

THE DESIGN OF PRODUCT IDENTIFIED TOWARDS THE COGNITIVE STYLES

H. Sihombing¹, M.M.H. Megat Ahmad², M.Y. Yuhazri³
and S. Rusman⁴

¹Faculty of Technology Management and Technopreneurship,
Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian
Tunggal, Melaka, Malaysia.

²Faculty of Engineering,
Universiti Pertahanan Nasional Malaysia, Sungai Besi, 57000
Kuala Lumpur, Malaysia.

³Faculty of Mechanical and Manufacturing Engineering Technology,
Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian
Tunggal, Melaka, Malaysia.

⁴Department of Mechanical Engineering,
Sekolah Tinggi Teknologi Mandala,
Bandung, 40275 Jawa Barat, Indonesia.

Corresponding Author's Email: 1phaery@utem.edu.my

Article History: Received 3 July 2019; Revised 10 January 2020;
Accepted 20 April 2020

ABSTRACT: Based on the philosophy of customer's preferences, today's market ultimately require an approach on how to fulfill the consumers' psychological needs. In this study, the investigation to the emotional expression and feelings against the design product were by utilizing Crane's Cognitive Alert Style and Kansei Engineering towards 8 pen designs proposed to 193 respondents. The results shows that the pen design no.4 (click-clip-grip) is the most preferable design (13.8%), while the most emotional feeling of product is 'Miserable~Comfortable'(MC) (17.3%). The pen design installed with grip increase the expression of product based on Slippery~Firm (SF) and Irritating~Convenience (IC), especially to peoples who were having 'Very consistent' characteristics. While, 'cup-grip' to peoples who were 'Follow what I know' characteristics. In conclusion, Crane's Cognitive Alert Style is having significant correlations to the product design, while the emotional expression towards the products design showed the characteristics' of customers itself.

KEYWORDS: *Kansei Engineering; Cognitive Alert Style; Product Design*

1.0 INTRODUCTION

The quality of product in today's competitive market relies on the customer's perception which is determined by several factors [1]. The satisfaction is not only lies on how to understand the customers' requirements, but also on how to provide them with what the product they require while reducing the costs and improve the customer value. In this sense, psychological needs have a significant relationship with some loyalty dimensions based on consumers' emotional satisfaction [2]. The judgment of satisfaction on such case is the result of the comparison between the subjective experiences of the consumer standard comparison [3-4]. However, customers have always been attracted to anything new, and they are continually seeking for new experience, new pleasure and new products [5]. To this idea, the understanding of customers' affective needs is, however, difficult to grasp since the product design practitioners often misunderstand what customers really want related to the influence of product design to the consumer evaluation [6-7]. Specifically, the forms of personality which deals with a person's approach in making decisions since the thinking tend to be analytical and logical to judge based on values [8].

Based on problems aforementioned, the questions to this reason is on how to decide consumer evaluation towards the product development. This is due to the design of a product determine the consumers' first impression and they form a message communicated to the product advantage. Specifically, the aesthetic appeal of a product towards the emotion aspect as a key consideration in today's consumer marketplace which increasingly important in product semantics [9].

2.0 METHODOLOGY

In this study, there were 193 samples taken from manufacturing engineering students and then quantitatively processed into statistical forms and analyzed using SPSS. Figure 1 shows the framework of this study based on Cognitive Alert Style [10] versus Kansei Engineering [11] towards product design characteristic as shown in Figure 2 using the semantic differential with the scaling 1 to 7 (Table 1).

The variant characteristic of pen design and the semantic differential of Kansei words constructed into X and Y axis based on specific characteristics identified. For X-axis, this is differentiated between 'no-grip' and 'grip' installed to the pen design, while for Y-axis towards the mechanism installed to the pen function.

