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ENHANCEMENT OF SLOW SHUTTER TECHNIQUE THROUGH A STRUCTURED EXPERIMENTAL CREATION OF LIGHT TOOLS

Mohd Firdaus Mohd Herrow
Centre for Diploma Studies,
Universiti Tun Hussein Onn Malaysia

Shahirman Sahalan
College of Creative Arts,
Universiti Teknologi MARA

Mohd Hatta Md Hani
Centre for Diploma Studies,
Universiti Tun Hussein Onn Malaysia

Corresponding Author
firdaushmh@uthm.edu.my

Abstract: This experimental research aims to create, modify, and combine existing light technology to produce artworks and images. Choosing appropriate light tools is crucial as each has its own strengths and weaknesses, which must be considered in line with the assignments or concepts. The research employs interviews, questionnaires, and experimentation to develop advanced photography techniques capable of revealing unknown scientific elements. The findings reveal six (6) interrelated categories that distinguish the light tools: brightness, colour, contrast, space, length, and power. The documented experiment on artificial light in producing light tools is key to these findings. This research contributes to the advancement of photography techniques and inspires readers to witness the resulting images based on creative ideas.

Keywords: Artificial Light, Bulb Technique, Light Painting, Light Tool, Slow Shutter Photography

1. INTRODUCTION

Light is important in our daily life and it is used as a main source not only in photography but also in other fields such as in the medical field, industrial, engineering, science, physic, etcetera. Modern technology today has made everything possible including using light for artistic and commercial purposes. Thus, the experimentation in artificial light for creating a light tool is vital in order to investigate the element, characteristic, direction and properties of light. This is done based on a slow shutter photography technique: a technique that captures and documents artificial light which creates a unique pattern that is invisible to the human eye. This is an old technique of photography which requires a bulb setting for long exposure that is able to capture a pattern which is not visible to the naked eye. It is about how to develop and improve creativity and experience when producing a unique and functional tool of light based on an existing light system or technology. The exposure in the technique is totally under the photographer's control and the shutter remains open as long as the shutter release button remains depressed. With the dawn of modern globalization, technology becomes one of the priorities in developing certain industry and when modern technology is discovered, light becomes assessable in every form and it will fit the current needs and requirement among the interested users.

Generally, this research is conducted in a laboratory by scientists who study the physic of light wave, technology and system. However, the experimentations are fundamentally based on a science-physic project and are absolutely a fascinating project if they are turned into an art experimental project. In this research, the tool is the focus and exploring of artificial lights in order to create an appropriate system based on the existing technology with a few adjustments, where modification and alteration are needed to accomplish the research necessity. This is an added process which the research will be able to contribute in developing an advanced technique in photography in terms of being able to 'see' the unknown elements, which are only visible in the world of art and science.

This research will be an experimental work that gives the readers the enthusiasm to watch the images that are produced based on creativity and exploration in producing the tools. The main aim of this study is to experiment on the various artificial lights systems for bulb technique (photography) in order to produce artworks. The researcher has also set a main research question which is, 'What is the main element in creating light tool for bulb technique?' Moreover, this research will educate both the art and science-physic stream individuals in studying and experimenting with the artificial light once it is successfully developed and improvised. Most importantly, this study is significant in exposing the great possibilities of capturing science which is beyond the knowledge of photography and art.

2. LITERATURE REVIEW

2.1 The Fundamental of Light in Photography

According to Faughn et al., (2006) light is a type of energy that is called electromagnetic radiation, and it travels through the space in tiny bundles that are known as photons. All photons travel through space at the same speed, but the electromagnetic field of some photons fluctuates faster than that of others. According to Hunter et al., (2015) the modern world is an electrified world that has become a development of the practical incandescent, electric light which has profoundly changes the human existence by illuminating the night, and making it hospitable to a wide range of human activities. Correspondingly, photography begins the moment when light is emitted from the source, and climaxes when more light is being reflected from a printed page or is beaming from a monitor and strikes the human eye. All the steps lie with how the light is being influenced – whether to control it, to record it or ultimately to present it to the viewers. Fundamentally, photography is the manipulation of light, whether the manipulations serve artistic or technical purposes hardly matters. Whether the manipulations are physical, chemical, electrical or electronic, they are all motivated by the same mission and are guided by the same understanding of how light behaves and reacts to certain situation, action or surface. Also, according to Hunter et al., (2015) photographers are interested in more than just the mental images of a given lighting effect. Being able to describe the light is the first step in being able to control it or if the light is not controllable, as it is not a landscape or an architectural picture, describing the light implies seeing the light well enough to know whether to shoot or to wait until the conditions improve. As photographers, they are primarily concerned when it comes to understanding the light characteristics, i.e., brightness, colour and contrast (see Figure 1). These three (3) important elements or characteristics will be an initial guideline for the researcher to create the light tools. Each element relates very closely with one another in order to produce better images.

