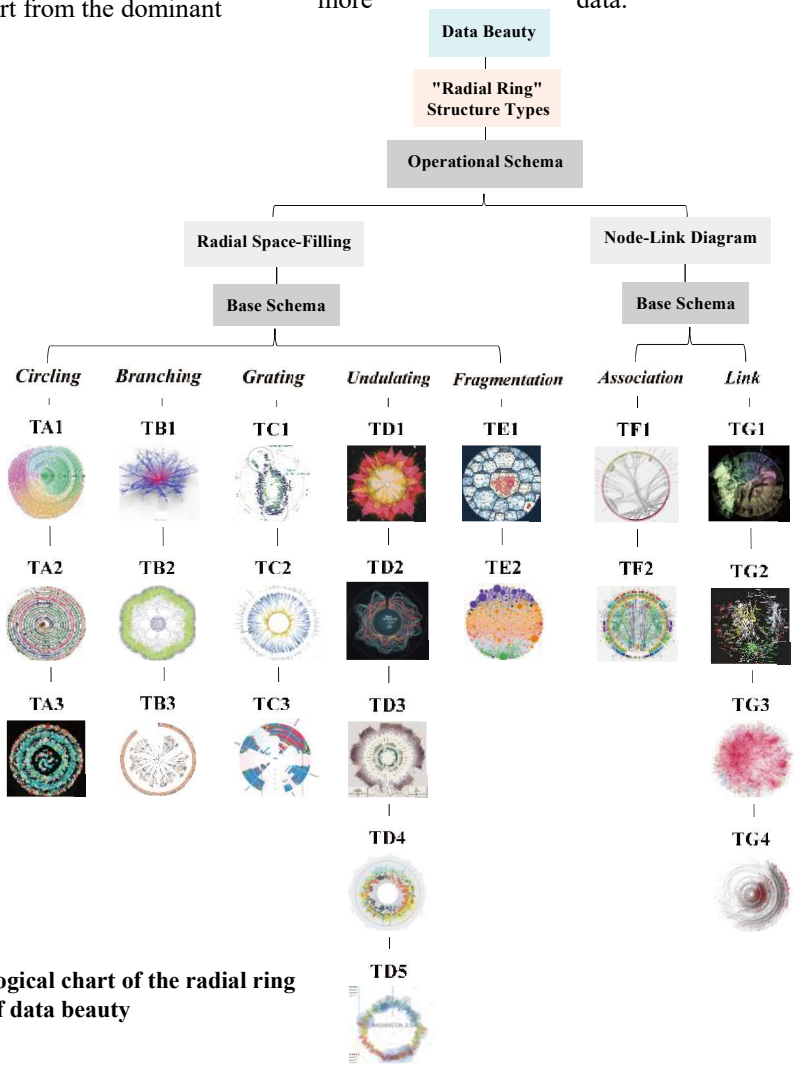


Figure 10. Base Genealogical chart of the radial ring types of data beauty

5. Conclusion and Future Studies

It is expected that in design activities, different fields are considered to integrate novel visual works. Deriving schemas through data is an artistic activity and pursuing aesthetic forms through typology is also art that cannot be ignored. This study considered whether the systematic view of typology and the concept of data can positively and systematically assist in visualization design. The study identified preliminary research findings.

The type-schema genealogical framework of data beauty constructed in the research findings is divided into two hierarchies: The first is the intention shown in the schema layout, which is the base schema of types; the second is the operation to complete the above schemas, which is the operational schema and derived rules. The base schema must be further interpreted before it can be prototyped, and this interpretation is carried out via operational schema. The differences in the type schemas of 22 cases are discovered; this originates from the difference in the database or the difference in the operational schemas.

Seven base schemas and two operational schemas were constructed in this study. The two operational schemas are radial space-filling and node-link diagram, which need to combine with seven base schemas, including circling, branching, grating, undulating, and fragmentation, to form a layout. This layout can reveal the complex attribute relationship in the data beauty types and provide an understanding of the data beauty. The contribution of this study can be used as a reference for design research on data aesthetics.

However, as most of the screen displays can only present two-dimensional planes, a three-dimensional or multi-dimensional resource presentation method may cause visual confusion problems. In particular, time attribute resources are independent of one-dimensional resources as they have the qualities of resource start and resource end. The node-link diagram and the radial space-filling can both distinguish the differences in the hierarchical structure. The node-link diagram does not have a bottom-up or top-down hierarchy, and the relationship expressed is more free and complex. The node-link diagram is supported by complex algorithms and huge databases, and the difference between the two lies in the hierarchical relationship between data resources.

In conclusion, data beauty is a concept. The data beauty constructed in this paper can be regarded as an open framework. The sustainable development of other types with radial ring framework is a topic for future research. In the future, the framework connotation cases will be derived with an expectation to develop and construct other different type families. In addition, this study will continue to carry out the application evaluation of the radial ring types of data beauty and extend this methodology to practical teaching. In the foreseeable future, big data will not be based on a single type or method. From the perspective of typology, the systematic thinking obtained by the concept of data can help the field of visualization design to acquire changing and rich resources.

Acknowledgments

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The Impact of Pokémon Go on Taiwanese People's Daily Life

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ABSTRACT

The current study aimed to explore 405 Taiwanese college students' (M: 165; F: 240) attitudes toward the impact of Pokémon Go on Taiwanese people's daily life. The instrument for data collection was an anonymous 27-item six-point Likert scaled online questionnaire. The results of the current study indicated that regardless of gender, all the participants' responses to all the questionnaire items were almost the same or slightly different. Overall, playing Pokémon Go could function to some extent as therapy, (foreign) language learning, and interpersonal relationship development. However, the three different groups' (still play, seldom play, and never play) responses to items 10 (Playing Pokemon Go can help make new friends) and 19 (Playing Pokémon Go can help learn English) were obviously different. Educationally speaking, Pokémon Go could be employed as a (foreign) language learning tool; on the other hand, morality education could not be overemphasized for the environmental protection in Taiwan.

Key words: Pokémon Go, Taiwan, online questionnaire

I. Introduction

Using a PC (Personal Computer) mouse and keyboard might often be unhandy in that the users must sit in front of their computers all the time. However, cellphones can be used anywhere anytime. Cellphones have been playing an important role in people's daily life. Many people are addicted to playing the games on their cellphones, and they love communicating with others via social networking applications (computer programs) (Apps). The development of cellphones and Apps has made game markets much more competitive than before (呂/Lu, 2010). In 2013, the most uploaded and profitable App was games, exceeding photo, tools and life style (Thompson, 2016).

Pokémon Go, created by Niantic and The Pokémon Company, is a free-to-play and place-based virtual game. It was in July 2016 that the virtual game was initially released in selected countries (鍾/ Zhong, 2016) such as the United States and Canada. The next month, people in Taiwan were allowed to play it. In September 2016, the Pokémon Go, with more than 0.5 billion downloads in iPhone OS (iOS) and Android platform, has become a global

game and it has been one of the most used and profitable mobile apps in 2016 (愛范兒/ Ai Fan Er, 2016). Millions of players, old or young, are attracted to play the game outdoors and most of them believe that they could walk more as an exercise (Howe, Suharlim, Ueda, Howe, Kawachi, & Rimm, 2016).

In the beginning, the game surprisingly encouraged tons of people to go outdoors and increased a lot of business opportunity. Globally speaking, the number of daily active users (DAU) declined from 28 million to 5 million (Arif, 2017; Smith, 2017), including Taiwan based on the CNA (https://udn.com/news/story/10222/2390934). Even though the peak of the game has gone, the number of players is still amazing around the world (Smith, 2017) and thereby exploring the advantages and disadvantages of the Pokémon Go in people's daily life is still worth investigating. As such, the purpose of the current study was to explore the impact of Pokémon Go on people's everyday life in Taiwan. The research question posed to motivate the current study was: How did Taiwanese college students respond to Pokémon Go in people's daily life?

II. Literature Review

2.1 Brief history of Pokémon

The origin of the Pokémon Go was from a game developed by an enthusiastic insect collector, Satoshi Tajiri, who combined insects and Ultra Seven (Chinese translation 鹹蛋超人) and employed the combination in a famous game machine called Game Boy (Madden, 2016). Afterwards, the game was launched to be a comic and cartoon (Amy, 2016), which is the narrative of pocket monsters' adventures. The characteristics of the game were to update the map from time to time to increase pocket monsters for players to collect; however, with the continuous development of science and technology and in competition with many other newly developed games, the pocket monster game has been gradually replaced. Much to people's surprise, in 2016 Pokémon Go appeared instead of the name of pocket monsters. The new game combined Augmented Reality (AR) with map to allow players to get seemingly in a world full of Pokémon monsters, and every player can be a master or a summoner in the game.

2.2 Previous game-related studies

Followings are five previous game-related research studies, which revealed the functions of online games, players' attitude toward online games, and the relationships between playing motivations and game players

陳/Chen (2002) examined the impact of online games on 12 players (M: 8; F: 4). The data collection included the participants' online game records and reviews. The results of the current study indicated that the participants could (a) get satisfaction and gain sense of belonging in a virtual world, (b) build up the interpersonal relationship and even intimacy such as love, and (c) gain sense of achievement.

Yee (2006) conducted a research study on the difference of the motivational factors among MMORPGs (Massively-Multiplayer Online Role-Playing Games) players and the relationships between motivation and demographic variables (i.e., age, gender, usage patterns, and in-game behaviors). The participants were 3000 MMORPGs players (M: 2769; F: 431). The source of data collection was a 40-question online inventory. The results of the current study indicated that (a) the motivations did not differ among the participating players, and (b) there was a positive correlation between motivation and demographics among players.

韓/Han,岳/Yue/,黃/uang,陳/Chen, and 李/Li (2010) conducted a research study on the relationship between 308 Taiwanese college students' (M: 146; F: 162) personality traits and playing Facebook games. The source of data collection was a questionnaire, paper and

online, including basic information and self-efficacy scale. The results of the study indicated (a) people who have part-time jobs would play many kinds of games, and (b) the friendlier players were, the more they knew about games; the stricter they were, the more deeply they would focus on the game.

Yang, Chiu, and Chen (2011) investigated the impact of social norms on 280 Taiwanese Business-Management majors' (M: 140; F: 140) attitudes toward online games. The instruments of data collection included focus group discussions and a survey. The results of the current study included (a) social norms could influence the college students' attitudes toward and in playing online games, (b) social norms could influence females much more than males, and (c) males tended to take more interest in playing online games than females.

劉/Liu, 葉/Yeh, 王/Wang, and 黃/Huang (2011) employed a 37-item online questionnaire, based on the Decomposed Theory of Planned Behavior (DTPB) proposed by Taylor and Todd (1955), to explore the factors which influenced 908 online game players' (M:555; F:353) behaviors in playing online games in Taiwan. The ratio of males and females was 61: 39 and most of them were college students. The results of the current study indicated that (a) The DTPB could be effectively employed to look into the relationship between online game players and the factors (e.g, game design, customer service quality, peer influence, personal ability, and controllable sources), and (b) Players' attitude was the most important factor affecting their intention of playing online games.

Watanabe et al. (2017) investigated the relationship between playing Pokémon Go and improving mental distress. The participants were 2530 adult workers. Data collection included one online self-report questionnaire and a follow-up survey. The results of the current study indicated that (a) Players were younger than non-players and (b) Improvement in players' mental distress was greater than non-players.

III. Methodology

3.1 Participants

All the participants were invited to rate the online questionnaire by all the researchers' friends or acquaintances in their different universities around Taiwan. Table 1 showed that the participants of the current study included 405 college students (M: 165, 40%; F: 240, 60%) in Taiwan. To be more specific, 23 participants (M: 9, F: 14) were from Northern Taiwan; 245 (M: 101, F: 144) Central Taiwan; 111 (M: 51, F: 60) Southern Taiwan; 16 (M: 2, F: 14) Eastern Taiwan; 10 participants (M: 2, F: 8) outlying islands. Furthermore, most of the participants were from Central Taiwan (60.49%), followed by from Southern Taiwan (27.41%), Northern Taiwan (5.68%), and Eastern Taiwan (3.95%) respectively. The least was those from outlying islands (2.47%).

Table 1. Participants' Demographics

Area (City/County)	Valid		Invalid		Total (%)	
	M	F	M	F	M	F
North (Yilan, New Taipei, Taipei,	9	13	0	1	9	14
Keelung, Taoyuan, Hsinchu)	22		1		23 (5.68%)	
Middle (Miaoli, Taichung, Changhua,	84	127	17	17	101	144
Nantou, Yunlin)	211		34		245 (60.49%)	
South (Chiayi, Tainan, Kaohsiung,	43	56	8	4	51	60
Pingtung)	99		12		111 (27.41%)	
East	2	12	0	2	2	14

(Hualien, Taitung)	14		2		16 (3.95%)	
Outlying Islands	1	8	1	0	2	8
(Penghu, Kinmen)	9		1		10 (2.47%)	
Total	139	216	26	24	165 (40%)	240 (60%)
	355 (87.65%)		50(12.35%)		405 (100.00%)	

All the participants were divided into three groups: Group 1 (n=27; 8%) in which the participants were still playing Pokémon, Group 2 (n=217; 61%) seldom played and Group 3 (n=111; 31%) had never played (see Table 2).

To be more specific, the percentage of the participants who were playing and seldom played Pokémon Go reached 69% (8%+61%), while only 8% (n=27) kept playing (see Table 2).