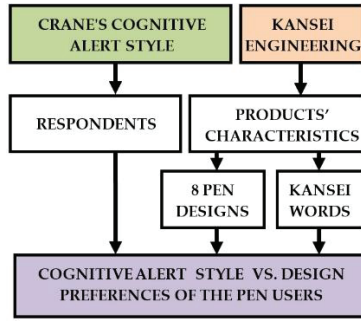


Figure 1: Framework of study

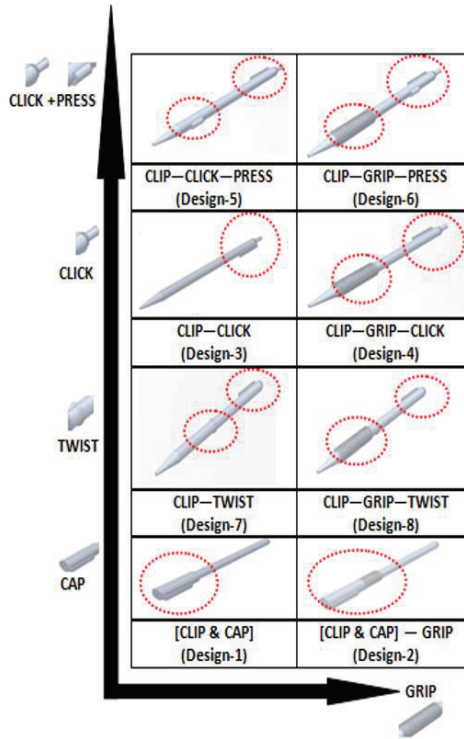


Figure 2: Pen design product and kansei words

Table 1: Kansei words

Miserable	① ② ③ ④ ⑤ ⑥ ⑦	Comfortable	MC
Slippery	① ② ③ ④ ⑤ ⑥ ⑦	Firm	SF
Irritating	① ② ③ ④ ⑤ ⑥ ⑦	Convenient	IC
Boring	① ② ③ ④ ⑤ ⑥ ⑦	Attractive	BA
Simple	① ② ③ ④ ⑤ ⑥ ⑦	Stylish	SS
Ugly	① ② ③ ④ ⑤ ⑥ ⑦	Beautiful	UN

3.0 RESULTS AND DISCUSSION

3.1 The Design Preferences

Figure 3 shows the most preferences design and Kansei where the most preferred design is the pen design no. 4 (13.8%), while the Kansei words that articulated the emotional expression of the design is 'Miserable~Comfortable' (MC) (17.3%).

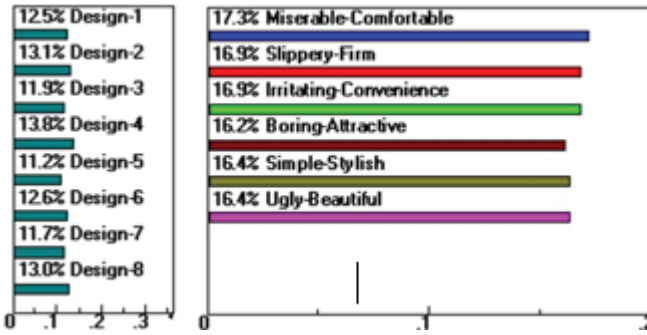


Figure 3: The design preferences with kansei words using expert choice

Table 2: Values of kansei words

No.	MC	SF	IC	BA	SS	UB	PRE
1	4.534	4.047	4.394	3.834	3.959	4.145	4.254
2	4.731	4.870	4.648	4.358	4.166	4.269	4.466
3	4.534	4.047	4.394	3.834	3.959	4.145	4.057
4	4.788	4.907	4.617	4.456	4.446	4.440	4.705
5	3.860	3.513	3.689	3.793	3.938	3.777	3.813
6	4.269	4.627	4.301	4.285	4.363	4.197	4.290
7	4.093	3.876	3.995	4.031	4.181	4.067	3.969
8	4.456	4.658	4.425	4.394	4.544	4.461	4.425

Based on Figure 3 and Table 2, the study found that the design no. 2, 4, 6 and 8 are having higher of average values for the design preference due to they all are installed with 'grip'. Based on Table 2, the study found that the pen design no. 1 and 3 were mostly articulating about 'Miserable~Comfortable' (MC) expression (4.534 each). While, the pen design no. 2, 4, 6 and 8 were mostly articulating about 'Slippery~Firm' (SF) expression (4.870, 4.907, 4.627 and 4.658, respectively). In addition, the pen design no. 5 and 7 were mostly articulating about 'Simple~Stylish' (SS) expression (3.928 and 4.181, respectively). It can be concluded that 'Slippery~Firm' (SF) is as the most concern of respondents to the pen design since most of the highest average values existed were on design no. 2, 4, 6 and 8.