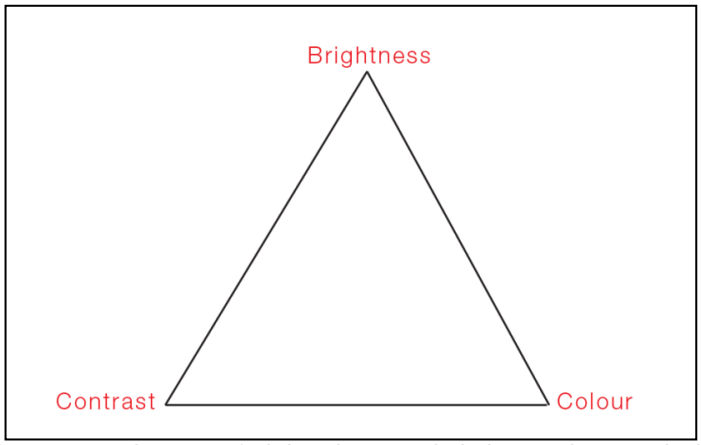


Figure 1. Important Element of Light Characteristic in Fundamental Photography
Source: Hunter et al., 2015

2.2 Slow Shutter Photography Technique

The slow shutter photography technique is also known as bulb photography. It is a technique where the lens of the camera is left open for a longer period than is usual. The camera shutter is often operated manually and is left open for as long as the shutter release is pressed. The effect of this is that the camera often captures images that are not usually seen by the naked eye such as the streaks that are left by transportation headlights, and not just the subject themselves. Accordingly, the editors time-life books, (1970) agree that long exposure has become an important method in photographically manipulating time in order to record patterns that the eye does not naturally see in a single image, where patterns of light will be occurring. When they are captured in a long exposure, fascinating and aesthetic photographs can be notably produced.

Bulb technique is an important technique because it will discover a pattern that the eye cannot see when using a certain medium, such as light. Light is a closest medium to explore when it comes to bulb technique because the camera capturing a light. Light can be a subject matter in this research. It is not about a pattern that the researcher is going to produce but rather it is about a tool; a light tool that is going to play a main role in order to produce aesthetic images. According to Wada et al., (2016) in the early 1900s, the first artistic light drawings have been created by Man Ray and later by Picasso. Similarly, the slow shutter is an art form where the light source is moved during a long exposure shot, creating trails resembling a stroke on a canvas. According to Salamon et al., (2016) and Huang et al., (2018) light painting is not only a popular activity for hobbyists to express creativities, but it is also a practice for the professional media artists and photographers to produce aesthetic visual arts and commercial photography.

2.3 Photographers in Light Painting Photography

Michael Bosanko, Patrick Rochon and Julien Breton are three (3) professional photographers and artists who are in light art, based on their representations; they have a different set of approach, skills, imagination and light tools to produce their images that are based on same technique, i.e., the slow shutter technique. But all of them have created their own light tools that are suitable, and can give better execution to them when they are producing their images in a single frame. Creating their own light tools is important because it will give an impact and a certain aesthetic when producing an artwork where most of the images are relying on the light tools.

Michael Bosanko and Patrick Rochon are both renowned photographers who have shown great skill and innovation in their use of light technology. They have

experimented with various materials and light sources in order to create specific patterns, shapes, textures, and lines to achieve their desired artistic effects. Despite their similar approach to light as a tool, the output of their artworks is distinctly different.

Michael Bosanko's approach to using light in his photography is centred around capturing the environment in a realistic and emotive way. His light tools are his brushes, with which he creates a sense of depth, contrast, and atmosphere in his images. Bosanko's work often includes natural landscapes, cityscapes, and industrial environments, which he captures using a variety of light sources to produce striking and impactful images. Figure 2 showcases Bosanko's ability to use light to create a realistic sense of feeling, with the cityscape coming to life in vibrant colours.

