ORIGINAL ARTICLE

PHYSICAL ERGONOMIC APPLICATION PREFERENCES IN THE DESIGN DEVELOPMENT PROCESS AMONG MALAYSIAN DESIGNERS

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ABSTRACT

The industrial designer holds a crucial part in the cycle of consumer culture by making new technology pleasant to be owned. The enjoyment of having an object falls within the aesthetic and ergonomic concept, where user preferences are given precedence. This research aims to see present practices among Malaysians who are specialized in the field of design, applying one of the physical ergonomic sub-criteria. A collection of information from 603 participants was acquired through 32 organizations that exercise design-related practices using a non-probability purposive sampling study. An overall understanding of Malaysian designers' tendency for physical ergonomics during the design development phase has been structured in line with the physical ergonomic sub-domain. The primary finding of this study is the amount of precedence segregation within the physical ergonomic component, helping designers to determine the most significant values during the design process. This will significantly assist the designer in performing the design development task by improving its effectiveness. This tabulation on the preference of the designer will also support in developing a new design structure comprised of the improved element in the physical ergonomic domain. Furthermore, it will positively assist the university in Malaysia to search for the loophole in their curriculum construct to improve the performance of their design-related students further.

Keywords: *Physical ergonomic, design process, ergo-aesthetic*

INTRODUCTION

Ergonomic is a comprehensive overview of human behaviour and how it interacts with the item. A product's originality features and aesthetics will be driven by culture and human behaviour (Christensen & Ball, 2015; Duncum, 2010; Lupo, 2011). Differentiation of culture can influence aesthetic assessment and communication with an item (Hoe, 2013; Manning & Amare, 2013; Taifa & Desai, 2016). The behaviour will also demonstrate the optimal evaluation of the item (Cai & Chen, 2016). The item, on the other side, functions as a communication tool medium between designer and user (Xenakis & Arnellos, 2013). A visual assessment can assist in evaluating the ergonomic variables, decrease primary deficiencies and de-crease the length required to analyse an item (Aromaa & Väänänen, 2016; Gao et al., 2016; Zhou et al., 2016). Besides, organisational ergonomics such as knowledge management culture, positive human resources, own brand and design, concentrating on a particular sort of furniture and a pleasant company atmosphere will assist in improving manufacturing output (Besch, 2005; Guimaraes et al., 2016; Jacobs et al., 2016; Ng & Thiruchelvam, 2012). Furthermore, the socio-demographic variable will also determine a user's purchasing attitude (Lihra et al., 2012).

There are three (3) primary areas of specialization in ergonomics, which are physical, cognitive and organizational (International Ergonomic Association, 2000). Each of these domains performs a crucial part in securing that the human factors in a product's design growth have been intensively ad-dressed. Each of these ergonomic classifications has been mentioned below following the International Ergonomic Association.

I. Physical ergonomic
    a. Human anatomical
    b. Anthropometric
    c. Physiological
    d. Biomechanical characteristics (working postures, materials

handling, repetitive movements, work-related musculoskeletal disorders, workplace layout, safety and health)

II. Cognitive ergonomic
   a. Mental processes (perception, memory, reasoning, and motor response)
   b. Mental workload, decision-making, skilled performance, human-computer interaction, human reliability, work stress and training as these may relate to human-system design

III. Organizational ergonomic
   a. Optimization of sociotechnical systems, including their organizational structures, policies, and processes
   b. Communication, crew resource management, work design, design of working times, teamwork, participatory design, community ergonomics, cooperative work, new work paradigms, virtual organizations, telework, and quality management

Based on these ergonomic fields, physical ergonomics perform a crucial part in the development phase of industrial design to guarantee that all designed products are entirely suited to all individuals. A designer generally finds it difficult to decide the essential component within physical ergonomics, including individual postures, item dimension, user motion, and item handling. This research embarks on the Malaysian designers' priorities studies towards physical ergonomics. Thus, it will assist designers in making a significant decision about the highest key component within physical ergonomics apart from the least priority component during the design process.

