งานวิจัยเชิงสร้างสรรค์ผ่านผลงานภาพประกอบเพื่อกระตุ้นการอนุรักษ์ป่าและธรรมชาติอย่างยั่งยืนในโลกยุคปัจจุบัน[1]

received 25 NOV 2019 **revised** 13 FEB 2020 **accepted** 21 APR 2020

ไพลิน ถาวรวิจิตร
สาขาศิลปะการออกแบบ (นานาชาติ)
คณะมัณฑนศิลป์ มหาวิทยาลัยศิลปากร

นิโคล แวร์ฏ
รองศาสตราจารย์ ประธานหลักสูตรดีไซน์
มหาวิทยาลัยสวินเบิร์น ประเทศออสเตรเลีย

บทคัดย่อ

ความก้าวหน้าทางเทคโนโลยีส่งผลให้ความสัมพันธ์ระหว่างมนุษย์ และธรรมชาติมีความห่างไกลกันออกไปมากขึ้น จุดมุ่งหมายของงานวิจัยชิ้นนี้ คือ การสร้างสรรค์ความเชื่อมโยงใหม่ระหว่างมนุษย์ และธรรมชาติ รวมถึงการกระตุ้นให้เกิดการแลกเปลี่ยนความเห็นเกี่ยวกับการอนุรักษ์ป่าอย่างยั่งยืนในบริบทของสังคมยุคปัจจุบัน งานวิจัยฉบับนี้ได้นำกระบวนการคิดเชิงภาพประกอบ (Illustrative) และการเล่าเรื่องผ่านภาพ (Visual Narrative) ควบคู่กับงานออกแบบภาพประกอบ และการใช้เทคโนโลยีงานโมชั่นกราฟิก (Motion Graphics) สู่การสื่อสารเรื่องราวเกี่ยวกับป่า และการทำลายป่า โครงสร้างด้านการจัดทำภาพประกอบเป็นผลจากการทดลองโดยการใช้ระบบสัดส่วนทองคำ (Proportional systems of the Fibonacci sequence) และระบบลินเดินไมเยอร์ (L-system) ควบคู่กับการวิเคราะห์ด้วยสายตาอย่างกว้างขวาง เพื่อใช้สำหรับการวิเคราะห์ใบไม้รูปแบบต่าง ๆ ในพื้นที่อุทยานแห่งชาติเขาน้ำค้าง ประเทศไทย ผลการวิเคราะห์ได้นำไปสู่การจัดลำดับ ซึ่งสามารถใช้สื่อสารในรูปแบบพรรณนาเพื่อแสดงให้เห็นถึงวิวัฒนาการ และความสามารถในการปรับตัวของธรรมชาติเพื่อเอาชนะความท้าทายอันเป็นผลมาจากการแทรกแซงของมนุษย์ อุทกภัย และความเสื่อมโทรม

งานวิจัยฉบับนี้มีวัตถุประสงค์เพื่อศึกษา และสำรวจความงามของธรรมชาติ โดยดำเนินงานวิจัยผ่านกระบวนการปรับใช้หลักทัศนธาตุ (Visual Element) ของใบไม้ร่วมกับการใช้ทฤษฎีสัดส่วนทองคำ (Fibonacci Sequence) ผนวกกับองค์ความรู้เรื่องการจำลองการเจริญเติบโตของพืช หรือระบบลินเดินไมเยอร์ (L-System) แม้ว่า “ใบไม้” อาจเป็นเพียงองค์ประกอบขนาดเล็กในธรรมชาติ หากแต่ใบไม้เหล่านี้เป็นสิ่งเชื่อมโยงและเป็นตัวแทนต้นไม้ในป่าได้เป็นอย่างดี นอกจากนี้ ใบไม้ยังเป็นสิ่งแสดงถึงจักรวาลระดับจุลชีวะของชีวิต และความงามในธรรมชาติ รวมทั้งสามารถบอกเล่าเรื่องราวเกี่ยวกับสภาวะโลกร้อน รวมถึงการเปลี่ยนแปลงของฤดูกาลและระบบนิเวศ ทัศนธาตุหรือองค์ประกอบทางศิลปะที่ปรากฏบนใบไม้เป็นสิ่งแสดงถึงการหล่อเลี้ยง และเติบโตในธรรมชาติ

[1] บทความวิจัยนี้เป็นส่วนหนึ่งของรายงานวิจัย เรื่อง “Exploring Visual Elements Through Natural Resources: Forest, Tree and Leaf at Khao Nam Khang National Park, Thailand” โดยได้รับทุนสนับสนุนการวิจัย จากโครงการปริญญาเอกกาญจนาภิเษก ประจำปี 2017 ดำเนินการวิจัยแล้วเสร็จปี 2020

เอกชาติ จันอุไรรัตน์
ศาสตราจารย์ ประธานหลักสูตรศิลปะการออกแบบ
ปรัชญาดุษฎีบัณฑิต (นานาชาติ)
คณะมัณฑนศิลป์ มหาวิทยาลัยศิลปากร

ทั้งนี้ วัตถุประสงค์ของงานวิจัยฉบับนี้เป็นไปเพื่อการเก็บรวบรวมข้อมูลจากองค์ประกอบทางศิลปะที่ปรากฏบนใบไม้ เช่น รูปร่าง รูปทรง สี และเส้นใยหล่อเลี้ยงใบ สู่การถอดรหัสธรรมชาติ และเพื่อใช้สำหรับการออกแบบระบบการสื่อความหมายด้วยภาพ (Visual Communication) ยิ่งไปกว่านั้น องค์ประกอบทั้งหมดที่ปรากฏบนใบไม้สามารถพัฒนาต่อยอด และประยุกต์ใช้กับงานออกแบบในหลายสาขา อาจกล่าวได้ว่าอีกหนึ่งวัตถุประสงค์ของงานวิจัยเป็นไปเพื่อรวบรวมข้อมูลสำหรับใช้เป็นแนวทางการศึกษาผ่านการบอกเล่าเรื่องราวในงานภาพประกอบ เพื่อให้ศิลปิน นักออกแบบ และนักวิจัยสามารถต่อยอดองค์ความรู้ และสร้างสรรค์ผลงานที่ก่อให้เกิดความตระหนักรู้ ในเรื่องของการเปลี่ยนแปลงของสภาพอากาศ สภาวะโลกร้อน และคุณค่าของผืนป่าเผยแพร่สู่สังคมต่อไปได้

คำสำคัญ: ภาพประกอบ, ภาพเคลื่อนไหว, ใบไม้, สัดส่วนทองคำ, ภาวะโลกรวน

Using illustration to stimulate discussion about forest conservation and sustainability in contemporary society[2]

Pailin Thawornwijit
Ph.D. Candidate, Ph.D Design Art
(International Program)
Decorative Arts Faculty,
Silpakorn University

Nicole Wragg
Associate Professor,
Chair, Communication Design and Digital
Media Design, School of Design,
Swinburne University of Technology, Australia

Abstract

Technological advancements apparently affect the relationship between humans and nature that their interaction seems to become more distant. The objective of this research is to create new connections between people and nature to stimulate a wider discussion about forest conservation and sustainability in the contemporary society. The research uses illustrative methods and visual narrative then combining them with illustration and motion graphics to communicate via written story about forests and deforestation. The underpinned illustration structure is derived from experimentation with proportional systems of the Fibonacci sequence and the L-system, alongside with extensive visual analysis of leaves from Khao Nam Khang National Park, Thailand. The study results in a sequence that demonstrates a narrative communication on how nature can evolve and adapt to overcome challenges from human intervention, flood and decay.

Aiming to explore the beauty of nature, the research has applied visual elements from “Leaf” together with fundamental of L-system and Fibonacci theory. Although “Leaf” is only a small element, it can represent trees in the forest. It also demonstrates a small universe about life and beauty. Furthermore, leaf is able to tell us about climate change, seasons and ecology. In other words, visual elements, occurred in leaves, are able to tell us about life nourishing and growing.

[2] The research article is part of “Exploring Visual Elements Through Natural Resources: Forest, Tree and Leaf at Khao Nam Khang National Park, Thailand” by granted from The Royal Golden Jubilee (RGJ) in 2017 and will complete in 2020

Eakachat Joneurairatana
Professor, Chair of Ph.D. Design Arts
(International Program)
Decorative Arts Faculty,
Silpakorn University

The purpose of this research is to collect data from leaf which composes of visual elements such as shape, form, color and vein's pattern to decode and use in visual communication design system. It was found out that all elements showed on leaf can be developed and applied in many design fields. Referring to the purposes of the research, it is expected that designers can employ the assembled data collection and use it to provoke public concern and awareness about climate change as well as forest benefit through storytelling.

Key words: Illustration, Motion Graphic, Leaf, Fibonacci, Climate Change

1. Introduction

At the beginning of the research, the researcher picked topics regarding climate change and deforestation. Both topics were presented through Practice Base research which was an experiment utilizing Fibonacci and L-system theories. It was long known that the theories are directly related to nature and surrounding environment and experiments in the research had tried to reach for further knowledge in both designing and educating. As a result, it could be considered as guideline for the interested visual communication designers and motion graphic designers, who share their roles in research presentation. Due to technology's advancement, it inevitably shares a part of our lives. In fact, we should realize that technology is something irresistible and we could not avoid or omit it. Therefore, learning how to cooperate and combine technology with nature study seems to be more challenging for new researches.

The researcher also hopes that this research should be able to guide the way and further study for other researchers, designers, artists including students.

According to the research objectives, they attempted to bring the significant element of nature out by studying and analyzing visual element from leaves in order to apply in art and design area. Furthermore, the researcher also tries to do the experiment on Fibonacci theory and L-system as to create visual communication design. It is expected that the designed illustration will be able to assemble awareness about forest conservation and climate change to the society.

At the very first step, the research directly came from personal interests of the researcher about ecosystem in Khao Nam khang National Park, Nathawi District, Songkhla Province. It is a fertile forest with high diversity of flora and fauna. With that reason, the researcher had selected the rainforest as study area and collected leaves samples for natural decoding process. The decoded leaves would be considered as one composition of art namely pattern, color, shape, surface and pattern because people in general do not usually pay much attention to them, however, leaves are the representative of trees, trees are the representative of forest and forest is the representative of nature. As a metaphor, leaves can be compared as a forest magnifying glass while leaf veins and structures are linked to the connection between leaves and forest area. These linkages not only show the miracle of nature, but they also link to the current situation in our planet, Climate change and natural disaster. The researcher has expected to forward the hidden message about awareness and natural conservation among this contemporary society.

