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The Effect of Auditory Icon on Food Intake Mimicry

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Abstract--- *Persuasive technology is very beneficial in inducing good human behaviour through mimicry which is defined as imitating someone or something. Thus in this study, an experiment is conducted to determine the effect of fixed and natural rhythm auditory icon on food intake mimicry based on gender, eating phases (i.e. slow, moderate & fast) and Wizard of Oz. Thirty males and thirty females are involved in four stages of the experiment. The first stage is implemented to screening their food intake patterns individually in eating an apple without listening to any sound. Next, they are categorised into three groups according to their natural eating phases; slow, moderate or fast. Then based on Wizard of Oz, they are divided into either yes or no conditions. In the second stage, fixed rhythm auditory icon which is represented by a sound of biting an apple for every ten second is introduced while each participant is eating an apple during the experiment. Natural rhythm is embedded in the third and fourth stages which are created from the natural eating phases of the participants in the first stage. Food intake mimicry is defined as eating that occurs within five seconds of hearing the fixed or natural rhythm auditory icon. ANOVA and Repeated Measures ANOVA were used to analyse the experimental data. Overall, fixed rhythm auditory icon contributes to the highest food intake mimicry percentage of about 50% because the participants of the experiments can adapt to fixed rhythm much better than natural rhythm because they can anticipate when the fixed sounds going to occur since it is fixed at 10 seconds. The main effect of gender, phase and Wizard of Oz is not significant but the interactions between them are significant (i.e. Gender & Phase and Phase & Wizard of Oz). These findings indicated that auditory icon can influence the eating phase where eating slowly is good for health.*

Keywords--- *ANOVA, Food, Auditory*

I. INTRODUCTION

According to Gaver (1986) auditory icons are everyday sounds that represent processes or actions in computers that can also be used to represent human actions in a remote place (Baharin & Muhlberger, 2010). Hermans et al (2012) implemented a study of food intake mimicry which indicated that people imitate their companion when they are eating together. This lead to a study conducted by Zin et al (2015) using a sound loop auditory icons of apple biting in food intake mimicry involving 13 participants. Ismail et al (2019) enhanced the experiment by incorporating fixed rhythm auditory icons based on 60 participants and focussing on gender. The results revealed that male and female has similar mimicry percentages of about 50%. This preliminary evidence indicated food intake mimicry existed and motivates us to further the experiments by including other factors.

Thus, the purpose of this study is to compare the effects between fixed and natural rhythm on food intake mimicry based on gender, eating phases (i.e. slow, moderate & fast) and Wizard of Oz.

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II. METHODOLOGY

This study is a factorial design experiment containing 4 factors which are rhythm (Fixed, Natural 1 and Natural 2), gender (male and female), eating phases (i.e. slow, moderate and fast) and Wizard of Oz (with and without). The respond variable (RV) is percentage of food intake mimicry. The experiment involves thirty males and thirty females in four stages. The first stage is implemented to screening their food intake patterns individually in eating an apple without listening to any sound. Next, they are categorised into three groups according to their natural eating phases; slow, moderate or fast. Then based on Wizard of Oz, they are divided into either with or without conditions. Wizard of Oz is a conditions created to convince the participants that there are someone eating an apple somewhere else and the sound of biting an apple comes from that person but actually the sound is just an auditory icon created and played using computers during the experiment.

In the second stage, fixed rhythm auditory icon which is represented by a sound of biting an apple for every ten second is introduced while each participant is eating an apple during the experiment. ANOVA and Exploratory Data Analysis (EDA, i.e. graphical and numerical) are used to analyse the data.

Natural rhythm is embedded in the third and fourth stages which are created from the natural eating phases of the participants in the first stage and since the eating phases of male and female are different; the natural rhythms are created based on gender. There are two natural rhythms involve in this experiment namely Natural 1 and Natural 2. Natural 1 is a moderate transition and Natural 2 is a drastic transition of auditory icon which participant who has slow eating phase will listen to sound of moderate and fast respectively; participant who has moderate eating phase will listen to sound of slow and fast respectively; and participant who has fast eating phase will listen to sound of moderate and slow respectively. Since the participants of Fixed, Natural 1 and Natural 2 are the same persons, repeated measures ANOVA are used to analyse all the three simultaneously which are Fixed, Natural 1 and Natural 2.