METHODS

RESPONDENT BACKGROUND

The survey set has been presented in a printout booklet form and has been conducted throughout 32 government agencies, design studios and design related institution in Malaysia, as per Table 1. A total of 603 respondents participated in the survey. Table 2 shown, groupage between 18 until 24 years old dominate the age group by 543 respondents, which are 90% of the total numbers. The number of female respondents is slightly higher, with 338 (56.1%) compared to male respondents who are 265 (43.9%), which has been shown in Table 3. All respondents have been specially selected to have an essential de-sign background, with 91.9% of them is currently studying design courses throughout the government and private institution in Malaysia. Furthermore, 56.1% of the respondent is either have a diploma certificate or bachelor's degree in design courses (Table 4). On the other hand, there are 23 respondents have a higher postgraduate degree in the design field.

Table 5 shown, most of the respondents are specialised in Industrial design area, which is 86.2% (520 respondents). On the other hand, 11.9% respondent (72 respondents) specialised in Build Environment sector which include Architecture, Landscape Architecture and Interior Architecture and the lowest group of respondents is from Engineering fields which is 1.8% (11 respondent). Majority of the respondents, which is 554 (91.9%) individuals is a designed based student, and 541 of them did not have any industry-related experience (Table 7).

Table 1 Distribution of respondent frequency according to affiliation numbering

Affiliation	Frequency	Percent
Organization 1	47	7.8
Organization 2	40	6.6
Organization 3	61	10.1
Organization 4	66	10.9
Organization 5	48	8.0
Organization 6	56	9.3
Organization 7	54	9.0
Organization 8	75	12.4
Organization 9	26	4.3
Organization 10	55	9.1
Organization 11	54	9.0
Organization 12	1	.2
Organization 13	1	.2
Organization 14	1	.2
Organization 15	1	.2
Organization 16	1	.2
Organization 17	1	.2
Organization 18	1	.2
Organization 19	1	.2
Organization 20	1	.2
Organization 21	1	.2
Organization 22	1	.2
Organization 23	1	.2
Organization 24	1	.2
Organization 25	1	.2
Organization 26	1	.2
Organization 27	1	.2
Organization 28	1	.2
Organization 29	1	.2

Organization 30	1	.2
Organization 31	1	.2
Organization 32	1	.2
Total	603	100.0

Most of the respondent show they are familiar with the industrial design process (n=562; 93.2%) with only 41 respondents (6.8%) did not know at all about it which has been listed in Table 8. Throughout the analysis part, it is essential to note that the result presented is highly influenced by design institution students (n = 554; 91.9%), which is resemble most of the respondents aligned with the output from the Table 6.

Table 2 Respondent background according to age criteria

Age (years old)	Frequency	Percent
18 to 24	543	90.0
25 to 34	53	8.8
35 to 44	7	1.2
Total	603	100.0

Table 3 Respondent background according to gender criteria

Gender	Frequency	Percent
Male	265	43.9
Female	338	56.1
Total	603	100.0

Table 4 Respondent background according to academic criteria

Highest academic qualification	Frequency	Percent
SPM, STPM or Matriculation Certificate	242	40.1
Diploma Certificate	127	21.1
Bachelor's Degree	211	35.0
Post Graduate Degree	23	3.8
Total	603	100.0

Table 5 Respondent background according to area of specialization criteria

Area of specialization	Frequency	Percent
Industrial Design	520	86.2
Engineering	11	1.8
Architecture, Landscape Architecture, Interior Architecture	72	11.9
Total	603	100.0

Table 6 Respondent background according to business nature criteria

Business nature	Frequency	Percent
Student	554	91.9
Design firm	11	1.8
Manufacturing Industry	13	2.2
Academic	24	4.0
Government Agency	1	.2
Total	603	100.0

Table 7 Respondent background according to design experience in related field criteria

Design experience in the related field	Frequency	Percent
Student	541	89.7
1 to 3 years	28	4.6
4 to 6 years	14	2.3
7 to 9 years	11	1.8
10 years & above	9	1.5
Total	603	100.0

Table 8 Respondent background according to familiarity with industrial design process criteria

How familiar are you with the industrial design process	Frequency	Percent
Not at all	41	6.8
Slightly	129	21.4
Somewhat	216	35.8
Moderately	193	32.0
Extremely	24	4.0
Total	603	100.0

RESULTS AND DISCUSSION

Designers preferences on physical ergonomic

Figure 1 shows the mean tabulation for Physical Ergonomic attributes in developing a design. Human Postures (M=4.12, SD=0.834) getting the highest tendency of priority among others with Product Dimension (M=4.01, SD=0.833) becoming the lowest one. User Movement (M=4.09, SD=0.823) and Product Handling (M=4.08, SD=0.810) received slightly the same level of preference with just 0.01 differences.

