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ASSESSING EYE FIXATION BEHAVIOUR THROUGH DESIGN EVALUATION OF *LAWI AYAM* ARTEFACT

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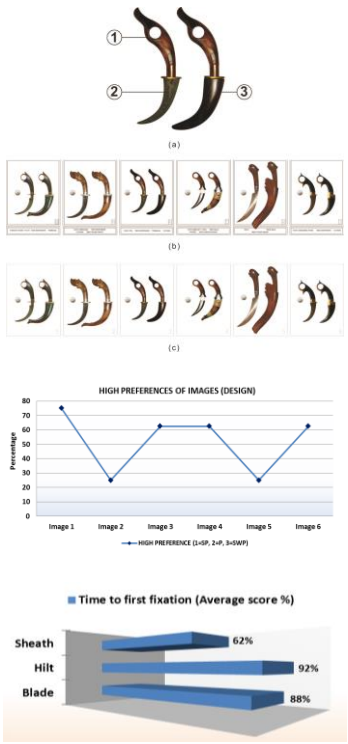
Graphical abstract



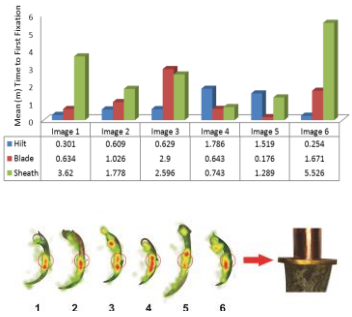
Abstract

There is a need for Malay cultural product knowledge preservation with the convergence of human science to establish the product knowledge development in innovative culture environment in Malaysia. The study uses eye tracking test to understand the user's cognition and eye behaviour towards the syntactic elements of the cultural artefact (*Lawi Ayam* – LA) using pre-existent experience. This study was conducted to evaluate the artefact effectiveness and usage efficiency through design preference. Findings from eye tracking were used to analyse the element in LA artefact that attracts the user attention using the time of first fixation and location of fixations. We concluded that the engrossed area of 3 syntactical components; 1) hilt, 2) blade, 3) sheath, revealed the factors of ergonomic rapport, anatomical, physical measurement and multi-material usage to obtain results on design preference and artefact effectiveness. We also found that pre-existent experience was recalled and manipulated effectively when defining the criteria of the syntactical component in dynamic accumulative cognition. Our findings could guide the on-going cognitive information processing on the cultural artefact to support the design-user knowledge preservation. This study recommends the future cultural and heritage product designer to use the user experience of the particular artefact in the designing process.

Keywords: Eye movement; syntactic analysis; pre-existent experience; *Lawi Ayam* artefact; artefact effectiveness

Abstrak

Pelestarian pengetahuan untuk produk budaya Melayu menjadi keperluan untuk memajukan pembangunan pengetahuan produk dengan penumpuan terhadap sains manusia dalam era kebudayaan inovatif di Malaysia. Kajian ini menggunakan ujian pengesanan mata untuk memahami kognisi pengguna dan kelakuan matanya terhadap elemen-elemen sintaktik artifak budaya *Lawi Ayam* (LA) dengan menggunakan pengalaman pra-wujud yang terbina. Ujian ini dijalankan untuk menilai tahap keberkesanan artifak dan penggunaan yang efisien melalui kecenderungan terhadap reka bentuknya. Hasil kajian dari ujian pengesanan mata digunakan untuk menganalisis elemen reka bentuk LA yang menarik pemerhatian mata pengguna melalui data masa pertama penetapan pandangan dan lokasi penetapannya. Kesimpulan kajian ini ialah



kelekaan perhatian pada kawasan 3 komponen sintaktikal; 1) hulu, 2) mata bilah, 3) sarung, telah menyingkap faktor-faktor perhubungan erat ergonomik, anatomical, pengukuran fizikal dan penggunaan multi-material ketika menyumbang keputusan pada kecenderungan reka bentuk dan keefektifan artifak. Kajian ini juga mendapati pengalaman pra-wujud dalam diri pengguna digunakan dan dimanipulasi secara berkesan ketika mentakrifkan kriteria pada komponen sintaktikal yang menyebabkan kognisi akumulatif yang dinamik. Hasil kajian ini dapat membantu pemprosesan informasi kognitif yang mampan bagi artifak budaya untuk menyokong preservasi pengetahuan reka bentuk-pengguna. Kajian ini juga mencadangkan pereka bentuk produk kebudayaan dan warisan untuk menggunakan pengalaman pengguna dalam sesuatu artifak dalam proses mereka bentuk.

