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The Exploration of Graphic Design Methods: Case Study on the Science Museum Exhibition for Children*

การสำรวจวิธีการออกแบบกราฟิก: กรณีศึกษาการจัดนิทรรศการพิพิธภัณฑ์วิทยาศาสตร์สำหรับเด็ก

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Abstract

The graphic design is important for the exhibition affecting the perception and motivation of children. Graphics are attractive and appropriate to keep them interested in learning. This research aimed to study the graphic design methods of a science museum exhibition for children, to propose the theory based on the new perspective of graphic design which the most efficient expression to motivate learning of 6 to 9 years old children, and to develop and install the prototype graphics in the temporary exhibition space. The research divided into three phases; the first step is the qualitative research to study the concept design and themes. The researcher used fieldwork case studies analysing of literature by selected 28 exhibitions from 3 countries in different regions and cultures include the United Kingdom, Japan, and Thailand to observe directly and compare the design methods. The analysis methods have been clarified in the table, and descriptive summary already was given. Along with in-depth interviewed with experts who are the key informants and stakeholders in this research. The study results have found that the graphic design of exhibitions in all countries with the consistent in several items such as illustration styles, visual symbols, gestalt, character

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styles, graphic layouts and colours. Among various parameters discussed, the mood and tone vary depending on the exhibit presented, and the role of the graphic is different because of the socio-cultural context of each country. The next phase will be experimental and test the samples to find the graphic design methods that suitable for children and the last stage is design and installation of the prototype graphics in the temporary exhibition space. The conclusion, the study results can be the guide or sources inspiration of further artistic creation and design that is attracting children.

Keywords: graphic design, science museum exhibition, children's learning

บทคัดย่อ

การออกแบบกราฟิกเป็นสิ่งสำคัญสำหรับนิทรรศการที่มีผลต่อการรับรู้และแรงจูงใจของเด็ก กราฟิกที่เหมาะสมและดึงดูดใจจะทำให้เด็กสนใจเรียนรู้ได้ งานวิจัยนี้จึงมีวัตถุประสงค์เพื่อศึกษาวิธีการออกแบบกราฟิกของนิทรรศการในพิพิธภัณฑ์วิทยาศาสตร์สำหรับเด็ก เพื่อนำเสนอทฤษฎีซึ่งเป็นมุมมองใหม่ของการออกแบบกราฟิกที่มีประสิทธิภาพสูงสุดต่อการกระตุ้นการเรียนรู้ของเด็กอายุ 6 ถึง 9 ปี และเพื่อพัฒนาและติดตั้งต้นแบบกราฟิกในพื้นที่จัดนิทรรศการชั่วคราว การวิจัยแบ่งเป็น 3 ขั้นตอน; ขั้นตอนแรกคือการวิจัยเชิงคุณภาพเพื่อศึกษาแนวคิดและรูปแบบ ผู้วิจัยใช้กรณีศึกษาภาคสนามร่วมกับการวิเคราะห์วรรณกรรม คัดเลือกนิทรรศการ 28 เรื่อง จาก 3 ประเทศ ที่มีความแตกต่างด้านภูมิภาคและวัฒนธรรม ได้แก่ สหราชอาณาจักร ญี่ปุ่น และไทย ใช้วิธีสังเกตการณ์โดยตรง แล้ววิเคราะห์เปรียบเทียบวิธีการออกแบบด้วยวิธีแจกแจงในรูปแบบตารางและสรุปผลเชิงพรรณนา รวมถึงการสัมภาษณ์เชิงลึกกับผู้เชี่ยวชาญที่เป็นผู้ให้ข้อมูลสำคัญและผู้มีส่วนได้เสียในการวิจัยครั้งนี้ ผลการศึกษาพบว่าการออกแบบกราฟิกของนิทรรศการในทุกประเทศสอดคล้องกันหลายรายการ เช่น รูปแบบภาพประกอบ สัญลักษณ์ภาพ เกสตอลท์ รูปแบบตัวอักษร การจัดวางกราฟิก และการใช้สี ท่ามกลางตัวแปรต่าง ๆ ทำให้อารมณ์และโทนสีแตกต่างกันไปขึ้นอยู่กับการจัดแสดงที่นำเสนอ บทบาทของกราฟิกมีความแตกต่างเนื่องจากบริบททางสังคมและวัฒนธรรมของแต่ละประเทศ ในขั้นตอนต่อไปจะทำการทดลองและทดสอบตัวอย่างเพื่อหาวิธีการออกแบบกราฟิกที่เหมาะสำหรับเด็ก และขั้นตอนสุดท้ายคือการออกแบบและการติดตั้งกราฟิกต้นแบบในพื้นที่จัดแสดงนิทรรศการชั่วคราว สรุปได้ว่าผลการศึกษาสามารถเป็นแนวทางหรือแหล่งที่มาของแรงบันดาลใจในการสร้างงานศิลปะและการออกแบบที่ดึงดูดความสนใจของเด็ก