On the other hand, Patrick Rochon's approach to using light is centred around portraiture as a concept to create unique and fresh visualizations. Rochon uses light tools to manipulate light around his subjects, producing striking images that challenge our perception of reality. His images are characterized by their surreal and ethereal qualities, often incorporating patterns and textures that create a dreamlike atmosphere. Figure 3 showcases Rochon's ability to use light to create a unique and fresh visualization of his subject, with the model appearing as if she is glowing from within. Both photographers have their own distinguish style, light tools and subject matter in order to persuade their audience but overall their still the same technique of photography by using slow shutter technique that allow light to enter the camera accordingly to their desire time frame.

Figure 2. Michael Bosanko’s Artworks in 2016

Figure 3. Patrick Rochon's Artworks in 2017

Julien Breton is another talented photographer who uses light technology to create stunning visual artwork. However, Breton's approach to light tools is unique in that he uses his skills in calligraphy to create his own light system. His light tools may appear simple, but they require an extraordinary set of skills and talent. Breton's ability to memorize the position of each letter that he draws in the air requires a high level of imagination and coordination. Breton's light calligraphy technique involves using his light tools to create flowing lines of light that resemble Arabic or Chinese calligraphy. His light tools are essentially long exposure photographs of his calligraphy, which he creates by moving a light source through the air in a specific pattern. The result is a stunning, three-dimensional image that appears to float in mid-air. Figure 4 showcases Breton's ability to use light technology to create his unique style of light calligraphy.

Figure 4. Julien Breton's Artworks in 2016

Hence, each of the photographers are a master in their field of work where most of the time they have their own method, experience and their respective experiment set to create their own light tools. The first exposure will lead to the first experiment, and from the experiment an experience will be gained. With experience a new method is identified in order to create better light tool so that it will produce a better effect. The process will go on and is repeated until it reaches a satisfaction that is based on what they want and that is required in order to produce excellent, unique and aesthetic images.

2.4 Current Situation of Research Gap

One (1) of the main problems in this research lies with the usage of the slow shutter technique in photography which is still facing a gap between the local and international photography scene in the light painting light tools exploration. According to Acar et al., (2016), Beloeil et al., (2013) and Ocvirk et al., (2013) the elements and principles as the main aids are essential for every artist, with the evolution of technologies having been expanded and modified, the way in which the element can be put to use is still very much based on the photographer's or artist's needs. This research on experiment artificial light tool for slow shutter technique in photography has never been documenting in formal education and approach. Lack of exposure and exploration in light art in Malaysian photography is one (1) of the factors that lead to the technique is less being used and excepted by many photographers.

3. METHODOLOGY

The mixed methods were employed in collecting data for this research, encompassing both quantitative and qualitative approaches. In the quantitative approach, the researcher utilized empirical analysis and surveys to collect data. According to Goodwin, (2005) empirical research is research that reports the results of a study that uses data that are derived from the actual observation or experimentation. It was also dependent upon the experience or observation per se, without utilizing a scientific method or theory. About 19 experiments were conducted to create better tools, divided into three (3) phases of experimentation: (i) the tool without modification, (ii) the tool with modification and (iii) the fully created light tool. Every experiment constructed an experimental approach that represented all the elements of art and design, conditions and relations of the consequences. Each experiment conducted needed to be recorded or documented for the purpose of data collection, enabling the researcher to make comparisons between previous experiments for the improvement of the tools and ultimately achieve better results and findings.

Meanwhile, a survey was used to gather general information regarding the slow shutter technique, blub technique and potential of light painting as a new form of digital art as well as the trends in Malaysian photography. Used online platform to gathered valuable information and used descriptive analysis to described and summarised data points. 200 respondents answered the survey, with 100 respondents from the public, 80 respondents being photography students and 20 respondents were professional photographer. This helped in obtaining a sufficient number of representative samples, enhanced statistical power, increased precision, improved reliability and facilitated meaningful and reliable information.