Since the values among the design were not very different and also the percentage of every Kansei words are closer enough, further investigation is therefore necessary to be conducted to every design based on what 'internal' emotion background (cognitive background) of the respondents when they see the product.

3.2 The Pen Design towards Cognitive Alert Style

Based on the statistical analysis related to Crane’s Cognitive Alert Style (CSA) against the 8 pen designs articulated in Kansei words (Tables 3, 4, and 5), there were none any significant correlations existed to the pen designs against “Deadline and schedule” (A2), “Time to Work” (A6), and “Job Process Preference”(A8) of Crane’s Cognitive Alert Style (CSA).

Table 3: The correlation between cognitive alert style (CSA) with kansei words-MC and SF

CAS	MISERABLE ~ COMFORTABLE								SLIPPERY ~ FIRM							
	MC-1	MC-2	MC-3	MC-4	MC-5	MC-6	MC-7	MC-8	SF-1	SF-2	SF-3	SF-4	SF-5	SF-6	SF-7	SF-8
A1																
A2																
A3																
A4	.159(*)															
A5			-.160(*)													
A6																
A7													-.155(*)		.176(*)	
A8																
A9		-.150(*)							.153(*)							
A10																
A11																
A12			-.192(**)							-.200(**)						
A13					-.196(**)		.164(*)									
A14									.163(*)							
A15																
A16															.167(*)	
A17	.173(*)				-.210(**)										.145(*)	
A18				.182(*)					-.190(**)	-.189(**)			-.180(*)		.156(*)	
A19				.151(*)	-.208(**)										.151(*)	-.199(**)
A20							.156(*)	-.161(*)					-.204(**)			

* Correlation is significant at the 0.05 level (2-tailed).
 ** Correlation is significant at the 0.01 level (2-tailed).

In addition, there were no correlation existed between Cognitive Alert Style (CAS) against Kansei words that articulated the emotional expression of 'Miserable-Comfortable' (MC) towards the pen design no. 6, 'Slippery-Firm' (SF) towards the design no. 4 and no. 6 as depicted in Table 3.

Table 4: The correlation between cognitive alert style (CSA) with Kansei words-IC and BA

CAS	IRRITATING ~ CONVENIENT								BORING ~ ATTRACTIVE							
	IC-1	IC-2	IC-3	IC-4	IC-5	IC-6	IC-7	IC-8	BA-1	BA-2	BA-3	BA-4	BA-5	BA-6	BA-7	BA-8
A1	.148(*)								.168(*)	.152(*)						185(**)
A2																
A3																
A4																
A5			.179(*)													
A6																
A7																
A8																
A9																
A10																
A11																
A12																
A13																
A14																
A15																
A16																
A17																
A18																
A19																
A20																

* Correlation is significant at the 0.05 level (2-tailed).
 ** Correlation is significant at the 0.01 level (2-tailed).

Table 5: The correlation between cognitive alert style (CSA) with kansei words-SS and UB

CAS	SIMPLE ~ STYLISH								UGLY ~ BEAUTIFUL							
	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8	UB-1	UB-2	UB-3	UB-4	UB-5	UB-6	UB-7	UB-8
A1	.184(*)															
A2																
A3																.151(*)
A4																
A5																
A6																
A7																
A8																
A9																
A10																
A11																
A12																
A13																
A14																
A15																
A16																
A17																
A18																
A19																
A20																

* Correlation is significant at the 0.05 level (2-tailed).
 ** Correlation is significant at the 0.01 level (2-tailed).