Table 2. Number and Percentages of Each Group

Group	**1.Still play**		**2. Seldom play**		**3.Never play**		**Total (%)**	
Gender	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Numbers	17	10	92	125	30	81	**139**	**216**
Total (%)	**27 (8%)**		**217 (61%)**		**111(31%)**		**355(100%)**	

The reasons why the researchers recruited college students to be the participants of the current study were (a) The largest group using smartphones in Taiwan were college students because they liked to pursue a trend and because it was rather convenient for them to work on things and kill time, as 游/ Yu's (2001) statement that college students almost spent three hours on the Internet every day, (b) They had much more free time to manage it even more flexibly than any other level cohorts, particularly than elementary- and secondary-education students, and (c) They were familiar with Pokémon when they were young because Pokémon first showed up from a video game in 1995 around which the participating students were born and soon it became popular and was adapted into comic books, and then put on its animation.

3.2 Instrument: Questionnaire

The design of the Chinese questionnaire (https://docs.google.com/a/nfu.edu.tw/forms/d/e/1FAIpQLSfFBjQ6zRPq7mtHbYfW9zyVpn3Wct3HCUoRkzKr5arWbWXZrg/viewform) spanned from October 3, 2016 to March 20, 2017. All the questionnaire items were produced through group discussion. The data collection time was limited from March 20 to April 9, 2017, that is, weeks 5 to 7. Weeks 8 and 9 were not suitable for the participants to rate, for they were supposed to be too busy preparing for and taking their mid-term exams in weeks 8 and 9 respectively to carefully rate the questionnaire, which could skew the results of the questionnaire. To increase the Chinese questionnaire validity, a class of 14 weekend-program students (present: 12; absent: 2) majoring in Applied Foreign Languages (AFL) were invited to check the questionnaire and its final draft was revised by an associate professor whose major was Chinese and had taught Chinese courses in a national technical university in the mid-southern Taiwan for seven and a half years.

The questionnaire consisted of three parts: (a) the participants' demographic data, and (b) 28 questionnaire items followed by "any other opinions or suggestions." Among

the questionnaire items, item 28 (Your questionnaire will be invalid if you rate this item) was designed to increase the reliability of the questionnaire results in case any absent-minded participant rated the questionnaire without concern. The reliability of the current study was also supported by the valid rate of the questionnaire, 88% (355/405) (see Table 1).

IV. Results and Discussion

Overall, in the current study, more female college students (60%) rated the online questionnaire than males (40%). It follows from Table 2 that Pokémon Go was a game suitable for males and females. Approximately 69% of the participants had been playing and seldom kept playing the game, but in the end more male players (16%: 17/(17+92)) who kept playing were twice more than female players who kept playing (7%:10/(10+125)) (see Table 2).

Over half of the participants disagreed that playing Pokémon Go could (see Table 3):

a. increase players' living cost (item 2: M=2.89, 69.30%),
b. increase family relationship (item 6: M=3.37, 52.39%),
c. improve single partner relationship (item 8: M=3.13, 57.75%),
d. marital relationship (item 9: M=2.90, 67.89%),
e. help know animals (item 13: M=3.26, 58.03%),
f. help know plants (item14: M= 3.10, 62.43%), and
g. help learn English (item 19: M=3.35, 51.27%).

Except for questionnaire items 2, 6, 8, 9, 13, 14, and 19, all the participants tended to agree with the other item statements. In particular, more than 90% of the participants tended to agree that the game could:

a. allow players to kill time (item 5: M=4.51, 90.70%),
b. encourage players to go outdoors (item 11: M=4.78; 96.06%),
c. increase the frequency of accidents (item 16: M=5.05; 97.46%),
d. cause traffic problems (item 17: M=5.12, 96.34%),
e. help players learn about different Pokémon charaters (item 23: M=4.65, 94.37%),
f. increase electricity consumption (item 25: M=5.25, 98.31%), and
g. make players' eyesight poor (item 27: M=4.89, 91.27%).

In some way, the Pokémon GO players need to go outdoors so they could know and catch many Pokémon GO characters, and thereby they could consume large amount of electricity and even forget to let their eyes rest at regular intervals.

Table 3. Results of all the Participants' Responses to the Questionnaire (N=355)

Item: Playing Pokémon Go can __.			Item: Playing Pokémon Go can __.		
*StA+A +SoA n(%)	*SoD+ D+St.D n (%)	Mean	StA+A+SoA n (%)	SoD+D+St.D n (%)	Mean
1. evoke childhood memories.			15. function as healing (e.g., depression).		
300(84.51%)	55(15.49%)	4.42	245(69.01%)	110(30.99%)	3.89
2. increase the living cost.			16. increase the occurrence of accidents (e.g., falls and car accidents).		
109(30.70%)	246(69.30%)	2.89	346(97.46%)	9(2.54%)	5.05
3. increase health (e.g., walking and cycling).			17. cause traffic problems (e.g., traffic congestion and car accidents).		
279(78.59%)	76(21.41%)	4.20	342(96.34%)	13(3.66%)	5.12

4. harm health (e.g., secondhand smoke and accident.).			18. affect students' academic performance.		
214(60.28%)	141(39.72%)	3.75	274(77.18%)	81(22.82%)	4.30
5. kill time.			19. help learn English.		
322(90.70%)	33(9.30%)	4.51	173(48.73%)	182(51.27%)	3.35
6. improve family relationships.			20. help inspire new technology.		
169(47.61%)	186(52.39%)	3.37	240(67.61%)	115(32.39%)	3.81
7. increase friendship.			21. affect players'daily schedule.		
274(77.18%)	81(22.82%)	4.14	272(76.62%)	83(23.38%)	4.27
8. improve single partner relationship.			22. affect work.		
150(42.25%)	205(57.75%)	3.13	278(78.31%)	77(21.69%)	4.31
9. promote marital relations.			23. help recognize Pokémon characters.		
114(32.11%)	241(67.89%)	2.90	335(94.37%)	20(5.63%)	4.65
10. help make new friends.			24. promote the economy of scenic spots.		
265(74.65%)	90(25.35%)	4.04	293(82.54%)	62(17.46%)	4.30
11. make people go outdoors.			25. increase electricity consumption.		
341(96.06%)	14(3.94%)	4.78	349(98.31%)	6(1.69%)	5.25
12. help know the local attractions (e.g., installation art, temples).			26. damage environment (e.g., damage to the turf and public facilities).		
295(83.10%)	60(16.90%)	4.35	292(82.25%)	63(17.75%)	4.47
13. help know animals.			27. make players' eyesight poor.		
149(41.97%)	206(58.03%)	3.26	324(91.27%)	31(8.73%)	4.89
**14. help know plants.					
133(37.57%)	221(62.43%)	3.10			

*StA+A +SoA = strongly agree +agree+ somewhat agree

*SoD+ D+St.D = somewhat disagree+ disagree+ strongly disagree

** One male participant who seldom played the game did not rate item 14.

From the perspective of gender, males' and females' attitudes toward the game were not or slightly different, with the mean value differences ranging from 0.01 to 0.55 (see Table 4). In particular, almost the same were the attitudes males and females took toward item 5 (Playing Pokémon Go can kill time) and item 9 (Playing Pokémon Go can promote marital relations) by the mean value difference 0.01, and item 6 (Playing Pokémon Go can improve family relationships), 0.02. That is to say, both males and females tended to agree that Playing Pokémon Go could allow players to kill time (item 5: 89.93%/4.51 vs. 91.20%/4.50), but slightly tended to disagree that playing the game could help improve family relationship (item 6: 52.25%/3.39 vs. 52.31%/3.37) and promote marital relationship (item 9: 64.75%/2.89 vs.69.91%/2.90).

On the other hand, more males tended to believe that playing the game could help players recall their Pokémon-related childhood and help make new friends than females by the mean vale difference 0.41 (item 1: 90.65%/4.67 vs. 80.56%/4.26; item 10: 83.45%/4.29 vs. 68.98%/3.88). The former difference indicated that more males watched Pokémon-related programs than females in their childhood; the latter one indicated that males tended to be extrovert while females introvert. More females tended to believe that playing the game would affect student's academic performances than males by the mean value difference 0.55 (item 18:

65.47%/3.96 vs. 84.72%, M= 4.51). Such a difference indicated that females cared much more about schooling than males.

Table 4. Results of Males' and Females' Responses to the Questionnaire (M=139; F=216)

Item						
Male			**Female**			**Gender**
StA+A+SoA n(%)	SoD+D+StD n(%)	Mean	StA+A+SoA n(%)	SoD+D+StD n(%)	Mean	**Mean Difference**
1. Playing Pokémon Go can evoke childhood memories.						
126(90.65%)	13(9.35 %)	4.67	174(80.56%)	42(19.44%)	4.26	0.41
2. Playing Pokémon Go can increase the living cost.						
40(28.78%)	99(71.22%)	2.86	69(31.94%)	147(68.06%)	2.91	0.05
3. Playing Pokémon Go can increase health (e.g., walking and cycling).						
111(79.86%)	28(20.14%)	4.32	168(77.78%)	48(22.22%)	4.13	0.19
4. Playing Pokémon Go can harm health (e.g., secondhand smoke and accident.).						
79(56.83%)	60(43.17%)	3.68	135(62.50%)	81(37.50%)	3.79	0.11
5. Playing Pokémon Go can kill time.						
125(89.93%)	14(10.07%)	4.51	197(91.20%)	19(8.80%)	4.50	0.01
6. Playing Pokémon Go can improve family relationships.						
66(47.48%)	73(52.52%)	3.39	103(47.69%)	113(52.31%)	3.37	0.02
7. Playing Pokémon Go can increase friendship.						
119(85.61%)	20(14.39%)	4.33	155(71.76%)	61(28.24%)	4.02	0.31
8. Playing Pokémon Go can improve unmarried partner relationship.						
64(46.04%)	75(53.96%)	3.16	86(39.81%)	130(60.19%)	3.11	0.05
9. Playing Pokémon Go can promote marital relations.						
49(35.25%)	90(64.75%)	2.89	65(30.09%)	151(69.91%)	2.90	0.01
10. Playing Pokémon Go can help make new friends.						
116(83.45%)	23(16.55%)	4.29	149(68.98%)	67(31.02%)	3.88	0.41
11. Playing Pokémon Go can make people go outdoors.						
135(97.12%)	4(2.88%)	4.85	206(95.37%)	10(4.63%)	4.73	0.12
12. Playing Pokémon Go can help know the local attractions (e.g., installation art, temples).						
123(88.49%)	16(11.51%)	4.53	172(79.63%)	44(20.37%)	4.23	0.30
13. Playing Pokémon Go can help know animals.						
63(45.32%)	76(54.68%)	3.32	86(39.81%)	130(60.19	3.23	0.09
*14. Playing Pokémon Go can help know plants.						
54(39.13%)	84(60.87%)	3.06	79(36.57%)	137(63.43%)	3.12	0.06
15. Playing Pokémon Go can function as healing (e.g., depression).						
106(76.26%)	33(23.74%)	4.00	139(64.35%)	77(35.65%)	3.82	0.18
16. Playing Pokémon Go can increase the occurrence of accidents (e.g., falls and car accidents).						
133(95.68%)	6(4.32%)	5.02	213(98.61%)	3(1.39%)	5.06	0.04
17. Playing Pokémon Go can cause traffic problems (e.g., traffic congestion and car accidents).						
132(94.96%)	7(5.04%)	5.09	210(97.22%)	6(2.78%)	5.14	0.05
18. Playing Pokémon Go can affect students' academic performance.						
91(65.47%)	48(34.53%)	3.96	183(84.72%)	33(15.28%)	4.51	0.55
19. Playing Pokémon Go can help learn English.						

73(52.52%)	66(47.48%)	3.44	100(46.30%)	116(53.70%)	3.30	0.14
20. Playing Pokémon Go can help inspire new technology.						
96(69.06%)	43(30.94%)	3.84	144(66.67%)	72(33.33%)	3.80	0.04
21. Playing Pokémon Go can affect players' daily schedule.						
99(71.22%)	40(28.78%)	4.14	173(80.09%)	43(19.91%)	4.36	0.22
22. Playing Pokémon Go can affect work.						
109(78.42%)	30(21.58%)	4.39	169(78.24%)	47(21.76%)	4.25	0.14
23. Playing Pokémon Go can help recognize Pokémon characters.						
132(94.96%)	7(5.04%)	4.76	203(93.98%)	13(6.02%)	4.57	0.19
24. Playing Pokémon Go can promote the economy of scenic spots.						
119(85.61%)	20(14.39%)	4.45	174(80.56%)	42(19.44%)	4.19	0.26
25 Playing Pokémon Go can increase electricity consumption.						
135(97.12%)	4(2.88%)	5.29	214(99.07%)	2(0.93%)	5.23	0.06
26 Playing Pokémon Go can damage environment (e.g., damage to the turf and public facilities).						
109(78.42%)	30(21.58%)	4.43	183(84.72%)	33(15.28%)	4.50	0.07
27 Playing Pokémon Go can make players' eyesight poor.						
115(82.73%)	24(17.27%)	4.68	209(96.76%)	7(3.24%)	5.03	0.35
*One male participant who seldom played the game did not rate item 14.						