On the other hand, in the qualitative approach, the researcher used a semi-structured interview to gather general information regarding the bulb technique. Used online platform to interviewed the respondents and used content analysis method to identified content by themes, concepts and words. Two (2) professional photographers were interviewed, namely Mohd Faizal Hamzah from Malaysia and Haikal El-Raysid from Indonesia. They were professionals in light art photography with both of them having extensive experience in developing their own light tools and techniques that suit to their work style. Additionally, they had been involved in numerous exhibitions and workshop locally and internationally throughout their careers in expanding light art photography.

Correspondingly, information was gathered about the tools and criteria of light art photography. A comparison was conducted to identify which tools produced a better effect in creating artwork. Tools were compared based on the criteria such as brightness, contrast and colour, that had been identified as element in produce creative and innovative light tools creations. Books, journals, newspapers, websites and articles were among the effective mediums used to gather information for secondary data to support each theory and previous studies in order to strengthen the framework of the research.

4. FINDINGS

4.1 Finding on Interview

The results of the interview highlight the early stage of the bulb technique in light art photography, indicating its potential to become the next trend in photography. This technique stands out due to its novelty, distinctiveness, uniqueness and mesmerizing glowing effects it produces which captivate the audiences. As a new style in digital art, light art can be evaluated based on specific criteria such as high aesthetic value, imaginative patterns, brightness of the light tools, vibrant colours, dynamic movement and precise line (essential elements and principles in art and design). Each exposure leads to new experiments and through these experiments, valuable experiences are

gained. With accumulated experience, the photographers identify and refine new methods to enhance their light tools, resulting in more impressive effects. This support Hunter et al., (2015) fundamental which prioritize three (3) key element of light characteristic which will aiding in the exploring and creation of light tools.

The meaning of the artwork, and a creative tool that requires creativity and innovation as light art tools play a major role in order to produce artworks. The bulb technique in light art can to be expanded by making the light tools as important role in order to produce an astonishing image. The tool can be in any form, colour, mix medium and material, surface etcetera, as long as it works according to what has been planned.

The experimentation process may involve trying out a wide variety of materials and tools in different combinations, and carefully observing the results to see what works best. For example, the researcher may experiment with different types of lighting, such as LEDs or fluorescent bulbs, and combine them with filters or lenses to achieve a particular effect. They may also explore the use of reflective surfaces or translucent materials to manipulate the way light is absorbed and reflected.

4.2 Finding on Questionnaire

From the result of the questionnaire half of the respondents are aware of light art photography as a majority of them have come across it through the internet, which means that light art photography has never been documented in the academic form. Besides, a majority of the respondents have never tried making light art photography. The Malaysian photography trend nowadays is controlled by wedding, fashion and commercial photography; it is supported by the factors from business, marketing, making new friends and aesthetic value. It is contradicted with the statement of Salaman et al., (2016) and Huang et al., (2018) where light art photography can be as one (1) of the professional media to produce collaboration artwork with others discipline such as commercial photography and fashion photography. There is still a lack of exposure and exploration in light art in Malaysian photography according to the professional photographers, students and communities. Light art photography has a huge potential to be the next trend in Malaysian photography and it can be commercialized in many aspects of area such as in fashion, fine art, commercial advertising and digital art.

4.3 Finding on Experiments

The second phase of the finding has been constructed base on an experimental approach. This data analysis will lead to the second phase of the finding, which is to the design development on the creation light tools as a main priority of possibility in producing creative images. An experiment will be fully conducted and monitored by the researcher so that the results can be compared with other findings, and the strength and weakness of the tools can be noticed. The previous experiments will be used as a guideline for the next experiment to improvise the deficiency of the light tool.

Figure 5 shows the sample of images that are based on experiment one (1) until experiment six (6) that are created using light tool on the existing light system in the market without making any modification and adjustment. Using a raw light system has tremendous disadvantage and weakness in producing an image such as intensity, space on each light and length of light. Several types of existing light system that are available in the market have been used in this phase such as LED torch light, glow stick, fluorescent light, tungsten light, laser pointer and bicycle headlight.