Furthermore, Table 4 shows there were no significant correlations existed between Cognitive Alert Style against Kansei words that articulate the emotional expression of 'Irritating~Convenient' (IC) and 'Boring~Attractive' (BA) towards the design no. 6 and design no. 4. Also, there were no correlations existed with the emotional expression of 'Simple~Slippery' (SS) towards the design no.6 and 'Ugly-Beautiful' (UB) towards the design no. 6 and no. 7 as shown in Table 5.

Based on data shows in Tables 3, 4, and 5, the study concluded that the design no. 6 and no. 4 were having less of significant correlations existed towards Kansei words. The design no. 6 is not existed towards 'MC', 'SF', 'IC', 'SS' and 'UB', while the design no. 4 towards 'SF' and 'BA'. Since the pen design no. 4 (which is having clip-grip-click) and no. 6 (which is having mechanism clip-grip-press) do not have any significant correlation to Cognitive Style Alert related to 'Slippery~Firm' (SF), therefore the study assumed the mechanism 'clip-grip' contribute to whether the respondents will feel 'Slippery~Firm' (SF) or not. Furthermore, since the pen design no. 6 (which is having mechanism clip-grip-press) and no. 7 (which is having mechanism clip-twist) do not have any significant correlation to Cognitive Style Alert related to 'Ugly~Beautiful' (UB), the study therefore assumed that 'Clip' contribute to 'Ugly~Beautiful' (UB).

3.3 The Pen Design Based on Kansei

Based on the respondents' expressions articulated in Kansei words against the product designs, the study found as follows:

- i. In case of miserable towards comfortable (MC) as shown in Figure 4, mostly the customers' emotional feeling of 'Usually early', 'Centered' and 'Very spontaneous' towards the pen design no. 7, 3, and 5 (without grip) were decreasing from normal to strongly comfortable, while the emotional feeling of 'Very spontaneous' increased from normal to strongly comfortable for design no. 8. By comparing the pen design no. 7, 3, 5, and 8, this study found that the clip component installed on the pen will influence on whether the design is comfortable or not. Also, the pen installed with 'twist' mechanism will shift the customer's expression from neutral to strongly comfortable if the design is having 'grip', especially to customers with characteristic of "Very spontaneous" (the pen design no. 7 versus no. 8).

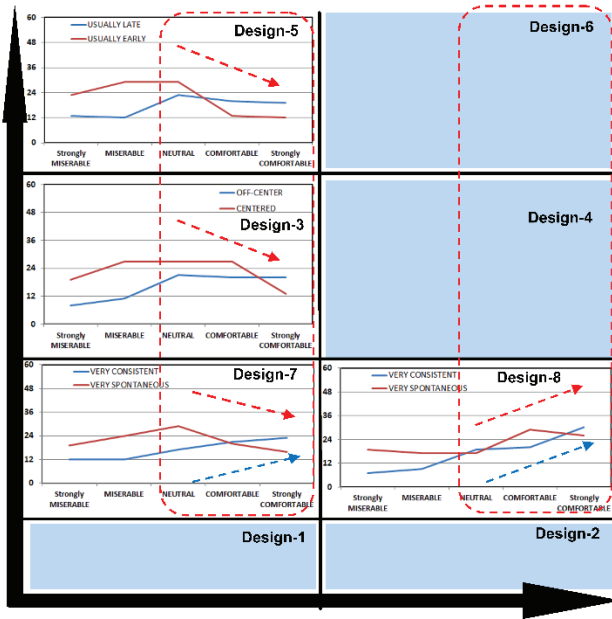


Figure 4: The pen design characteristics versus miserable ~ comfortable (MC)