Kata kunci: Pergerakan mata; analisis sintaktik; pengalaman pra-wujud; artifak *Lawi Ayam;* keberkesanan artifak

1.0 INTRODUCTION

In recent years, multiple autonomous perspectives are required in accepting the validity of higher-level accounts of human behaviour for the study of art artefacts. Exploration in cognitive neuroscience and evolutionary psychology on art artefacts leverages the empirical evidence for aesthetic experience research beyond the theoretical evolutionary considerations [1]. The process of presenting this implicit information could affect the creativeness in local cultural design state of mind [2]. For instance, the often-ignored Malay philosophy has various potential in aesthetics assessment such as representational design inspiration and the body movement rapport to mitigate ambiguity of the user's intangible knowledge [3].

This paper foresees a corroboration of user experience in eye movement test to reveal the Malay culture behavioural knowledge and cognitive evidence in aesthetic interaction between person context and artefact context for the development of design-user interrelationship guideline system. In this study, the usage of computational interaction like eye tracking method was employed to support the understanding of users' ergonomic behavioural towards functional artefact, and to leverage the data for the new designing purposes. Although, eye tracking have already been used in some other design fields such as fine art [2], web design [7] and landscape [4, 5] the method is still new in cultural artefact research. Hence, this paper reports the role of eye tracking technology to present the Malay tacit knowledge during the perceptual user's eye observation by improvising the user experience knowledge of *traditional Lawi Ayam* as an art artefact. During the experiment, 'salience mapping' [6] was employed to understand how an eye gaze could influence the result of behavioural as cognitively driven. Also, fixation time analysis [8] methodology on a syntactical component in eye-tracking method was selected as the research approach and data acquisition method.

2.0 LITERATURE REVIEW

In aesthetic experience, many researchers use eye movement test as a method to reveal covert perceptual and a cognitive process that trigger the visual perception and aesthetic evaluation. Based on the data obtained from keyword search of "eye tracking" in Google Scholar, it was found that (619 articles on Malaysian design) eye tracking had previously been used to understand user behaviours on tourism, e-Commerce, e-Learning, package label and designs, gaming environment and affective interaction design using fixation and heat maps generated from eye tracker [7]. In a recent study of eye tracking [8], they found that Malaysians are highly attracted to the prominent design elements such as large buttons with good affordance that speeds up decision making to proceed to determine the price of the hotel. In comparison, there are high tendencies for Malaysian users to hold back their feedback during the usability testing that could impact the results from usability testing [9]. However, the study for Malaysian user seldom involves a specific user who dealt with a cultural artefact.

In line with the above proposition, recorded fixations and gaze data from eye-tracking experiments are useful to understand the user preference through the focused location and dwell time on each composition of stimulus [10, 11]. Longer viewing time and multiple fixations are caused by occurring memory of specific scenes during the test to result in better data encoding [12, 13, 14]. There is a wealth of literature dealing with fixation pattern [15] in reading such as interactive computer interaction and picture perception [4, 5], font, logos and also for colour preferences. These studies show that fixation is a popular metrics employed by prior researchers that entirely dependent on the intervening saccades of fixation that can be detected and which the researcher wants to recognize. Despite the great works, the author argued that they only focus on how the viewer interprets their perception towards the stimuli using current experience. Therefore, our study attempts to

understand how user mind interacts with the potent stimulus obtaining the use of pre-existent experience using data from fixation metrics (time of first fixation and hotspot location).

