The Use of Fuzzy Logic System in Determining Preferences toward GUI Design for E-Commerce Website

Oras F. Baker[1], Kasthuri a/p Subaramaniam[2] , Wong Shu Mee[3]

Faculty of Management& Information Technology, UCSI University

Kuala Lumpur, Malaysia

[1]*orasbaker@ucsi.edu.my*

[2]*kasthurisuba @ucsi.edu.my*

[3]*wongshu@ucsi.edu.my*

Abstract— **This paper presents the findings of a survey that correlate human personality types with the preferences towards graphical user interface (GUI) design for e–commerce website. Myers–Briggs Type Indicator (MBTI) inventory is the personality instrument used to conduct personality test on human beings in this study. The targeted sample is the students from UCSI University KL Campus. They are first group into one of the sixteen MBTI personality types, and then they are further grouped into one of the four Myers–Briggs temperaments. 2 types of surveys are imposed: the Personality and Preferences Questionnaire (PPQ) which aim to figure out the correlation; and User Evaluation Questionnaire (UEQ) which is conducted online is used to collect user feedbacks on the resultant website prototypes. Fuzzy logic theory together with the data collected during PPQ is implemented into ANFIS systems to come out with inferences about whether or not the suggested correlation exists. Conclusion drawn from this study is that human's personality type does affect some of the preference towards website elements (website layout and font type used), but not all.**
.

Keywords— **GUI, ANFIS, Fuzzy Logic, E- Commerce, Personality Types.**

INTRODUCTION

In today's world, computers have become a household necessity like the electrical appliance or the television set. The emergence of the Internet further links people from every single corner of the world together in front of the monitors. Also, due to the rapid growth of Internet users, the "information on the web has been growing tremendously during the last several years" [1] slowly, an increasing amount of products are being brought online for sale. Therefore, website designs for E-Commerce become an important tool to attract more business.

The aim of this study is to investigate how to design the graphical user interface (GUI) for an e–commerce website to suit users of various personality types. The study addressed correlation between personality differences with the preferences of GUI design, which uses MBTI Personality Inventory. First, the subjects need to answer the personality inventory questions embedded in Personality and Preferences Survey; after their personality type is confirmed, they are grouped under one of the 4 Myers–Briggs temperaments, so that the design preferences comparison can be made [13],[12].

Then, all the data collected from the survey is entered into SPSS tables to be analysed, to find the percentage of respondents who belong to each type of temperament, and also the mode, mean and standard deviation values for those Likert questions. After that, the same data is entered into 4 separate Adaptive Neural Fuzzy Inference Systems (ANFIS), to test whether the relationship between personality and the preference towards website design is valid, where the personality pairs are entered as the inputs and preference for each website components is the output for each system [2].
After the validation with the artificial intelligence system, the researcher starts to design the website, an e–commerce website which will be the product of this project. There will

be 4 types of website interfaces being designed; each is specifically for one type of temperament [5]. However, the functionalities for all of the 4 websites are exactly the same, despite the user interface differences. The last part of this study will be to conduct the User Evaluation Survey, to obtain users feedbacks on the website design, in order to make adjustment accordingly.

RESEARCH METHODOLOGY

In terms of research methodology, there will be 2 types of survey conducted: the personality and preference survey, and the user evaluation survey. The first one is distributed as the earlier stage of project development (2nd step in the waterfall model of Figure 1). The respondents are needed to jot down their favourite choice of layout, or font in the questionnaire form. Next, the same batch of subjects will undergo MBTI test at the same time [6].

After going through analytical work, 1st draft of UI (the website) will be designed. This time, 4 types of website interfaces would be produced to let the respondents choose which type suits their taste most, after they do the MBTI test again. They need to repeat the test because the first batch and second batch of respondents may or may not be the same group of students. Despite selecting their favourite look of the UI, responder's intention to re–visit the website will be accessed in order to find out whether the personalized design can attract more traffic to the website. In the assessment, the assumption made is: respondents' answers are honest and reflect their true desire.

