Gazing behavior reactions of Vietnamese and Austrian consumers to wafers and their relations to wanting, expected and perceived liking

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Air line distance Vienna-Hanoi: 8240 km / 5120 miles
Frame: Factors Influencing Eating Behavior and Food Choice

(modified from E.P. Köster, Diversity in the Determinants of Food Choice, FQP 2009)
Studied Aspects

Panel effect: Austria vs. Vietnam
Product effect: Four different flavour variants
Research questions

• Is there an effect of panel (samples from two countries AT, VN) on consumers’ gazing behaviour? If yes, how do they differ?
• Is there an effect of panel on consumers’ preference for flavours in an international food product like wafers (widely consumed in both countries)?
• Can perceived liking be predicted/explained by measuring the expected liking?
• Can expected liking and gazing behavior data explain choice decision in the two panellist samples?
Participants

75 Austrian females
53 Austrian males
73 Vietnamese females
41 Vietnamese males

All aged 18-55
Recruited under students and staff of Universities in Vienna and Hanoi
4 product variants (hazelnut, whole grain, vanilla, lemon) supplied by Josef Manner & Comp. AG company. Wafers have same size (16x49x17mm) and same number of wafer layers (5).
Each participant went through three-sections:

**Section 1: Wanting & Gazing**
Four product front package images were shown on a screen. Participants had to choose the product that they wanted to try the most. During this process, participants’ gazing behaviour was recorded with an eye-tracker. Position of the images on the screen was balanced according to a Williams Latin square.

**Section 2: Expected Liking**
Four real product front packages (without wafer) were given to participants in a sequential monadic design according to a Williams Latin square. Participants were asked to estimate their expected liking to the products using conventional 9-point hedonic scale, anchored from “I dislike very much” (1) to “I like very much” (9).

**Section 3: Tasted Liking**
One piece of product samples was given to participants in a sequential monadic design according to a Williams Latin square. Participants were asked to taste and rate their perceived liking of the product samples using conventional 9-point hedonic scale. Each wafer sample was presented on a white paper plate coded with three digit numbers. Samples were served as fresh as possible after the product package was opened.
Eye-tracking technique
Data analysis

• Comparing the most-wanted-to-try products between the two panels: **chi-square \( (\chi^2) \)** tests of independence and pairwise comparisons with Bonferroni corrections of \( P \) values

• Comparing gazing, expected liking and perceived liking data of both panels: **two-way analyses of variance (ANOVAs)**

• Comparing expected liking and perceived liking scores for each panel: **one-way ANOVA** with mean effect as *Product* followed by pairwise comparisons using Tukey-Kramer test

• **Correlations** among the gazing measures, wanting to try, expected liking and perceived liking within each panel: the correlation coefficient between each pair of parameters

• R version 3.1.2, Statgraphics Centurion and Microsoft Excel 2010 were used for statistical analyses.
Choice rate: Which product do you want to try the most?

- Panel effect
- Product effect

<table>
<thead>
<tr>
<th>Product</th>
<th>AT</th>
<th>VN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazelnut</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td>Whole Grain</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Lemon</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Vanilla</td>
<td>10</td>
<td>23</td>
</tr>
</tbody>
</table>

Frequency of response [%]

0 10 20 30 40 50
Expected and tasted liking

- Panel effect
- Product effect

ns: non significant
Means with the same letter are not significantly different at 5% level (Tukey-Kramer test)
Expected and tasted liking example Hazelnut Wafers

**Austria Hazelnut Expected Liking**

- Diff. mean values = 1.3

**Austria Hazelnut Tasted Liking**

- Diff. mean values = 1.6

**Comparison of Means**

- 95.0% confidence interval for mean of Austria Hazelnut Expected Liking: 7.86519 ± 0.217905
- 95.0% confidence interval for mean of Austria Hazelnut Tasted Liking: 6.55944 ± 0.205833
- 95.0% confidence interval for the difference between the means assuming equal variances: 1.30775 ± 0.298624

**t test to compare means**
- Null hypothesis: mean1 = mean2
- Alt. hypothesis: mean1 ≠ mean2
- assuming equal variances: t = 8.62198, P-value = 1.79286E-7
- Reject the null hypothesis for alpha = 0.05.