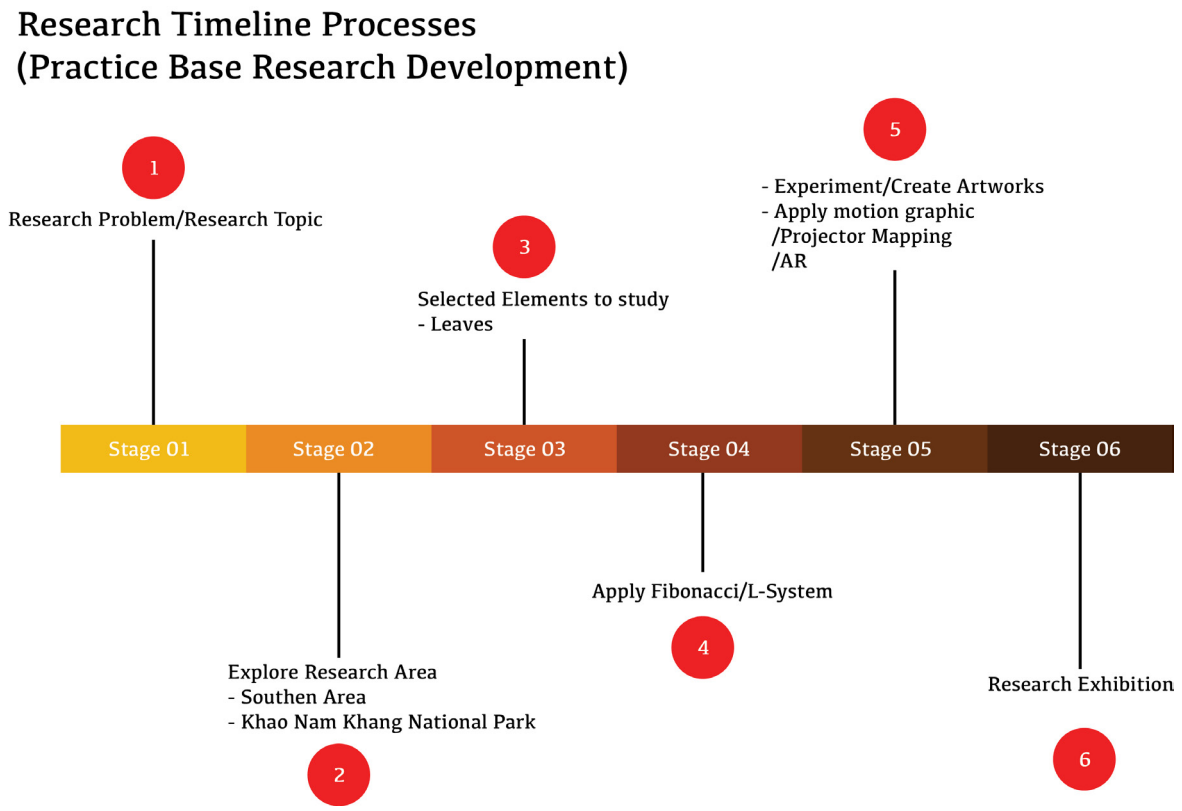

Figure 1: The picture shows research timeline in all processes.
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2. Forests and deforestation

When we think about a forest, we might imagine a quiet, cool, shady place of tall trees, with colours of green, orange, yellow and brown, home to mostly hidden plants, birds, animals and small insects. When we walk through the forest, we smell the fresh air, hear the insect and bird's sounds combining with the sound of a waterfall; we sit on a rock and observe the plants and soil littered with fallen leaves. We realise how small we are in the scheme of things and how trees can heal our soul and calm our minds.

It has been long known that forests provide us with food and shelter for thousands of years. Many studies also noted that forests are accounted for 20% of total income among rural household in developing countries. Furthermore, they play significant role in supplying human with valuable ecosystem services, oxygen, absorbing carbon dioxide and removing particular matter from the air.

Despite the importance of forests to the physical and psychological well-being of humans and all other living creatures, deforestation continues apace worldwide. According to the World Bank, between 1990 and 2016, the world lost 1.3 million square kilometers of forest, an area larger than that of the Republic of South Africa (Tariq & Mahyar 2019). Agriculture is the main driver of deforestation. In Indonesia and Malaysia, deforestation occurs to make way for production of palm oil; in the Amazon, there is a huge fire this year. Following from National Institute for Space Research (INPE 1971) found 87,000 forest files rising rapidly since 2010 until this year forest fires seems continually high.

It was shocking that 1,000 football fields is the amount lost forest area per hour throughout the world during 1990 – 2015 (Tariq & Mahyar 2019).

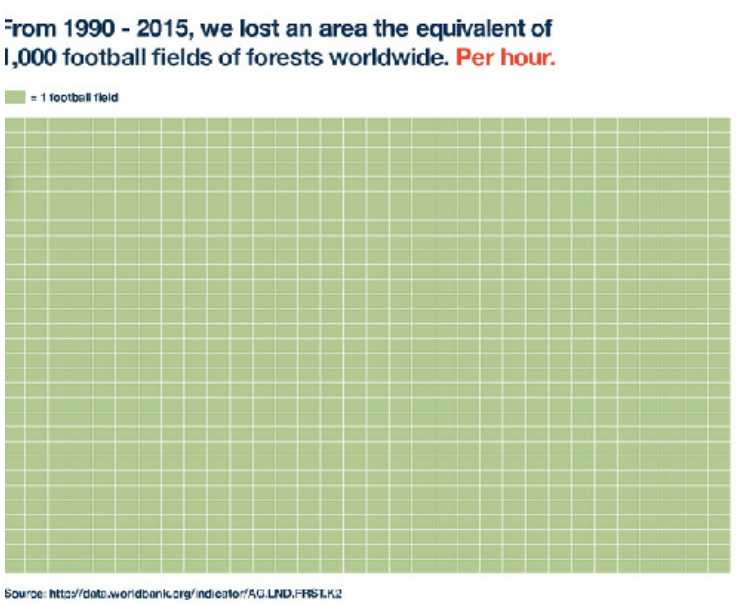


Figure 2: The picture shows the forest area where equivalent of 1,000 football fields.
(source: World Bank 2015, online)

Urbanisation is a relatively minor but still significant factor in deforestation. As cities grow, forests recede. Forests and urban living are becoming increasingly separate as civilisation and technology come to dominate human life.

The sound of car horns, trains passing, people shouting; these are sounds we hear in everyday life in big cities. We smell car exhaust and cigarette smoke. These are familiar elements of the city that make our lives stressful and unhealthy but are not the primary reasons why many city people are becoming concerned about the state of the natural world and working to preserve it. People are beginning to realise the significance of forests to our lives due to the increasingly dire effects of climate change such as flooding, bushfires, extreme storms and drought.

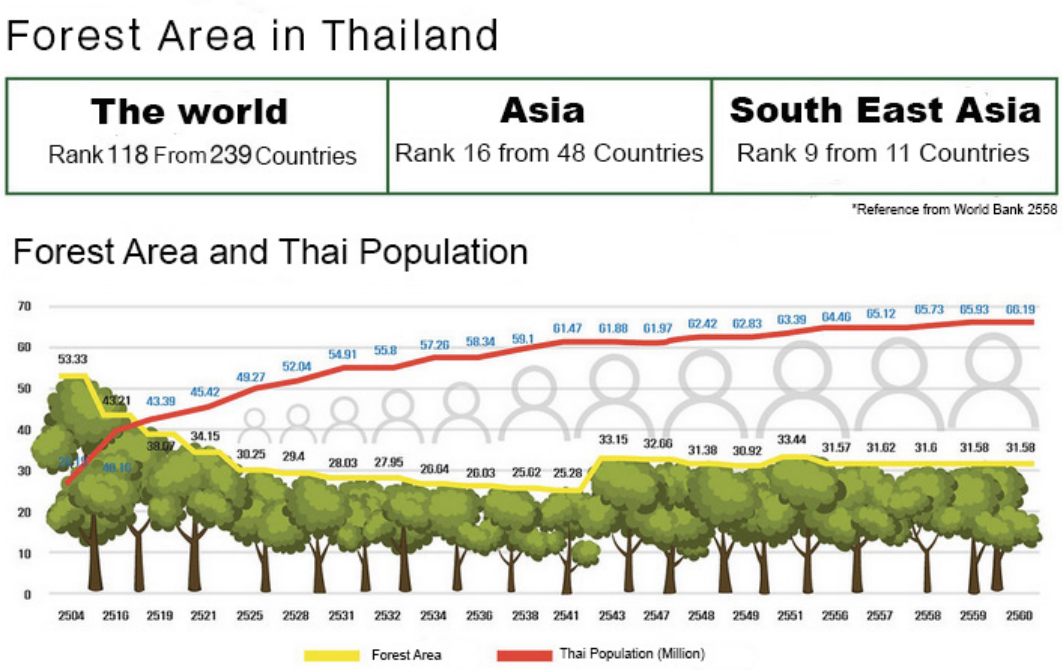


Figure 3: The comparison of forest areas and Thai population from 2504 – 2560 (source: World Bank 2015, online)

About the deforestation situation in Thailand, following the report from Sueb Nakhasathien Foundation, it shows information about the number of forests compared with population. The diagram was used to illustrate the population rapidly growing up while the number of forests slightly dropped. The issues which effect the smaller number of forests come from the expanding of city, agriculture and manufacture industry (Seub Nakhasathien Foundation 2018).

There is still hope for the preservation of forests. Also, the Paris Agreement of 2016, within the United Nations Framework Convention on Climate Change, includes goals related to the forest conservation and decreasing deforestation as part of action to limit harmful climate change (Yard 2019).

In this article, we describe our use of illustrative methods and visual narrative to explore ways to create new connections between people and nature and stimulate a wider discussion about the conservation and sustainability of forests in contemporary society.

3. Climate Change issue

Nowadays, it could be said that the climate change situation is not getting do any better. It is getting worse all over the world. In 2019, Amazon rainforest, the biggest lung for mankind, was ravaged by thousands of fires. The number of forests had a shape decrease after that incident. Referring to the official figures, it stated that there were over 87,000 forest fires solely in Brazil during the first eight months of 2019. That was the highest number since 2010. Comparing to the same region in 2018, the rainforest was estimated to have 49,000 fires. Moreover, NASA and Brazil's Instituto Nacional de Pesquisas Espaciais (INPE 1971) had noted in the fire statistic of the Amazon rainforest that 2019 was the most active year of the forest fire. (The Visual and Data Journalism Team 2019)

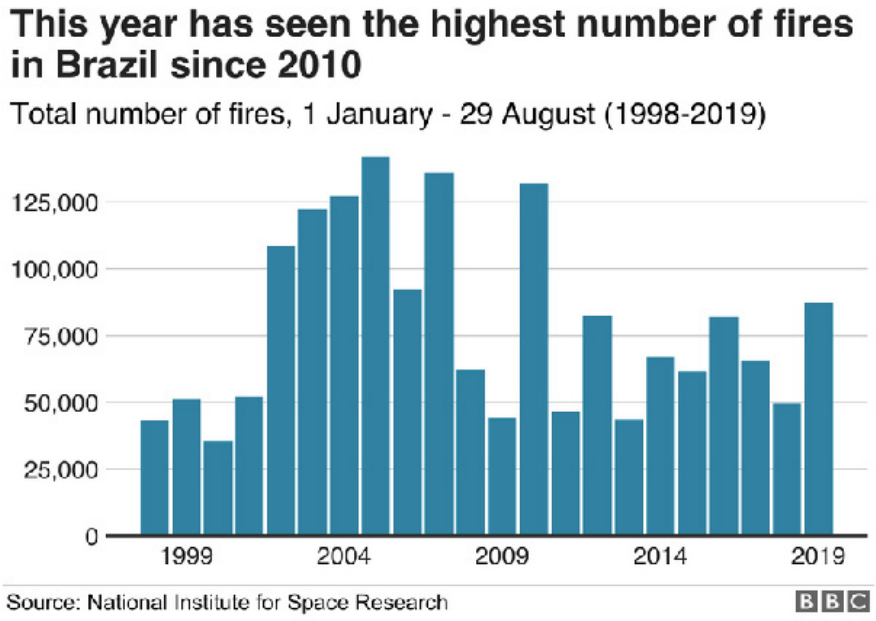


Figure 4: The picture shows number of fires in Brazil between 1998 – 2019 (source: National Institute for Space Research 2019, online)

3.1 How Amazon bushfires impact environment

Smoke and haze from bushfire phenomenon spread and covered Brazil and across other countries. Furthermore, carbon monoxide emission and non-methane organic compounds were released into the atmosphere and environment. It was said that carbon dioxide caused the planet to heat up while greenhouse gases had been increasing. Both gases had brought about higher average global temperature as well as climate change. The threatening circle was so dangerous that it affected nature and destroyed rain forests.