Food intake mimicry is defined as eating that occurs within five seconds of hearing the fixed or natural rhythm auditory icon. The experiment was recorded using a good video camera in ensuring accurate data is collected by counting the number of biting for each participant. Food intake mimicry is presented by percentages as outline by the following equation.

$$\%\, Food\ intake\ mimicry = \frac{no.\ of\ biting\ occurs\ within\ five\ seconds\ of\ hearing\ the\ fixed\ rhythm\ auditory\ icon}{total\ number\ of\ biting} \times 100$$

III. FINDINGS AND DISCUSSIONS

Repeated Measures ANOVA are used to analyse the data due to the same 60 participants in the Fixed, Natural 1 and Natural 2 rhythm. Figure 1 and Table 1 display the assumptions checking for Repeated Measures ANOVA. Based on the three histograms (Figure 1), there are no outliers and Table 1 indicated the fulfillment of normality (Shapiro-Wilk Test) and homogeneity of variances (Mauchly's Test) assumptions.

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Figure 1: Histogram of Food Intake Mimicry Percentages (Fixed, Natural 1 and Natural 2)

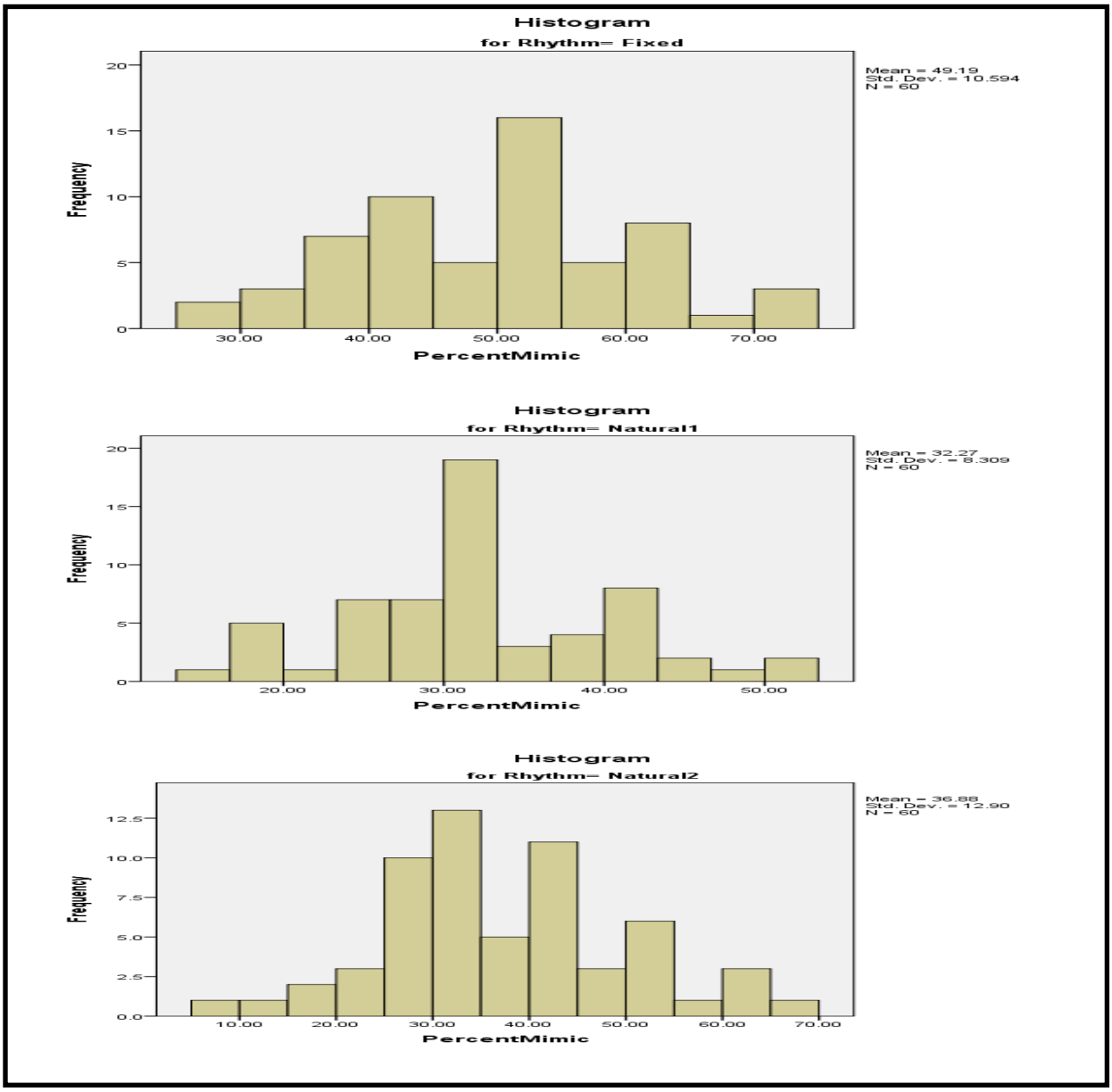

Table 1: Repeated Measures ANOVA Assumptions of Food Intake Mimicry Percentages of Fixed, Natural 1 and Natural 2

Normality Test Food Intake Mimicry Percentages of	**Shapiro-Wilk**	
	Statistics	**P-Value**