**Comparison of Medians**

- Median of sample 1: 8.0
- Median of sample 2: 7.0

- Mann-Whitney (Wilcoxon) W test to compare medians
- Null hypothesis: median1 = median2
- Alt. hypothesis: median1 ≠ median2
- Average rank of sample 1: 178.297
- Average rank of sample 2: 96.1299
- W = 3738.0, P-value = 0.00
- Reject the null hypothesis for alpha = 0.05.

**Kolmogorov-Smirnov Test**

- Estimated overall statistic D = 0.697771
- Two-sided large sample K-S statistic = 5.73458
- Approximate P value = 0.00

**Comparison of Medians**

- Median of sample 1: 7.0
- Median of sample 2: 6.0

- Mann-Whitney (Wilcoxon) W test to compare medians
- Null hypothesis: median1 = median2
- Alt. hypothesis: median1 ≠ median2
- Average rank of sample 1: 177.594
- Average rank of sample 2: 97.7892
- W = 3822.0, P-value = 0.00
- Reject the null hypothesis for alpha = 0.05.

**Kolmogorov-Smirnov Test**

- Estimated overall statistic D = 0.681540
- Two-sided large sample K-S statistic = 5.45659
- Approximate P value = 0.00
Expected and tasted liking example Hazelnut Wafers

Comparison of Means
95.0% confidence interval for mean of Austria Hazelnut Expected Liking: 7.46719 +/- 0.217095 [7.46499; 7.46948]
95.0% confidence interval for mean of Austria Hazelnut Tasted Liking: 4.96819 +/- 0.261398 [4.93557; 5.00081]
95.0% confidence interval for the difference between the means assuming equal variances: 0.908498 +/- 0.315272 [0.905158; 0.911839]

I test to compare means
Null hypothesis: mean1 = mean2
Alt. hypothesis: mean1 NE mean2

Test statistic: t = -2.45835
P-value = 0.0134569
Reject the null hypothesis for alpha = 0.05.

Comparison of Medians
Median of sample 1: 8.0
Median of sample 2: 8.0

Mann-Whitney (Wilcoxon) W test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

Average rank of sample 1: 140.618
Average rank of sample 2: 166.012
W = 6593.5 P-value = 0.0032647
Reject the null hypothesis for alpha = 0.05.

Kolmogorov-Smirnov Test
Estimated overall statistic DN = 0.470552
Two-sided large sample K-S statistic = 3.8125
Approximate P value = 0.6

Comparison of Means
95.0% confidence interval for mean of Vietnam Hazelnut Expected Liking: 6.55944 +/- 0.206343 [6.36313; 6.75575]
95.0% confidence interval for mean of Vietnam Hazelnut Tasted Liking: 5.83956 +/- 0.257702 [5.58138; 6.09774]
95.0% confidence interval for the difference between the means assuming equal variances: 0.72028 +/- 0.328783 [0.599497; 0.84096]

I test to compare means
Null hypothesis: mean1 = mean2
Alt. hypothesis: mean1 NE mean2

Test statistic: t = -4.31217
P-value = 0.0000223251
Reject the null hypothesis for alpha = 0.05.

Comparison of Medians
Median of sample 1: 7.9
Median of sample 2: 6.0

Mann-Whitney (Wilcoxon) W test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

Average rank of sample 1: 163.178
Average rank of sample 2: 123.822
W = 7410.5 P-value = 0.00000108933
Reject the null hypothesis for alpha = 0.05.