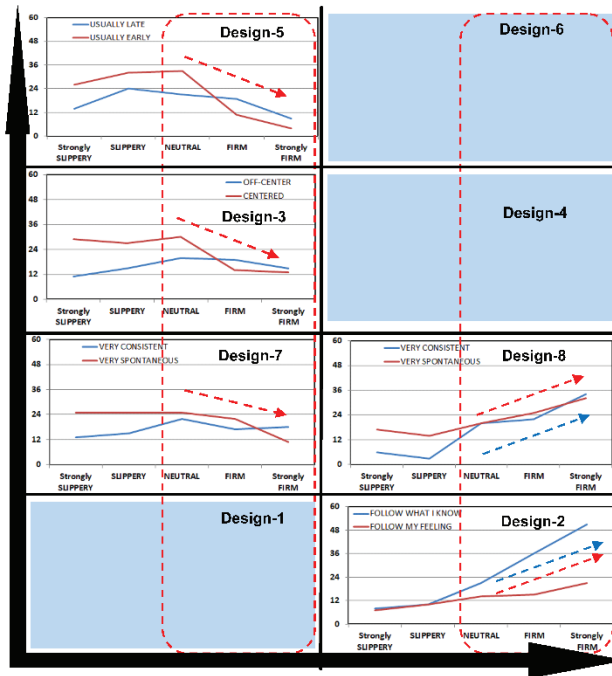


Figure 5: The pen design characteristics versus slippery ~ firm (SF)

- ii. In case of slippery towards firm (SF) as referred to Figure 5, mostly the customers' emotional feeling of 'Usually early' and 'Centered' and 'Very spontaneous' towards the pen design no.

7, 3, and 5 (without grip) were decreasing from neutral to strongly firm, while the emotional feeling of 'Very consistent' and 'Very spontaneous' towards the design no. 2 and 8 (with grip) were increasing from neutral to strongly firm. This is meant that the existence of 'grip' will influence the pen design in terms of strongly slippery to firm which was also confirmed by comparing the pen design no. 7 against the design no. 8 and no. 2 in terms of the peoples' characteristics of 'Very consistent' and 'Very spontaneous'.

- iii. In case of irritating towards convenience (IC) (Figure 6), mostly the customers' emotional feeling of 'One way work well', 'Centered' and 'Very spontaneous' towards the pen design no. 7, 3, and 5 (without grip) were decreasing from normal to strongly convenience. This is also to the pen design no. 8 (with grip) in which the emotional feeling of 'Very spontaneous' decreased from normal to strongly convenience, while for 'Very consistent' is stable. By comparing the pen design no. 7, 3, 5, and 8 against the pen sign no. 2, this study found that the grip component installed on the pen will slightly influence on whether the design is convenience or not based on 'Follow my feeling'. But for the customers whose having emotional feeling of 'Follow what I know', will significantly influence to their convenience when the pen installed with a grip and cup.
- iv. Figure 7 shows the pen design characteristics based on boring towards attracting (BA). Mostly the customers with emotional feeling of 'Usually early', 'Centered' and 'Very spontaneous' towards the pen design no. 7, 3, and 5 (without grip) were decreasing from normal to strongly attractive. While, the pen design no. 8 and 2 (with grip) in which the emotional feeling of 'Very consistent' tend to stable from normal to strongly attractive, while for 'Follow what I know' is increased. By comparing the design no. 7 towards no. 8 and 2, it can be confirmed that the grip installed to the pen is not significantly influencing to increase the attractiveness. The attractiveness will increase when the grip is combined with cup, though it is only for customers who have 'Follow what I know' characteristics.