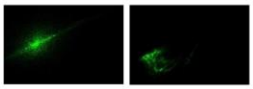
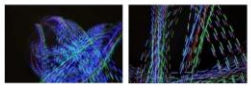
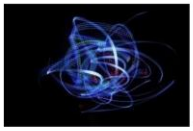
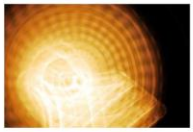
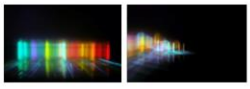
No of Experiment	Light Tool	Outcome Image	Characteristic of Light
1	1. Laser Pointer 2. Crystal Ball 		1. Poor amount of brightness 2. Average colour contrast 3. Good light propagation direction 4. Poor of colour combination (monochromatic) 5. Poor of pattern distribution
2	1. RGD LED light stick 		1. Average amount of brightness (3V) 2. Good colour contrast 3. Average colour combination 4. Poor of pattern distribution a. Limited distance between LED
3	1. LED bicycle light indicator 2. LED torch light 		1. Average amount of brightness (3V) 2. Good colour contrast 3. Good colour combination (Three colour combination and white LED) 4. Poor of pattern distribution a. Limited distance between LED b. Lack of LED length
4	1. Ceiling fluorescent light 		1. Excellent amount of brightness (36W) 2. Good colour contrast 3. Poor of colour combination (monochromatic) 4. Poor portability 5. Average pattern distribution a. Average light length creates a swoosh effect of pattern
5	1. Ceiling tungsten light 		1. Excellent amount of brightness (25W) 2. Good colour contrast 3. Average of colour combination 4. Poor portability 5. Average pattern distribution a. Average distance between light bulb creates decent light length that able to create decent pattern
6	1. Glow stick 		1. Poor amount of brightness 2. Average colour contrast cause from the lack of brightness 3. Excellent colour combination (variety of colour choice) 4. Average pattern distribution a. Poor light length

Figure 5. Sample of Artworks Bases on Tool Without Modification

Figure 6 shows the sample of images that are based on experiment seven (7) until experiment 13 that are created using light tool that is existing in the market with modification and adjustment. This phase is to be considered as the breakthrough of the research where many of the light tools start to show potential by being able to produce aesthetic images and to solve some of the weaknesses such as brightness intensity. It can be seen in the quality of the images such as brightness, contrast, colour selection, stroke of the line, effect of the texture and effect of the light have started emerging and evolving. Various light system is used in this phase such as the LED torch light with colour rice paper being attached to it, toys e.g., the light saber from Star Wars, portable decoration light that is being arranged parallel to create better length and colour paper that is shaped.

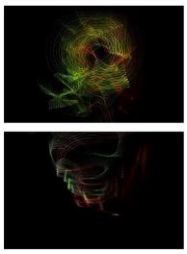
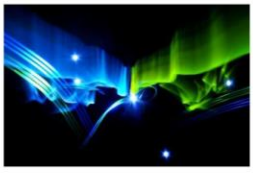
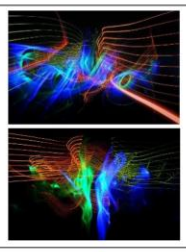
No of Experiment	Light Tool	Outcome Image	Characteristic of Light
7	1. LED light with color gel paper 		1. Good amount of brightness (6V) 2. Good colour contrast 3. Good colour combination (Three colour combination) 4. Average pattern distribution a. Limited distance between LED b. Poor light length
8	1. LED color decoration light 		1. Average amount of brightness (3V) 2. Poor brightness contrast because of the LED Watt is too low (1W) 3. Good colour contrast 4. Average colour combination (Three colour combination) 5. Average of pattern distribution a. Average distance between LED b. Average light length (freedom to arrange distance that create suitable length of the tool)
9	1. Light toy (light saber) 		1. Average amount of brightness (3V) 2. Poor brightness contrast because of the LED Watt is too low 3. Poor light distribution because of the length of light shaper too length 4. Good colour contrast 5. Good colour combination (Two colour combination) 6. Good of pattern distribution a. Good light shaper length make distribution across the frame (glowing effect)
10	1. LED light with color gel paper 		1. Good amount of brightness (6V) 2. Good colour contrast 3. Good of colour combination (Two color combination) 4. Good pattern display base on light shaper creates aurora glowing effect 5. Average pattern distribution a. Replicate light saber from previous experiment b. Average on light shaper length
11	1. LED color decoration light 2. Light toy (light saber) 		1. Average amount of brightness (3V) 2. Good colour contrast 3. Excellent of colour combination 4. Good pattern distribution a. Two types of light patterns were emerged (line stroke and glowing effect) b. Average light length