During the Amazon fire incident, dust clouds, blowing from the Amazon jungle, had filled up the sky in São Paulo with particulate matter. Foster Brown, an atmospheric geochemist at the Woods Hole Research Center in Massachusetts, said the high PM 2.5 levels (the smallest particulate matter capable of causing severe health problems while caught in airways) stayed at the highest levels. (Cardona 2019)

In addition, the bushfire also affected biodiversity including agriculture and livestock operations in the affected areas because some animal species have low mobility such as turtles, lizards and insect. Under the same circumstance of fauna, we lost many kinds of trees as more as carbon dioxide was emitted into the atmosphere. The increasing deforestation and the number of fires should not be seen in isolation from what might happen in the future Amazon.

Figure 5: Winds carry ash to Brazilian cities far from the Amazon.
(source: NASA EOSDIS/LANCE 2019, online)

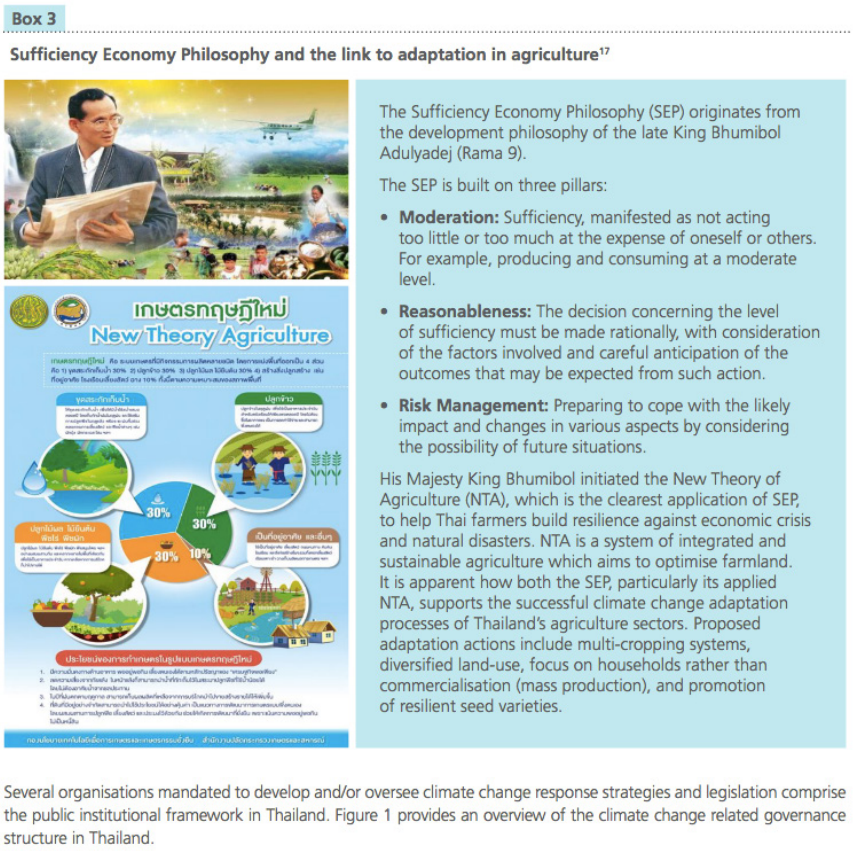
Results of deforestation has affected the overall world temperature as it is the cause of natural disasters such as flooding, landslides and damaged agricultural crops.

According to United Nations Climate Action Summit (UN 2019) in New York. President Donald Trump met with the youngest protestor Greta Thunberg who built up environment protests. Thunberg has asked for cooperation from young people around the world. She also criticized the restricted expectations at the summit, claiming that none of the countries' proposals are in line with the rate of reduction necessary to restrict warming to 1.5 degrees Celsius. The more ambitious goal of the Paris Climate Agreement. Countries like Germany have suggested that a reduction in coal reliance, the introduction of more renewable energy and support for warming adaptation. However, Thunberg said that they don't move the needle far enough and fast enough when compared to the rate of global warming and climate change. The movement occurs all over the world to protest and evoke government concern about climate change issue. (Umair 2019)

In addition, the information from United Nations Development Programme (United Nations Development Programme : UNDP 2019) has regarded that climate change effects happen in many countries around the world includeThailand. Climate change has direct impact on Thailand's food export and agricultural products, which is one of the country's main sources of income. (United Nations Development Programme : UNDP 2019)

3.2 SEP Philosophy

We all know that agriculture is the main source of income for poor farmers in the country. Therefore, climate change has tremendous impact on individual farmer and has exacerbated the issue of poverty. Fortunately, the late King Bhumibol Adulyadej (King Rama the 9th) established the philosophy called 'The Sufficiency Economy Philosophy (SEP)' to help and support people.



Box 3

Sufficiency Economy Philosophy and the link to adaptation in agriculture[17]

The Sufficiency Economy Philosophy (SEP) originates from the development philosophy of the late King Bhumibol Adulyadej (Rama 9).

The SEP is built on three pillars:

- **Moderation:** Sufficiency, manifested as not acting too little or too much at the expense of oneself or others. For example, producing and consuming at a moderate level.
- **Reasonableness:** The decision concerning the level of sufficiency must be made rationally, with consideration of the factors involved and careful anticipation of the outcomes that may be expected from such action.
- **Risk Management:** Preparing to cope with the likely impact and changes in various aspects by considering the possibility of future situations.

His Majesty King Bhumibol initiated the New Theory of Agriculture (NTA), which is the clearest application of SEP, to help Thai farmers build resilience against economic crisis and natural disasters. NTA is a system of integrated and sustainable agriculture which aims to optimise farmland. It is apparent how both the SEP, particularly its applied NTA, supports the successful climate change adaptation processes of Thailand's agriculture sectors. Proposed adaptation actions include multi-cropping systems, diversified land-use, focus on households rather than commercialisation (mass production), and promotion of resilient seed varieties.

Several organisations mandated to develop and/or oversee climate change response strategies and legislation comprise the public institutional framework in Thailand. Figure 1 provides an overview of the climate change related governance structure in Thailand.

Figure 6: The information about SEP philosophy from King Bhumibol Adulyadej (King Rama the 9th) (source: Food and Agriculture Organization of the United Nations 2019, online)

The SEP is created on 3 main pillars:

3.2.1 Moderate

Sufficiency manifested an action that is not too much or too frugal. It can be achieved by producing and consuming at moderate level.

3.2.2 Reasonableness

The decision on the level of sufficiency must be made in a rational manner, taking into account the factors involved and carefully anticipating expected results.

3.3.3 Risk Management

Risk management is how to prepare for the predicted impact and changes in different aspects by considering potential and possible future situations.

SEP Philosophy helps Thai farmers build resilience to natural disasters and economic crises. NTA is an integrated and sustainable farming system aimed at optimizing farmland.

It is apparent how the SEP supports the successful climate change adaptation processes of Thailand's agricultural sectors, particularly applied NTA. The proposed adaptation measures include multi-cropping systems.

4. How do we engage in the mysteries of the forest when we are becoming more remote from them

In the south of Thailand, Khao Nam Khang National Park encompasses 220 square kilometres of jungle and a huge diversity of plants and animals. Outside Khao Nam Khang is an ancient village. Its people respect nature and believe in tree spirits, which is a common occurrences in rural areas of Thailand. Most of the villagers are farmers, but they also tap rubber trees and harvest forest plants. Some have extensive knowledge about forest herbs and use them to make traditional medicines. The forest gives the villagers many gifts, explaining their deep relationship with nature that is embedded in their culture.

In contrast, people who live in the city have little opportunity to connect with forests. In many cities nature is not a major and visible part of everyday life, even though we cannot live without it. We need green space to maintain our well-being, thus designers attempt to incorporate green space into homes and public buildings and spaces. In Melbourne, Australia, an Urban Forest Strategy aims to adapt the city to climate change and create a healthier urban ecosystem through extensive tree planting (City of Melbourne 2012). The project involves community engagement and seeks to realise physical benefits. In Singapore, the Skyrise Greenery Incentive Scheme (National Parks Board, Singapore 2019) aims to encourage the installation of green roofs, edible gardens, recreational rooftop gardens, and vertical greenery on building façades, creating a distinctive image that locates this high-density city in its tropical climate. These examples show that despite the remoteness of many humans from nature, we attempt to bring nature back to us in various ways.

5. How to recreate the forest via a new and compelling illustration method

Illustrations are like windows to the house of knowledge.They let light in upon the understanding and they facilitate the outlook upon truth and beauty. To illustrate is to help one sense using another, to reason by analogy and to teach the unknown by the known. (Gaither et al. 2019)

As the saying goes, a picture is worth a thousand words. Images have the power to communicate ideas to a global audience, regardless of age or location. Illustration, which underpins the disciplines of Graphic Design and Communication Design, allows design practitioners to create images that connect instantaneously with our emotions, memories and experiences through vision (Andrew 2011).

Creating a visual narrative is always a challenge. To find new narratives, we can examine our emotional responses to our physical environment and to the events and actions it contains. A visual narrative gives the story a formal structure with a beginning, middle and end, enabling the audience to comprehend it (Connie 2011). In this research, we explore a new and compelling way to create a visual narrative about forests and deforestation by combining a Fibonacci sequence and L-system into illustration.

A Fibonacci sequence is a simple recurrence relation in which each number equals the sum of the two numbers before it (0, 1, 1, 2, 3, 5, 8, 13, 21, ...) (Fractal Foundation 2019B). It can be represented graphically as a spiral and is found widely in nature, including in fern fronds, seashells, pinecones and sunflowers (Figure 1). In our research, we recreate the story of nature by using a Fibonacci sequence in illustration. We do this with the help of L-systems, which allow us to use iteration to produce realistic plant-like structures (Fractal Foundation 2019A) (see Figure 8).

Figure 7: The Fibonacci sequence or spiral shape.
(source: Medium 2019, online)

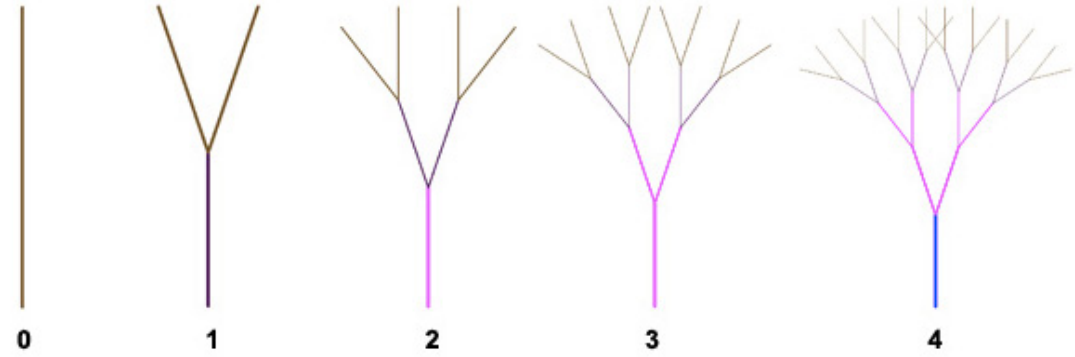


Figure 8: Simplified tree growth producing using an L-systems algorithm.
(source: Fractal Foundation 2019A, online)

6. Methodology

We use methods that mimic the forest in a stylised way. The L-systems concept of biomimicry is used to form structures resembling leaf veins, tree branches and trunks to create a stylised forest that can be made accessible to everyone. Our methodological process is outlined in Figure 9.