Finally, small modifications will be done to give birth to the final product, which is 4 websites design for 4 types of Myers–Briggs Temperament.
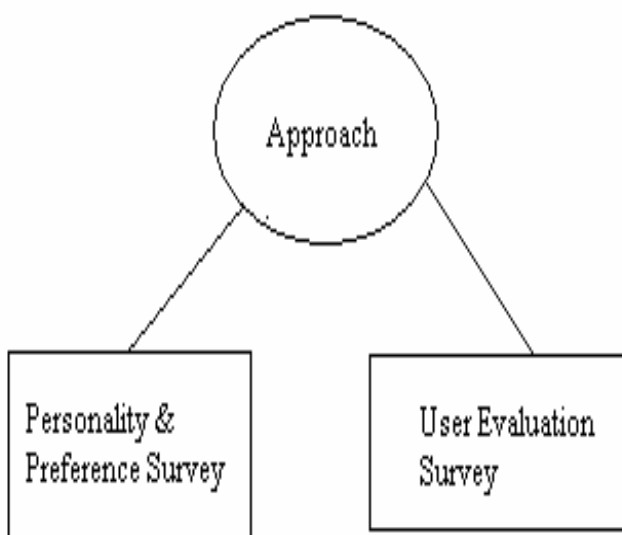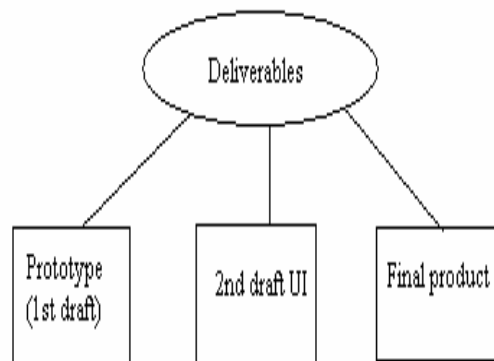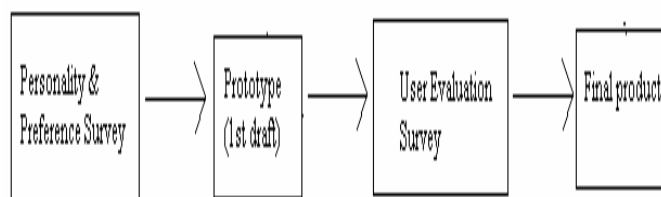

Fig 1: Approaches

Fig 2: Deliverables

Fig 3: Sequence of approaches and deliverables

DATA COLLECTION & ANALYSIS

A total of 100 copies of Personality & Preference Questionnaire were distributed, respondents were approached spontaneously and they were required to complete the questionnaire and submitted it on the spot. All 100 copies of them were successfully collected back in the end. After analysing using SPSS, the researcher uses ANFIS to deduce the degree of human's personality temperament in affecting the website design preferences, for the 4Components that involve: namely the website layout, font type, search bar position and main links position [9], [8], [7].
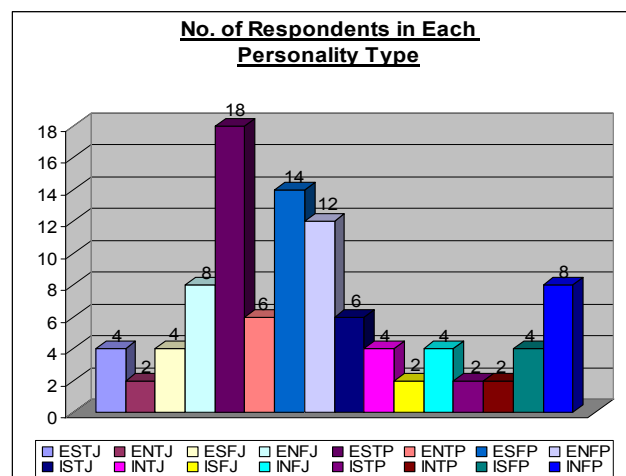

Fig 4: Categorization of respondents based on personality type

303

From data collected from the questionnaire forms, the group of respondents covers all those 16 types of personalities, with the minority of only 2 respondents (2%) are of ENTJ, ISFJ, ISTP, and INTP personality type, respectively. Meanwhile, the dominant personality type is ESTP, which covers 18% of the sample. It is then followed by the ESFP type and ENFP type, which has 14% and 12% respondents each. All other types of personality have 4% to 8% of respondents individually (as shown in Figure 4). From Figure 4.6 to Figure 4.9, we can see that there are more respondents with Extrovert and Perceiving preference where they cover more than 65% in respective opposite preferences pair; while at the meantime, the other 2 opposite preference pairs have almost equal coverage (around 50% each). This explains why the dominant personality types are the 3 mentioned above, which start with 'E' and end with 'P'.
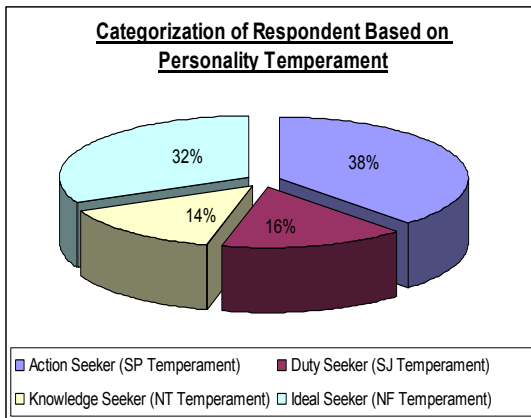