As fixation metrics is chosen, previous study highlighted well-known models of 'salience map' to predict salient regions in an image [6]; regions that are likely to draw attention to the person based on a significant proportion made while free-viewing different images to explore design and syntactic features such as material, colour, form, texture, surface pattern and decoration details [16]. The mapping uses time, location and duration of fixations to understand if the aesthetic factor could also affect positive feedback [17]. A study had proven a strong relation between salience mapping and syntactic dimensioning on stimulus when a user able to respond using different types of information on the artefact appearance. For instance, artefact appearance can convey; it's aesthetic and symbolic value as a design element [11, 18], can correspond with functional characteristics and ease of use, can draw attention by visual novelty and correspond with product categorization [2]. However, there is a rare discussion about the role of syntactic properties of cultural artefact towards artefact effectiveness in the eye movement from the perspective of a specific user group. Therefore, salience mapping is useful in scrutinizing the artefact using fixation information in eye tracking test by a trained user.

This study uses a Malay traditional small curvy weapon (4 inches to 12 inches) associated with hilt, blade and sheath known as *Lawi ayam* (LA) [3, 19, 20, 21, 22, 23, 24] in the eye tracking test to understand how the LA trained user's eye behaves toward predicted syntactic properties with amalgamation of pre-existent experience. The study limits on the artefact effectiveness and usage or movement efficiency. The LA trained user is the person who is experienced with the use of a LA artefact through the understanding of cultural analogic thinking [3, 18]. A recent study posited that analogic thinking is the representational persuasion from nature to explain the inferences of behavioural ergonomics and cognitive knowledge to enhance the understanding of the design characteristic and intangible philosophy of LA artefact [19].

The objective of this study is to investigate the uses of pre-existent experience on design evaluation of traditional LA artefact associated with specific skill usage in eye tracking technology. Specifically, it examines the behavioural responses of trained user on the syntactic features of LA focusing the feedbacks on the design preference, artefact effectiveness and usage efficiency. In line with skill-base artefact, 'aesthetic interaction framework' [2] could support the investigation of interaction between the person and the stimulus (LA) to determine a good quality of behavioural data on eye observation and pragmatic rapport as attributes to dynamic interaction.

This study attempts to elicit various distinctions of eye behavioural evidence in aesthetic judgement on skill-base artefact design (LA) in the process of how the user mind interacts with the potent stimulus obtaining the use of pre-existent and cultural memory. Therefore, the user-product interrelationship for knowledge preservation in Malaysian cultural product could be established. This paper will present the finding of the relationship between users' eye behaviour and main syntactic components of Malay traditional weapon artefact using an analysis of behavioural responses data and eye tracking data (time of first fixation, hotspot visualization and RTE feedbacks).

3.0 METHODOLOGY

Eye movements were recorded with a Tobii T60 Eye Tracker, Tobii Studio and Mi-UXLab, (formerly known as URANUS, [25] in Lab Based Usability Testing (MIMOS Berhad, Malaysia). Participants are required to fill up the data in Mi-UXLab application during the warm-up session using the print out picture based on their design preference. Next, the participant was seated in front of the computer screen of Tobii T60 Eye Tracker equipped with Tobii Studio.

3.1 Participant

In this study, eight users (qualified users) were recruited from various Malay *Silat* martial art schools in several states of Peninsula Malaysia (Kelantan, Penang and Selangor). The number of participant meets the minimum requirement for heat map generated from eye tracking that requires about 6 participants when conducting a qualitative eye tracking study [25]. The mean age was 50. All users have more than 10 years of experience in Silat practice and more than 5 years in artefact practise such as LA, *kerambit, tongkat* (wooden stick), *golok* (cleaver), *lembing* (javelin) and *keris*. They are familiar with the context of use in term of artefact typology and body movement (the user, the ring of training place (*gelanggang*) and LA artefact that was used in a training session. All of the participants had normal or corrected-to-normal vision.

3.2 Stimuli

The stimuli of this study consisted of 6 designs of LA artefact that were superimposed on the white background in 6 different frames. The artefact design was selected after the terminology and the physical criteria were redefined through ethnographic study [19]. In every image, the LA was positioned in basic gripping angle. The artefact without sheath (exposing the blade) arranged side by side with the artefact in the sheath. Three main syntactic components were the independent variables predicted to be observed; hilt, blade and sheath

(Figure 1a). Two types of series of images prepared in this test; 1) printed version for the warm-up session (Figure 1b) Jpeg file images with 300 dpi for eye tracking test (Figure 1c). Every image accompanied by 50 cent coin (Diameter=32mm) to show the consistent scale of every artefact.