From the perspectives of three groups, the order of the three groups' percentage agreement or disagreement with all the items often corresponded to the players' playing frequency, except for items 10 (Playing Pokémon Go can help make new friends) and 19 (Playing Pokémon Go can help learn English) especially on the basis of percentage and mean value (see Table 5). In general, the mean value differences among the three groups indicated that their responses to all the items were from slight differences to differences (0.23 – 1.60). To be more specific, the order of agreement with item 10 was Group 1, followed by Group 3, and then Group 2, with percentages/mean values 85.19%/4.67, 76.58%/4.02, and 72.35%/3.97 respectively, but their mean value difference (0.70) was slight. Additionally, the order of agreement with item 19 was Group 1, followed by Group 3, and then Group 2, with percentages/mean values 66.67%/3.78, 42.86%/3.24 and 55.86%/3.48 respectively, but their mean value difference (0.54) was slight.

Table 5. Results of Three Groups' Responses to the Questionnaire (G1=27; G2=217; G3=111)

G1: Still Play			**G2: Seldom Play**			**G3: Never Play**			
Item									
A*	**D***	***M**	**A***	**D***	**M**	**A***	**D***	***M**	**MVD***
1. Playing Pokémon Go can evoke childhood memories.									
26 (96.30%)	1 (3.70%)	**5.11**	189 (87.10%)	28 (12.90%)	4.55	85 (76.58%)	26 (23.42%)	4.01	1.10
2. Playing Pokémon Go can increase the living cost.									
3 (11.11%)	24 (88.89%)	2.30	52 (23.96%)	165 (76.04%)	2.69	54 (48.65%)	57 (51.35%)	**3.43**	**1.13**
3. Playing Pokémon Go can increase health (e.g., walking and cycling).									
25 (92.59%)	2 (7.41%)	**4.44**	178 (82.03%)	39 (17.97%)	4.35	76 (68.47%)	35 (31.53%)	3.86	0.58

4. Playing Pokémon Go can harm health (e.g., secondhand smoke and accident.).									
11 (40.74%)	16 (59.26%)	3.44	125 (57.60%)	92 (42.40%)	3.65	78 (70.27%)	33 (29.73%)	**4.02**	**0.58**
5. Playing Pokémon Go can kill time.									
26 (96.30%)	1 (3.70%)	**4.89**	198 (91.24%)	19 (8.76%)	4.47	98 (88.29%)	13 (11.71%)	4.48	0.42
6. Playing Pokémon Go can improve family relationships.									
22 (81.48%)	5 (18.52%)	**4.30**	105 (48.39%)	112 (51.61%)	3.35	42 (37.84%)	69 (62.16%)	3.21	1.09
7. Playing Pokémon Go can increase friendship.									
25 (92.59%)	2 (7.41%)	**4.85**	172 (79.26%)	45 (20.74%)	4.18	77 (69.37%)	34 (30.63%)	3.90	0.95
8. Playing Pokémon Go can improve unmarried partner relationship.									
18 (66.67%)	9 (33.33%)	**3.96**	93 (42.86%)	124 (57.14%)	3.11	39 (35.14%)	72 (64.86%)	2.96	1.00
9. Playing Pokémon Go can promote marital relations.									
15 (55.56%)	12 (44.44%)	**3.67**	69 (31.80%)	148 (68.20%)	2.82	30 (27.03%)	81 (72.97%)	2.86	0.85
10. Playing Pokémon Go can help make new friends.									
23 (85.19%)	4 (14.81%)	**4.67**	157 (72.35%)	60 (27.65%)	3.97	85 (76.58%)	26 (23.42%)	4.02	0.70
11. Playing Pokémon Go can make people go outdoors.									
26 (96.30%)	1 (3.70%)	**5.07**	212 (97.70%)	5 (2.30%)	4.83	103 (92.79%)	8 (7.21%)	4.59	0.48
12. Playing Pokémon Go can help know the local attractions (e.g., installation art, temples).									
24 (88.89%)	3 (11.11%)	**4.78**	190 (87.56%)	27 (12.44%)	4.51	81 (72.97%)	30 (27.03%)	3.93	0.85
13. Playing Pokémon Go can help know animals.									
17 (62.96%)	10 (37.04%)	**3.85**	88 (40.55%)	129 (59.45%)	3.28	44 (39.64%)	67 (60.36%)	3.10	0.75
**14. Playing Pokémon Go can help know plants.									
15 (55.56%)	12 (44.44%)	**3.67**	79 (36.57%)	137 (63.43%)	3.10	39 (35.14%)	72 (64.86%)	2.95	0.72
15. Playing Pokémon Go can function as healing (e.g., depression).									
24 (88.89%)	3 (11.11%)	**4.48**	151 (69.59%)	66 (30.41%)	39.4	70 (63.06%)	41 (36.94%)	3.66	0.82
16. Playing Pokémon Go can increase the occurrence of accidents (e.g., falls and car accidents).									
24 (88.89%)	3 (11.11%)	4.67	213 (98.16%)	4 (1.84%)	5.09	109 (98.20%)	2 (1.80%)	**5.05**	**0.42**
17. Playing Pokémon Go can cause traffic problems (e.g., traffic congestion and car accidents).									
24 (88.89%)	3 (11.11%)	4.78	209 (96.31%)	8 (3.69%)	5.13	109 (98.20%)	2 (1.80%)	**5.19**	**0.41**
18. Playing Pokémon Go can affect students' academic performance.									
8 (29.63%)	19 (70.37%)	3.07	170 (78.34%)	47 (21.66%)	4.33	96 (86.49%)	15 (13.51%)	**4.54**	**1.47**

19. Playing Pokémon Go can help learn English.									
18 (66.67%)	9 (33.33%)	**3.78**	93 (42.86%)	124 (57.14%)	3.24	62 (55.86%)	49 (44.14%)	3.48	0.54
20. Playing Pokémon Go can help inspire new technology.									
21 (77.78%)	6 (22.22%)	**4.00**	145 (66.82%)	72 (33.18%)	3.77	74 (66.67%)	37 (33.33%)	3.85	0.23
21. Playing Pokémon Go can affect players' daily schedule.									
10 (37.04%)	17 (62.96%)	3.26	158 (72.81%)	59 (27.19%)	4.10	104 (93.69%)	7 (6.31%)	**4.86**	**1.60**
22. Playing Pokémon Go can affect work.									
12 (44.44%)	15 (55.56%)	3.37	166 (76.50%)	51 (23.50%)	4.25	100 (90.09%)	11 (9.91%)	**4.64**	**1.27**
23. Playing Pokémon Go can help recognize Pokémon characters.									
25 (92.59%)	2 (7.41%)	**5.00**	207 (95.39%)	10 (4.61%)	4.65	103 (92.79%)	8 (7.21%)	4.55	0.45
24. Playing Pokémon Go can promote the economy of scenic spots.									
24 (88.89%)	3 (11.11%)	**4.63**	189 (87.10%)	28 (12.90%)	4.43	80 (72.07%)	31 (27.93%)	3.95	0.68
25. Playing Pokémon Go can increase electricity consumption.									
26 (96.30%)	1 (3.70%)	5.19	213 (98.16%)	4 (1.84%)	**5.40**	110 (99.10%)	1 (0.90%)	4.99	0.41
26. Playing Pokémon Go can damage environment (e.g., damage to the turf and public facilities).									
14 (51.85%)	13 (48.15%)	3.70	175 (80.65%)	42 (19.35%)	4.44	103 (92.79%)	8 (7.21%)	**4.72**	**1.02**
27. Playing Pokémon Go can make players' eyesight poor.									
20 (74.07%)	7 (25.93%)	4.22	195 (89.86%)	22 (10.14%)	4.89	109 (98.20%)	2 (1.80%)	**5.06**	**0.84**

*A= strongly agree +agree+ somewhat agree *D= somewhat disagree+ disagree+ strongly disagree

*M=Mean *MVD=Mean Value Difference (the highest one – the lowest one)

**One male participant who seldom played the game did not rate item 14.

V. Conclusions, Limitations, and Suggestion

The findings of the current study could be elicited from the abovementioned discussion as follows, together with the implications of the current study as well as limitations and suggestion.

5.1 Conclusions

5.1.1 *Healing function*

Playing the game functions as healing, especially for males and the players who kept playing (Group 1). The game could encourage people to go outdoors instead of staying at home as geeks, and even melancholies, especially slightly distressed patients, could eliminate their negative emotion such as depression (item 15: 69.01%, M=3.89) (see Table 3). Moreover, more male players (76.26%, M= 4.00) agree with the game's healing function than female ones (64.35%, M= 3.82) (see Table 4). In particular, 88.89% of Group 1 believed the healing function of the game (see Table 5), and this implied that the game as a healing approach was of much help for players with emotional difficulties such as

depression. Such an implication echoed the result that Playing Pokémon Go could improve adult worker players' mental well-being in the research study by Watanabe et al. (2017). Future studies may be carried out to investigate the effectiveness of the game on people with emotional difficulties such as depression, especially on players or male ones.

5.1.2. *Language learning*

Almost half of the participants tended to agree with the efficiency of the game on the players' English learning (item 19: M=3.35, 48.73%) (see Table 3). In April, 2017, Pokémon Go announced that Taiwanese players were required to use Traditional Chinese as the interface (Lou, 2017), which would decrease the opportunity for learning English. Even so, playing the game still possibly could be employed by language learners as a supplemental learning tool as 66.67% of Group 1 believed learning English by playing the game of English version (see Table 5). Likewise, players could learn Spanish by playing the game of Spanish version in Spanish-speaking countries/areas or learn French by playing the game of French version in French-speaking countries/areas. On the other hand, foreigners could learn Chinese by playing the game of Chinese version and know more about scenic spots in Taiwan. Future studies may be conducted to explore the language learning efficacy of the game on Taiwanese learners of any foreign languages or foreign learners of Chinese language.

5.1.3. ***Interpersonal relationship***

It is reported that Pokémon GO could boost interpersonal relationship in daily life (White, 2016), which was reflected in the current study, especially for males and players. All the participants tended to believe that the game could help players increase friendship (item 7: 77.18%, M=4.14) and offer them an opportunity to make new friends (item 10: 74.65%, M=4.04) (see Table 3), but not the familial, unmarried partner and marital relationships. Moreover, more males believed that the game could increase friendship and help make new friends than females (item7: 85.61%/4.33 vs.71.76%/4.02; item 10: 83.45%/4.29 vs. 68.98%/3.88) (see Table 4); it follows from the result, 92.59% and 85.19% respectively of Group 1 believed the game could increase friendship (M=4.85) and help make new friends (M=4.67), that playing the game could be a positive social activity for players.

5.1.4. *Educational implication*

Most of the participants tended to agree that playing the game could increase the occurrence of accidents, especially car accidents (item 16: 97.46%, M=5.05), and cause traffic problems (item 17: 96.34%, M=5.12) such as traffic congestion. Moreover, males and females almost took the same attitude toward items 16 (95.68%/5.02 vs. 98.61%/5/06) and 17 (94.96%/5.09 vs. 97.22%/5/14) (see Table 4); interestingly enough, the attitudes Group 1 took toward items 16 (88.89%/4.67 vs. 98.16%/5.09 vs. 98.20%/5.05) and 17 (88.89%/4.78 vs. 96.31%/5.13 vs. 98.20%/5.19) were a little different from those of Groups 2 and 3 (see Table 5) but the three groups' attitudes tended to be highly strong. Such results revealed the importance of traffic safety for players.

Over 82% believed that the players could damage environments such as turf and public facilities (item 26: M=4.47); more than 60% agreed that the game could harm the players' health (item 4: M=3.75) especially because some players liked to catch and smoke at the same time without considering other people around them (see Table 3). Almost the same were males' and females' attitudes toward item 26 (78.42%/4.43 vs. 84.72%/4.50) (see Table 4); about half of Group 1 disagreed that players could damage environment, while the other two groups tended to agree (item 26: 80.65%/4.44 and 92.79%/4.72 respectively) (see Table 5). Furthermore, almost the same

were males' and females' attitudes toward item 4 (56.83%/ 3.68 vs. 62.50%/3.79) (see Table 4); only 40.74% of Group 1 disagreed with item 4, while the other two groups took more positive attitudes toward item 4 (57.60%/3.65 and 70.27%/4.02) (see Table 5). The above results indicated that it is still necessary to educate Taiwanese people, especially elementary and secondary school students, about citizenship, morality, and laws. Future studies may be conducted to explore the relationship between the game and the players with different SES (social-economic statuses).

5.1.5. *Technology inspiration*

Playing the game could inspire players to create new technology, which was supported by about 68% of the participants (item 20: 67.61%/3.81) (see Table 3). The above positive result reflected the fact that Pokémon GO has made Augmented Reality (AR) more popular in technology, and thereby Sony decided to set up a new company to invent the technique of AR and has combined AR with brand new Global Positioning System (GPS) (Smith, 2016). Furthermore, almost the same were males' and females' attitudes toward item 20 (69.06%/ 3.84 vs. 66.67%/3.80) (see Table 4). On the other hand, the three groups' attitudes toward item 20 were just slightly different (77.78%/4.00 vs., 66.82%/3.,77 vs. 66.67%/ 3.85) (see Table 5), and such a result presented that players had much more interest in technology than non-players.

5.2 Limitations

Two limitations in the current study may skew the results of the current study. Firstly, the participants of the current study were limited to college students, so its results could not be generalized to other groups of different ages, careers, and social-economic status. Secondly, only 8% (27/355) of the participants were players who still kept playing, which possibly skew the results of the current study, too.