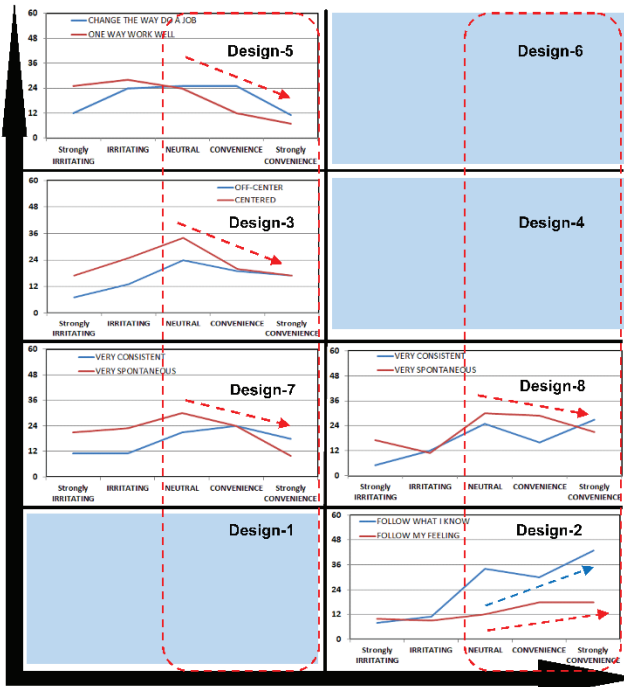


Figure 6: The pen design characteristics versus irritating ~ convenience (IC)

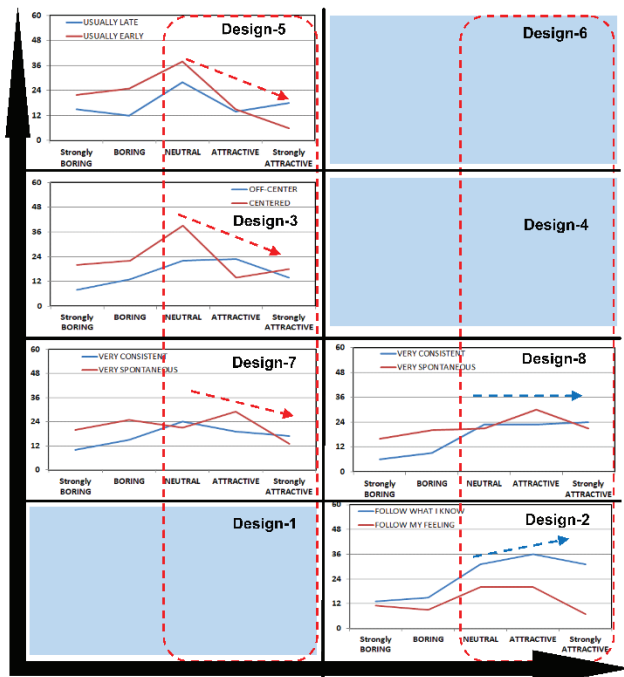


Figure 7: The pen design characteristics versus boring ~ attractive (BA)

- v. Figure 8 shows the pen design characteristics in terms of simple towards stylish (SS). Mostly the customers' emotional feeling of 'Usually early', 'Very spontaneous', and 'Follow my feeling' towards the pen design installed with or without grip is decreasing from neutral to strongly stylish, except on the pen design no. 8. While, the emotional feelings of 'Usually late', 'Very consistent', and 'Follow what I know' were increasing, except on the design no. 7. By comparing the pen design no. 7 against no. 8 and no. 2, this study found that the grip installed on pen will influence the customers' emotional feeling, that is 'Very consistent', to valuing increased from neutral to strongly stylish.

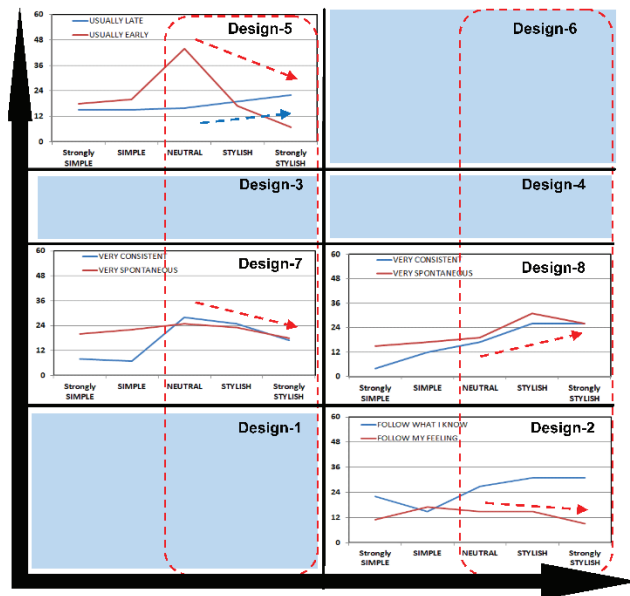


Figure 8: The pen design characteristics versus simple ~ stylish (SS)