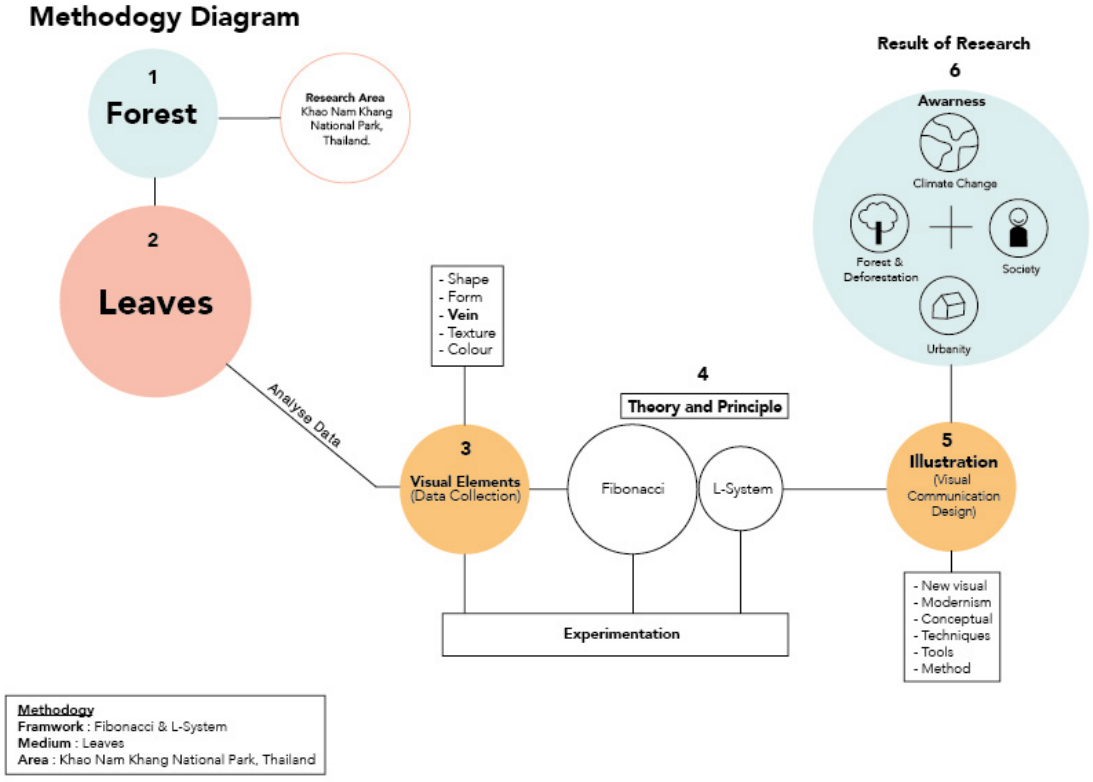


Figure 9: Illustration of research methodology
(© Pailin Thawornwijit 16/07/2017)

The preceding methodology diagram has 6 steps to develop the research which can explain more as following:

6.1 Research Area: “Khao Nam Khang National Park”

The forest area base in Tumbon Nathawee, Songkhla province in the south of Thailand. First known in the local language as “Khao Nam khang”, the national park was known as the Namkhang National Park, which implies to Namkhang Mountain. “Khao” means mountain from this mountain’s name, and in English “Namkhang” means dew. From the initial legend, it was told that the Namkhang Mountain hilltop temperature is quite low throughout the year. People who climbed up to the mountain top in the old days said they tended to discover a web like dew on grass even at night. It was named after the natural beauty of its own as the Namkhang Mountain gives a distinct and fascinating landscape of the mountain. The Namkhang Mountain was later proclaimed as “Namkhang National Park” in 1991 (2534 B.E.). It was Thailand’s 65th National Park with 212 square kilometers (Figure 10).

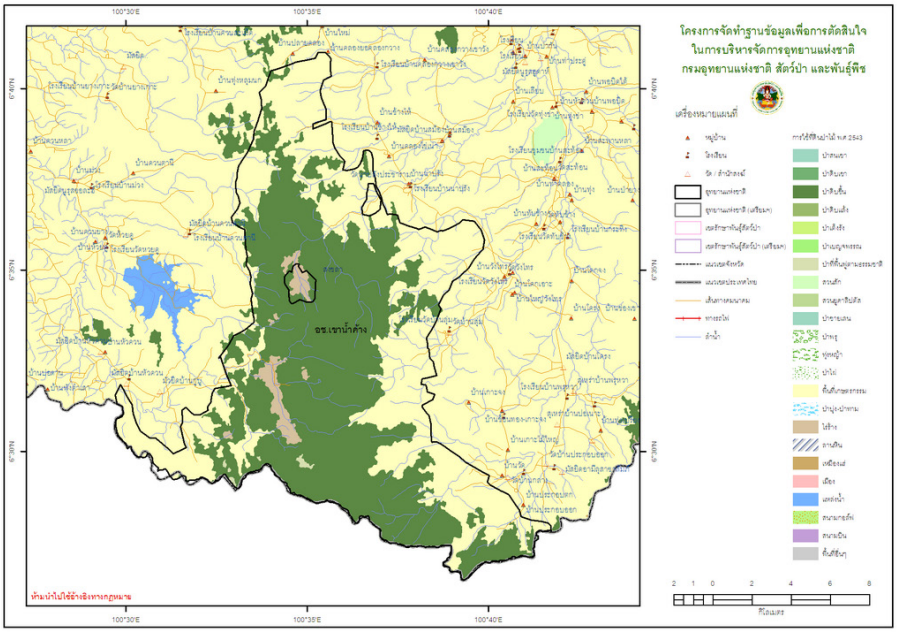


Figure 10: Map of Khao Nam Khang National Park
(source: National Park Thailand 2016, online)

According to the record, Khao Nam Khang National Park is an area full of high diversity of floras and faunas. There are trees from various classifications and type established in the national park, such as Hlumpa, Iron Wood, Meranti, Massawa, Orange Champak, Bullet Wood, Mangifera Caloneura Kurz, Bamboo, Orchid, Fern and Moss. Also, the fauna in Khao Nam Khang National Park consists of a huge variety of animal and wildlife such as Boar, Bear, Gibbon, Tortoise, Barking Deer, 43 Chamois, Tapir, Panther, Mouse deer, Palm civet, Lizard, Hornbills, Pheasant, Arbor Phila, Peacock, Mountain Myna and Magpie.

Figure 11: Conserved plants from Khao Nam Khang National Park
(© Pailin Thawornwijit 09/07/2017)

According to the observation and survey in the national park area with Forestry officers, there were 11 important types of tree to the area, which were Parashorea Stellata, Michelia Champaca L., Elater Iospermum Tapas Blune, Dillenia, Anthocephalus Cadamba, Shorea IeprosulaMiqa, Catophyllum Teysmanii Miq, Adinandra Integerrima T. Anders. ex Dyer, Canarium Denticulatum Blume, Chebulic Denticulatum Blume, Chebulic Myrobalans, Shorea Guiso B1. Somehow, there were more collections of trees growing in the area to be explored since the researcher mainly focused on collecting the names of trees growing along the stream.

Figure 12: Preserved leaves from Khao Nam Khang National Park
(© Pailin Thawornwijit 19/12/2017)

6.2 Collecting Data

Due to the forest area being huge, the research focus on collecting leaves by random to use in experimentation in the research. Referring from figure 12, it shows the example of leaves collecting during summer. In fact, the researcher intended to collect leaves in summer and rainy season. The collected leaves were examined by applying visual techniques such as shape, veins and colors. In the process, the research aims at choosing leaves that are strikingly different from others in the area. Moreover, the collected leaves should also bear different shapes and veins obviously.

6.3 Visual Elements

In this step, the research examines to decode visual elements from leaves.

6.4 Theory and Principle

The research applies Fibonacci theory and L-system to create artworks.

6.5 Visual Communication Design (Illustration)

In this state the research attempt to create illustration which narrate the story about relationship between human and nature.

6.6 Awareness

The last step in methodology is build up the awareness and conversation to society.

The research process started with the collection of leaf specimens from the research area. We analysed and decoded the visual elements of each leaf using Photoshop. Then, we combined the theory and principle of the Fibonacci sequence and L-systems to generate results for use in illustration design. Finally, we created an illustration and narrated stories about four topics: forest and deforestation, people, city and climate change. Figure 13 shows the research framework.

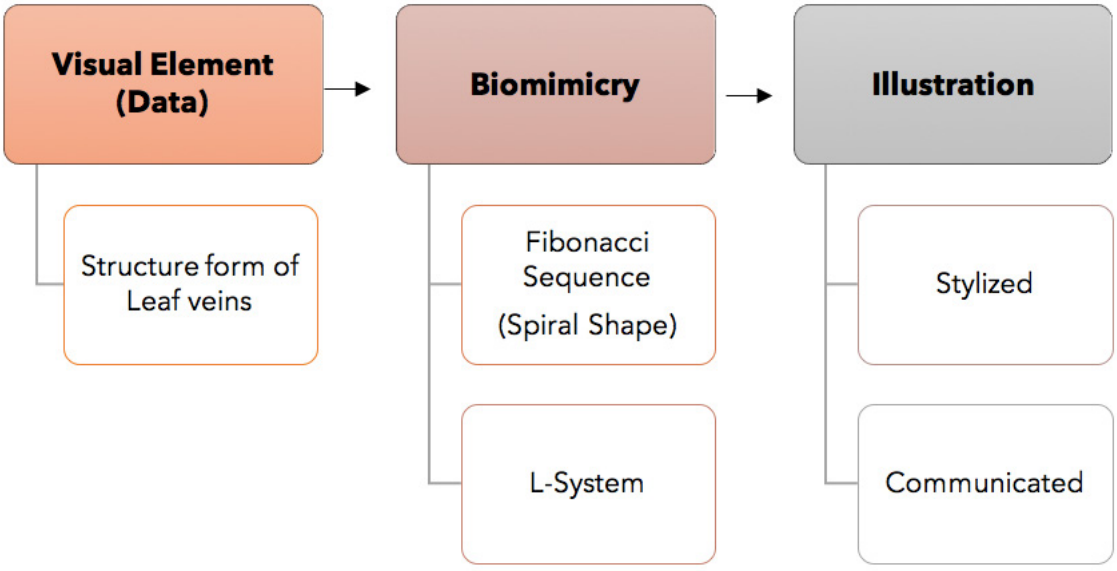


Figure 13: Research framework
(© Pailin Thawornwijit 26/08/2019)

7. Visual Elements

We gathered visual elements from leaves we collected from Khao Nam Khang National Park. Then, we analysed the visual elements which appeared on the leaves, including shape, form, veins and colours, as shown in Figure 14. This process focuses on decoding a visual element from Leaf and record all the data in a guild book.

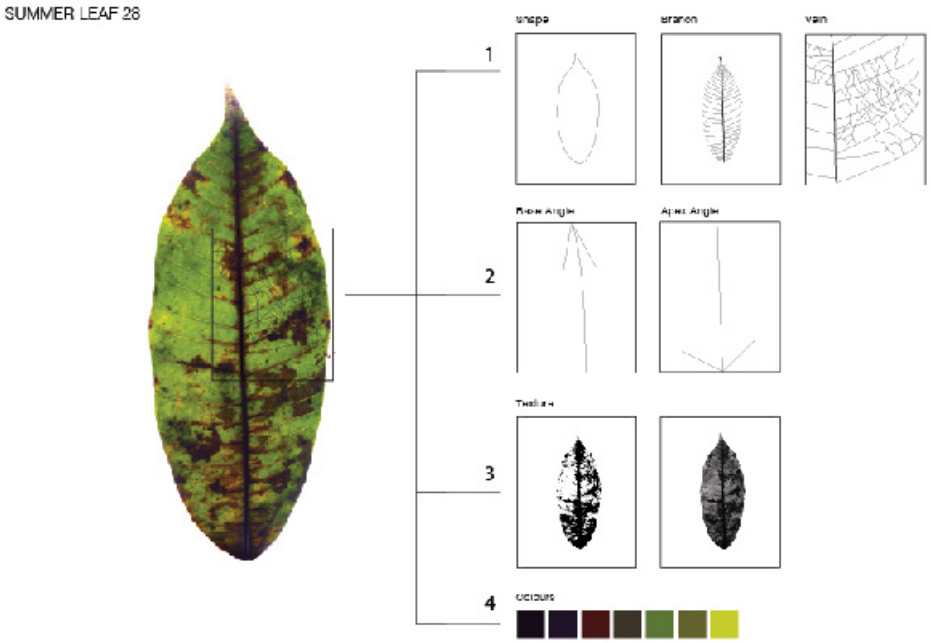


Figure 14: Decoding and collecting data from leaves
(© Pailin Thawornwijit 09/09/2019)

After analyzing the randomly collected leaves, the fundamental analysis demonstrated that there were 52 different types of leaves as follow;

Season	Amount	Usable	Unusable
Summer leaves	24	23	1
Rainy leaves	28	16	12

Table 1: The table shows the amount of leaves which collected from National Park

As stated in the table above, the information derived from leaves was decoded to be implemented in visual elements. From the collected data, there were 24 summer leaves and 28 rainy leaves. While all of the summer leaf veins could be applied in visual element, only 16 rainy leaves out of 28 could be used since leaf veins were quite unclear and could not be applied in the following process.