5.3 Future studies

The researchers should have interviewed voluntary interviewees to collect qualitative data, and the analysis of such data could be employed to explain some results of the questionnaire and thereby make the current study more reliable and meaningful. Thus, quantitative and qualitative data could be collected for deeper analysis in future identical or advanced research studies. Moreover, the participants of the future studies may be recruited from different groups of ages, careers, social-economic status, and even foreigners. Furthermore, the research instrument SPSS used to analyze the quantitative data will be likely to make the future relevant studies more precise and meaningful, as Sheu (2019) stated that it was statistical analysis that made the results and implications of a research study broader and generalized.

5.4 Suggestion

Even though it is not difficult to play Pokémon GO, players may easily feel bored in a routine game. Pokémon GO had better produce more fresh attractions to consolidate current players' zeal and attract more people to involve themselves in the game. For example, it can set up more Pokéstops and gyms especially in the countryside, increase the difficulty of the game, produce more game activities, release uncommon Pokémon monsters, and sustain stable Internet connection (張/Chang, 劉/Liu, 陳/ Chen, 陳/Chen, & 蔡/Tsai, 2010).

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玩寶可夢對於台灣人日常生活的影響

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摘要

本研究旨在探討來自台灣各地區，405 位大學生(男:165;女: 240)對於寶可夢在日常生活中的影響及看法。透過網路問卷調查，以全台受測大學生與性別來看，玩家對寶可夢的看法幾乎相近或僅有些微差異，整體而言，玩寶可夢某種程度上可以增進人們身心健康、提供語言學習機會、及增進人際關係。但以三個群組(一直在玩的玩家、不常玩的玩家和從沒玩過的玩家)來看，某些看法差異較大，尤其是第十題的玩寶可夢有助於交朋友及第十九題的玩寶可夢有助於學習英語。以教育方面來說，寶可夢可以作為語言學習的工具;另一方面，台灣人民對環境保護的道德教育有待提升。

關鍵字:寶可夢 Go、台灣、線上網路問卷

On the Achievements of Animation Art Teaching Practice

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ABSTRACT

A flourishing creative time has accompanied the advent of the digital era. Animation and stop-motion creations naturally took advantage of this rise in power. Technological advances are now accessible and their democratization and ease of use have placed into the creator's hands powerful and virtually infinite tools. It has never been so easy for an artist in the field of animation or stop-motion to express himself and create contents. Educators in charge of accompanying students in their creative journey have an important role to play to help animation students to distinguish themselves in a world literally filled with images and digital contents. What does really make a difference between digital creations and how to bring them to the next level so they can stand out from the rest. After an historical overview of animation and stop-motion through time, this paper aims to point out the constantly diverging dichotomy between reality and its representation through the prism of the animation medium. The importance of unbiased connexion with reality is made difficult in a world where technology and virtualization take a greater place everyday. The use of rotoscopy and chronophotography can relieve this distended link between reality and its representation into animation and help students to move their creative project to a superior level.

Keywords: Art, Animation, Education, Stop-motion, Chronophotography, Cut-out animation

1. Introduction

In the past, during the golden age of artistic creation, films, animation, comics, video games and electronic music gradually appeared. The innovation of art technology gave birth to a prolific century and caused the gradual collapse of traditional artistic values. In the conflicts, weapons were no longer used to fight, but instead, works of art were used to fight. To the five arts compiled by Hegel (G. W. F. Hegel, *Aesthetics. Lectures on Fine Art*, trans. T. M. Knox, 2 vols. Oxford: Clarendon Press, 1975.), Ricciotto Canudo in his manifesto "*The Birth of the Sixth Art"* published in 1911, argued that cinema was a new art and made it the seventh art as it combines the five artistic elements of language, sound, image, action and interactivity. Then in 1964, Claude Beylie published in "Lettres et Médecins" an article entitled "La bande dessinée est-elle un art ?" and invented for the occasion the term "Ninth Art" to determine the comics, defining and making an historical distinction between film and animation (*Lettres et Médecins*, supplément littéraire de *La Vie médicale*, 1964). The genesis of animation technology originated from the prehistoric period and it has been mainly dedicated to art painting, while film was made possible by the birth of photography. After World War I, with the loss of religious moral authority, human emotions were vented through comics as a medium, and artists used animation media to convey specific emotions and thoughts, so animation began to involve a wider range of topics, such as Albert Barillé in "Il était une fois l'Homme" which tells human stories, from the origin of life to speculation on the future to 2150. Through the story of a single character, animation approached some crucial and delicate problems. By adapting the novel of Hector Malot (Sans Famille) into an animation for a young audience and thus, tackling the issue of abandoned childhood during the nineteenth century "Rémi sans famille" tells the story of a young boy who, in the hope of being reunited with his foster family, works for a traveling group of street musicians. These two animations skillfully exposed and faced controversial issues.

Animation gradually took a greater part in advertising media and did not only affect children's preferences. Nowadays animation is not just limited to a small circle that ends with educational morality. Animation is not bound by ethics

anymore and is preserving at the same time morality and subverting morality. Compared with Europe's simplistic view of cartoons, Japan has adapted more mature cartoons. Animations, such as "Akira" by Katsuhiro Otomo which is set in a post-apocalyptic and futuristic Neo-Tokyo or "Fist of the North Star" have a deep, visionary and violent sci-fi approach. Akira has, since then, become a valuable artwork and has not only established a reputation in the manga industry, but also competed with traditional animation such as Disney theatrical animated feature films. The influence of Japanese manga culture has led to changes in the fundamentals of cartoon ideas, graphic styles and themes in Europe.

Animation history began with the magic lantern invented by Father Athanase Kircher in Germany and Father DeChâle in France in the 17th century, as the first slide projector which could partially animate images, to the 20th century dominated by computer animation and motion picture video technology. Animation changed children's preferences for family. Gradually, they became extremely obsessed with animation, manga, movies, radio, music, games, video games, and multimedia products. In particular, animation has become the second preference of children, and animation is no longer ethical or limited to the educational level. Animated films were gradually used as a medium of communication to approach deeper and more mature themes. With the invention of new technologies in different eras, animation technology also follows diversity from documentary graphic research on prehistoric cave paintings to the current graphic design of computer drawing, the artist also joined the eighth art that has expanded thanks to new technologies, using animation as a means of conveying the artist's creative thought, such as in "La Planète Sauvage" in 1973, a sci-fi animated film, produced by director René Laloux and illustrator Roland Topor, it is an animated film that can represent the style of surrealism. In 1993 was released an "Imaginary opera" produced by Pascavision for television. It is a film combining animation techniques and the art of opera. In 1999, Takashi Murakami and Louis Vuitton, a fashion brand collaborated in a commercial animation. The famous monogram letters are completely integrated in the overall design of the visual style of the animation. Artists use animation to produce artistic creations. Creative thinking and production skills are used to reflect a unique creative style at the intersection of social and cultural biases.

2. Motivation

There's an important link between art and animation, artists using animated media to convey specific emotions and ideas. Art and culture can set the scene for the animation style through traditional animation technology, computer animation technology or stop-motion animated film.

In the age of continuous progress in science and technology, in the era of intelligence and virtualization, the art of animation is diversified and widely developed. This new art allows the analysis of subjects that societies are experiencing and contemporary trends, including leisure, artistic trends, music, clothing, social and humanities. The desires and imaginations of individuals are increasingly fueled by the stories and visions developed in science fiction films. The animation teaching practice focuses on creativity and aesthetics and its goal is to make a dazzling animated film in practical production in the future.

3. Purpose

How to make animated characters more realistic and how to design the animation that audiences like to watch has always been the main goal of animators. This animation teaching practice uses stop-motion photography technology to guide creative stories, and cultivate excellent animators with this unique art style brought by stop-motion photography technology.

4. Process

The framework of animation production starts with the first idea, developing and creating story scripts, establishing animation characters, simulating and shooting the personality of animated characters and setting the scene style to finish with the post-production process. Every step is very important.

In this animation teaching practice, the main learning is the principle of stop-motion photography technology to assist animation production. This principle is divided into three major processes: pre-production, animation production and post-production. The pre-production process includes: story scripts, storyboarding scripts, animatics, character design, and scene art design. Animation production includes layout composition, original painting, and animation. Post-production includes coloring, compositing, editing, post-recording, dubbing and video editing.

In stop-motion animation, chronophotography, step-by-frame animation, paper-cut animation, and rotoscoping are the main guiding examples.

The theoretical basis of this article will study the historical development of traditional animation technology, stop-motion photography technology, and computer animation technology, supplemented by related knowledge concepts, and analyze the artistic style of animation through the development of animation technology, so that it is easy to analyze and understand the animation creators through their animation art style.

5. Research on the Development of Animation Technology

The origin of animation lies in traditional art. The technology of animation originated from prehistoric times. From the image of the buffalo running in the "Grotte de Lascaux", which captured different times and different actions through image records, to ancient Egyptian paintings or capture images on ancient Greek black porcelain, such as the "Vase François". The development of animation technology today is just the transposition of ancient ways of recording actions adapted to modern technologies, the core of the concept remaining the same through time. The 17th century "Magic Lantern" technique originated from the production of shadows from puppets in the firelight of an ancient cave. The magic lantern is mainly composed of three-element: a light source, a decorated glass plate and a lens. According to the darkroom principle, artificial light is projected onto the screen.

In 1895, Emile Reynaud invented the Praxinoscope and made the first animated film "Pauvre Pierrot" using 12 photos in a loop. The Lumiere Brothers, the inventors of film and film projector transformed the "Kinetoscope" invented by Thomas Alva Edison. The film "Workers Leaving the Lumière Factory" was shot at 16 frames per second with real persons.

In 1902, producer Georges Melies experienced in the movie "Le Voyage dans la Lune" special effects which brought mystery to the scenes. In this movie, many of the visual techniques employed used "stop-action" by changing the image and switching to a new scene. In 1906, James Stuart Blackton released "Humorous Phases of Funny Faces", an animation created using chalk lines. He was the first producer to use "stop-action" or "stop-motion" shooting techniques, and became one of the basic techniques of later 3D animation films. Blackton's stop-motion technique was a process of drawing life-like faces with chalk lines on a blackboard, erasing a part of it after taking a picture, and then redrawing it. Blackton is a pioneer of "Chalk Animation".

In 1898, Blackton and Albert E Smith made the first film "Humpty Dumpty Circus" using stop-motion puppet animation. In 1907, Blackton and Albert Smith played in the live-action film "The Haunted Hotel", a movie combining live action and stop-motion to create peculiar effects. In 1899, the British film producer Arthur Melbourne Cooper used stop-motion photography to produce animated commercial films: "The Matches: An Appeal", in 1912 "Wooden Athletes" and in 1908 "A Dream of Toyland".

5.1 Research on the Development of Stop-motion Photography Technology

In 1908, a satirical cartoonist and film producer named Emile Cohl used stop-motion photography technology to produce "Fantasmagorie", a movie depicting the adventure story of a clown with a simple pen line method.
Giovanni Pastrone and Wladyslaw Starewicz (also known as Ladislas Starewitch) produced in 1917 "The War and the Dream of Momi", a movie combining real-life and puppet stop-motion photography techniques. In the works of "The Magic Clock" and "Black and White Love", a clay model technique is used to make stop-motion animation.
Starewitch, the pioneer of puppet animation, was influenced by Cole's 1908 film "Animated Matches". In 1912, he created the first puppet-animated film "*The Beautiful Leukanida*" showing insect characters in a series of modern fables. "The Cameraman's Revenge" features a grasshopper on a bicycle and a little miracle of a dragonfly ballerina. Other famous puppet movies by Starewitch include "Town Rat", "Country Rat" and "Tale of Fox". In 1927 "Love in Black and White" with Charlie Chaplin as one of the puppet characters and in 1934 "The Mascot", a movie mixing real people and puppet animation.

In 1917, Argentine producer Quirino Cristiani's released a paper-cut animation silent feature film "El Apóstol" (El Apóstol) and in 1931 a paper-cut animation synchronized sound film "Peludopolis". German animation director Lotte Reiniger used color scenes in the 1926 paper-cut animation feature film "Adventures of Prince Achmed". In 1932, "The idea" created by Berthold Bartosch is

an animated film featuring the beauty of prints and the electronic music score of Swiss composer Arthur Honegger.

5.2 Research on the development of real person and doll animation

Jan Švankmajer was inspired by Ladislas Starewitch's film "Mascot" and often combined animation with live-action movies. In 1964, "The Last Trick" combined the dramatic skills of real people into an animated film. Another example is the 1988 "Alice" and later the 1994 "Faust". Švankmajer's animation technique is considered a variation on the art of animation and it is particularly noticeable in "Dimensions of Dialogue" in 1982.

Another animation trendsetter was the Russian animator Alexander Ptushko. The scenes he shot in "The New Gulliver" (1935) feature a live-action actor and about 3,000 puppets, a fusion of special photographic effects and animation techniques. Putushko's other feature films combined animation and live action like in 1937 with "The fisherman and the fish" and in 1939,"The golden key".