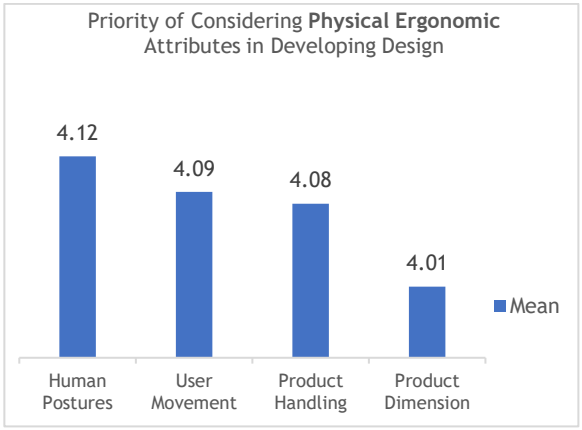

Figure 1 Mean tabulation on priority of considering physical ergonomic attributes in developing design

Table 9 Descriptive tabulation on priority of considering physical ergonomic attributes in developing design

Physical ergonomic	N	Minimum	Maximum	Mean	Std. Deviation
Human postures	603	1	5	4.12	.834
Product dimension	603	1	5	4.01	.833
Product handling	603	1	5	4.08	.810
User movement	603	2	5	4.09	.823
Valid N (listwise)	603				

The Physical Ergonomic graph (Figure 2) visually can be separated into two leading groups which are Group A which has a higher number of mean (Human Postures, User Movement, Product Handling) and Group B with a lower number of mean (Product Dimension). Group A is an element that highly related to the normalisation of daily human activity. This process of doing or handling something becoming a habit which afterword affect the judgement on the comfort level of performing a task. Thus, Group A is a group of elements that highly related to the human, and it surely will be considered by designers while developing a design. On the other hand, Group B (Product Dimension) is quite as crucial as other elements, but the access towards the actual anthropometry data on the specific product is hard to obtain as most of the respondents are from the student group.

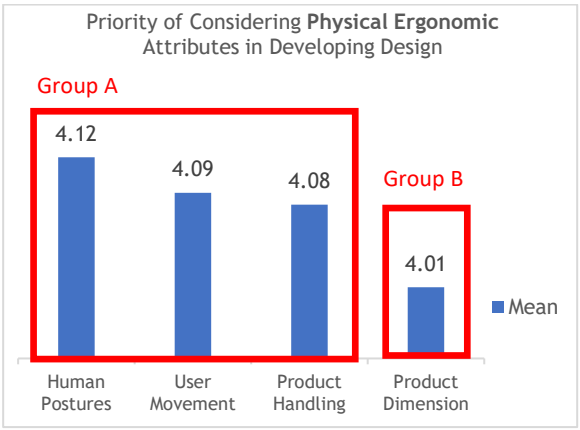

Figure 1 Mean tabulation on priority of considering physical ergonomic attributes in developing design by group

CONCLUSION

Designers will gain a thorough understanding of their item by applying the physical ergonomic concept. In return, consumers will achieve a fresh and sophisticated brand experience appreciation. Besides, this approach will restrain the item from being alienated but will instead be accepted by the users through a well-adapted cultural linkage. The physical ergonomic segregation can reflect the significant importance that the designers need to take into consideration. In fact, it is possible to achieve a sophisticated and neat impression of the furniture by proper use of material and forms that conform to natural postures and customer motion. In other words, when designing a consumerism item, the correct implementation of physical ergonomics will lead to a more thorough understanding of users' demand.

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COMPETING INTERESTS

There is no conflict of interest.

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