Figure 6. Sample of Artworks Bases on Tool With Modification

Figure 7 shows the sample of images based on experiment 14 until experiment 19 that are created using a light tool that is based on fully owned creation light tool. In this phase, the creation of a light tool gives a big impact in producing excellent images such as a significant brightness that gives clarity and quality of the pattern, a good contrast between each light tool, a variety of colour selection and combination based on desire as well as the length of the light tool; one (1) of the advantages in producing variety and a different quality of line stroke is the positioning of the LED light bulb and the brightness intensity from the different volts, which give a huge quality of stroke effect that is able to give the images depth in tonality and value; it creates a perspective of 3 dimensional drawing. A variety of LED light bulbs and material are being used in order to create the light tool, which is being arranged in parallel in order to give an equal distribution of power supply to the LED light bulb.

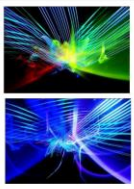
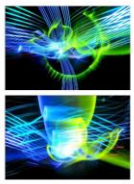
No of Experiment	Light Tool	Outcome Image	Characteristic of Light
12	1. LED light, switcher and battery port on balsa wood 		1. Excellent amount of brightness (6V) 2. Using parallel circuit (V1=V2) 3. Good LED brightness (5W) 4. Good colour contrast 5. Good colour combination (Three colour combination) 6. Good pattern distribution a. Average distance between LED (freedom to set distance between each LED create different line stroke) b. Average light length (freedom to add amount of LED light)
13	1. LED light, switcher and battery port on balsa wood 2. Light toy (light saber) 		1. Excellent amount of brightness (6V) 2. Using parallel circuit (V1=V2) 3. Good LED brightness (5W) 4. Good colour contrast 5. Good colour combination (Two colour combination) 6. Good pattern distribution a. Average distance between LED (freedom to set distance between each LED create different line stroke) b. Average light length (freedom to add amount of LED light)
14	1. LED light, switcher and battery port on balsa wood 2. Torch light with color paper 		1. Excellent amount of brightness (6V) 2. Using parallel circuit (V1=V2) 3. Good LED brightness (5W) 4. Excellent colour contrast 5. Excellent colour combination (Three colour combination) 6. Good pattern distribution a. Average distance between LED (freedom to set distance between each LED create different line stroke) b. Average light length (freedom to add amount of LED light) c. Two types of light patterns were emerged (line stroke and glowing effect)
15	1. LED strips on PVC pipe with switcher and battery port 		1. Excellent amount of brightness (9V) 2. Using parallel circuit (V1=V2) 3. Good LED brightness (8W) 4. Excellent colour contrast 5. Excellent colour combination (Three colour combination) 6. Excellent pattern distribution a. Good distance between LED (freedom to set distance between each LED create different line stroke)
			b. Good light length. (LED strip allow to custom the length accordingly – 3 feet) c. The pattern distributes across the frame equally d. Two types of light patterns were emerged at one tool (line stroke and glowing effect)
16	1. LED strips on PVC pipe with switcher and battery port 		1. Excellent amount of brightness (9V) 2. Using parallel circuit (V1=V2) 3. Good LED brightness (8W) 4. Excellent colour contrast 5. Excellent colour combination (Three colour combination) 6. Excellent pattern distribution a. Good distance between LED (freedom to set distance between each LED create different line stroke) b. Good light length (LED strip allow to custom the length accordingly – 1.5 feet) c. Two types of light patterns were emerged at one tool (line stroke and glowing effect)

Figure 7. Sample of Artworks Bases on Fully Creation Light Tool

5. DISCUSSION AND CONCLUSION

5.1 Discussion

Light art photography is evaluated based on aesthetic value, unique patterns design, brightness, colours, movement, lines and contrast of the colour. Valuable experiences in exploring leads into refining the light tools for impressive visual effects. the bulb technique can be expanded by emphasizing the role of light tools which can take in various of forms and materials. light art photography shows promising potential as an emerging digital art. Different lighting types, filters, reflective surfaces and translucent materials can manipulate light for desired effects.

The need for more exposure and exploration in the creation of light tool for light art photography is important to break-through the potential of the art style as new form of digital art with opportunities for commercialization as a professional medium for collaborative with other discipline such as fashion, fine art advertising and new media art. By embracing and promoting light art, Malaysia photography can diversify in creating creative expression and contribute to the growth and development of the local photography industry.