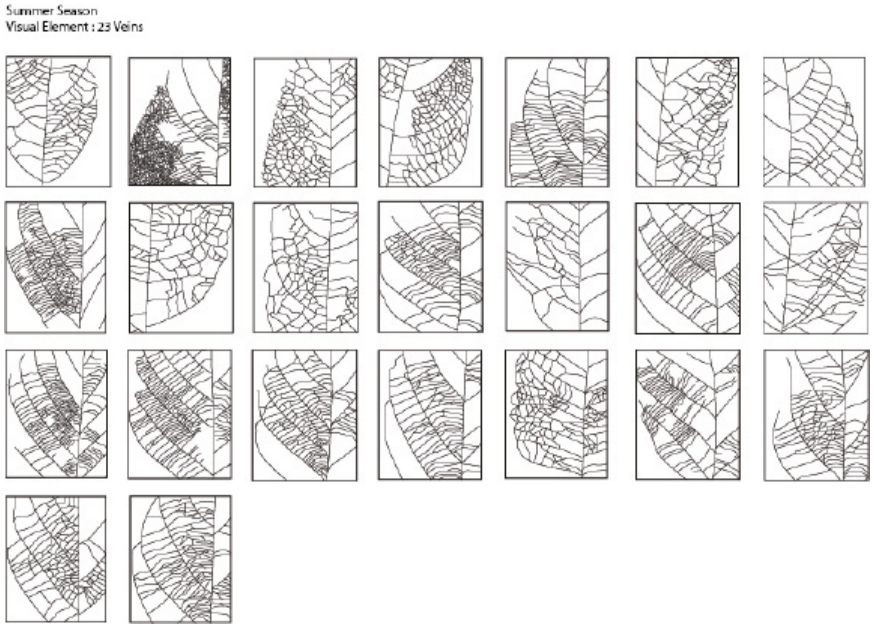


Figure 15: The illustration shows 23 leaf's veins which usable
(© Pailin Thawornwijit 07/09/2019)

From figure 15, it shows 23 different types of summer leaves that can be applied in artwork. According to the table, there are 23 types of leaves that already deconstruct visual elements. After the deconstruction process, details inside each leaf were finally revealed. Somehow, one of the leaves was unable to use in the process since it lacked necessary detail.

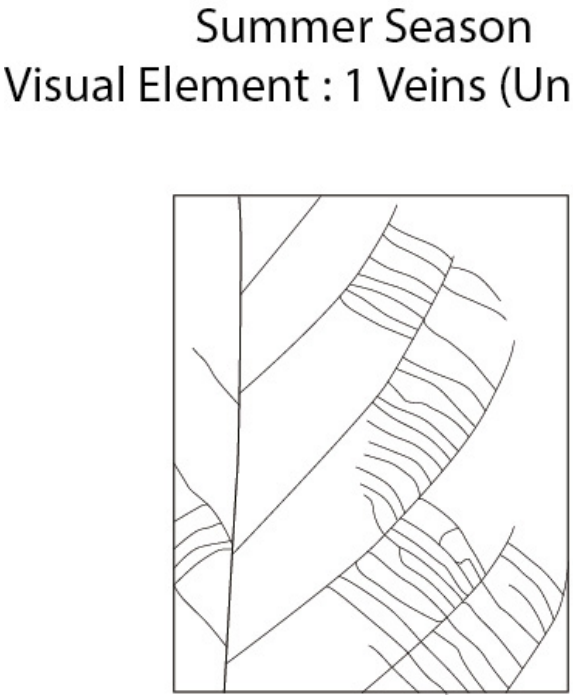


Figure 16: The data shows 1 vein that unusable
(© Pailin Thawornwijit 07/09/2019)

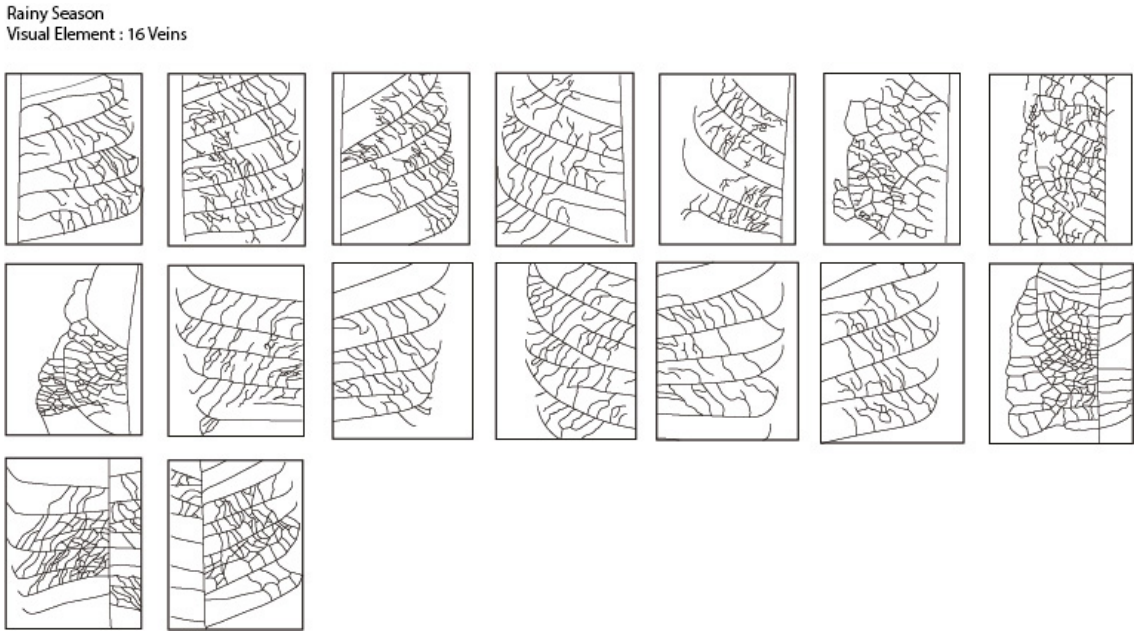


Figure 17: The data shows leave's vein from Rainy season
(© Pailin Thawornwijit 07/09/2019)

According to figure 17, data collection from rainy season leaves shows that only 16 leaves could be used in the visual element process. Due to some errors in decoding visual elements and limited yielding result, some leaves in figure 18 were unusable in the research.

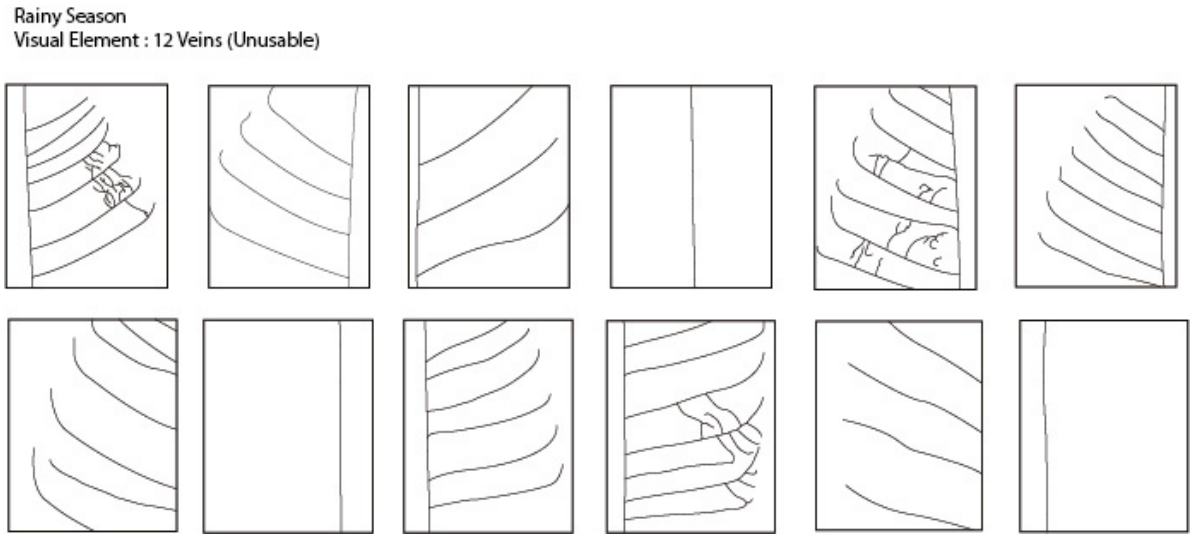


Figure 18: The table shows 12 visual elements of vein which unusable
(© Pailin Thawornwijit 07/09/2019)

To summary, the collected leaves from the research area can be separated into 2 groups as following; summer group and Rainy group

7.1 Summer group – The Summer group leaves consist of 24 leaves. According to the number, it can be divided into 23 usable leaves and 1 unusable leaf.

7.2 Rainy group – The Rainy group leaves consist of 28 leaves. According to the number, it can be divided into 16 usable leaves and 12 unusable leaves.

In order to examine different visual element result, leaf veins are necessary to be carefully inspected. It is found out that summer leaves are more delicate and richer in detail. On the other hand, the rainy leaves tend to show vague detail and simple pattern.

8. Biomimicry

We applied Fibonacci and L-systems principles to experiment with the data, creating illustrations within these frameworks in various ways (Figure 19). A Fibonacci sequence can be used as a grid to divide proportions in different ways, and as a guideline to create the storylines. L-systems help us to understand how the tree grows, focusing on branches and veins. Applying L-systems to the data reproduced the harmony of nature. Biomimicry make us understand how special nature is and how we can copy that ability to apply in various ways.