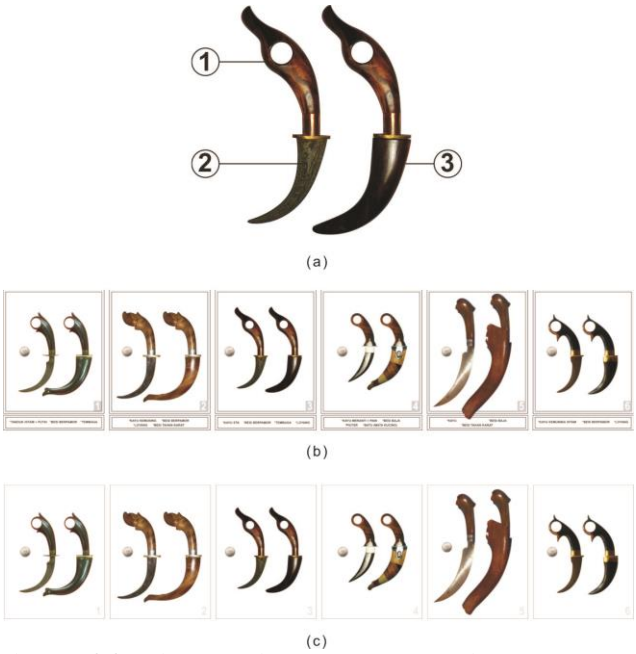


Figure 1 (a) Main syntactic components predicted to be the region point of attraction; 1) Hilt, 2) Blade 3) Sheath, (b) 6 printed images with material indication for warm-up session. (a) The same six images without material indication for the eye-tracking test.

3.2 Procedure

The test conducted in 2 different rooms. The background tests started with warm-up questions. Participants were asked to identify and rank the artefact design based on printed version of the stimuli (6 design of LA) by the moderator. The user answering it by filling up the data in Mi-UXLab based on 6-point Likert scale (1 (strongly preferred), 2 (preferred), 3 (somewhat preferred), 4 (somewhat less preferred), 5 (less preferred), 6 (strongly less preferred). The 6-point scale was chosen to have an even number of ratings on the scale to obtain participants' preference either the positive or negative response to the stimuli. To note, neutral rating (forced response) may not be as necessary compared to a situation if a participant is very familiar with the subject, where it could be argued that the participant could truly have a neutral attitude towards the subject at hand in the latter case. The verbal feedbacks were recorded using audio recorder. The warm-up session ended within 10 minutes.

Next, the user seated in front of eye tracker in the second room. The eye tracking procedures occurred into two stages; 1) the calibration procedures, 2) the experimental procedures. During the calibration process, the participant was required to fixate at various points on the screen. After calibrated, the test began with a slide that informed them to view the artefact shown to evaluate their syntactical preference. The participant was allowed to view the image for 10 seconds. Then, the moderator extracted the heat map from the eye tracker and displayed it to the user and requested the user to think aloud and explain his action based on the heat map and gaze plot. The participant also requested to justify his sequence of visual cues based on gaze plot verbally. The procedure was repeated for the rest of 5 images, which is known as Retrospective Think Aloud with Eye Tracking (RTE), which is similar to study by Rösler [26] and Goh *et al.* [27].The equipment was recalibrated throughout the experiment when necessary.

4.0 RESULTS AND ANALYSIS

The analysis for this study is twofold to answers the study theoretical propositions. First, the behavioural responses data based on user pragmatic rapport recorded in the Mi-UXLab using the mean analysis to understand the viewer's eye preference in the whole design of artefact in the physical image presented. Secondly, the syntactic analysis covers the component, the structure of the design and the material using the time of first fixation data, RTE feedbacks and heat map analysis (hotspot) to represents the viewer's visual attention and eye preference. Recent study supported that fixation, heat map data and RTE had successfully proven to analyse the content dimensions, the spatial organization of the content and the participant verbal description to show strong associations with dynamic depictions on stimuli [4]. Results on the artefact effectiveness and usage efficiency will majorly use the data from visual attention to elicit in the process of how user mind interacts with the stimulus (LA artefact) obtaining the use of pre-existent usage experience. The result is useful to establish the user-product interrelationship.