คำสำคัญ: การออกแบบกราฟิก, นิทรรศการในพิพิธภัณฑ์วิทยาศาสตร์, การเรียนรู้ของเด็ก

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Introduction

A science museum exhibition is designed to give children the opportunity to learn and to discover a new science experience apart from learning within the school. Graphics are always used in the exhibition to communicate the visual to visitors by synthesising images and complex texts that visitors can quickly recognise, understand easily, and have also worked with other elements to draw a child attention to focus on various objects in the exhibition.

When referring to the children visitors who are just starting to a school-age, they would have the opportunity to acquire knowledge and experience from the exhibition in the science museum. However, children are thinking and experience to recognise different from adults. Even between young children and older children, their ideas are not the same. George E. Hein (1998: 143) states that to classify all young visitors simply as "children" meaning the glossing over vast developmental differences as Jean Piaget's major stages of development all occur within the population labelled as "children." Apparently, the youngest visitors still unable to read are developmentally different than older, elementary school visitors. But these latter, in turn, are quite different from teenagers.

Also, Pam Locker (2011: 47, 121) suggested that children will require a hierarchy of information that is of interest to a range of age groups and learning abilities. Their exhibitions will require specialist design decisions regarding height, size, colour, and use of materials. The age group will dictate their literacy levels and will influence how they engage intellectually. Children require the use of appropriate language, font choices, and images, and tend to respond positively to interactive environments. Similarly, exhibition graphics usage for children would be interactive media whether or not object labels. They need to consider literacy level, child-friendly typefaces, and content as well as engaging imagery.

However, the graphic design is important for the exhibition affecting the perception and motivation of children. They would be the most efficient if are appropriate communicate to children. Therefore, this research aimed to study the graphic design methods of a science museum exhibition for children, to propose the theory based on the new perspective of graphic design which the most efficient expression to motivate learning of 6 to 9 years old children, and to design and install the prototype graphics of the exhibition for 6 to 9 years old children in the temporary exhibition space. These finding would be useful for graphic designers creating artworks that attracting children to learn.

Objectives

1. To study the graphic design methods of a science museum exhibition for children.

2. To propose the theory based on the new perspective of graphic design which the most efficient expression to motivate learning of 6 to 9 years old children.

3. To design and install the prototype graphics of the exhibition for 6 to 9 years old children in the temporary exhibition space.

Methodology

The conceptual research framework involved three main issues including graphic design space, exhibition space, and children's learning approach. This study divided into three phases. Phase I: Exploring fieldwork case studies and interview the experts to study the concept design and themes, Phase II: Experimental procedure and testing the samples to find the graphic design methods, and Phase III: Design and installation of the prototype graphics of the exhibition for children in the temporary exhibition space.