Hunter et al., (2015) have come out with three (3) characteristics of light that can be a guideline in identifying the great light source as characteristic in fundamental photography for the photographer to master, they are brightness, colour and contrast. These three (3) characteristics of light are the essential properties of light, but for this particular research, the researcher has identified that there are six (6) characteristics where three (3) are the new edition base on the finding throughout the 20 experiments. These characteristics have a huge potential to be used as a component guideline in order to create innovative and creative light tools, which are brightness, colour, contrast, spacing, length and power source (volts). The categories are closely related and have successfully helped the researcher in order to create better and well functional light tools base on the artistic desire.

Figure 8 shows a collection of light tools that are produced during the research, which gives a variety of perspectives, feedbacks, experiences and inputs that are developed base on experiments with the light tools.

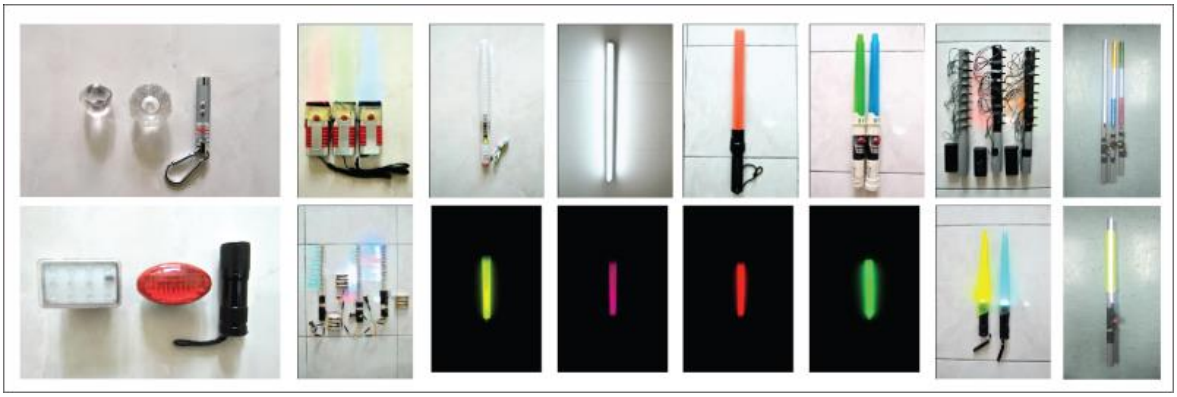


Figure 8. Light tools collection throughout experiments

Figure 9 shows that the six (6) characteristics in creating light tool with which brightness will relate with power. Brightness in this term is similar to the quality of the line; the highest power will produce better brightness which creates a good quality of line, while the lowest power will produce a thin and fine line. This will also give a better depth and the sense of perspective on the artwork. Line and quality of line is crucial because a line is considered as the main focus in the element and principle of art and design. It is also to be considered as the basis in creating an artwork. Colour will relate with contrast; the variety of colours will give more contrasts between each light tool which is able to bring forth the representation of the light in different meaning and approach. Colour also plays an important role in physiology and in creating attention to the audience. Length will relate with the space. Space in this term is space and position between the light bulb on the light tool whereby the more spacing there is between the light bulb, the longer are the light tools that will be produced and vice versa. The characteristic of length and space between LED are also important in this research because they will determine the capability of the tools in producing an attractive pattern, shape and stroke effect on the artwork.