4.1 Behavioural Response Data: Relationship Of Design Preference Among Artefact Effectiveness And Usage Efficiency

The results of frequency analysis were used to identify the relationship between the user perception and syntactical properties of the artefact for these images. The frequency analysis provides a percentage score to quantify overall result based on design evaluation in the ranking task. In Table 1, the researcher summarized the total of 6 ranking scales into two groups, that is high preference (1 = SP, 2 = P, 3 = SWP) and low preference (4 = LP, 5 = SWLP, 6 = SLP). This grouping provided better understanding when the comparisons of criteria were made. In addition, verbal responses in this ranking task also revealed some promising insights.

Table 1 Percentage Analysis of preference ranking of LA artefact images

	1 = SP	2 = P	3 = SWP	Total %	4 = LP	5 = SWLP	6 = SLP	Total %	N
	%	%	%		%	%	%		
Image 1	12.5	25	37.5	**75**	12.5	0	12.5	**25**	8
Image 2	12.5	12.5	0	**25**	0	50	25	**75**	8
Image 3	0	25	37.5	**62.5**	37.5	0	0	**37.5**	8
Image 4	25	25	12.5	**62.5**	12.5	12.5	12.5	**37.5**	8
Image 5	12.5	12.5	0	**25**	12.5	12.5	50	**75**	8
Image 6	37.5	12.5	12.5	**62.5**	25	12.5	0	**37.5**	8

*SP (strongly preferred), P (preferred), SWP (somewhat preferred), SWLP (somewhat less preferred), LP (less preferred), SLP (strongly less preferred).

Based on the high preferences ranking group, the majority of the participant (62.5% to 75%) highly preferred the images of 1, 3, 4 and 6 that have appropriate design criteria of artefact effectiveness. The participant responded that the artefact on the images have the appropriate measurement of angle, length and radius of the curvy blade, which effective for good cutting sphere and causing severe injuries. According to various studies, the LA was designed based on user's anatomy such as the blade width is based on the size of the owner's eye and forefinger phalanx, meanwhile, the length and curvature is based on the distance along the ear to the centre of his eye (one side) [21, 23]. Accurate blade measurement with ergonomic grip position (the exposed blade from the gripping line by at least 50%) will result in high effectiveness with only a minor swing slash or upward ripping movement [19]. Besides that, 7 out of 8 participants significantly preferred the hilt with ring hole to insert the finger to secure the grip compared to the hilt that lacks ring hole. In the same token, the designs were ranked according to minimal uses of technique and body movement on using the artefact [29].

In comparison, Images 5 received the highest 87.5% percentage of participants' agreement on SLP (50%) based on three low preferences ranking group. In similar with Images 5, the frequency analysis shows an identical percentage of SWLP for Image 2. Interestingly, the researcher found both designs had similar criteria that are, hilt without ring, which is believed to contribute to the less preferred ranking. The RTE supports with a majority of them has given negative feedbacks on the particular image that there is no ring in the hilt and the wide radius of the blade is uncommon with what they have normally use. Due to the significant differences in the design criteria, limited ergonomic criteria and safety factor are issues that could affect the quality of handling and inefficient skill usage. They emphasized that the artefact in Images 5 is not a LA, although one of the participants claimed that the artefact is the same type of LA.

The frequency analysis was also used to identify the interrelationship between the LA user and LA artefact in the images to reflect the design preference among artefact effectiveness. Based on the percentage value in high preference group, graphs were plotted in Figure 2. Surprisingly, the graph fluctuates when the images were randomly positioned. The fluctuation suggested that the participants were consistent during ranking of the images they saw without any bias from design differences. The graph shows that the design in Image 1, 3, 4 and 6 have high possibilities of effectiveness when the preference percentage increases. As discussed previously, one possible reason that led to this dynamic evaluation is the measurement criteria and ergonomic handling in usage ability to ensure the effectiveness that proved the participants' agreement. For instance, the graph shows the participants were convinced with the design in Image 1 as the effective LA.