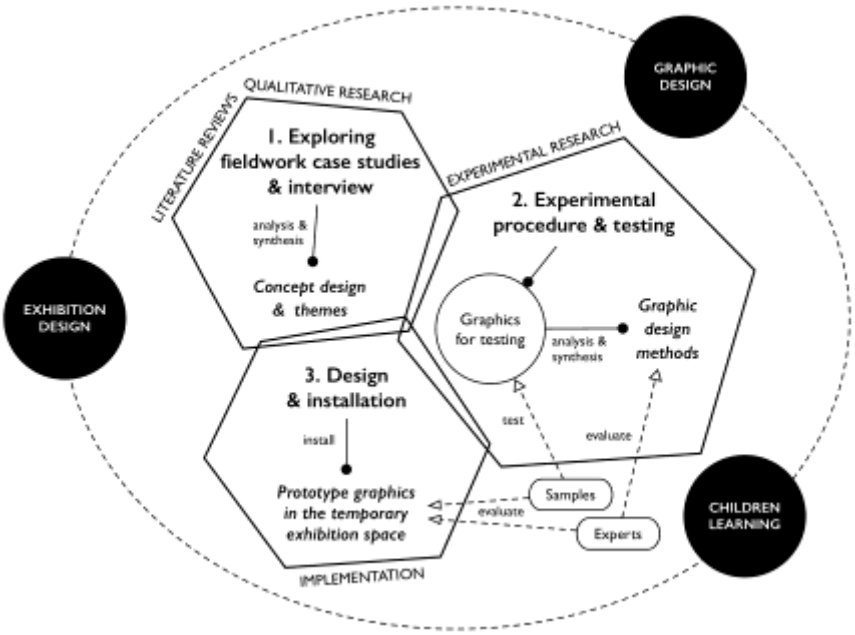

Figure 1: Diagram of the research methodology.

This report describes the study on Phase I. As qualitative research; the researcher observed directly to obtain accurate information and reliability. Then to involve in some events and activities to test the presentation and explained certain behaviours manually, along with in-depth interviewed with experts who are the key informants and stakeholders in this research by using interview schedules, documents, field notes, and taking photos.

The selection criteria of science museum exhibitions, the researcher analysed to classify the categories of science learning courses for Thai students in the elementary school grade one, two, and three; according to the Basic Education Core Curriculum A.D. 2008 (Bureau of Academic Affairs and Educational Standards, 2008). As the result, the science learning is divided into five categories namely Animal & Plant Life, Earth & Environment, Human Life, Science & Technology, and Space & Universe.

After that, the researcher used fieldwork case studies analysing of literature by selected twenty-eight exhibitions from three countries in different regions and cultures include the United Kingdom, Japan, and Thailand. A both the permanent exhibition space and temporary exhibition space that exhibited during the years 2015-2016 and there are a content of science and nature education. The following is the list of exhibitions:

1. Natural History Museum, London, the United Kingdom; four exhibitions are as follows: 1) Dinosaurs, 2) Ecology, 3) Human Biology, and 4) Sensational Butterflies

2. Science Museum London, the United Kingdom; six exhibitions are as follows: 1) Atmosphere, 2) Cravings: Can your food control you?, 3) Exploring Space, 4) Launchpad, 5) Pattern Pod, and 6) Who am I?

3. National Museum of Nature and Science (Kahaku), Tokyo, Japan; four exhibitions are as follows: 1) ComPaSS, 2) Investigation Technology for the Earth, 3) Navigators on the History of Earth, and 4) Origins of Biodiversity

4. National Museum of Emerging Science and Innovation (Miraikan), Tokyo, Japan; five exhibitions are as follows: 1) Curiosity Field, 2) Earth Environment and Me, 3) Songs of Anagura, 4) Stories of One, Everyone, and You, and 5) This is ISS, go ahead

5. Children's Discovery Museum, Bangkok, Thailand; four exhibitions are as follows: 1) Creative Science, 2) Dino Detective, 3) Incredible Me, and 4) Miracle of Life

6. Science Center for Education, Bangkok, Thailand; four exhibitions are as follows: 1) The Blue Planet, 2) Inspired by Astronomy, 3) Kid City, and 4) The Secret of Life

7. National Science Museum, Pathum Thani, Thailand; an exhibition is as follows: 1) Fun Science

The selected exhibitions are consistent with the categories of the science learning that used the selecting specific methods. They are designed to young visitors can visit and also be a popular exhibit for children. The information is provided by the curators and studying the documents. Review of twenty-eight selected exhibitions into five science learning content categories classified in figure 2.