Fixed	0.984	0.608
Natural 1	0.980	0.448

Natural 2	0.981	0.478
Homogeneity of Variances	**Mauchly's Test of Sphericity**	
	0.608	0.608
	0.970	0.494

Based on Table 2, two interactions are significant (Rhythm & Gender and Rhythm & Eating Phases) and one main effect (Rhythm) is significant.

Table 2: Repeated Measures ANOVA Results for Fixed and Natural Rhythm

Tests of Within-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Rhythm	9179.350	2	4589.675	51.525	.000
Rhythm * Gender	517.814	2	258.907	2.907	.059
Rhythm * Phase	3647.748	4	911.937	10.238	.000
Rhythm * WizardOz	80.054	2	40.027	.449	.639
Rhythm * Gender * Phase	532.436	4	133.109	1.494	.210
Rhythm * Gender * WizardOz	264.077	2	132.038	1.482	.232
Rhythm * Phase * WizardOz	646.797	4	161.699	1.815	.132
Rhythm * Gender * Phase * WizardOz	296.766	4	74.191	.833	.508
Error(Rhythm)	8551.369	96	89.077		

Figure 2 shows the significant different among the three rhythms (Fixed, Natural 1 and Natural 2) based on the Box plot, mean and pairwise comparisons. Fixed has the highest food intake mimicry percentage of 49.2% as compared to Natural 1 (32.3%) and Natural 2 (36.9%). This indicates that participants of the experiments can adapt to fixed rhythm much better than Natural 1 and Natural 2 because they can anticipate when the fixed sounds going to occur since it is fixed at 10 seconds.