- vi. In case of ugly towards beautiful (UB) as shown in Figure 9, mostly the customers' emotional feeling of 'One way work well', 'Centered' and 'Very spontaneous' towards the pen design no. 7, 3, and 5 (without grip) were decreasing from normal to strongly convenience. This is also occurred to the pen design no. 2 (with grip). However, the pen design no. 8 shows the increment from neutral to strongly beautiful for customers' emotional feeling of 'very consistent', while for 'very spontaneous', increased to beautiful and then decreased on strongly beautiful. In this case, the existence of grip that is installed on the pen will also influence to the beautiful value of product.

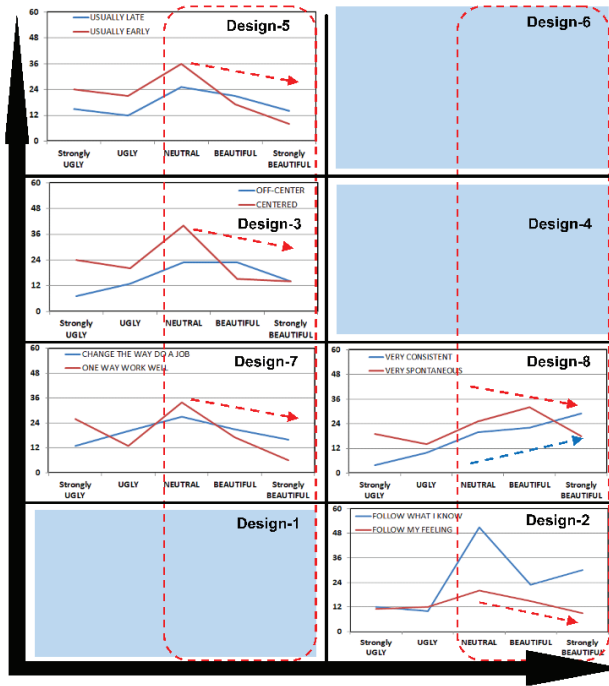


Figure 9: The pen design characteristics versus ugly ~ beautiful (UB)

Based on the cartesian axis to map the mechanism installed on the pen design compared to MC, SF, IC, BA, SS, and UB (Figure 4 until Figure 9), this study found that the grip existence (installed on the pen) will influence to highest value of the pen design based on emotional articulation refers to Kansei Engineering, except towards BA. This refers to the relationship between the individual and the world in terms of the experiences expression of “being-in-the-world” [12]. In case of the pen design with grip, the customers with ‘Very consistent’ characteristics valuing the pen design with highest on strongly level of comfortable, convenience, firm, stylish, and beautiful compared to neutral. However, it is stable when relating to the attractiveness of product, except for the other factors [13-14]. While, the customers with ‘Very spontaneous’ characteristics valuing the pen design installed with grip with highest on comfortable, convenience, firm, stylish, and beautiful compared to neutral, but then decreased when it comes to strongly level. It can be concluded that the customers with emotional feeling of ‘Very consistent’ is more valuing the pen design rather than the customers with emotional feeling of ‘Very spontaneous’.

Furthermore, in case of the pen design with grip and cup (the pen design no. 2), the customers with ‘Follow what I know’ characteristics valuing more rather the customers with ‘Follow my feelings’

characteristics. The highest values towards these emotional feelings when it is confirmed to valuing the pen design between ugly versus beautiful is neutral. Whiles, customers that have 'Usually late' and 'Centered' characteristics will value with highest values on neutral towards the pen design with clip-click mechanism.