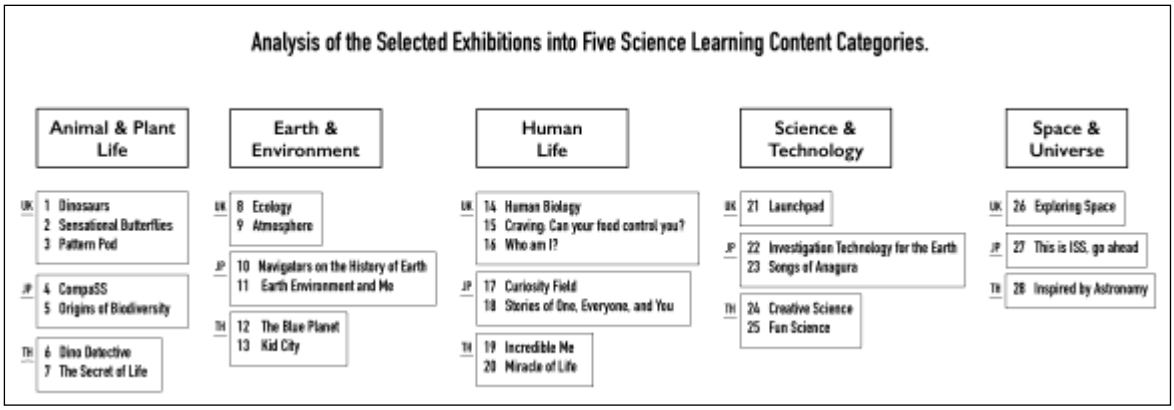

Figure 2: The selected exhibitions into five science learning content categories.

The study conducted the graphic design principles and exhibition design approaches to compare in eleven topics: 1) site and space 2) visual image 3) text 4) layout 5) colour 6) lighting 7) material 8) interactive 9) model 10) sensory perception and 11) mood and tone. The analysis methods clarified in the table, and descriptive summary already was given.

Furthermore, the researcher interviewed the experts in three fields namely science museum, exhibition production, and children learning. Everyone is a stakeholder with this research. The total is seven persons from three organisations including Science Center for Education, Children Discovery Museum, and National Science Museum, Thailand.

Results

The research results of Phase I can be concluded as follows:

1. Site and space; the exhibition separated into three sizes, namely a small-size is less than 200 square metres, a medium-size is 201-500 square metres, and a large-size is more than 500 square metres. The exhibition spaces are in various forms. They are exhibited in rectangular area shape and may be constructed in different ways depending on the exhibits presented. In the same way, they used various devising paths, mostly the areas of affinity that allow visitors to make immediate visual connections between exhibits, compare them directly and follow a thread of exploration from one artefact to another, and secondary is star exhibits

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that visitors enliven the areas around them, and also tend to draw visitors through a gallery and create a sense of expectation throughout the journey.

2. Visual image; the stroke and style of visual images or illustrations; all exhibitions usually used a representation, a silhouette and contour drawing comes as the second. However, a pictograph, exhibitions of the United Kingdom and Japan more used than Thailand. Experts agreed that a representation image should be applied to children while some experts thought different that a silhouette is suitable for children because it helps them to build imagination and creativity. Moreover, mostly exhibitions used cartoons and diagrams to be the visual symbols, consistent with the opinion of experts that a cartoon will be able to attract children attention and a diagram should be the picture chart more than showing only text.

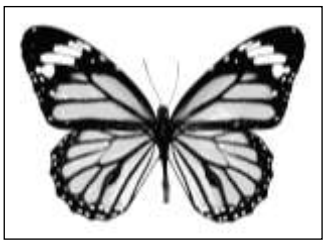

Figure 3: The example of the representation image.

The gestalt principle, mostly exhibitions used the similarity rule that meaning is a similar colour, shape, or size for grouping images. It is consistent with Amy E. Arntson (2007: 80-84) states that "When people see things that are similar, they naturally group them. Grouping by similarity occurs when they see a similar shape, size, colour, spatial location (proximity), angle, or value. All things are in some respects and different in others. In a group of similar shapes and angles, they will notice a dissimilar shape or angle." Also, Rudolf Arnheim (2004: 79) cites that "The same sensible attitude prevails in perception. Comparisons, connections, and separations will not be made between unrelated things, but only when the setup as a whole suggests a sufficient basis. The similarity is a prerequisite for the noticing of differences."

Besides, the core of the image transformation of three countries is the cropping especially a photo. The difference between the British and Thai exhibitions used the image exaggeration. In the Japanese case, they did not use the same technique.

3. Text; the result of using texts, all exhibitions used the sans-serif typeface with the English language. In the case that English is not the national language, they used the bilingual both the national language and English. The case of Thailand, exhibitions mainly used Thai language and the serif typeface with headlines and body texts. The experts agreed that friendly fonts to Thai children should be the serif font. Conventionally correct Thai character

writing is required have a head, and then children are familiar with the character's head when they learned in the school. Besides, the exhibition for children is popularity to use the handwriting font the title and section or zone that made for young sense and casual.