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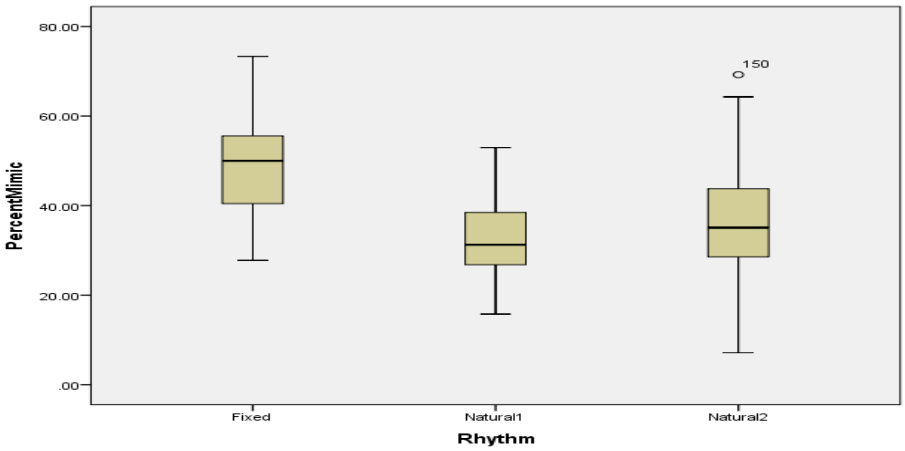
Figure 2: Box Plot, Mean & Standard Deviation and Pairwise Comparisons of Fixed, Natural 1 and Natural 2



Estimates

Measure: PercentMimic

Rhythm	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	49.188	1.280	46.615	51.762
2	32.271	1.099	30.062	34.480
3	36.878	1.329	34.205	39.550

Pairwise Comparisons

Measure: PercentMimic

(I) Rhythm	(J) Rhythm	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	16.917*	1.716	.000	12.661	21.174
	3	12.311*	1.594	.000	8.357	16.264
2	1	-16.917*	1.716	.000	-21.174	-12.661
	3	-4.607*	1.850	.049	-9.197	-.017
3	1	-12.311*	1.594	.000	-16.264	-8.357
	2	4.607*	1.850	.049	.017	9.197

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Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Based on Table 2, there exist interaction between Gender and the rhythms. Figure 3 highlighted the highest food intake mimicry percentage is female (50.1%) for fixed rhythm but for Natural 2 the male (40%) has higher percentage. But when tested individually in each rhythm, the gender is not significantly different.

Figure 3 Mean Plot of Gender & Rhythm (Fixed, Natural 1 and Natural 2)

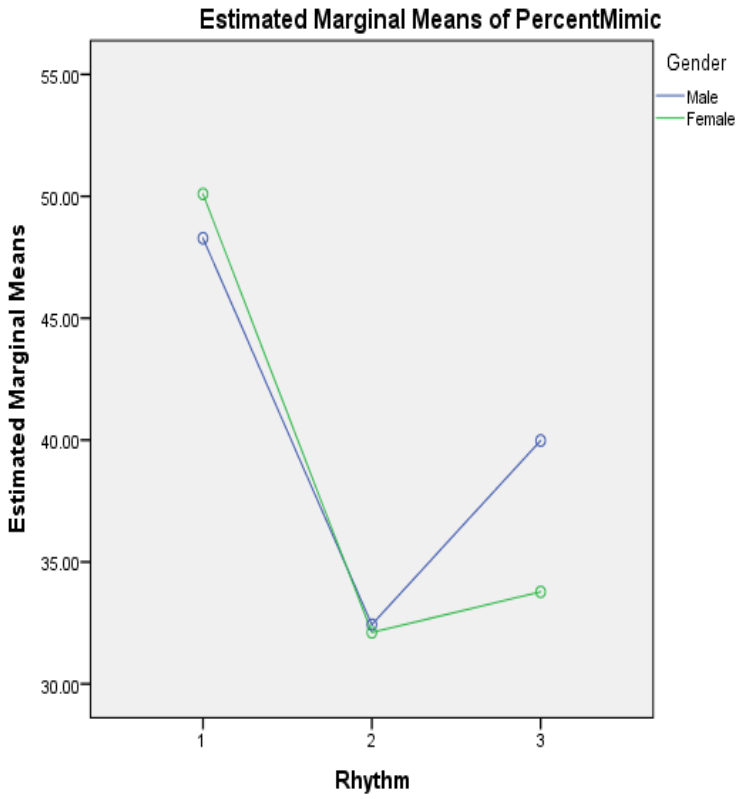

Figure 4 show that fast phase of fixed rhythm has the highest food intake mimicry percentages but fast phase also has the lowest percentage in Natural 2. This indicate that the group of fast participants can mimic best for fixed rhythm but poorly mimic in Natural 2 due to they need to listen to slow sounds in Natural 2 experiment.