In stop-motion animation, Hungarian animator George Pal created a series of fairy tales based on animated films, including the 1934 animated film "The Ship of the Ether", which featured a sailing ship made of blown glass. "Puppetoons" is a series of puppet shows using hand-carved dolls. Pal created one of his most popular characters, the young black boy Jasper, who appeared in films such as "Jasper Goes Fishing" (1943), "Jasper and the Beanstalk" (1945) and "Jasper in Jam" (1984). The film was followed by "Joop Geesink" and Ray Harryhausen's puppet films "Little Red Riding Hood" , "Hansel and Gretel", "The Story of Rapunzel" and "The Story of King Midas".

Czech illustrator and animator Jiří Trnka created Disney characters in folk tales such as "Grandpa Planted a Beet" (1945) and "The Animals and the Brigands" (1946)."The Emperor's Nightingale" (1949) and "The Hand" (1965) are puppet animations based on Hans Anderson's fairy tales, featuring a central character dressed as an old Italian comic clown, Pierrot, whose expressions are stilted and typical.

Brestilav Pojar inherited the tradition of Jiří Trnka's puppet animation. It is especially noticeable in "Lion and Song". Kihachiro Kawamoto also followed the path of Trnka. He released "Demon" (1972), "A Poet's Life" (1972) and "House of Flame" (1979).
Garry Anderson directed "The Adventures of Twizzle" and "Torchy the Battery Boy", is considered a pioneer of puppet films for television. He also released 'supercats" in 1961, 'stingrays" in 1964 and "Thunderbirds" in 1965.

5.3 Comics and Animation Development Study

There were also many artists who pushed the boundaries of animation, such as American cartoonist and animator Winsor McCay, whose comic Little Nemo in Slumberland became an animated short in 1911 and another famous animated film, Gertie the Dinosaur, was produced in 1914.

Raoul Barre's film series, "The Animated Grouch Chasers", featured comic book albums and technical advances such as positioning pegs on the animation paper to prevent the paper from shifting during filming.
In Colonel Heeza Liar, comic book character creator John Randolph Bray pioneered the animation technique of drawing backgrounds on celluloid paper and placing them on animated paper. Later Bobby Bump creator Earl Hurd animated the characters on celluloid.
Some of the artists who dominated the early years of animation were Pat Sullivan who created Felix the Cat and his associate Otto Mesmer. Dave Fleischer with the animation "Out of the Inkwell", Paul Terry, the creator of "Aesop's Fables" and Walter Lantz with "Dinky Doodle" and "Woody Woodpecker".

With Steamboat Willie in 1928, Walt Disney, the creator of Mickey Mouse, added sound to cartoons and brought animation to a whole new level. Snow White and the Seven Dwarfs" produced in 1937 was the first full length animated feature film. With "Flowers and Trees" in 1932, Disney won an academy award for the first animated movie to make use of the Technicolor method.

5.4 Research on the development of puppet animation

In 1949, Lou Bunin adapted "Alice in Wonderland" using live performers and puppets. Tim Burton made his first animated horror film for children, Vincent, which was a negative precursor to the genre. Later, in 1984, he made the horrific stop-motion film "Frankenweenie". In 1993,

Burton produced and conceived "The Nightmare Before Christmas".

Willis O'Brien's pioneering work in clay animation. He has made historic comedies in clay such as "Curious Pets of our Ancestors" in 1971 and "The Birth of Flivver". O'Brien created special effects for Merian C. Cooper's classic fantasy, "King Kong". Cinematographer and stop-motion animator Ray Harryhousen was inspired by O'Brien's animation techniques and surpassed them in films as Mighty Joe Young (1949), The Animal World (1956), 20, "The Beast 20,000 Fathoms" in 1953, and in 1955 "It Came from Beneath the Sea".

Max Fleischer and his collaborator Roland Crandall changed the traditional animation technique of cel-animation. In 1955 Art Clokey created the stop-motion film "Gumby" using clay. Will Vinton created films such as "Closed Mondays", followed by Leo Tolstoy's "Martin the Cobbler", Washington Irving's released "Rip Van Winkle" and "Little Prince". Joan Gatz directed the clay-animated films "A Claymation Christmas Celebration" and in 1992 "Mona Lisa Descending a Staircase". Will Winton's other traditional works include "The Adventures of Mark Twain" and "Return of Oz".

Peter Lord, one of the co-founders of Aardman Animations, is best known for his clay animation MORPH and produced "Chicken Run" with Nick Park. Thanks to Peter Lord's pioneering efforts, Aardman Animation has become a preferred destination for many animators. Peter Peake produced "Pib and Pog", Richard Goleszowski directed "Indent" and "Rex the Runt".

5.5 Research on the Development of Computer Animation

Ivan Sutherland created the Sketchpad in 1951, which pushed the development of computer animation. In 1982, Steven Lisberger's "Tron" was the first to use computer graphics and an experiment in the field of computer animation. In the rapid development of computer animation, creators of this innovative technology stand out such as Phil Tippett with 'star Wars", "Empire Strikes Back" and Jurassic Park. In 2001, Peter Jackson directed "The Lord of the Rings". In 1995, Pixar Animation Studios made "Toy Story", its first feature-length animated film computers. It was followed by "A Bug's Life" and "Finding Nemo", and competed with Studio Dreamworks to create 'shrek. Aardman Animations used modern computer animation technology (Pixilation) to make the film Angry Kid. As technology continues to advance, more and more innovations have been introduced, often with breathtaking visual special effects.

Animated films are a different cinematic medium, in which artists use animation techniques to convey contemporary emotions and transcendent ideas, while animation deals with broader historical and aesthetic themes, such as the purpose of space travel in science fiction novels and futuristic concepts of futuristic technology and alien world landscapes. In 1988, Japanese comic artist and animation director Katsuhiro Otomo released the sci-fi animated film "Akira", an adult animated film with a violent and bloody theme, inspired by the theme of nuclear weapons and the atmosphere of the Cold War. "Akira" had a strong influence on the western world, creating a wave of Japanese animation interest.

5.6 Theme Content

From traditional animation technology to modern computer animation technology, animation presents the viewer with a series of realistic sketches and a series of paintings of continuous images, these continuous images can represent the real world, but unlike photography, animation does not look like the real world, animation is like magic that can show things that cannot be done in real life. Therefore, in the world of animation, it is allowed to create special environments, in reality the characters can be changed by the animator to have special ways, special movements, special messages, so that the viewer can believe the animation world shown on the screen.

As a carrier of art, animation, like other artistic creations, plays a role in conveying human emotions and thoughts. Because of its unique expressive tension, animation surpasses other art media. For example, Takahata Isao's 1988 animated film "Grave of the Fireflies" uses realism to make animated works feel the hardships of World War II. From the artist's point of view, the creativity of animation art is to create a broader and infinite imagination. People's perception of reality is based on the recognition of common life experiences. Therefore, in the world of animation, how can the realism of the characters make the audience feel and believe the animated world in front of the screen?

This animation teaching practice introduces the artists in the history of stop-motion photography as a guiding example, analyzes the key techniques of stop-motion photography, and simulates characters in order to understand the authenticity of animated characters.

6. Teaching Applications

Chronophotography, cut-out animation and rotoscopy opened new fields in creation for artists and entertainers in terms of efficiency and realism. Suggesting to students or animation learners to use those techniques so their workflow is noticeably facilitated is a motivation as a teacher. Alleviating students from the tedious frame-by-frame animation process is also a data to be considered. By doing so, they can focus on the creative aspect of their project and improve its artistic value. Various teaching exercises involving chronophotography, cut-out animation and rotoscopy were proposed to students in order to help them.

6.1 Production Methods and Techniques of Chronophotography and Rotoscopy

In 1882, Étienne-Jules Marey invented chronophotography, and in the same year Marey, in collaboration with the Parisian shutter manufacturer Otto Lund, developed the photographic rifle, which allowed to shoot continuously at 12 frames a second at 1/720th, and could follow a particularly rapid movement, shooting a series of photographic images that break down each stage of human or animal movement in chronological order. The movement is too short to be observed accurately by the naked eye. The result of Marey's work on movement influenced 20th-century artists such as Futurist Giacomo Balla's in "Dinamismo di un cane al guinzaglio" (The Dynamism of a Dog on a Leash) and "Ragazza di un cane al guinzaglio" (A Girl Running on a Balcony) or Marcel Duchamp's "Nu descendant un escalier n° 2".

Eadweard James Muybridge used multiple cameras to capture moving objects and invented the Zoopraxiscope.

Today, Chronophotography is still used in the scientific field, advertising and fine art photography. The modern equivalent of Chronophotography is the burst mode.

Rotoscoping is a technique for capturing the silhouette of a character in a real shot in order to record its shape and movement in an animated film. The movement of the film subjects can be reproduced realistically, using a rotating transparent table that projects the real film image under the table one by one. Designers can trace outline shapes on layers.

The following pictures describe how rotoscopy cut-out animation and chronophotography can be used as reference documents in animated projects by students.

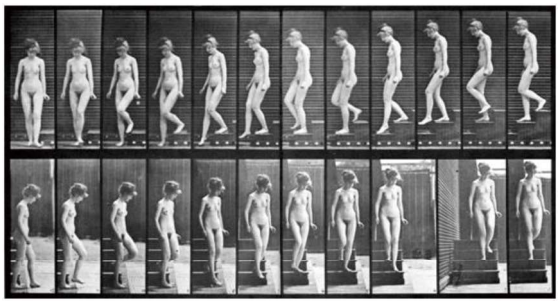

Figure 1. Eadweard Muybridge, Chronophotography (Reference document)

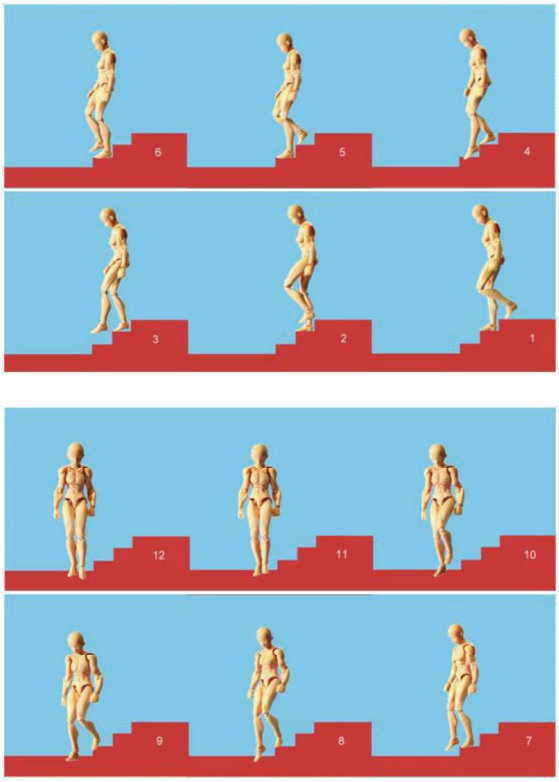

Figure 2. Stop-motion project using Chronophotography as a reference.

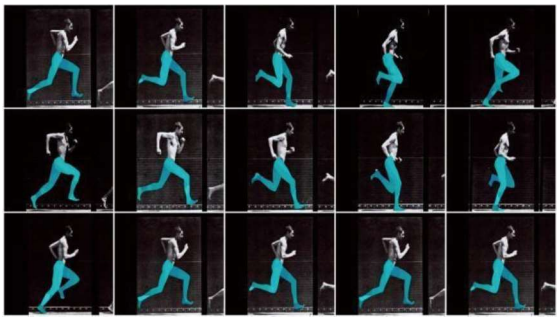

Figure 3. Animation project using Chronophotography as a reference.

Table . Achievements obtained by students using rotoscopy and chronophotography to facilitate their animation project:

Student name	Contest name/ Awards category	Instructor
柯秉杉/ 許家賢	2012 新一代銅獎、曜越文創獎 2012A+創意季入圍	Romain PATTE
鄭凱方/ 黎怡秀/ 林宗昱/ 曾怡嘉/ 涂秉逸/ 林彥任	2012A+創意季入圍	Romain PATTE
劉栗利	租稅短劇比賽第一名	Romain PATTE
劉翊宏	統一發票推行暨戲說租稅短劇比賽第一名	Romain PATTE
王靖雅 蔡佳臻	2013A+創意季入圍 高雄青春影展入圍 第 9 屆全國技專校院電腦動畫競賽佳作 原鄉故事創意海選計畫暨內灣夢之鐵動漫競賽－－內灣夢之鐵動漫競賽圖文繪本獎	Romain PATTE
楊依樺/ 林芳妤/ 曹瀚文	第二屆台南創意新人獎入圍	Romain PATTE
許家瑞/ 管珮萱/ 吳芷妘/ 楊子毅/	2014 全國技專校院學生實務專題製作競賽入圍	Romain PATTE
朱紹瑋/ 黃翠羽/ 盧盈君/ 郭欣慈/ 黃雅妤	2014 全國技專校院學生實務專題製作競賽入圍 第十屆 全國技專院校電腦動畫競賽直接參賽組 佳作	Romain PATTE
吳星燁/ 張雅瑜/ 紀睦貽/ 陳美淑/ 丁天佑/ 姜禮辰	2015A+新秀設計競賽－－數位媒體類入圍	Romain PATTE
廖浩璁/ 卓均憲/ 簡渙楨/ 張瑜真/ 陳義傑	2015A+新秀設計競賽－－數位媒體類入圍	Romain PATTE
張怡文/ 蕭雅瑄/ 楊登宇/ 杜金燁/ 柳孟辰/ 陳韋穎	2016 金點新秀設計獎入圍 青春有影－2016 台灣大學盃創意短片組佳作、百大精選	Romain PATTE
蔡元錡/ 江政育/ 曹家彰/ 吳岱穎/ 夏廷俊/ 柯景晨	第 12 屆全國技專校院電腦動畫競賽佳作	Romain PATTE
陳稜蕙/ 王孟婷/ 賴瑋婷/ 林依靜/ 張苑真	2017A+創意季設計競賽－－數位媒體類入圍 2017 放視大賞－－2D 動畫創作組入圍 第 13 屆全國技專校院電腦動畫競賽－－A 組直接參賽組入圍	Romain PATTE
廖柏翰/ 曾靖庭/ 何宜芳/ 張雅棋/	2018 金點新秀設計獎－－數位多媒體設計類入圍 2018 放視大賞《2D 動畫創作組》入圍 2018 第 14 屆全國技專校院電腦動畫競賽－－A 組直接參賽組佳作	Romain PATTE
許博程/ 李宜臻/ 陳羿甄/ 李柏青/ 汪建佑	2018 金點新秀設計獎－－數位多媒體設計類入圍 2018 A+創意季－數位媒體設計類入圍 2018 放視大賞《2D 動畫創作組》廠商特別獎 2018 第 14 屆全國技專校院電腦動畫競賽－－A 組直接參賽組優勝	Romain PATTE
施昱丞/ 許瑞承/ 許智稚/ 卓新祐/ 劉榮狀	2020 金點新秀設計獎循環設計特別獎入選 2020 放視大賞動畫類－2D 動畫創作組 2020 年第 16 屆技專校院電腦動畫競賽	Romain PATTE
徐璿達	你好,彰化(Sup, Changhua)佳作	Romain PATTE
賴威君	109 年「繪出青春 拒絕私菸」暨防制菸品稅捐逃漏宣導活動佳作	Romain PATTE