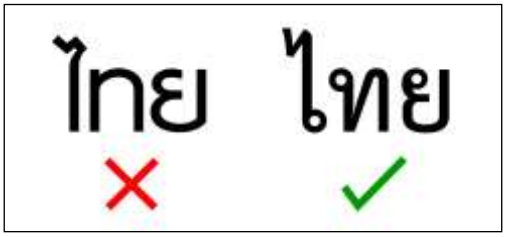

Figure 4: The example of the correct Thai character's writing.

Types of character, all exhibitions used a regular and bold character, while some of them also used an extra bold character to highlight the distinct texts on the title label and section or group label. Moreover, the British and Japanese exhibitions mainly used one or two typefaces In the case of the Thai exhibitions, and several typefaces are usage. The typeface structure exhibits mostly arranged horizontally, but the Japanese exhibitions arranged their quote text vertically.

When analysing the amount of content, the experts commented that contents of Thai exhibitions defined by the scholar which to be a lot of data because of Thai education culture. Also, Thai education system forced many academic contents to children. The amount of content would affect the layout directly.

4. **Layout;** exhibitions mainly used four levels of text hierarchically. Level 1 used for titles, headlines, quotations, and introductory text. Level 2 used for general overviews on introduction panel to specific themes or sections of the exhibition. Level 3 used for exhibit contents as well as primary text on labels and multimedia or interactive devices. And level 4 used for exhibition content-label and caption text. In spite of Thai exhibitions also used four levels of text but each level used many typefaces and font sizes. However, exhibitions that designed primarily for children still used two or three levels of text and did not be several fonts consistent with the experts' opinion that the text for children should limit to two to three levels and should have it on title and section or group label only because children do not read any message.

Labels, panels and signs of all exhibitions have installed the title label and mainly have had the introductory or orientation label and identification label. In the case that the exhibition separated the section or zone, the section or group label would be used. The difference is several Thai exhibitions have installed prohibitive signs and some temporary

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prohibitive signs made by curators, while the other countries are quite less to appear. Experts are the further opinion that Thai children behaviours especially young children who visited with their parents. Some hands-on objects in the exhibition were damaged quickly as the result of their parents did not provide them with cognitive before to play objects, so it was the cause that the museum stuck prohibitive signs at various points. It became to echoes of some parents that blocked their children's learning. Also, Thai children have lacked the freedom to learn because the education system has emphasised memorization rather than critical thinking and creativity. So, Thai children have been freedom to learn in the museum less than children in other countries.

The graphic layouts, all exhibitions usually used the asymmetry composition similarly because this method makes them look casual. Also, the scale relationships between text and images on a label and a panel found that the proportional of images rather than text, but it depends on the amount of content.

5. **Colour;** the colour of the graphic element namely text, image, background, and pattern found that the text in the exhibition was mainly in light or dark colour, but images were in vivid colour. Backgrounds were in light, dark, and vivid colour and they also were in contrast to the text. Each exhibition used the different colour of patterns but rather less to appear. According to the experts' opinion, a visual image is suitable for children should have with vivid colour. The exhibition needs the light text colour in dark or vivid background or reversal.

Figure 5: The example of the vivid colour image.

6. Lighting; the closed exhibition space installed lighting including the spotlight, wall-wash lighting, contour spotlight, and ambient lighting that to build an atmosphere and illuminated an object, label, and panel, some of them installed the coloured lighting. In contrast, the open exhibition space used a natural lighting.

7. Material; all exhibitions used the graphics on ink-jet printed to mount on panels and labels are made of the plastic, acrylic, plywood, and fibreboard. Experts stated that the ink-jet printed materials are the lowest cost and easily adjusted, suitable primarily for the

temporary exhibition. In the Thai case, permanent exhibitions mainly used the ink-jet printed mounted on plywoods or fibreboards but several damaged that due to materials deteriorated from the long term use.

8. Interactive; the most exhibitions are the hands-on type; visitors could explore experience by touching and used the interactive media namely touch-screen computer, VDO, and electro-mechanical to interact with them. It is consistent with the experts' opinion the exhibitions are designed for children mainly to encourage children the new experiment. And also they used the device function as the instruction media replacing the static text on panels because children need not read the message but those media will cause to gain knowledge and fun at the same time.