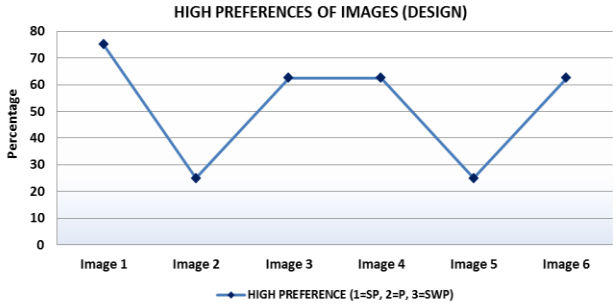


Figure 2 The graph depicts the three scales of strongly preferred, preferred and somewhat preferred that categorized as high preferences category

4.2 Syntactic Analysis Eye Tracking Data: Heat Maps, Time To First Fixation And RTE

In the syntactic analysis, the result was inferred and analysed from data of heat map visualization and time of first fixations for each image with the support of the RTE data. Previous scholar supported that significant finding of the larger amount of fixations in the same observation time will increase the observer's capacity to identify, recognise and memorise what represented in the image [3, 15]. Unfortunately, data from 1 out of 8 participants cannot be generated due to a recording error. Probably, because of the particular participant's eye are small. The number of total participants still meets the minimum requirement when conducting a qualitative eye tracking study [25, 26]. The result validity is compared with the behavioural response results section to see the significant finding on the design preference and artefact effectiveness.

Figure 3 shows the percentage mean score of the time of first fixation result for every main syntactical component. The hilt received the highest average score (92%) for the times of first fixation result, despite every six designs are different. The blade component received the total average score of 88%. Meanwhile, the sheath has the lowest (62%). Syntactical analysis

has proven to provide the perspectives of ergonomic rapport on how functional artefact should be designed according to the suitability of the proper usage and user movement [30].

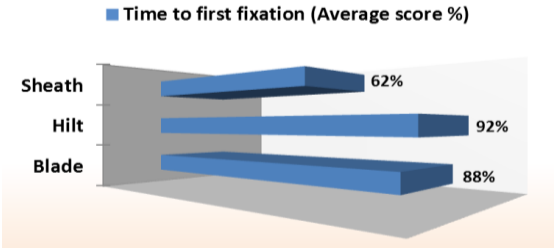


Figure 3 The average percentage score of time to first fixation for every main syntactical component

The following syntactic analysis of every component refers the result of time to first fixation in Figure 4.

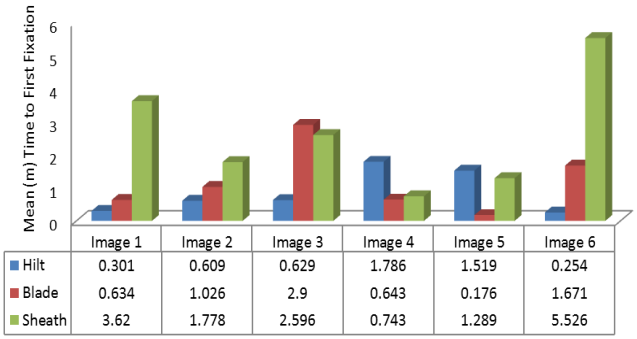


	Image 1	Image 2	Image 3	Image 4	Image 5	Image 6
Hilt	0.301	0.609	0.629	1.786	1.519	0.254
Blade	0.634	1.026	2.9	0.643	0.176	1.671
Sheath	3.62	1.778	2.596	0.743	1.289	5.526

Figure 4 Mean analysis of time to first fixation on every main syntactical component

4.2.1 Syntactic Analysis Of Component 1: Hilt

Table 2 shows the comparison of the mean score of time to first fixation for every syntactical component. Mean analysis indicated that image 4 has highest average score time to first fixation showed the hilt of (m=1.786). As RTE supports, this suggested that the participant were more likely to take some time to fixate on the hilt design as they (expert user) know that simpler hilt design provide definite effectiveness in LA uses. They highly preferred the ring on hilt without additional sub-component has a better ergonomic grip position that the design and size of hilt should moderately suitable with the LA owner hand size [19].