6.2 Paper Cut-out Animation Technology

Cut-out animation is a paper-cut animation technique. Like a puppet, it is made up of several individual limbs that are linked to each other. These limbs are partially cut out of paper, such as hands, arms, heads, legs and feet. These individual limbs are linked together by contact points, and the individual limbs are moved through a process called frame-by-frame animation. In the case of cartoon characters, it would be costly to give the illusion of movement and life to the characters as they move from one position to another, but paper-cut animation is very economical as it allows a single character to be used in the entire scene, as long as the shape does not change.

Figure 4. Cut-out student project using Chronophotography as a reference.

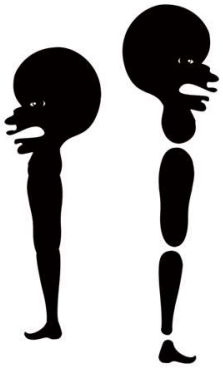

Figure 5. Cut-out project using Chronophotography as a reference.

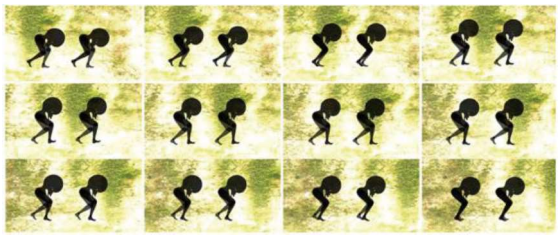

Figure 6. Cut-out project using Chronophotography as a reference.

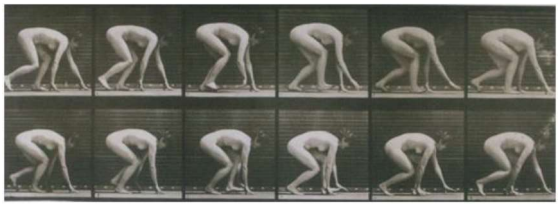

Figure 7. Eadweard Muybridge (Chronophotography)

7. Conclusions

After introducing the multifaceted development of techniques in the history of animation but also reflections on artistic styles and examples of pioneering artists, this paper underlines the importance of chronophotography and rotoscopy as a valuable improvement and help in many disciplines of animation, such as traditional animation, frame-by-frame animation, computer animation, and other animation production techniques. In the learning process of frame-by-frame animation, learners are able to better understand a sequence of animation. Through the study and analysis of frame-by-frame animation, learners are able to better understand the distance between poses and time speed adjustments when animating. Since their apparition in animation history, rotoscopy and chronophotography have proven how useful they could be to help animators and animation students throughout the often tedious animation process and learning.

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中文摘要

隨著數位化時代的到來，進而成就一個蓬勃發展的數位創意時代。動畫和定格動畫的創作自然地受益於這股力量的提升。如今可以輕易獲取新進技術與知識，其民主化和易用性使創作者擁有了強大的創作工具和無限可能性。動畫或定格動畫藝術家從未如此輕鬆地表達自己的創造內容。做為指導學生動畫創作生涯的教育工作者來說，幫助動畫學生在充滿圖像和數位內容的世界中脫穎而出的過程中，可以發揮重要作用。使用數位創作與如何將其帶入新的水準，從而使它們與眾不同脫穎而出。針對動畫和定格動畫進行歷史性回顧，本文主旨以通過動畫的不同視角突顯現實與表現現實之間的分歧。在每天都有更多新的技術和虛擬化的世界中，表現真實性變得越來越難分。轉描技術和定時攝影術的使用可以讓現實與動畫表現之間產生聯繫，並幫助學生將他們的創意提升到一個新的水平。

關鍵字：藝術，動畫，教育，定格動畫，定時攝影，剪紙動畫

數位媒體中的虛擬身體-以當代科技藝術為例

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摘要

當代藝術潮流透過數位媒體科技的推波助瀾下，影像創作成為藝術家參與體驗的實驗過程，不僅融合了數位媒介與科技創造，展現出多元的虛擬影像特質。本研究列舉數件當代科技藝術作品，分析探討身體議題如何融入科技媒介，作為虛擬影像的概念表現，除了消彌數位時代中的虛實界限，並且構思結合跨領域技術，進而觸發影像與觀者之間的感官鏈結，然而，數位時代中影像呈現具有反身性媒體效應與被觀看特質，超越傳統攝像成果所產生的圖像序列思維，因此，科技藝術中的虛擬身體可被視為身體與科技的介入方式，延展出數位時代中獨特的視覺樣貌。

關鍵詞：虛擬影像、科技藝術、數位時代、媒體效應、虛擬身體

The virtual body in digital media: Take contemporary technology arts as examples

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ABSTRACT

The contemporary art trend is fueled by digital media technology, and image creation has become an experimental process for artists to participate in the experience. It not only integrates digital media and technological creation, but also displays multiple virtual image characteristics. This study lists several contemporary scientific and technological art works, analyzes and explores how physical issues can be integrated into the technological media as the conceptual expression of virtual images. In addition to eliminating the boundaries of virtual and real in the digital age, the concept combines cross-domain technologies to trigger the image and the viewer. However, the presentation of images in the digital age has reflexive media effects and characteristics of being viewed, surpassing the image sequence thinking produced by traditional photography. Therefore, the virtual body in technological art can be regarded as the intervention method of body and technology, extending the unique visual appearance in the digital age.

***Keywords*:** Virtual image, Technology arts, Digital era, Media effect, Virtual Bodies

1 緒論

1.1 研究動機

本文以數位媒體時代作為研究動機基礎，媒體科技藉由編碼傳遞、圖像訊息與載體元件等相關環節綜合體，隨著數位時代的技術發展不斷地變化與革新，已然成為當代科技藝術（Technology Arts）的重要發展趨勢，例如透過虛擬影像融入科技產生人機互動模式，使大眾了解科技發展下的重大突破，其重要特點可運用真人穿戴動態捕捉(Dynamic capture) 來表現，比起以往 3D 建模在動作時效性方面除了可以省去不少時間外，並且掌握角色在畫面裡的動作表現，進而產生靈活運用的產出方式，尤其是表現在角色動畫製作設定除了在開發情境和主題特色可隨時改變外，亦能融入網絡平台創造出新的潮流與熱度，例如日本虛擬主播 Vtuber 絆愛(A.I.Channel)已成功在 youtube 線上平台達到 260 萬左右訂閱人數，不僅是科技應用實質上的突破，更是媒體市場行銷發展開發的方向。

然而，科技應用除了能展現多元的影像特質，本文探討科技藝術的觀念意識與形式表現，主要以「身體」（Body）概念與其衍伸性議題作為研究主軸。論述研究形成驗證架構透過藝術家作品案例分析，客觀性說明其研究內容。此外，本文著重研究科技藝術作為身體與物質、機器與技術、環境與時代所呈現的跨時代意義，延展數位時代下「身體性」的當代觀點及其敞開性，進一步探討科技數位時代中身體議題的進行時態，進而探測當代科技藝術發展趨勢與表現類型。因此，本研究動機探討科技藝術作品所延伸之影像技術整合，透過數位技術整合不但可活絡媒體開發趨勢，網絡互動交流增進蓬勃發展，相互交流共創展現出創意視野，成為當代藝術與媒體設計相關產業研究發展的重要趨勢。

1.2 研究問題

本文探討科技藝術中虛擬影像所衍伸的時代性意義，除了審視其中所展現的鏈結面向，透過多元形式表現結合科技媒介的呈現方式，隨著數位技術的進步發展不斷地變化革新下，如何體現虛擬影像的呈現方式，延伸創意界限構思內容與媒材應用，拓展與觀者產生關係鏈結。

基於上述思考，本文研究問題包括：

一、 虛擬媒介技術與科技藝術間所產生的轉向為何？

二、 透過多樣性媒材整合並體現（embodiment）數位化思維的可能性？

三、如何檢視虛擬媒介的影像時間與媒材的實驗過程？

科技藝術結合動態影像與虛擬媒介的表現形式，其創作動機傳遞身體潛能，透過所顯現的技術操作，混合跨領域、多媒材的詮釋方式，引發觀者感受體驗不同的感官途徑，藉此延伸科技性所發展出的身體概念。隨著網絡生活型態的改變，行動科技加入虛擬網絡平台，除了快速融入科技應用，數位影像作為電子傳遞媒介，取決於信號的傳輸，隨著信號持續運動，數位影像與顯示器之間的動態影像播放，同時製作與復制的過程使得動態影像成為當代媒體傳播的獨特特質，不同於攝影圖像與電影序列的中心思維。因此，本研究著重於科技藝術作品中所產生的虛擬影像特殊視覺效果，如何轉化影像經驗可被視為身體與科技介面間的觀看行為，在這種情境中指涉或呼應產生嶄新的心理經驗。

1.3 研究內容

經由上述研究觀點，動態影像作為時間延續的下意識，關於影像創作作為研究觀察，當影像成為紀錄時間意識的關聯性，身體意識成為重要的媒介載體。因此，身體語言是一種表達與溝通的方式，身體影像也會做出相對的反應。回溯影像發展中，透過攝錄影機記錄反映自身與行為意識，成為轉譯到影像媒介上的重要發展之一（陳永賢， 2010，25）。

回顧藝術發展歷程的創作表現中，許多以身體概念作為媒介所發展的表現型態，創作者自身的身體觀念除了具有反思現實性意識，並且成為個體主觀特殊的知覺方式與視角觀點。然而，關於人的主體感知成為研究的重點，現象學家梅洛龐蒂(Maurice Merleau-Ponty)認為身體不只是一件物事與科學性的研究對象，它同時也是經驗的永恆前提，知覺為先即是經驗為先，因為處在知覺覆蓋下的是一個建設性的身體概念，呈現世界知覺性的開放性，使得意識和外在世界產生關聯（梅洛龐蒂，2007，80-95）。

因此，「身體」不但具有創作者的主體性地位，藝術家透過想像力轉化成為視覺符號，

反映出時代下的自我認同與創作動機，無形中傳遞出身體意志潛能，並且隨著時代發展融入媒體技術與跨域建構。由此觀察下，影像創作是透過時間與影像的密切關係，在時間過程中思考影像的動態經驗，透過視知覺經驗與其意向結構，探究影像媒材、邏輯語言中所展開的鏡頭語言、敘事構成、場域構圖等整體表現，承載著藝術家所賦予的影像介面意義。

承接上述，本文試圖發掘科技藝術中媒介多元形式表現，透過當代藝術作品創作觀念檢視下， 分析當代藝術創作以「身體成為媒介」（Body as Medium）之觀點，轉譯反映藝術家個人思考情感與自我認同，創作動機中傳遞出獨特的身體意志潛能，藉此探討科技藝術的展現形式，如何思考身體概念作為藝術創作的邏輯思考，針對創作與研究內容進行雙向提問。

1.4 研究方法

如前所述，科技藝術中影像創作圍繞於身體性的相關議題，用來陳述與對應藝術家創作狀態中的身體經驗與感知特質，思考身體議題性的差異連結，如何延展成為科技性的身體美學論題，透過研究方法的助益下，藉此釐清身體觀念在當代藝術發展的重要關鍵。因此，文中研究分析數位影像創作案例與類型，並且延伸探討關係文本，包含藝術相關評論與藝術家創作自述等，並且針對探討之藝術家案例進行脈絡交叉性分析，建立探討科技藝術中虛擬影像之發展架構。

透過上述研究方法，將相關文獻資料整合出數位影像創作中以身體作為發展概念，探討如何結合當代跨領域技術與多重脈絡軌跡，思考數位藝術與時俱變的多元樣貌。再者，本文探討數位影像創作發展脈絡與展現形式，作為創作邏輯思考影像介面體現出的虛擬幻覺，延伸視覺與多層次的感官經驗，並且隨著當代藝術潮流展現出多元發展，表現類型與創作風格，並不侷限於單一媒材與某種技術層面。