9. Model; touchable model is the most popular be usage in exhibitions, and the naturalistic model comes as the second. The current experts' opinion is that a visitor can touch on explores the model closely, the old fashion of "please don't touch" is outdated. This method is effective for children that can attract the attention of children as well because they like to touch objects. The significant, safety precaution for visitors must be considered whether the objects on display, experimental player, interactive media, interior design, and decoration, etc. These must be safe and do no harm to visitors.

10. Sensory perception; the perception of visitors to the exhibition including the visual, auditory, and tactile senses was usage. Some case visitors could use the smell sense to perceive, but the taste sense did not be usage. Also, the experts' opinion is that the exhibition would avoid the exposure of children to taste because to the concern health problem possible impression.

11. **Mood and tone;** referring to Shigenobu Kobayashi's Colour Image Scale theory (1990: 12-13) can be applied to classify overall mood and tone of exhibitions. The results found that each exhibition had different mood and tone depending on its content. The British exhibitions mainly designed to make the enjoyable casual image (warm-soft). The Japanese exhibitions used several mood and tone such as enjoyable casual image (warm-soft), youthful cool-casual image (cool-soft), and artistic-tasteful chic image (cool-soft). Thai exhibitions mainly designed to make the vigorous dynamic image (warm-hard), and enjoyable casual image (warm-soft) comes second.

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In the case of exhibitions that designed for children only such as Pattern Pod in the United Kingdom, ComPass in Japan, finally Kid City and Fun Science in Thailand found that the core mood and tone have make the enjoyable casual image (warm-soft) corresponding all countries, according to the experts' opinion as well.

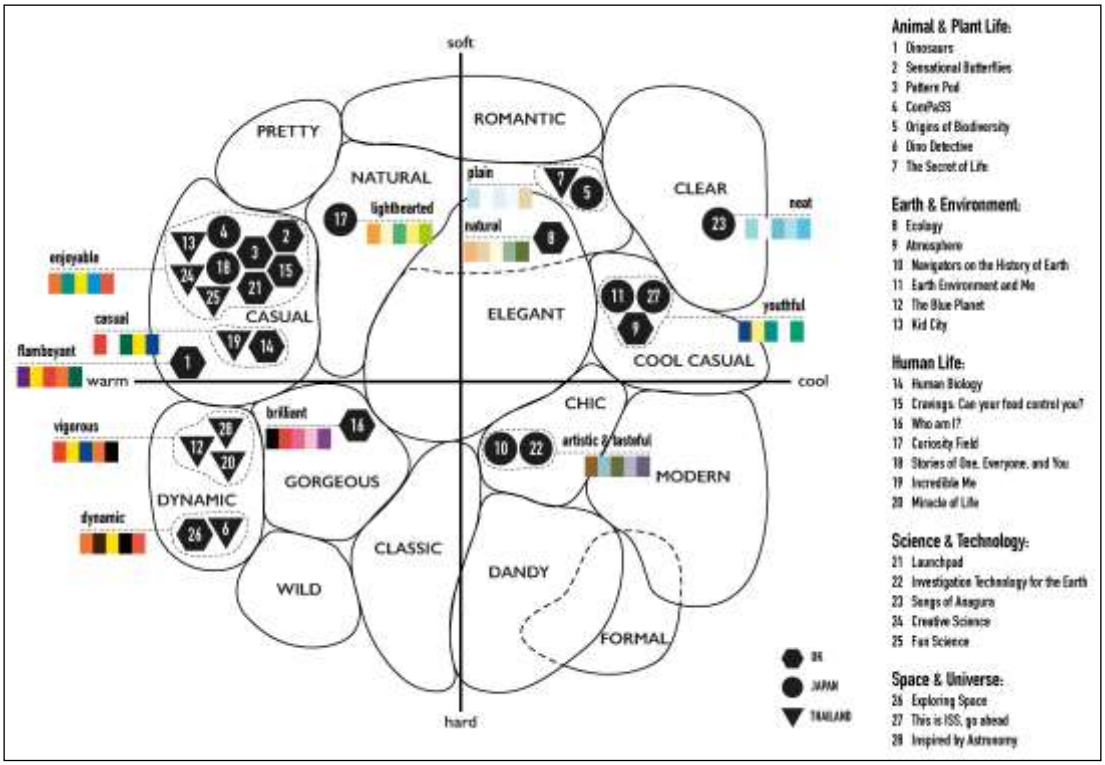

Figure 6: Analyse overall mood and tone of exhibitions.