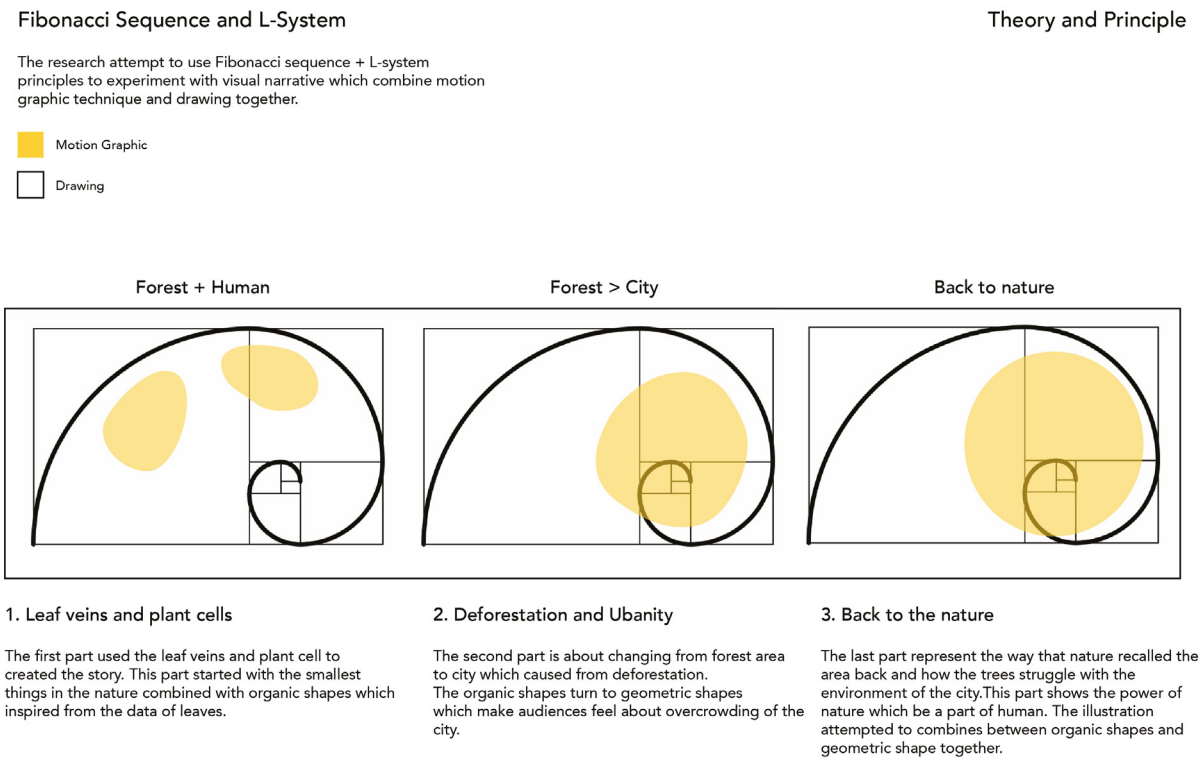


Figure 19: The use of a Fibonacci sequence and L-systems in the artwork.
(© Pailin Thawornwijit 04/07/2019)

9. Illustration

The objective of the research is to find new ways to create illustrations that can communicate stories about forests and deforestation. We applied Fibonacci principles to mimic natural elements in three illustrated stories:

9.1 The story about humans and forests – how humans live within nature and depend on forests; human and forest has relationship

9.2 How humans are destroying forests and the natural environment in general, and how forests are being overrun by cities; and

9.3 How nature can recolonize cities and allow people to reclaim their connection to forests.

10. Motion graphics

Motion graphics is a genre of communication design that communicates over time and through motion. We converted aspects of the illustrations and analysis of the forest leaves into four motion graphics embedded into the four metre illustration:

10.1 Diving deeply into the forest, similarly, to swimming down through marine life.

10.2 Plant's cell elements which represent the connections between leaves, trees, the forest and the universe.

10.3 The story of deforestation and its effects through its contribution to climate change, including natural disasters such as bushfires, floods and storms. The motion graphic also shows a forested area turning into a city.

10.4 The artwork integrates the techniques of drawing, three-dimensional form, as seen in motion graphics (Figures 20 & 21). The story in the motion graphic will show the power of nature, which wants to claim the forest back. In this motion design, the viewer sees the branches grow across a series of three-dimensional forms that represent houses. As the branches grow, there is a sense that the forest is reclaiming lost territory.

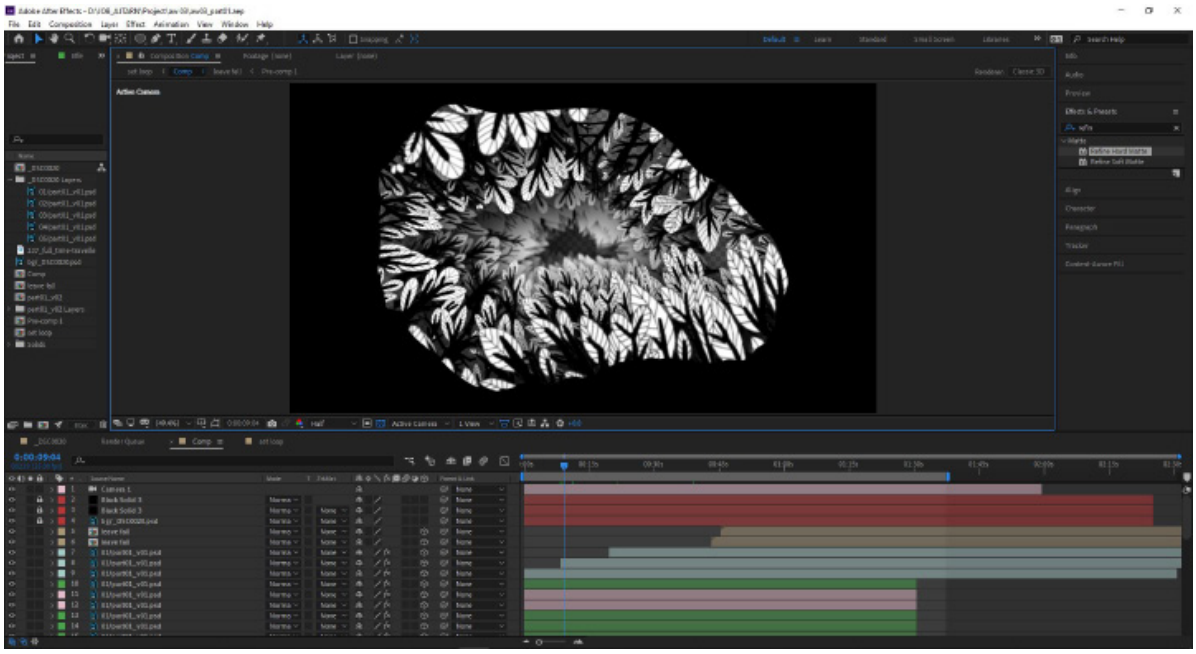


Figure 20: Creating a motion graphic which takes the viewer on a journey down into the forest. Through this motion graphic, there is a sense that nature is never ending. (© Pailin Thawornwijit 08/07/2019)

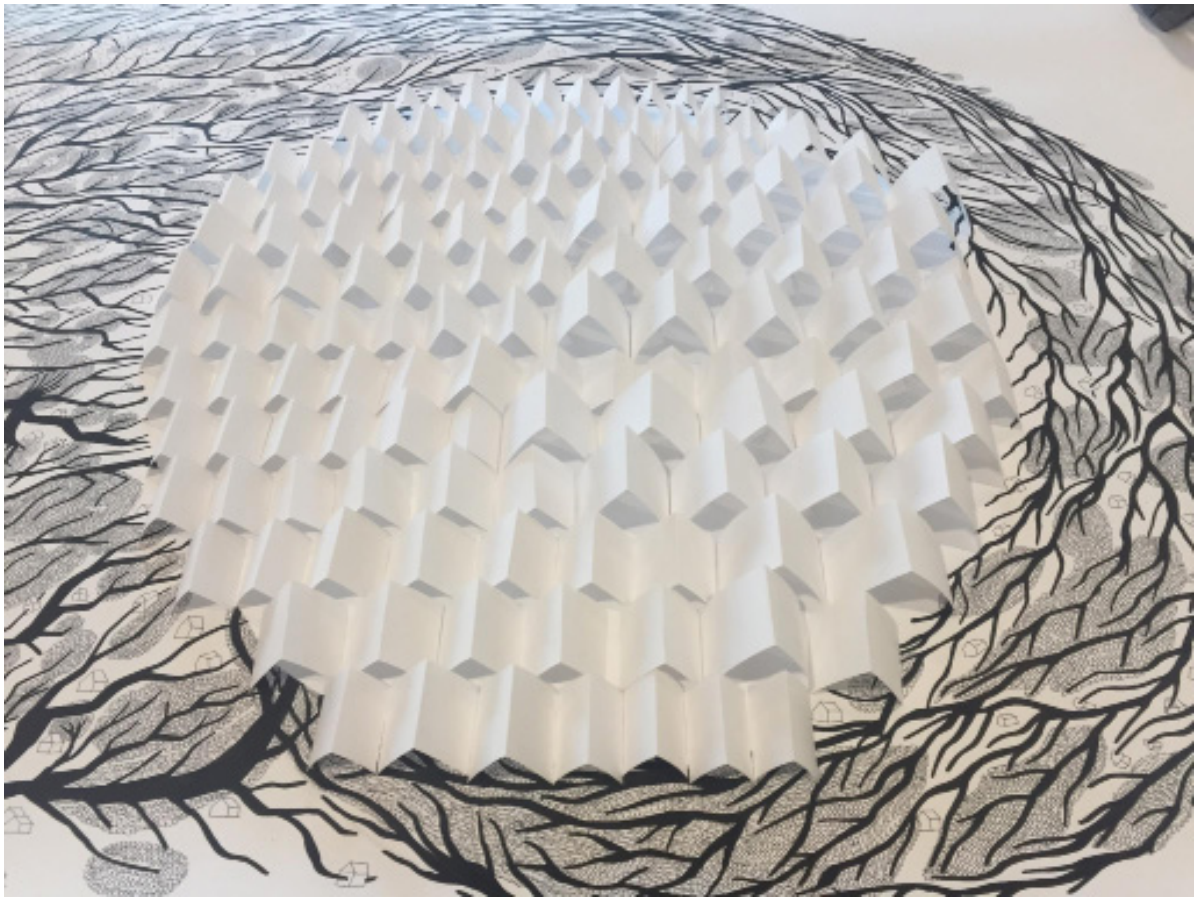


Figure 21: Paper forms representing houses combined were projected with images of the branches growing across the forms. (© Pailin Thawornwijit 26/07/2019)

11. Projector Mapping

To develop hand drawing to motion graphic, projector mapping was used to support motion graphic and make the artwork look more contemporary. In addition, projector mapping is a new technology to support artist and designer to develop their work. So, we can combine projector mapping with hand drawing in research.