Conversely, Image 6 has the lowest average time of first fixation (m=0.254) suggested the hilt design attracts the participant faster. They responded in RTE that an impropriate position and size of sub-component (horn) on image six could result in inflexible uses of the technique. The result suggested the hilt in Image 6 is likely for aesthetic purposes unless it was designed based on a personal grip preference, how an individual moves and uses of the technique.

On the other hand, all the heat maps in Figure 5 shows the most fixated areas in artefact images are between the blade and the hilt area. Analysis on the red spot on the heat map visualizations shows the fixated area is focusing on the 'guard' between the hilt and the blade (Images 1, 2, 3, 4 and 6). The RTE analysis showed that 5 out of 7 participants agreed that the guard component makes it difficult to grip the LA firmly and to use manoeuvre technique. They stated that the unnecessary modification of LA hilt area could result in ineffective initiation, artefact handling and body movement. Although the guard design fits with the purpose of protecting the hand from getting injured, it does not provide a major function in the required technique of LA usage. In fact, half of the participants believed that the existence of guard in LA is an influence from the other weapon such as colonial sword, Pattani sword, Arabic sword or even the *Jembiah* (curvy dagger) [20, 22]. The researcher found that the additional sub-component in LA had been innovated based on personal preference of design and collective design influences. This result showed 7.5% of the participants agreed on the similar issue.

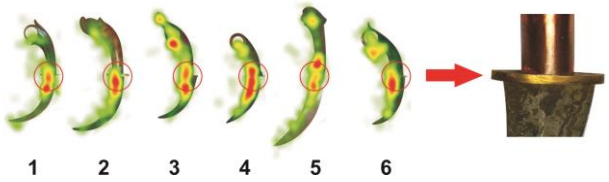


Figure 5 Circles on heat map images to indicate the fixated on guard sub-component of the LA

Surprisingly, in this result, the hilt characteristic is still a prominent marker in the context of LA design and usage although not statistically significant. This result suggested that the user who is vastly familiar with the hilt design has excessively viewed the other components, for instance, they were more attracted to the six different blades presented in the images. These results may also be associated with the time to first fixation that involved a particular sub-component (guard) that distracts their perceiving on the images.

4.2.2 Syntactic Analysis Of Component 1: Blade

In Figure 4, the average *mean* of time to first fixation for blade component showed the Image 5 received the fastest time (m=0.176). Probably, the fast fixation result was caused by the physical blade appearance. Figure 6 compares the Image 5 with the Image 3, which received the slowest fixation (m=2.900). The red spot in the heat map in Image 3 is rather uniform compared to Image 5. The scattered green spot in Image 5 suggested how the eye behaviour of participants tried to evaluate the radius of the blade due to the significant weirdness.

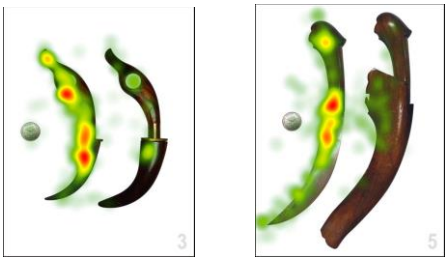


Figure 6 Hot spot Comparison in Heat Map visualization of Image 3 (left) and Image 5 (right)

The RTE has supported that 6 out of 7 participant has less preference on the blade curvy shape as it has bigger radius than it is supposed to be (which at least 45 degrees angle and the blade length is between eyes to ear). The researcher also learned from the participants about the inappropriateness in blade measurement could lessen the effective impact of upward stabbing (*sauk*), swing slashing (*layang*) and hooking (*cangkuk*) [19]. This finding confirmed the behavioural result that the lack of ergonomic factor and low safety factor affects the quality of handling, artefact effectiveness and inefficient skill usage.

Conversely, although the blade of Images 3 has the attracts the slowest mean score, the RTE analysis found that the participant believed if the blade width proportioned with the length, the cutting sphere would be more efficient. These results proven when participants' agreements were consistent on the blade criteria that good curve angle and length should not impair the usage technique.