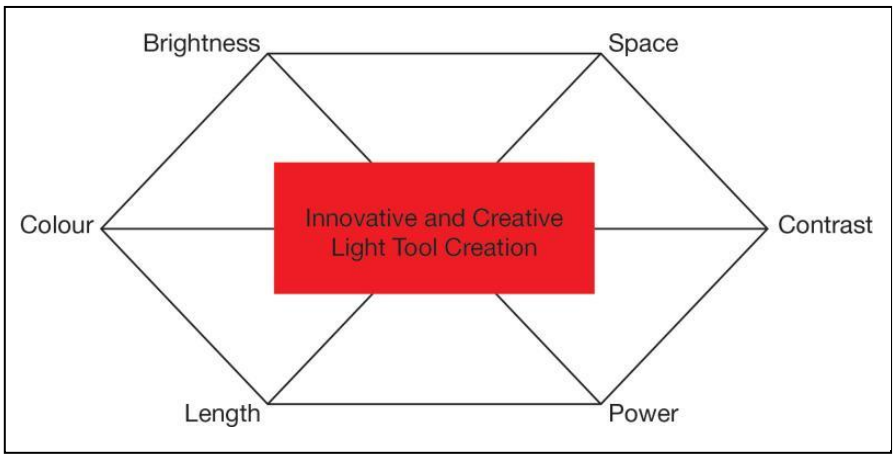


Figure 9. Framework for Creating Light Tool

5.2 Conclusion

After all the experiments have been conducted, the researcher realizes and established that every light tool has its own characteristic in order to produce an artwork. Different brightness, power, colour, contrast, length and space will give a different effect on the light pattern effect which eventually influences the images. This shows that light tools are important in order to produce artworks because it will absolutely affect the artworks. Notably, these six (6) characteristics are the essence to create a creative and innovative light tool.

This study can be extended by conducting more research and experimentations to document the process of creating light tools and in capturing fascinating images from different perspectives, such as in exploring shapes to produce light effect and exploring the value or colour gradient effect in light transition. For this study, although limited equipment has been used yet quite a number of interesting patterns has emerged.

Moreover, this research can be collaborated with other research that involves light such as research regarding light and sound for certain purpose, light and movement for particular motion or gesture, promoting a commercial value that can be related with light as a concept, storytelling on certain situation or environment by using light as the subject matter of expression, new media research that involves light such as time lapse, projection mapping, hologram, augmented reality, etcetera.

Other than that, research on improvising the essence of creating a creative and innovative light tool can also be done, and it is still acceptable as there are a lot of areas that can be covered especially in the field of electric and electronic engineering. It gives huge opportunities in expanding the light tools itself by focusing the mechanism, circuit board, configuration and blueprint of the light tools. There are great opportunities to discover something new which can be a guideline to others who are involved in a related issue. This can enhance the research into another phase by making interactive education in art and design become more vibrant and interesting. Research about light in photography is one (1) of the important fundamentals because light is the main component in order to produce fascinating and beautiful images.

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REFERENCES

1. Acar, H.M., & Kavuran, T. (2016). Photo art creativity in the education: Light drawing. SHS Web Conferences, 26, 01083. doi:10.1051/shsconf/20162601083
2. Beloeil, G., Riaboovitchev, A., & Castro, R. F. (2013). *Art fundamentals: Colour, light, composition, anatomy, perspective & depth*. England, United Kingdom: 3D Total Publishing.
3. Faughn, J., Serway, R., Vuille, C., & Bennett, C. (2006). *Fundamental of physic.* United States: Thomson Brooks.
4. Goodwin, J. (2005). *Research in psychology: Methods and design*. United States: John Wiley & Sons.
5. Huang, Y., Tsang, S.-C., Wong, H.-T. T., & Lam, M.-L. (2018). Computational light painting and kinetic photography. *Expressive: Computational Aesthetics Sketch-Based Interface and Modelling Non-Photorealistic Animation and Rendering*, *14*, 1-10. doi:10.1145/3229147.3229167
6. Hunter, F., Biver, S., & Fuqua, P. (2015). *Light science & magic: An introduction to photographic lighting.* Oxford, United Kingdom: Focal Press.
7. *Julien Breton: French calligrapher*. (2016). Retrieved from http://kaalam.free.fr/
8. *Michael Bosanko: Light art*. (2016). Retrieved from http://www.michaelbosanko.com/
9. Ocvirk, O. G., Stinson, R. E., Wigg, P. R., Bone, R. O., & Cayton D. L. (2013). *Art fundamentals: Theory and practice* (12th ed.). New York City, NY: Mc Graw Hill.
10. *Patrick Rochon: The art of moving light*. (2017). Retrieved from http://www. https://www.lightofrochon.com/
11. Salamon, N. Z., Lancelle, M., & Eisemann, E. (2017). Computational light painting using a virtual exposure. *Computer Graphics Forum* (Vol. 36, No. 2, pp. 1-8).
12. Time-Life Books. (1970). *Photography as A Tool.* United States: Time.
13. Wada, M., Nakano, A., Mizuno, Y., & Hada, H. (2016). The light painting by a fluorescence string figure. *Proceedings of the 13th International Conference on Advances in Computer Entertainment Technology* (pp. 1-5).