舉例來說，當今在網絡媒體活躍的虛擬角色 Vtuber 開發，其必須應用的相關軟體技術（表一），創作者通過技術的發展與實現，除了運用影像媒介與觀眾產生互動與連結，延展出當代性身體界限與其可能性。因此，創作者透過實驗表現虛擬影像創作，在當代藝術潮流與媒體世代的推波助瀾下，成為參與影像的特殊體驗方法。

iClone 7	3DXchange	Pop Video 3	Maya

表1　建構虛擬 VTuber 所需的軟體應用（作者製表）

經由上述方法研究數位影像中的身體表現，將相關藝術作品資料整合出「身體作為藝術」之概念探討，思考科技藝術如何發展結合跨領域模式，讓虛擬影像的發展過程有著多重的脈絡軌跡，改造與轉化擴展成為與時俱變的多重面貌與展現風格。

2 文獻探討

對於真實的幻覺，如何再現時間與空間下組織人類的經驗，新媒體學者 Manovich 在《新媒體的語言》（The Language of New Media）指出新媒體是各種仰賴電腦設備與軟體呈現傳播的新文化形式，包括：網站、虛擬世界、擬真實境、多媒體、電腦遊戲、電腦動畫等。他談到新的藝術形式與舊的藝術形式之間的連續性與不連續性，獨特地創造出屬於當代性的真實幻覺（Manovich，2001）。因此透過數位科技發展下，電腦呈現與傳播的文化形式，隨著電腦設備軟硬體設備進展與非線性演化，加上科技藝術、數位藝術或跨領域設計的蓬勃發展，在當今與未來趨勢下呈現與傳播的形式經歷著快速變遷的劇烈變化。此外，Manovich 更將影像的數位化過程稱為「元資料化」(metadating)，他指出影像的元資料化牽涉以新方法來中介真實以及人類經驗的新典範，因此，數位時代中活動影像會產生四個關鍵概念: 新結構(new structure)、 新規模(new scale)、新介面(new interface)，以及新影像(new image)（邱誌勇，2012， 111-115）。

再者，透過視知覺經驗成為藝術家主導的意向結構，將影像介面所體現的真實幻覺，延伸了人類的視覺經驗與多層次感官，Chris Meigh-Andrew 談到隨著數位科技的發展，影像技術越趨廣泛與成熟，影像媒材與邏輯語言，透過蒙太奇拼貼、運鏡轉換編序等關鍵表現亦能搭配空間屬性或是結合裝置型態展現(Chris Meigh-Andrew，2014)。

綜觀科技藝術發展，創作者透過技術發展交替，已非侷限於單一媒材與技術層面，創新科技不斷形成認知世界的新模式，媒介除了提

升操控先進且前衛的影像媒體，藝術家所展現的身體意識成為潛在的創作文本，為當代科技藝術創造嶄新表現與美學概念外，透過影像介面體現出真實的幻覺，延伸視覺與多層次的感官經驗，並且隨著數位化潮流展現出多元創作發展，結合了表演、劇場、裝置藝術、虛擬實境等，已然出現於國內外許多重要展覽許多替代空間、當代藝廊或美術館呈現出多元化的展示效果與形式。

3 數位科技中的身體擬態

數位時代下影像成為重要的電子媒介，取決於信號的傳輸，隨著信號持續運動，思考數位影像與顯示器之間的動態影像播放下，同時製作與復制的過程使得動態影像成為媒體中具反身性的特質。因此，透過媒體的視覺效果觀點，影像經驗被視身體與科技介面間的觀看行為，如何在這種情境中指涉或呼應出創作主體或者產生全新的心理經驗。當代數位科技的介入，「超真實」所造成的自然異變，進而形成一種「擬像」(simulation)現象。

3.1 擬仿物的真實擬態

尚・布希亞(Jean Baudrillard, 1929-2007)對於「超真實」(Hyperreal)一詞的書寫，來自對於原本固有真實的質變，他在《擬仿物與擬像》(Simulacres et simulation)所主張的真實是一種高度科幻的社會，透過以國家機器中的各色光景為載體，將擬像以液態化的形式滲入日常生活（尚・布希亞，1998，72）。藉由上述觀點思考數位科技介入藝術創作中，「超真實」進而形成一種「擬像」現象。因此，在觀察影像創作的策略中，透過「擬像」所建立的內容，抑或模擬某事物特徵或其潛藏的關係，除了消彌真實與虛擬的二元劃分，並且將真實性建構於某一對象物或參考對照。法國學者居伊・德波（Guy Debord, 1931-1994）曾透過「景觀社會」（the society of spectacle）論點，訴說真實世界已變成實際形象，純粹的形象以轉換成實際的存在，在現代生產條件蔓延的社會氛圍中，整個生活表現成為一種巨大的奇觀積聚，現代化都變成了純粹的表徵（張賜福，2014，8-9）。

然而，奇觀將物質生活變成景觀的世界，透過觀察當代社會奇觀下的綜觀議題，並且強調出扮裝化的身分意識，例如在瑞秋・麥克林（Rachel Maclean, 1987-）創作中運用影像結合多媒材，將妖嬈扮妝與華麗色彩帶入視覺畫面，用來探討個人身分、流行文化、社會階級和政治相關的議題，風格充滿誇張異想，並帶有怪誕詭奇的藝術風格（陳永賢，2017）。

麥克林的多媒體影像裝置作品〈內在含義〉（What’s Inside That Counts）, 2016）【圖1】，藉由探討社群軟體與媒體間的諷刺評論，影像中以愛自拍的名人女性為主角，通過黃皮膚，無鼻樑的形象，扮演著數據的實體化身，借用了全球化公司概念銷售福祉，宣示著青春與幸福的技術想像，透過廣告詞不斷地轟炸觀察外在形象，然而卻形塑出現代人的內在焦慮。麥克林的作品透過影像與相關印刷品批評消費主義社會，尤其側重於當代對於社群軟體與數位技術的依賴性表徵。（Eddy Franke，2016）。麥克林作品中透過虛擬出社交名人的形象，為絕望的人群提供自拍與互聯網訊息，直到她的系統被駭客入侵，導致麥克林所描繪的病態社會徹底崩潰。因此，在她的影像創作幻想環境中，她模仿了童話故事、兒童電 視節目、美容產品廣告、網絡視頻和流行文化，將自己扮演穿著奢華服飾角色， 影像既具誘惑性且又如噩夢般光鮮怪異，觸發著觀看者的內在慾望。

圖1. 瑞秋・麥克林,〔內在含義〕, 2016.

圖版來源 ：藝術家網站

<http://www.rachelmaclean.com/we-want-data/>

(檢索日期2020/08/02)

3.2 科技性的身體擬態

數位科技發展中電腦呈現與傳播的文化形式，隨著電腦設備軟硬體設備進展與非線性演化，加上科技藝術、數位藝術或跨領域體藝術的蓬勃發展，未來趨勢與傳播內容經歷著快速變遷的劇烈變化。如此而言，當代藝術對於跨領域藝術相互作用的概念，作品的內容中使用不同的媒材及結合其類型之藝術，因而呈現複合意義，而作品意義的開展方式也反映出多元特質，亦即跨領域藝術蘊藏了複合，甚至轉化後的新美學，其藝術內涵的體認相對需要更包容、更強烈的感受力。（邱誌勇，2018）因此，創作者不斷思考碰撞出影像結合數位科技的互動性，除了豐厚跨領域的廣泛討論，擴展對於當代影像創作與其延伸的可能性發展。

3.2.1 感官、刺激與神經元

Manovich認為在數位時代中，電腦呈現與傳播的新文化形式，創造出了真實的幻覺，再現時間與空間，並且延長人類的感官經驗（Manovich，2001）。在面臨數位化時代潮流下，科技介面成為創作媒介，轉譯成多層次的視覺語言符碼，反映著時代性下的個體、社群、環境認同與生存動機，無形中傳遞身體意志的潛能，並且隨著科技發展融入多媒體、跨領域的形式，成為數位世代的載體生產建構者。

日本數位多媒體藝術家真鍋大度（Daito Manabe, 1976-），擅長結合編寫技巧跨領域計畫，並且將媒體科技集合了舞台表演，將 3D 掃描合成技術結合娛樂活動。在他與日本電音女團 Perfume（電音香水）量身定制的演唱會舞台互動系統作品〈Perfume 東京巨蛋巡迴演出「睡美人」3D掃瞄系統〉（3D Scan System for “Sleeping Beauty” of Perfume Tokyo Dome Tour, 2013）【圖2】，透過使用紅外線相機和測距相機，把人作為移動對象，進行動態投影，透過歌手們的指甲上塗有光學迷彩的反射材料，舞台周圍的高速攝像機捕捉手指反射回來的紅外線，並由此時定位歌手的位置，並且同時在透明的屏幕上投影即時影像，透過電腦遠程控制服裝，配合投影變換形態（張仁吉，2014，26-29）。透過全息成像尖端科技將未來性發揮到極致，他為製作影像的多重分身，觀眾得以透過掃描系統與舞台開啟嶄新的連結互動關係。

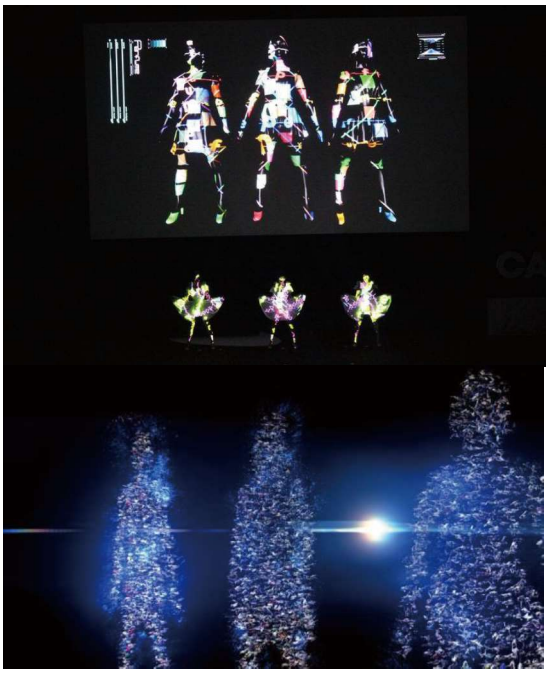

圖2. 真鍋大度,
〔「睡美人」3D掃瞄系統〕, 2013.
圖版來源 ：藝術家網站< http://www.daito.ws/en>
(檢索日期2020/07/25)

3.2.2 運算、網絡與資料庫模式

數位藝術創作蘊涵著資料庫邏輯，讓資料結構、資料流，及其可採取的視覺形式之間產生不可避免的張力。因此，「資料庫」(Big Data)e概念成為數位科技創作中不可避免被談論的觀念，它可以是任何形式的資訊、過濾後的資料集合，或是視覺化的資訊。

透過運算現實數據並且體現藝術計畫中，法國藝術家格雷戈里·夏通斯基（Grégory Chatonsky, 1971-）研究社交媒體的心理效應，觀察討論理想化的身體樣貌與令人羨慕的生活方式，完全基於虛擬構造出不合理的圖像標準。因此，他為了批評這種痴迷和空虛的文化模式，作品〈完美肌膚II〉（Perfect Skin II）【圖3】創造了一張關於美的臉部混合物，他將超過51,000 張在社群軟體上標記美的照片，使用Unity3d設計的軟體程式運算數據圖樣，結果呈現出臉部圖像就像被拉扯般並產生積聚扭曲的肉體。

具體而言，格雷戈里從數據運算中將名人的臉變成了無盡空虛的景觀，選擇將外表曝露於直率的批評之中，將個人的形象視為社交媒體的基準，作品以批判方式展示了如何觀看外在形象，儘管在數位時代中已然成為文化性的空虛表徵。

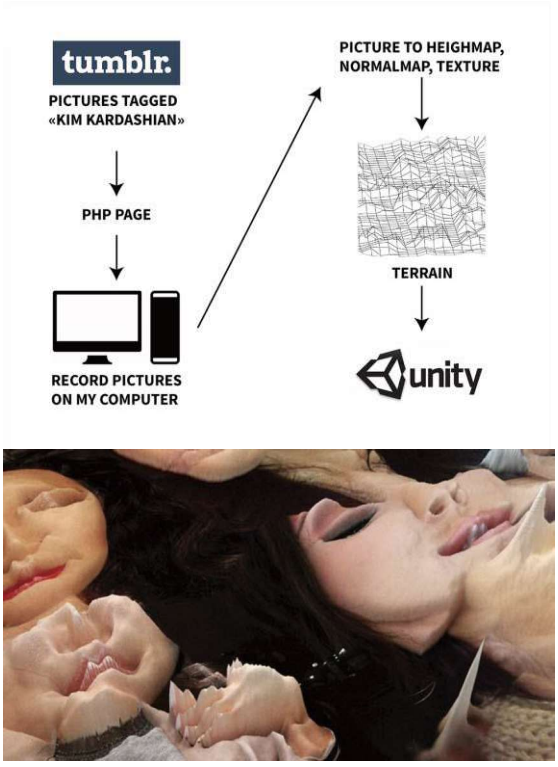

圖3.雷戈里·夏通斯基
〔完美肌膚II Perfect Skin II〕, 2015
圖版來源 ：藝術家網站<http://chatonsky.net/>
(檢索日期2020/08/05)