Overall, the blade shows the average fixation score is high (88%), and the F-score shows that the result is significant. The result supported by 80% of the participants suggesting that they attracted to the blade; 1) the hand movement in LA usage such as swing-slash, upright stab and ripping off the targeted part complemented the function of the blade curvy design, 2) the blade initiated with tactical moves could easily; cutting off the nerves system, jugular vein, joints, slicing the flesh, and eye socket, even breaking the bone, 3) the high preference for the simplest hilt design confirmed that the hilt with ring hole is more ergonomic to grip and to use.

4.2.3 Syntactic Analysis Of Component 1: Sheath

Artefact image 4 has the lowest score (m=0.743) amongst all the mean score of time of first fixation. The result suggests that the participants' eyes faster attracted to the sheath design of Image 4 compared to the other five designs. In RTE analysis shows the high preference in the sheath design of Image 4. The variant of material is the major factor to serve as the aesthetical element to represents the status of the owner by the use of semi-precious stone, high quality of wood and decorative material, e.g., silver and pewter. Incorporation of different material serves as a desirable aesthetic factor by certain LA user and craftsmen to attribute meaning to object design [22, 31]. In contrast, Image 6 resulted in the highest average mean score time of first fixation (m=5.526) which indicated most of the participants took some time to favours the finishing and material quality on the particular sheath. However, these results suggest that the sheath component has less connection in LA artefact effectiveness and usage efficiency as sheath function is to protect the owner from getting injured by the sharp or poisonous blade. As the previous study fails to elucidate further about the function of LA sheath [21, 32], information of the sheath component was ameliorated by the RTE and fixation result.

5.0 DISCUSSION

Our novel finding showed the link between the time to first fixation and pattern has a dynamic interaction when the pre-existent usage experience are recalled (philosophy of artefact and the philosophical movement) and manipulated in an implicit manner. Thus, the finding enhances the visual feedback during the artefact ranking session (75%). The results agree with previous studies [14, 15] when the participant (trained user) consistently presented both negative and positive feedbacks to justify their preference. The result in this study supports previous study [5] that how the eye behaviour of the viewer interprets their perception towards the stimuli, which is associated with the past and current experience. To note, our finding interestingly reveals the aesthetic perception by LA trained user based on their pre-existent experiences.

Through syntactic analysis, the study confirmed the vital physical requirement yet ergonomic in LA design ensures the effectiveness and usage efficiency. The significant result in time of first fixation and RTE showed that; 1) the blade is the vital component to contribute severe fatality during the artefact initiation, 2) the hand movement in LA usage such as swing-slash, upright stab and ripping off the targeted part complemented the function of the curved blade design (the blade with those moves could easily cutting off the nerves system, jugular vein, joints, slicing the flesh, and eye socket, even

breaking the bone). This finding increases the validity of the behavioural analysis by 75% agreement.

The highest preference on the simple design of LA confirmed that the hilt with ring hole is a prominent marker of the artefact and more ergonomic to grip. Thus, the eye tracking result compliments the finding from previous ethnography study [19]. However, this study found that how the blacksmith and novice user seems unaware of certain innovation that could inflict the user performance and artefact use even when they adding small sub-component (guard). Therefore, the findings from the 'salience mapping' and interaction framework are likely useful to form a dynamic design-user attention based on the outer level of syntactic properties.

Therefore, this study recommended syntactical analysis on traditional artefact like LA could bridge the ambiguous understanding the physical behaviour ergonomic and pre-existent experience/knowledge of LA user. As a recommendation, a further statistical analysis can help to understand how syntactic properties affected the gaze behaviour. These recommendations provide specific insights on how the future functional cultural artefact should be sustained and further designed according to the user experience.

6.0 CONCLUSION

An eye-tracking test was used to help the design evaluation process on several Malay traditional artefact designs to understand the user experience and object identification. We found that expected fixated area had revealed the crucial design factor to define the artefact effectiveness and usage efficiency. Interestingly, the finding also has proven eye-tracking to be a systematic way to justify every criterion of LA artefact in Malay traditional weaponry system to assist the LA artefact classification. This eye movement and pragmatic rapport knowledge contribute the new paradigm of ergonomic behavioural study and creates a new corpus of artefact-driven assessment using a Malay traditional weapon artefact. We hope that these significant findings would contribute to close the knowledge gap for our young generation towards traditional knowledge preservation in new culture setting environment.

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