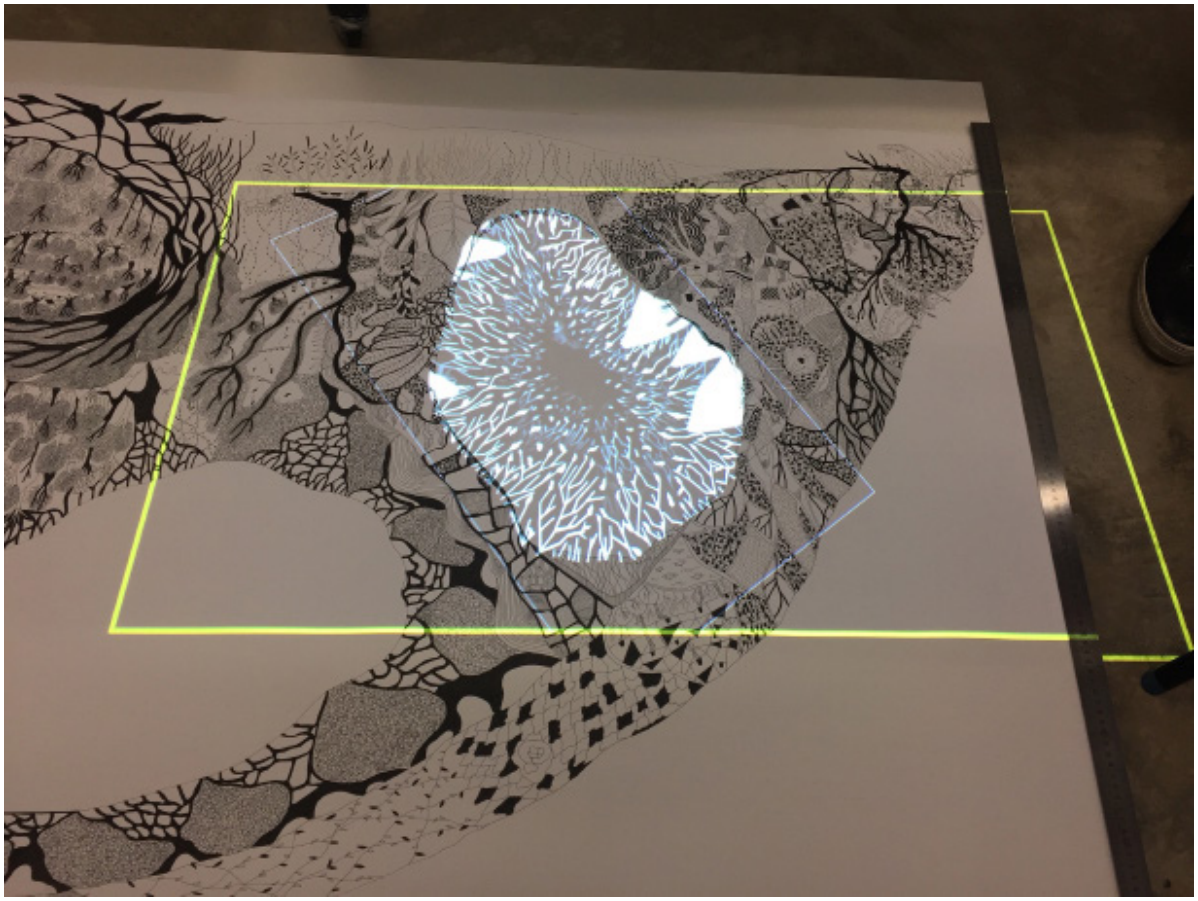


Figure 22: The picture shows motion graphic mapping process
(© Pailin Thawornwijit 26/07/2019)

12. Augmented Reality (AR)

Another technique which can develop in the research is AR technique. AR becomes more attractive to viewers. The research attempts to use AR and testing with groups of people in the exhibition. The benefit of using AR is the viewers can download application and play motion graphic in their phone without using projectors.

13. Artworks

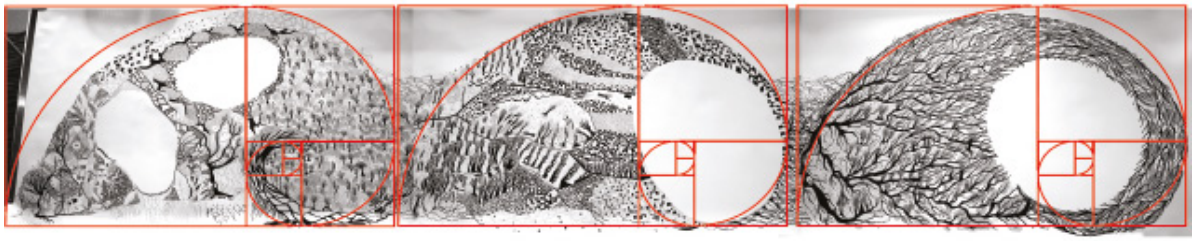


Figure 23: Drawing with Fibonacci template
(© Pailin Thawornwijit 17/09/2019)

If examine the artwork was separated in 3 parts following from red frame which use Fibonacci to apply in the artwork. The stories were divided in 3 parts and narrate different message as following;

13.1 Forest and Human

The very first part of the narrative depicted the story about how humans take advantage of nature and how humans live harmoniously without destroying nature. In order to give a clear statement, artwork in this part of the research conveys an approach of how visual elements from leaf veins and plant's cells were used to weave the connection among every fraction in nature, for example; cell pattern and universe. Also, organic shapes from nature such as veins, roots and cells were used to develop the landscape.

13.2 Forest and Urban world

The second part of the story tells the consequence of Fibonacci sequence from the first part where forest was destroyed by human. Since more and more forest area turns into city, the phenomenon of deforestation occurs almost everywhere in the world. According to this part of the research, visual elements have been changed from organic shapes (trees) to geometric shapes (buildings).

13.3 Back to nature

The last section of the illustration is the climax of the final artwork. In this part, the power of nature was unveiled, and the forest would like to reclaim its territory back from humans. Humans will perceive that nature is so powerful that it cannot be defeated and why they ought

to respect nature. The last part is the combination of organic shapes and geometric shapes. Eventually, if you study the detail of this illustration closely and carefully, you will figure out why and how tree is so furious at human.

14. Exhibition

The exhibition can set a pilot and create conversation about climate change via drawing 4 projectors to project motion graphics. The space also has a big white board to invite people to get involve and write a comment about exhibition and climate change issue.

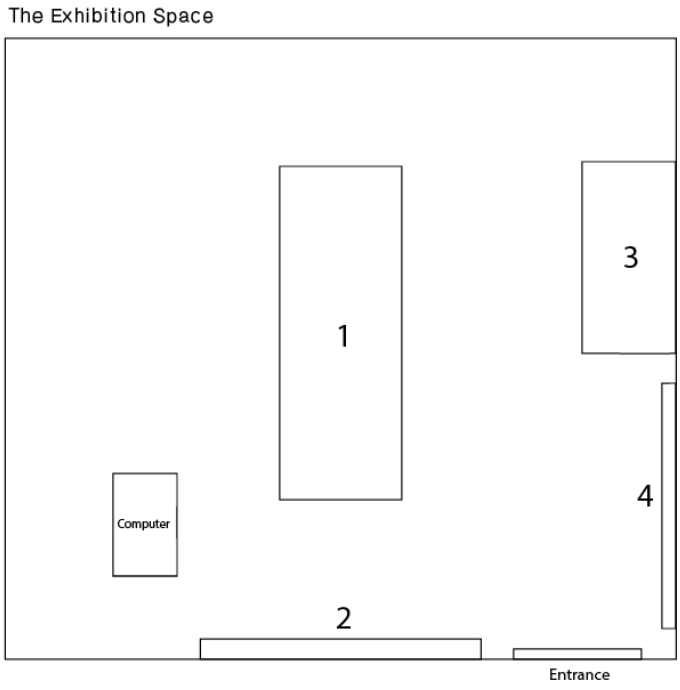


Figure 24: Exhibition space
(© Pailin Thawornwijit 17/06/2019)

14.1 Main work

Main work is set up to show a big drawing with 4 projectors which viewers can walk around and see the artwork. Moreover, the exhibition allows people to spend time observing details in the drawing and explore hidden messages. In addition, it is an important area in the center of the exhibition.

14.2 Screen

A big screen in an exhibition showing videos that present 2 stories. The viewers can see the work's processes from video; Documentary in National Park and Time lapse of drawing.

14.3 Data collection

A big table shows a book of data collection. In the book contains all visual elements which decode from leaves.

14.4 White board

The comments from viewers are so significant since it shows the results of research. Included on the white board are 4 questions which link to research question. All the answers from viewers are kept recording and used to conclude result of research. The comments from viewer are so significant since it shows result of research. On white board include 4 questions which link to research question. All the answers from viewers are keep recording and use to conclude result of research.

The exhibition also represents in installation platform since it combines with motion graphic technology that rising the drawing to be more attractive with a space. In addition, the motion graphic shows a process development of drawing to look more contemporary art and cross from visual communication field to art field as well.

15. Results and discussion

The illustration is intended to create a conversation, discussion and critical analysis about forest sustainability and its connection to climate change. It represents the power of nature and asks why climate change and deforestation issues have become so important in contemporary society. In the artwork, we used a Fibonacci sequence in conjunction with L-systems to generate grid and story lines which allow the audience to follow the story visually. We used biomimicry of leaf veins to produce a map and landscape that lead viewers to all parts of the illustration.

15.1 The result of applying Fibonacci theory and L-system in artwork

Both Fibonacci and L-system principles were adopted to conduct in the research. Fibonacci sequence was expected to be able to design artwork in the storyline. In order to accomplish the goal, the researcher had put a lot of effort in designing artwork in the storyline follow Fibonacci sequence. However, it was later found out that L-system principle was not appropriate with the research since it worked better on 3D work.

Topic of experimentation	Fibonacci theory	L-system principle
1. Applying with 2D visual element artwork	Very good (4)	Poor (1)
2. Creating storyline in the 2D artwork	Excellent (5)	Poor (1)
3. Conducting main key visual element in the artwork	Very good (4)	Poor (1)
4. Applying special techniques such as specific computer program and motion graphic	Good (3)	Very good (4)
5. Appropriateness to the designed artwork	Very good (4)	Medium (2)

Table 2: The table shows capability of applying theory and principle to the artwork.

During the research experimentation, Fibonacci theory and L-system principle were employed in practice in order to seek for suitable approach to create artwork. The yielded experimentation outcome could be summed up in 5 criteria as follow;

15.1.1 Poor – The theory or principle cannot be applied or support the research.

15.1.2 Medium – The theory or principle can hardly be applied or support the research.

15.1.3 Good – The theory or principle can be applied or support some part of the research.

15.1.4 Very good – The theory or principle can be applied or support overall parts of the research.

15.1.5 Excellent – The theory or principle can be applied or support the research in almost every aspect.

The researcher tried to focus on finding research outcome from 5 different topics above. After the assessment, the conducted research could be concluded as below;

15.2 Applying with 2D visual element artwork

Since the researcher had focused on employing visual element to create 2-dimensional artwork, the research outcome eventually turned out that Fibonacci could work well with visual element. With that reason, Fibonacci was considered to be in (4) Very good criteria. L-system on the other hand could not handle the approach that it stayed in (1) Poor criteria.

15.3 Creating storyline in the 2D artwork

Owing to research experimentations, it was found out that Fibonacci could create (5) Excellent storyline in the artwork. However, L-system was categorized in (1) Poor criteria when it came in term of working with 2D artwork.

15.4 Conducting main key visual element in the artwork

The researcher had put a lot of effort to share message about nature, forest and climate change to audiences. By exploring key visual in the artwork, the researcher had evaluated that Fibonacci could work along with key visual very well that it was noted in (4) Very good criteria. Somehow, L-system could not work well with the key visual that it stayed in (1) Poor level.

15.5 Applying special techniques such as specific computer program and motion graphic

The researcher had combined 2 different approaches in organizing visual element, hand drawing and motion graphic. In this case, both Fibonacci and L-system were applied in the motion graphic process. The result from the experiments showed that L-system had higher ability to work with motion graphic that it got (4) Very good while Fibonacci got only (3) good.

15.6 We summaries the results of the research in terms of our use of a Fibonacci sequence and L-systems as follows:

1. A Fibonacci sequence creates a repeatable structure to create ongoing illustrations that can be arranged based on the prioritisation of events.

2. Fibonacci underpinned the composition of the illustration as it was familiar to viewers through natural structures in the world such as sunflower seeds and seashell.

3. Using Fibonacci shapes, enable us to continue the illustration in ongoing sequences; Human and nature, Deforestation and Power of nature.

4. L-systems informed the data collection and analysis as well as the approach to the motion graphics and the illusion of depth.

5. Leaf veins were used as a visual metaphor for maps and landscapes in the illustration. They allowed the audience to follow the story; and leaf veins was used to connect visual elements in the illustration.

6. The intention of the research was to create a conversation about the sustainability of the forest in the illustration as follows.

7. Exhibiting the illustration was piloted at the School of Design, Swinburne University of Technology, Melbourne Australia.

8. Based on this pilot, conversations about climate change emerged in viewing the illustration artworks, which represent natural disasters such as bushfires, floods and storms.

9. The illustration communicates through visual language and parts of the illustration combine organic shapes and geometric shapes to represent the meanings of nature and the artificial world.