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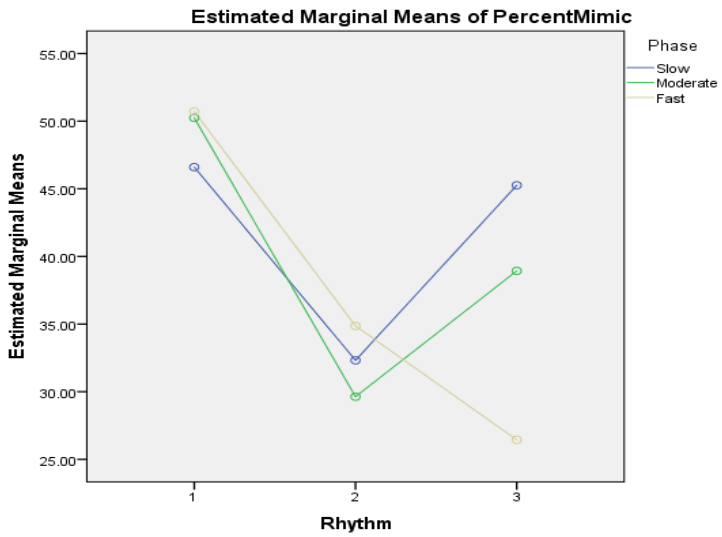
Figure 4 Mean Plots of Rhythm & Phase



IV. CONCLUSIONS

Overall, fixed rhythm auditory icon contributes to the highest food intake mimicry percentage of about 50% because of the fixed sounds of every 10 secondswhich shows that food mimicry exist and can be used in persuasive technology. The main effect of gender, phase and Wizard of Oz is not significant but the interactions between them are significant (i.e. Gender & Phase and Phase & Wizard of Oz). It is noticeable that food intake mimicry started only after the participants have engaged in half of the experiment time. Perhaps by prolonging the eating time, the mimicry percentage will increase because the person is already adapting to the fixed rhythm. These findings indicated that auditory icon can influence the eating phase where eating slowly is good for health (Stuart (1967), Andrade et al (2008), and Zandian et al (2012)).

REFERENCES

[1] Andrade, A. M., Greene, G. W., &Melanson, K. J. (2008). Eating Slowly Led to Decreases in Energy Intake within Meals in Healthy Women. *American Dietetic Association, 108*(7), 1186-1191.

[2] Baharin, H., & Muhlberger, R. (2010). Hearing but not listening: auditory icons and presence. Paper presented at the *International Conference on User Science and Engineering (i-USEr).*

[3] Hermans, R. C., Lichtwarck-Aschoff, A., Bevelander, K. E., Herman, C. P., Larsen, J. K., & Engels, R.C. (2012). Mimicry of food intake: the dynamic interplay between eating companions. *PloS One, 7*(2), e31027.

[4] Ismail, S., Yusof, N., &Baharin, H., (2019).The influence of Fixed Rhythm Auditory Icon on Food Intake Mimicry. Springer Book of Conference Proceedings, chapter 74, 591- 595.

[5] Lakin, J. L., Jefferis, V. E., Cheng, C. M., & Chartrand, T. L. (2003). The chameleon effect as social glue: Evidence for the evolutionary significance of nonconscious mimicry. *Journal of nonverbal behavior, 27*(3), 145-162.

[6] Stuart, R. B. (1967). Behavioral Control Of Overeating. *Behavioral Research and Therapy, 5*, 357-365.

[7] Zandian, M., Ioakimidis, I., Bergström, J., Brodin, U., Bergh, C., Leon, M., . . .Södersten, P. (2012). Children eat their school lunch too quickly: an exploratory study of the effect on food intake.*BMC Public Health*.

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