Kolmogorov-Smirnov Test
Estimated overall statistic DN = 0.465331
Two-sided large sample K-S statistic = 3.94170
Approximate P value = 0.0
Expected and tasted liking

### Expected Overall Liking

<table>
<thead>
<tr>
<th>Sum sq</th>
<th>df</th>
<th>F</th>
<th>p</th>
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<tbody>
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<td>161.28</td>
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### Tasted Overall Liking

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<td>247.14</td>
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<td>Residuals</td>
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→ *Panel* effect was observed for both expected and tasted liking score: One country gives higher liking scores than the other (AT > VN) – PANEL EFFECT

→ *Product* effect was observed for both expected and tasted liking score: Products have been differently appreciated in both expected and tasted estimation (HN > WG > V > L) – PRODUCT (FLAVOUR) EFFECT

→ Interaction *panel* product effect was observed for both expected and tasted liking score: preference pattern for these products is different from one country to the other – FAMILIARITY EFFECT?
Expected Liking vs. Choice

![Graph showing Expected Liking vs. Choice for Vietnam and Austria. The graph includes data points for each country, with Vietnam represented by red circles and Austria represented by blue circles.](image-url)
Gazing: fixation & visit duration

Panel effect
Product effect
Shorter decision time in the Austrian panel
Gazing: fixation & visit count

→ Panel effect
→ Product effect
<table>
<thead>
<tr>
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<th>Sum Sq</th>
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<td>2542.18</td>
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→ *Panel* effect was observed for all measures: **One country gazes differently than the other (VN > AT: higher count and longer duration) – PANEL EFFECT**
→ *Product* effect was observed for all measures: **Certain product attracts more consumer’s attention than others (O, WG > V, L) – PRODUCT (FLAVOUR) EFFECT**
→ Interaction *panel* *product* effect was observed for all measures: **The way that consumers gazed on these products is different from one country to the other – FAMILIARITY EFFECT?**
Choice vs. Gazing Parameters in Vietnamese Panel
Gazing Parameters vs. Choice in Austrian Panel

Gaze parameter [sec] or []

Number of Choices

0 1 2 3 4 5 6 7

Fixation Duration
Visit duration
Fixation count
Visit count

Hazelnut
Whole Grain
Vanilla
Lemon
Prediction Rates of Gaze Parameters for Choice of Austrian & Vietnamese Panel

- No panel effect
- No product effect
Correlations between gaze measures, WTT, Expected and Tasted Liking

<table>
<thead>
<tr>
<th></th>
<th>Total fixation duration</th>
<th>Total visit duration</th>
<th>Fixation count</th>
<th>Visit count</th>
<th>WTT</th>
<th>Exp Overall Liking</th>
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<td>AT</td>
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<tr>
<td>WTT</td>
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<td>0.7563</td>
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<td>Exp Overall Liking</td>
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<td>Per Overall Liking</td>
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<td>VN</td>
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<td>Per Overall Liking</td>
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</table>

→ Strong positive correlations between gaze measures, WTT choice rate, expected and tasted liking – FAMILIARITY EFFECT

→ Strong positive correlations between gaze measures and WTT choice rate; poor correlations between gaze measures and expected/tasted liking; poor correlations between WTT choice rate and expected/tasted liking; poor correlations between expected and tasted liking – FAMILIARITY EFFECT
8 Conclusions

1. All tested gazing behaviour parameters are highly country panel-dependent.
2. However, in both panels they are positively correlated with the *wanting to try*-choice rate.
3. Decision time for choice is much shorter in the Austrian panel.
4. Predictive value of gazing parameters is the same for both panels.
5. *Wanting to try* is in compliance with *expected liking* for the Austrian consumer panel only, which is very familiar with the products.
6. *Expected* and *perceived liking* of the products are highly country panel- and product dependent.
7. *Expected liking* is strongly correlated with *perceived liking* for the Austrian panel only.
8. These findings imply the important role of familiarity with products in shaping consumers’ food related behavior. They underline also the importance of a multiple-tool approach in improving the understanding of consumers’ food choice perception and behaviour.
1. Further tests with the Vietnamese panel, to make them more familiar with the products – changing gazing behavior, expected & perceived liking?

2. To separate familiarity from other country-related factors products with
   • low familiarity in Austria and
   • high familiarity in Vietnam as well as
   • products with similar low and
   • similar high familiarity in both countries will be tested
Thanks to the organisers and the scientific committee of Pangborn!
Thanks to all colleagues!
Thanks to all test persons!
Thanks to Manner!
Thanks to Vietnamese Authorities!
Many thanks for your visual & acoustic attention!

Best Wishes from

Viet Phu Tu

Thi Minh Hang Vu

Jun

Austrian Landscape