4.0 CONCLUSION

Based on this study, the design no. 4 is the most preference design compared to others, while the 'Miserable-Comfortable' (MC) is the highest of respondents' emotional expression. This is influenced by the present of 'grip' installed to the pen. The existence of 'grip' mechanism influenced to the pen design, especially for the peoples who have characteristics 'Very consistent' and 'Follow what I know'. Whenever the grip combined with the cup, the peoples who have characteristics 'Follow what I know' characteristics shows more significant rather than 'Follow my feeling' characteristics. Based on this reason, the study concluded that Crane Cognitive Style Alert (CAS) is having correlation to the design of product, especially pen product. Therefore, the design of product can be used to predict the peoples characteristics based on Crane Cognitive Style Alert (CAS). Since the study carried out is to the manufacturing engineering students, further investigation is however necessary and required towards broad respondents. Specifically, on how to map each relevant factors physically and appearance of design and its alternative based on materials and color.

ACKNOWLEDGMENTS

The authors would like to thank Universiti Teknikal Malaysia Melaka for providing the facilities and equipment throughout the study.

REFERENCES

- [1] H. Takeuchi, and J. Quelch "Quality is more than making a good product", *Harvard Business Review*, vol. 61, no. 4, pp. 139-145, 1983.
- [2] A. Shahin, A.A. Abandi and M.H.M. Javadi, "Analyzing the relationship between customer satisfaction and loyalty in the software industry - with a case study in Isfahan system group," *International Journal of Business and Social Science*, vol. 2, no. 23, pp. 129-136, 2011.

- [3] Y. Évrard, "La satisfaction des Consommateurs: État des Recherches," *Revue Française du Marketing*, vol. 144, pp. 53-66, 1993.
- [4] J. Vanhamme, "La satisfaction des consommateurs spécifique à une transaction: Définition, antécédents, mesures et méthodes," *Recherche et Applications en Marketing*, vol. 17, no. 2, pp. 55-85, 2002.
- [5] S.K. Radford and P.H. Bloch, "Linking innovation to design: consumer responses to visual product newness," *The Journal of Product Innovation Management*, vol. 28, no. S1, pp. 208-220, 2011.
- [6] S. Bahn, C. Lee, C.S. Nam and M.H. Yun, "Incorporating affective customer needs for luxuriousness into product design attributes," *Human Factors and Ergonomics in Manufacturing & Service Industries*, vol. 19, no. 2, pp. 105-127, 2009.
- [7] M.E. Creusen and J.P. Schoormans, "The different roles of product appearance in consumer choice," *Journal of Product Innovation Management*, vol. 22, no. 1, pp. 63-81, 2005.
- [8] R. Lin, C.Y. Lin and J. Wong, "An application of multidimensional scaling in product semantics," *International Journal of Industrial Ergonomics*, vol. 18, no. 2-3, pp. 193-204, 1996.
- [9] N. Crilly and P.J. Clarkson, "The influence of consumer research on product aesthetics," in *International Design Conference*, Dubrovnik, Croatia, 2006, pp. 689-696.
- [10] L.D. Crane, *The alert scale of cognitive style*. Kalamazoo: Western Michigan University Press, 1989.
- [11] M. Nagamachi, "Perspectives of kansei engineering/kansei ergonomics," in *International Conference on Human-Computer Interaction*, Singapore, 2001, pp. 315-319.
- [12] P. Lévy, "Beyond kansei engineering: The emancipation of kansei design," *International Journal of Design*, vol. 7, no. 2, pp. 83-94, 2013.
- [13] C.H. Lo, G.Y. Liao, Z.X. Tan, X.W. Chen, H.F. Xu, and J.H. Linda, "A study of iPhone attractiveness factors by the miryoku engineering approach," in *International Conference of Organizational Innovation*, Fukuoka, Japan, 2018, pp. 1680-1690.
- [14] J. Yoon, A.E. Pohmeyer, and P.M.A. Desmet, "When 'feeling food' is not good enough: Seven key opportunities for emotional granularity in product development," *International Journal of Design*, vol. 10, no. 3, pp. 1-15, 2016.