Discussion

The difference between the United Kingdom, Japan and Thailand, graphics for the exhibition of all countries are as an instructional media, but the role of graphics is different. In the case of the United Kingdom, graphics are served as the information to communicate the content of the object to display such as a history, a scientific principle, etc. While Japan, graphics are served as the narrative and the exhibition would have a story theme. Graphics would be use as a media to visualise the story and to build the atmosphere which surrounded visitors. Nonetheless, the case of Thailand, graphics are also served as the information, but they could not communicate well enough because of a lot of contents on the panel.

Thai children have less freedom than the British and Japanese children as the education system. The British education system is designed to support children learning freely such as a course has the homeroom class offered to them that need to learn anything.

Meanwhile, the Japanese education system has focused on the creative learning such as a folding art is called “Origami” to be a subject in the course that children required knowledge, it has pushed them can be analysed brilliantly, intelligent and creative. So, both the British and Japanese exhibitions are designed to encourage children learning independently, and they have the learning media stimulate a child's creativity.

The issue of the art and design culture, the United Kingdom is a country with the concept of modern art. The exhibition designers have focused on design regard to the corporate identity. Notice the use of typefaces in the exhibition is consistent with the organization's logo. The mention of Japan, a country with the highly nationalistic and also highly progress in science and technology. Various designs have reflected the Japanese style. They are proficient in creating that conscious about saving space. Thus, the exhibition is organized mainly in a small-size and medium-size space used the creativity to present the content to quickly understanding in a short time and could maintain their Japanese style as well which is evident from the Japanese is the primary language in the presentation of the exhibition.

Thailand has given the cultural influence of Western countries and international cultural leaders of Asia such as Japan and Korea. The graphic design of the exhibition usually uses the cute cartoon character and internationalization could appeal to children better. Simultaneously, showing the national identity could be done because the Thai language is the national language which Thai people use essentially, so the exhibition is also required to present the contents in Thai. In term of the exhibition for Thai children should design such as a title label and section or group label with a few texts in large-size typeface and may show description with a cartoon character and picture diagram on the advice of experts.

Science museum exhibitions mainly have been focusing on the school-age target. However, their purposes allow children to experience by spontaneous playing, while adults still need the formal information such as teacher and parent read messages on the label and panel for suggesting children to learn and know how to play. Children are not interested in the detail of content on the label and panel. They are only interested in playing everything which can be touch.

The design concept of the exhibition for children is touching and safety. The exhibition should be installed with the object, mechanic, and interactive media that focusing on the visitor’s experience and also be considered the safety. Graphics for the exhibition served as the information and narrative. Simultaneously, the graphic design should make

visitors perceive to touch and safe such as to use the bright and vivid colour visual attracting visitors to contact, the rounded typeface to make the sense of safety, etc. Moreover, graphics should be able to create a learning atmosphere with mood and tone to illustrate comfortable, informal, and colourful image to stimulate imagination and creativity to children.

Conclusion

The study results indicated that the graphic design methods of exhibitions in all countries with the consistent in several items such as illustration styles, visual symbols, gestalt, graphic layouts, character types, and graphic colours. Among various parameters discussed, the mood and tone vary depending on the exhibit presented, and the role of graphics is different because of the socio-cultural context of each country.

A good exhibition design that includes:

1. The content is appropriate for visitor's learning ability. Learning materials such as real model, simulated model, and interactive media for the visitor can learn from exposure experiments. Beautiful graphics and engaging content to help viewers get to know and understand quickly.

2. The text is a concise thematic material with the national language by the character and placement of the correct language.

3. Construction and decoration exhibition tones create an atmosphere to the material presented. The objects positioning and devising paths viewers learn the content in its entirety and meet the objective of the presentation. Inclusive of lighting illuminated with a message on the panel and backlight to create an atmosphere to the place.

The graphic design of an exhibition for children, the designer, needs to know what the different artistic style between children and adults, studies the physical and intellectual development of children, learning behaviour, and their satisfaction. The designer must act to transform these data into easily visual communication to make children understanding and motivating them to learn.

In the next two phases, there will be the experimental procedure and test the samples to find the graphic design methods that suitable for 6 to 9 years old children and the last step to design and install the prototype graphics in the temporary exhibition space. The conclusion can be drawn that the study result is serving as guide or sources inspiration of further artistic creation and design that attracting children.

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