Figure 5: Categorization of respondents based on personality temperament

In spite of the 16 personality types, they can be further group into 4 categories named as the Myers–Briggs Temperament, which depicts our needs, values, behaviors and desires that motivate us to do something [4]. In fact, this temperament will be used to associate with choice of font, placement of certain component, and overall website layout, which in the end will be used to design the website interface. From Figure 5, it shows that most of the respondents (38%) can be categorize as Action Seeker, or belongs to SP temperament. In another words, all those with personality type that has 'S' and 'P' in it belongs to this group. This follows tightly with Ideal Seeker or the NF temperament, with 32% of coverage. The other 2 groups of temperament, Duty Seeker and Knowledge Seeker, cover up only a total of 30% of the sample, which is 16% and 14% each.

INFERENCES BASED ON ANFIS

The researcher built 4 Sugeno Fuzzy System with 3 inputs and 1 output each. The inputs are the 3 out of the 4 opposite personality pairs that determine which type of personality a person is (exclude the pair with Extrovert and Introvert), while the outputs are the preference of website design towards 4 types of components. It is because the first personality pair does not play a role in determining the Myers–Briggs temperament. Then, the data collected during the survey are entered into the Array Editor of Matlab to be stored as MAT

file type which is to be used as training data and checking data later on. A random selection of 25 sets of questionnaire data are input as the training data for all of the 4 ANFIS systems; while another 25 sets are selected as the checking data. In the end, if the trained data are very close with the checking data set, that means the rules set are correct, and the inputs–output relations are correctly matched. Inversely, if the graph shows obvious distinction between the 2 data sets, it means that the inputs cannot be mapped correctly onto the output, so the rules are not accurate.

i)   Effect of Temperament towards Preference of Website Layout
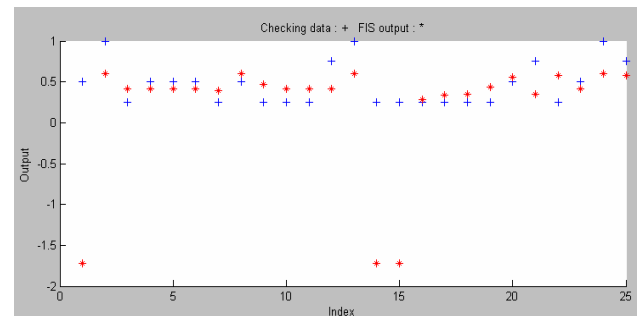

Figure 6: Rules of Layout ANFIS

Figure 7: Comparison of checking data and FIS output after training

The conclusion obtained in this case is that the ANFIS model is validated by the checking data (depicted by Figure 7), which means Myers–Briggs temperament does affect the preference on website layout. The rules defined can be applied for website design later on.

ii)   Effect of Temperament towards Preference of Search bar Location
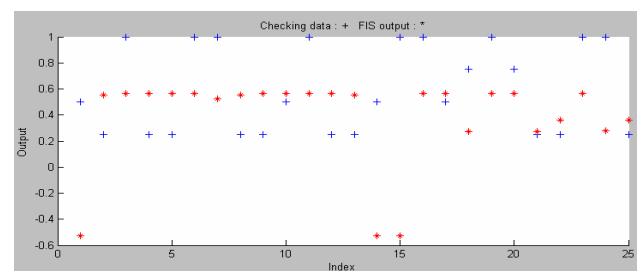

Figure 8: Rules of SearchBar ANFIS

Figure 9: Comparison of checking data and FIS output after training

The conclusion obtained in this case is that the ANFIS model is not validated by the checking data because Figure 4.6 shows the training and checking data sets are sufficiently different. This finding indicates that the data collected does not support the rules defined as shown in Figure 8, and thus indicates Myers–Briggs temperament does not bring obvious effect in affecting the preference on the position of search bar. The rules defined can be ignored during website design later on.