15.7 Relationship between traditional hand drawing and technology (Motion graphic, AR and Projector Mapping in Technical terms

In order to create new artwork that is more attractive and looks more contemporary, the researcher attempts to explore various possibilities technical terms by combining hand drawing with motion graphic, projector mapping and AR. Because producing artwork by using hand drawing is an action coming from human, the researcher, as a result, selects the hand drawing technique as a metaphor to represent nature. Moreover, motion graphic as one of the tools helps to support the presentation of the story and make the artwork becomes more alluring. Somehow, the challenge comes from exploring alternative approach to present visual art by combining traditional technique like hand drawing with modern technique like motion graphic, projector mapping and AR. Since the exhibition is presented in public space that audiences need to concentrate on the artwork, projector mapping is applied as a tool to enhance the presentation of motion graphic. Also, projector mapping is a new and delicate technique, it consumes a large amount of time and budget to install it in the exhibition. Fortunately, with the full support from Thai government scholarship and Swinburne University of Technology, the research is provided with facilities and encouragement during the exhibition. To the audiences' surprise and astonishment, the projector mapping can work together with hand drawing harmoniously. Although projector mapping is more striking, it is difficult to set up in the space since it needs further equipment to substantiate. Augmented Reality (AR), on the other hand, there is cheaper and can be access easie by using a mobile phone. With that reason, AR can provide wider chance for audiences to participate with the artwork while visiting the exhibition. In short, all techniques applied in the research are an implement using to support an ideal research. Moreover, they not only service the research to give more sense of tangibility but also welcome more audiences to the exhibition.

15.8 Comments from the audiences

The exhibition provides white board with 4 questions that let audiences answer and write their opinions as follows:

15.8.1 How does climate change affect to your life?

According to this question, results receiving from comments among audiences can be concluded in each topic in percentage as below;

1. Extreme weather 70%

Almost people who visit the exhibition agree that extreme weather is a main reason that affect to their life.

2. Dying species of animals 20%

The audiences also point out the problem that more animals died from bushfire, hot weather and deforestation.

3. Rubbish and environment 10%

Rubbish found in the sea are the main problem which affect environment and marine life.

4. Future and young generation 5%

Some audiences concern that climate change is affecting their children and young generation in the future.

5. Heath problem 5%

There are only 5% of audiences who concern about health problem.

15.8.2 What is benefit of natural forest?

The question would like to examine about what people concern the most about benefit from green space around them.

1. Provide the oxygen and control temperature 70%

The answers from the question shows that people are aware of green area which providing them with pure oxygen and decreasing overall temperature.

2. Animal sanctuary 20%

Green space also provides shelter for animals and good for ecology.

3. Wellbeing and health 10%

Forest area provides humans with wellbeing and good health.

15.8.3 Do you think we need more forest/green space to integrate in the cities?

1. Yes, we need more forest/green space 100%

2. No, we don't need 0%

The answers can guarantee that humans still need more forest and green space area in the cities to absorb carbon dioxide and provide them with fresh air.

15.8.4 Does this research inspire you to save your closet forest?

1. Yes, it does inspire to save the forest 100%

2. No, it doesn't inspire to save the forest 0%

The comments were received from audiences after visiting the exhibition.

The result shows that the audiences still concern more about climate change, environment and forest area.

16. Research Conclusion

The researcher has employed 2 main theories in conducting the research, Fibonacci theory and L-system principles. After conducting several experiments and creating more interesting stories, both theories yielded pleasant result when the researcher applied them with illustration design. Moreover, it is expected that those advanced techniques would be capable of developing in other Visual communication designs in the future. In other words, compiling the exhibition topic "Climate Change" with modern techniques, drawing and motion graphic would be able to make more fascinating and interesting illustration as well as attracting more attention

among audiences.

As a designer and a researcher, both advance techniques and ability to communicate with audiences are crucial components of the research. The research has emphasized on one controversial topic, Greenhouse Effect and Climate change. It is hoped that a designer can share a role in pushing public awareness forward to the entire society. It is undeniable that human action has resulted in unpredictable and severe natural disasters. Somehow, communicating with the society via visual communication design as well as conversation through illustration work will arouse exhibition participants' consciousness toward the importance of forest conservation and environmental preservation. Techniques could be counted as important element in the research project. With the help of the combination techniques between Fibonacci, L-system and Biomimicry with visual communication design, all the theories could be considered as one indication of future direction of innovative creativity. Furthermore, it could be applied as research approach for designers, artists, researchers and students. The researcher had hoped that research

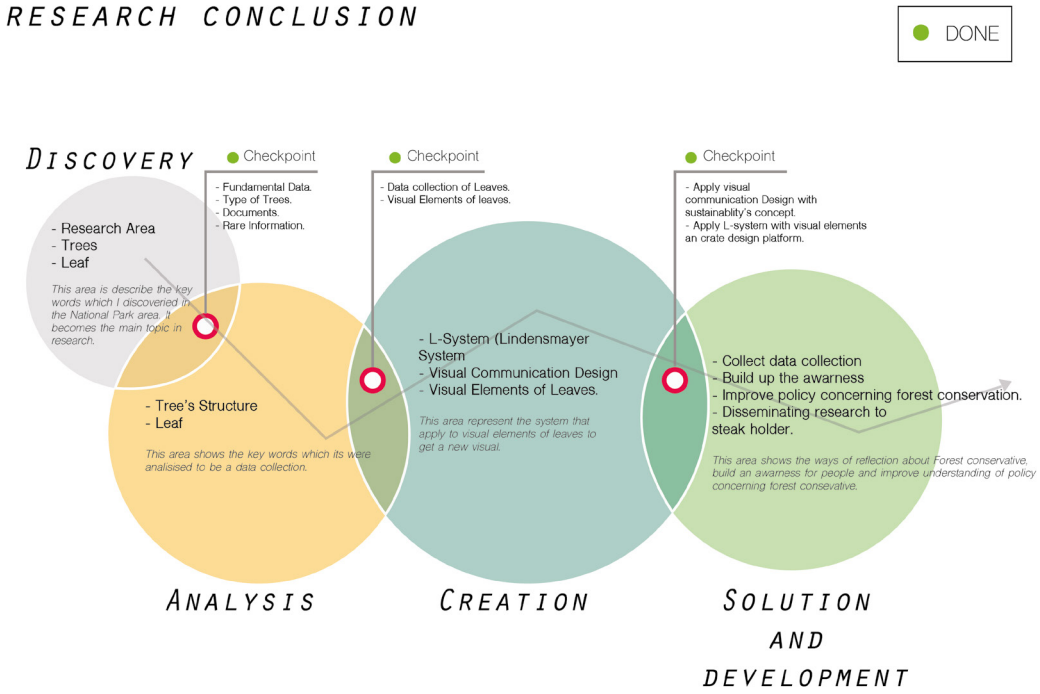


Figure 25: The diagram of research conclusion
(© Pailin Thawornwijit 20/11/2018)

According to research objectives, we can summarize the results in a last state as follows:

16.1 To establish the significant of nature from studying elements of leaves.

Result: The research found that the significant of nature from studying elements of leaves by discover some small details which can provoke about climate change problem to the society. Also, the result of research be able to connect data collection from leaves and develop in design area to represent the benefits of the forests, ecology and environment.

16.2 To collect and analysis visual elements of leaves as a data collection.

Result: The research gets advantages from studying leaves and collect the data since it contains information from nature. The data collection book compile fundamental elements of leaves which can disseminate to public in the future.

16.3 To create visual communication design (illustration) combine with L-system/ Fibonacci theory.

Result: The research be able to prove that Fibonacci theory and L-system can apply in visual communication design (Illustration) by experiment with shape, form and proportion to create artwork.

16.4 To build up the awareness about forest conservative and climate change to people.

Result: The audiences can receive messages about benefit of the forests, deforestation and climate change issues through the artworks in final exhibition. To build up the awareness to people, the research needs to shows in public space and invite people to get involve with the artwork. The results come from audience's comments that can use to evaluate the research's goals.

17. Research and artwork development in the future

1. The method of research focus on decode the visual element from nature which can apply to use in other design areas.

2. The research's results show the ability of visual communication design which can communicate the climate change issue in artistic way.

3. The research achievement not only come from the design processes yet from the key message that can convey the story of forest, deforestation and climate change which occur around the world nowadays.

4. In technical terms, research venture to get involve with new technology as motion graphic combine with traditional hand drawing to metaphor the parallel world between nature and technology which seems cannot encounter in the real the world, but it happens in the artwork.

5. The Fibonacci theory and L-system principle can apply to create design and artwork in the future.

6. The problems of climate change, deforestation still occur in the world but as a researcher and designer, we need to build up the awareness to young generation.

7. The new knowledge from the research come from research processes, design processes which can continue to use in other platforms.

8. Visual communication design is just a tool to create a conversation and awareness but the ideal of conservation green area is more important.

9. The research can develop to improve the policy concerning forest conservation.

10. The research can disseminate to National Parks in Thailand.

References

Andrew, H. *Illustration*. London: Laurence King, 2011.

Cardona Paz Jose, A."Fire in Brazil's Amezon have devatating consequences." news.mongabay.Accessed November 6, 2019. https:/news.mongabay.com/2019/09fires-in-brazils-amazon-have-devastating-consequences.

City of Melbourne. "Urban Forest Strategy: Making a great city greener 2012 - 2032." City of Melbourne, Accessed November 22, 2012. https:/www.melbourne.vic.gov.au/Sustainability/UrbanForest/Documents/Urban_Forest_Strategy.pdf.

Malamed, C. *Visual Language for Designers: Principles for Creating Graphics that People Understand.* USA: Rocket, 2011.

Food and Agriculture Organization (FAO). "The State of the World's Forests." Food and Agriculture Organization (FAO). Accessed October 12, 2019. http:/www.fao.org/3/ca0188en/ca0188en.pdf.

Fractal Foundation. "Lindenmayers Systems (L-systems)." fractalfoundation. Accessed July 4, 2019A. https:/fractalfoundation.org/OFC/OFC-2-4.html.

_____. "Fibonacci Fractals." fractalfoundation. Accessed July 4, 2019B. http:/fractalfoundation.org/OFC/OFC-11-2.html.

Gaither, Alma E. and Cavazos G. "Gaither's Dictionary of Scientific Quotations." 2nd ed. books.google. Accessed November 18, 2019. https://books.google.co.th/books?id=8qlZuhFlAK0C&printsec=frontcover&hl=th&source=gbs_atb#v=onepage&q&f=false.

National Parks Board, Singapore "Skyrise Greenery Incentive Scheme." National Park Board. Accessed June 1, 2019. https:/www.nparks.gov.sg/skyrisegreenery/incentive-scheme.

Seub Nakhasathien Foundation. *Sà-Tăa-Ná-Gaan Bpàa-Mái-Tai.* [Thai Forest Situation]. Nontaburi: Seubnakhasathien, 2018.

Tariq, K. and Mahyar E.T. "Five forest figures for the international day of forests." Worldbank. Accessed November 21, 2019. https:/blogs.worldbank.org/opendata/five-forest-figures-international-day-forests.

The Visual and Data Journalism Team. "The Amazon in Brazil is on fire - how bad is it?." BBC. Accessed August 5, 2019. https:/www.bbc.com/news/world-latin-america-49433767.

Umair, I. "You have stolen my dreams: Greta Thunberg rages at world leaders at UN climate summit." Vox. Accessed October 17, 2019. https:/www.vox.com/2019/9/23/20879924/greta-thunberg-climate-action-summit-2019-un.

United Nations Development Programme (UNDP). "Integrating Agriculture in National Adaptation Plans (NAP-Ag) Programme." Adaptation-undp. Accessed October 17, 2019. https:/www.adaptation-undp.org/sites/default/files/resources/thailand_case_study_.pdf.