再者，日本藝術家谷口曉彥（Akihiko Taniguchi, 1983-）透過網路互動方式，作品〈3D瀏覽器（TheBigBrowser 3D）【圖4】將影像呈現巨觀的網路瀏覽器，參與者透過操控谷口曉彥替身瀏覽網頁，彷若漫遊於類似遊戲場景中並且進行探索，透過身體位移呈現出動態錯覺，就如同參與者的身體開始縮小並且被導入動態的網絡世裡，由錯置觀看身體與透過操作感覺某人的身體，因此，主控者在控制瀏覽的過程中感覺到身體的錯覺（邱誌勇，2018）。

對於身體感知與時間意識產生的存有向度，是否已不在現實時序的矩陣之中？尤其當藝術家將時間性概念導入創作之中，身體是否能在自然法則中穿越時間光速，生產出時間媒介流動下的影像流轉？新媒體學者馬克·漢森（Mark B. N. Hansen, 1965-）提出速度與時間性的計時性概念，他指出「身體」猶如是一個計時器（Time Machine）概念，因其生理時鐘的循環，以及時間增長致使其結構產生變化，延伸此觀念把時間概念植入科技儀器之中，從精密的計時器到工業用機械器材，例如廣播、電視、到電腦等，處皆存在著計時速度的概念（Mark b.n. Hansen，2006）。

然而，對於當代社會對於時間與速度的關係定位中，認知模式、世界形象與現實感被迫轉形、進化與變質，尤其是媒體技術的迅速發展，時間與速度促成影像創作將身體感官知覺推向延展領域。藝術創作結合數位技術，使用影像技術搭配裝置技巧，透過圖像即時運算且能快速地利用網路資源分享，因此，由群體間拓展的疆域界線也被無限擴大著。當科技媒介開拓人類的感官知覺，急速地擴展了知識與意識範圍。

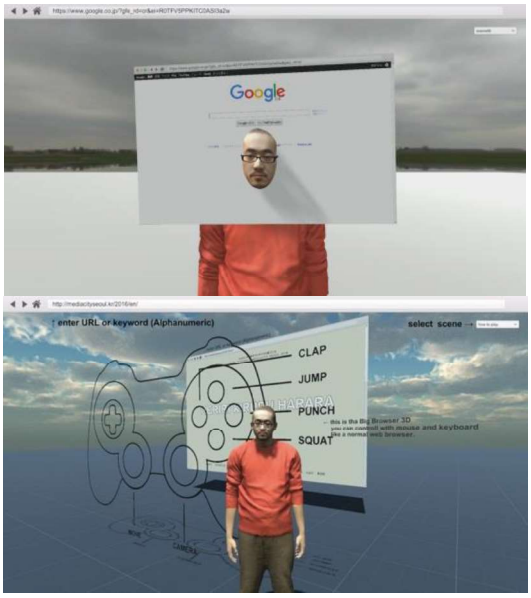

圖 4.谷口曉彥, 〔3D 瀏覽器〕, 2016.
圖版來源 ：藝術家網站< https://okikata.org/>
(檢索日期2020/07/20)

4 數位幻象中的身體轉塑

在理解數位影像生成的編碼過程中，影像不斷地處於變動之中或處於動態變化的狀態，觀者的觀看行為將物質世界與虛擬世界中的影像，透過感知接收而連結一起（邱誌勇，2014，4-5）。運用數位軟體技術讓身體形象與身體形態實施分離途徑，企圖將觀看的經驗奠基於身體感知，並且作為意識主體下的身體向度（Body orientation）。因此，當代數位科技的蓬勃發展下，影像創作透過不同的媒材或技術碰撞，展示性也由固定的場景進入流動的開放場域，藝術家體現多向度的身體概念，透過實驗與合作的過程，呈現出數位科技時代下自我存在的方式。

4.1 虛擬分身的繁衍

科技技術影響了身體議題，亦即是透過科技控制與生產下重構並掌控身體的多面向度，藝術家展現身體意志存在虛擬的空間裡面移動，不再只是被困住的隱藏靈魂，身體影像在透過科技與虛擬空間裡面遊走，觀者看到的影像形態不只是表面的媒介革新而已，它同時更展現出擬仿模式，進而產生幻象的虛實並置關係。

經由上述觀點分析安卓·湯瑪斯·黃（Andrew Thomas Huang）與歌手碧玉（Bjork）合作的作品〈家庭〉（ Family, 2016）【圖5】透過交互式CG模型平台Sketch fab，展示出三顏色屏幕互動VR作品，作品述說關於女性從心碎、癒合到賦權的旅程故事。此作品展現出身體的多向度，影像構成以虛擬實境方式呈現，不僅可以說是將聲音視覺化的結合，並且運用科技界面放大了情感部分，成功突顯出歷經創傷之後的情境感受。

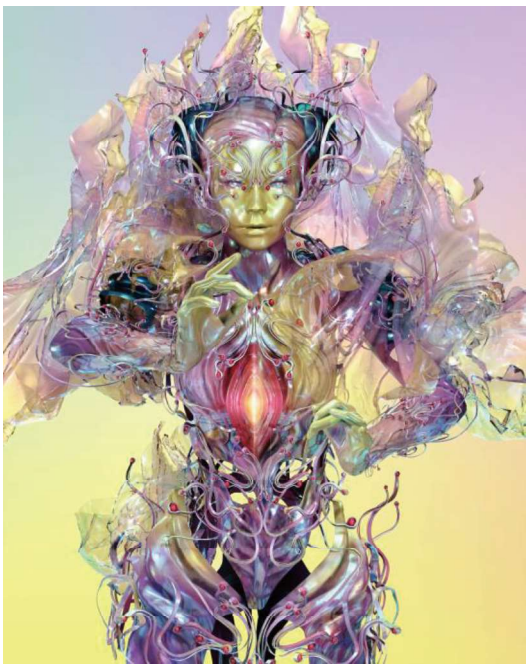

圖 5. 安卓·湯瑪斯·黃,〔家庭〕, 2016.

圖版來源 ：藝術家網站

<http://www.andrewthomashuang.com/ >

(檢索日期2020/08/07)

4.2 擴張性的媒介轉塑

數位影像藝術不斷地透過技術開發與實驗性精神，直接導致不同於傳統形式的表現手法，在電子資訊媒體急速發展下，各種科技媒體研發便於創作者個人化操作運用外，並且展開與科技專業人員的跨領域合作模式。例如美國藝術家霍莉·赫倫登（Holly Herdon, 1980-）則使用 Max / MSP 等編碼軟件，對於身體影像進行電子儀器與軟體程序進行編程。思考數位化的人性技術是她長期以來創作的主軸，將音樂、電視與電話的大量音頻由互聯網介入，電腦關係與通訊軟體 YouTube 和 Skype 等服務不僅影響如何消費聲音，還影響著如何播放，企圖扭曲數位聲音，並且構成令人不安的旋律。

此外，她進了一步挖掘互聯網音頻資源，透過通訊軟體獲取聲音，剪輯成猶如幽靈般的詠嘆調。霍莉的作品〈家〉（Home, 2014）【圖6】反思美國國家安全局（NSA）偵察或駭客竊聽或非法下載，採用數據流和循環式分層（diva-esque）的演唱形式，唱著「我知道你知道我比我更了解我」（I know that you know me better than I know me），重疊聲音搭配影像蜂擁而至的訊息符號。此作品影像由荷蘭設計工作室 Metahaven 所執導，並以 NSA 符號的「數據雨」（data rain）為特色，部分遮蔽了作者的臉部。在變化萬千的背景下，透過觀看凸顯出身分與電腦間的親密關係，實際上卻是探討國家安全局的監視，違反著公眾與私人的關係情況。

圖 6.霍莉·赫倫登, 〔家〕, 2014.

資料來源：網路圖版

<http://www.self-titledmag.com/watch-holly-herndon-home/ > (檢索日期 2020/07/25)

5 結論與建議

本文分析當代影像創作以身體議題作為本文論題，如何透過科技體現出影像媒介的置身處境，思考影像時間下的身體變化，藉由影像媒介串聯探討影像中的身體表徵與行為意

涵，結合時間與空間的相互關係，結合當代科技軟硬體模組裝置促使影像介面作為訊息溝通。因此，科技藝術透過影像敘事傳遞觀念訊息，對於身體議題與其衍伸的概念議題提出回應與詮釋，試圖為人性感官開發新的定義與可能。然而，隨著數位化潮流展現多元化影像的可能性，刺激視覺感官延展身體的界限，其背後的意義不僅反映真實抑或模糊現實，透過交互觀點的檢視下，更能突顯影像藝術的虛擬特質與其發展對話空間。然而，針對思考科技媒體的發展與未來趨勢下，身體的經驗向度成為當代科技藝術探討的辯證議題。因此，在延續探討科技媒體與身體的存有關係下，身體存在與科技體現之間，媒體藝術指向了既非此亦非彼的中界地帶，再將他人與自我的身體存在轉換為科技條件下的存在處境時，透過不同條件的拆解、連結與互動，突顯、反諷出兩者的限制，亦提供與其他互動的可能變樣。（龔卓軍，2004）

因此，透過研究相關身體論述，並考究身體議題作為科技藝術表現的相關作品，試圖拓展影像創作除了時間性因素，是否與身體產生不可切割的聯屬關係，尤其是藝術家以自身身體作為直接性表現當中，產生了以下的轉譯功能與動作：

（一）科技藝術中的身體意涵：身體本身的自發性的力量，透過影像作品中回到身體的感知狀態，兩者之間的矛盾與差異性即形構出多樣面貌。

（二）科技藝術中的身體延展：身體觀念不斷演變即是重新界定身體的空間定義，運用影像媒介與觀眾產生互動與連結，以身體作為觀念的測定器。

（三）科技藝術中的身體表現：運用新的科技媒材與專業知識，擴展身體創作形成複合式的媒體藝術，創作角色也由自身主體操作轉向開放觀者理解模式。

儘管科技體現出不同以往的創作多元特質，促使影像介面作為即時的訊息溝通，影像如何傳遞嶄新的觀念訊息，對於數位時代下的人性感官詮釋出新的定義與可能性。然而，數位化潮流不僅反映真實抑或模糊現實，透過交互觀點的檢視下，科技發展不僅豐富大眾媒體的審美潛力，數位科技如何形構成嶄新的圖像意義，不固定性、流動性與變革性成為當代影像創作特徵，然而，藝術家除了思考媒體技術的構成，面對數位時代的不斷推進，如何跳脫數位科技作為工具的模式思考，而是進入數位科技的情境階段，開拓出屬於當代性的影像創作策略。再者，承接上述觀點，當代媒體的發展的趨勢下，影像創作除了具有模擬的特點，軟體技術產生重置性的編碼剪輯功能外，如何創新變革且超越時空維度，並且與當代數位科技緊密相連，創作者的身體意識主導並反映出數位時代中的媒體理論思維。

因此，數位科技為影像創作技術帶來的不單只是展示性的改變，作為這樣的展示性轉向，影像本身就是一種媒介，從不斷開發新技術發展，通過媒體語言與符號系統建立其美學觀點。數位科技並不因為提供了快速與便捷，如何在影像技術的交替過程中，透過影像發展強化觀者的感官刺激，作為探討虛擬影像的表現類型與創作風格，著重於身體性的經驗發展路徑，進而開拓出區隔性的影像美學。

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台灣數位媒體設計學會 入會申請書

<table>
<tr><td rowspan="4">會員類別</td><td>❶ 個人會員</td><td>會員證編號</td><td rowspan="4">（二吋脫帽彩色照片）</td></tr>
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中文姓名	英文姓名	性別	出生日期
		❶男 ❶女	年 月 日

學 歷		身分證字號
經 歷		
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通訊住址	❶同戶籍住址	

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中華民國審查	年 月 日 申請人： （簽章）
日期 經過	年 月 日 第 屆 第 次理事會議審查：
審查結果	❶通過 ❶不通過 原因：

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Taiwan Association of Digital Media Design

123 University Road, Section 3, Douliou, Yunlin 64002, Taiwan, R.O.C

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International Journal of Digital Media Design

《IJDMD 國際數位媒體設計學刊》

第 13 卷第 1 期徵稿 (call for papers)

台灣數位媒體設計學會出版之 International Journal of Digital Media Design《IJDMD 國際數位媒體設計學刊》第 13 卷第 1 期向各位學會會員徵稿，稿件以隨到隨審為原則，敬請踴躍投稿。

一、IJDMD 國際數位媒體設計學刊經台灣人文及社會科學期刊評比暨核心期刊收錄(申請科技部專題研究計畫學術專業表現有加分)，2018 年經科技部期刊評比通過，收錄於臺灣人文及社會科學引文索引資料庫（Taiwan Citation Index - Humanities and Social Sciences，簡稱 TCI-HSS）。 投稿稿件採國內、外專業學者雙盲審查制(Double-blind Review)，凡有關數位媒體設計之數位媒體、科技藝術、動畫、文化創意等相關議題論文，歡迎中、英文稿件投稿。

二、投稿相關規定及格式請參考臺灣數位媒體設計學會網站(http://www.dmd.org.tw) 左側選單「IJDMD 專區」中下載中、英文格式。

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研究論文

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