iii) Effect of Temperament towards Preference of Main Links Location

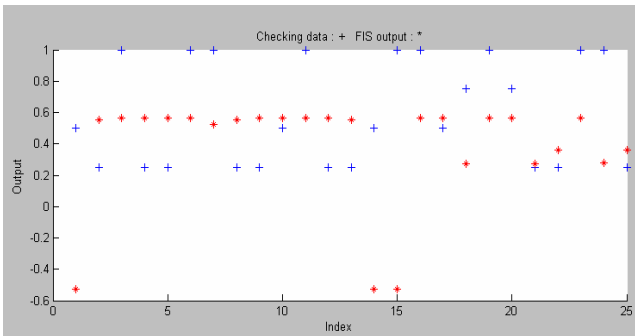
Figure 10: Rules of Links ANFIS

Figure 11: Comparison of checking data and FIS output after training

The conclusion obtained in this case is that the ANFIS model is not validated by the checking data because Figure 4.8 shows the training and checking data sets are sufficiently different. This finding indicates that the data collected does not support the rules defined as shown in Figure 4.7, and thus indicates Myers–Briggs temperament does not bring obvious effect in affecting the preference on the position of main links. The rules defined can be ignored during website design later on.

iv) Effect of Temperament towards Preference of Font Type

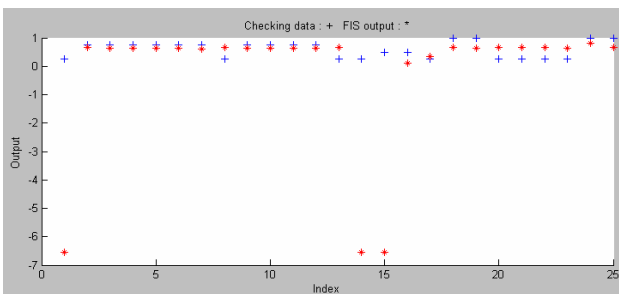Figure 12: Rules of Font ANFIS

Figure 13: Comparison of checking data and FIS output after training

The conclusion obtained in this case is that the Font ANFIS model is validated by the checking data (depicted by Figure 13), which means Myers–Briggs temperament does affect the preference on font type. The rules defined can be applied for website design later on.

EVALUATION

User Feedbacks

An online evaluation survey was posted for users to feedback on the website design. A prototype was posted on the Webs (2009), a free web hosting site where the respondents will be given a link according to their personality temperament in the online survey form. There are 4 designs in total. The prototype is not operational, the main purpose is just for the respondents to rate the design.

A total of 52 replies are collected over the one week evaluation period from the 5th Nov to 11th Nov 2009. The ratings are summarized in the line charts below.
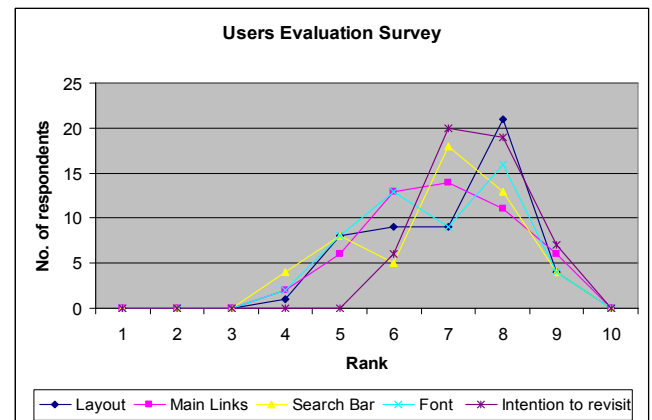

Fig 14: Analysis of user evaluation survey

Question	1	2	3	4	5
Mode	8	7	7	8	7
Mean	7.02	6.85	6.77	6.79	7.52
Standard Deviation	1.31	1.32	1.39	1.35	0.87

Table 1: Statistical analysis for questions in website evaluation

According to table 1, the mode value for the first question is 8, with a mean of 7.02 and standard deviation of 1.31. The result suggests that most of the respondents like the overall layout of the website, where most of their answers fall into the range of 5.71 to 8.33. Whereas for Question 2, the mode answer is 7, average is 6.85 and deviated by 1.32. So, most of the respondents are somewhat comfortable with the position

of main links with a ranking range of 5.53 to 7.71. For Question 3 and 4, they have very similar value for mean (6.77 and 6.79) and standard deviation (1.39 and 1.35), even though the mode value for the previous one is 7 and 8 for the later one. Therefore, the respondents are quite satisfied with the position of search bar (the answer mostly in the range of 5.38 to 8.16) and the font type, where the answers are within the range of 5.44 to 8.14. The most important question of all in this evaluation questionnaire is the last question, Question 5, which enquire whether the respondents are intended to re–visit the website again. From table 1, it shows that the answer with highest occurrence is 7, with a mean value of 7.52 and small deviation value of 0.87. This finding shows that most of the respondents are interested to visit the website again, with the dominant range of 6.65 to 8.39.

In short, this prototype receives positive responds from the users and thus it can be used as the interface for further development as an e–commerce website.

VI   CONCLUSION

This survey is designed to look at the problems with the hope of incorporating personality type in graphical user interface design, which form the basis for this study. The findings are summarized below together with some recommendations on future enhancement of this project. From the data collected in the Personality and Preferences Survey, the dominant personality type for the 100 respondents are ENTJ (18), followed by ESFP (14) and ENFP (12) among the total of 16 personality types. Meanwhile, ENTJ, ISFJ, ISTP and INTP are the personality types with the least number of respondents, which are 2 for each. As for the grouping of Myers–Briggs Temperament, the SP temperament (Action Seeker) is the dominant one, with 38 respondents belongs to this type. The NF temperament (Ideal Seeker) followed closely at the back, with a total of 32 respondents. Nonetheless, SJ (Duty Seeker) and NT (Knowledge Seeker) temperaments have 16 and 14 people respectively.

Based on the findings obtained from the Adaptive Neural Fuzzy Inference System, one's Myers–Briggs temperament does play a role in affecting one's preference towards the website layout and font type used for the content, but it is neutral in the case of object placements on the website, regardless it is the main links or the search bar.

Thus, 4 types of website interfaces are designed according to the findings gained from the ANFIS systems. The design for Action Seeker is using a layout of "2 columns with right sidebar, header and footer", and font type used is "New Times Romans". Seems the core needs of an action seeker is action and excitement, the researcher uses light pink as the background colour, and there are blinking components which gives an exciting mood. Next, the website layout for Duty Seeker is "one centred column with header and footer", with "Comic Sans MS" as the font type. A duty seeker is generally a concerned person who enjoys being of service. Therefore, the researcher uses crystal blue and light green as the background colour, which promotes a sense of environmental perseverance.

Then, for knowledge seeker, a "three column with header and footer" layout is applied in the website design, and the font type used is "Calibri". As knowledge seeker is a cool, calm and collected person, the background color of the website is fixed to be light ocean–blue that brings out a peaceful feel. Last but not least, another type of design specifically for an ideal seeker is using "2 columns with left sidebar, header and footer" layout, together with "Arial" as the font type. An ideal seeker sees himself / herself as someone who is emphatic, imaginative and yearns for romance; therefore the design is based on the idea of royal palace in the 18th century, which gives a sense of romance [10], [11].

From the User Evaluation Survey, the results shows that the dominant respondents are satisfied with the overall design of the website, and most of them indicate that they will visit the website again in the near future.

REFERENCES

[1]   BusinessTown.com (2003). The Definition of E-Commerce. Retrieved 28 May 2009 from the World Wide Web: http://www.businesstown.com/internet/ecomm-definition.asp

[2]   Dang M (2003). User Interface. Retrieved 06 June 2009 from the World Wide Web: http://searchsoa.techtarget.com/sDefinition/0,,sid26_gci214505,00.html

[3]   Kostov V & Fukuda S (2001). Development of Man–Machine Interfaces based on User Preferences, Proceedings of the IEEE International Conference on Control Applications, pp.1124–1128.

[4]   Rowe R (2005a). Myers–Briggs Temperaments, accessed on 03 Nov 2009 from the World Wide Web: http://russellrowe.com/myers-briggs_temperaments.htm

[5]   Webs (2009). Create Your Own Website for Free, accessed 9 Nov 2009 from the World Wide Web: http://www.webs.com/

[6]   Dang M (2003). User Interface. Retrieved 06 June 2009 from the World Wide Web: http://searchsoa.techtarget.com/sDefinition/0,,sid26_gci214505,00.html

[7]   DJS Research Ltd (2009). What is Quantitative Research, retrieved 04 November 2009 from the World Wide Web:

[8]   http://www.marketresearchworld.net/index.php?option=com_content&task=view&id=11&Itemid=64

[9]   Havelund L (2007). SPSS or Excel? , accessed 03 Nov 2009 from the World Wide Web: http://www.marketresearchtech.com/spss-or-excel.htm

[10]   ISO (2009). ISO 13407: 1999, retrieved 04 Nov 2009 from the World Wide Web: http://www.iso.org/iso/catalogue_detail.htm?csnumber=21197

[11]   Kostov V & Fukuda S (2001). Development of Man–Machine Interfaces based on User Preferences, Proceedings of the IEEE International Conference on Control Applications, pp.1124–1128.

[12]   Lim L. (1999). Individual Differences in Human Computer Interaction. Honours Thesis, School of Information Technology, Murdoch University, Perth, Western Australia.

[13]   Meyer J F (2008). What are research methods , retrieved 04 Nov 2009 from the World Wide Web: http://sociology.camden.rutgers.edu/jfm/tutorial/methods.htm