# Do picture labels give better idea to customers? A comparison of picture labels to traditional text describe labels in choice experiments

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**Abstract**

Choice experiments (CE) and choice-based conjoint analysis are widely used to estimate consumer WTP and tradeoff between foods attributes. Traditional CE normally consists of several choice sets that asks respondents to choose an alternative from several alternatives that are bundles of product attributes. All the attributes which are described in verbal. Increased use of internet surveys further promote the popularity of CE and also make it easier to design or imitate products or scenarios with multimedia such as picture or videos to motivate consumers provide answers that are more accurate. We compared two version of surveys that presented the CEs with different forms (verbal vs picture). The significance of attributes are similar of two versions of CE. In general, the WTPs from picture CE are lower than those from text CE.

**Keywords:** Strawberry, WTP, Choice Experiment, Mixed Logit

## Introduction

The use of experimental markets to investigate consumers' preferences and willingness-to-pay (WTP) for food quality attributes has become increasingly popular. Choice experiment (CE) and choice-based conjoint analysis are widely used to estimate consumer WTP and tradeoff between foods attributes because they are easy to implement and can better simulate real shopping scenarios than other hypothetical or nonhypothtical valuation methods (Adamowicz, 1998). CE normally consists of several choice scenarios that ask respondents to choose an alternative from several alternatives that are bundles of product attributes. It is in consumers' best interest to choose the alternative that can maximize their utility in each scenario. The popularity of CEs can be explained by that the choice task in such experiment is relative closer to the real grocery shopping situations and CE is consistent with Lancasters utility maximization theory. Because CE focuses on tradeoff between scenarios with different combinations of attributes and price, it is usually applied to the studies on consumers' WTP.

The relative importance of attribues to consumers is usually elicited by presenting them with a series of choice sets where the levels of attributes are changed across the sets. According to previous studies, two initials steps are generally involved in experiment design process: identifying attributes and assigning levels. (Hensher, 2005) (Coast J. a., 2007) (Coast J. H.-J., 2012). Attributes can be quantitative (e.g., price) or qualitative (e.g., organic vs conventional) and are considered to be based on knowledge consumers acquired. The context and goal of CE can be very different and there is no standard definition of attributes (Louviere, 2000). CE cannot include all the attributes which means that the attributes included should be the most important attributes and are relevant to objective of the studies. Based on the attributes in CE, respondents could get a general idea of the products that researchers are trying to describe. The combined set

of attributes should well functional in describing choice so that respondents can make trade-offs among those attributes, which is consistent with underlying economic theoretical framework and compensatory decision making. The most important part in CE is that attributes must reflect the true motivations of the respondents in the given choice scenario (Lancsar and Louviere, 2008). Besides, all of attributes in the choice sets should be formulated in a way that ensures the repondents understand the content of attributes. Therefor qualitative work is needed as a basis for ensuring them in a clear and concise manner (Mays And Pope, 2000) (Kuper, 2008). All the attributes in CE should be explained thoroughly to avoid mistakes from respondents' misunderstanding of the attributes and choice tasks (Peters, 2006).

In a tradition CE, attributes are presented using plain text description. Respondents compare the the alternative with attributes at different levels in each choice set, and then use the imaginary pictures of two or more products in the each choice set to make comparison and then choose the one they prefer the most. Most recently, some studies use real logos or pictures (e.g. USDA Organic Logo) in CE to present products trying to mimic what consumers will see in real world shopping as close as possible for respondents' to have a better understanding of the choice task and more realistic choice. Increasing usage of internet surveys also make it possible to design or imitate products or scenarios with multimedia such as pictures or videos. The format of which information is stored and manipulates human brain is the classic debate in cognitive psychology and cognitive science (Kløjgaard, 2012). However, it is expected that picture labels containing the attributes would be more straight forward and easier to understand than verbal description of the attributes because these are what consumers usually seen in the real world. As a result, more accurate answer will be provided when consumer do the choice task in CE.

Even with aforementioned benefit of using picture labels, most previous studies merely use verbal description and few studies use pictures of real labels to present the alternatives in CE. The reason may be that using pictures labels consume more time than using verbal description when designing a CE and in many times real picture labels are not available in the market. In this station, should researchers spend more time in design picture labels with the assumption that they will improve the information collected from CE for better WTP estimation or should they simply use the verbal description of attributes which are simple and straightforward to design? With a direct comparison of these two CE formats it is difficult to conclude on the impact of picture labels in motivating consumers to make better choices and for more efficient WTP estimates The objective of this study is to explore the potential benefits of using picture labels to present alternatives in CEs in comparison with the most popular verbal description of alternatives. We will determine whether the WTP estimates from the two forms of CE differ significantly and whether CEs with picture labels enable us to obtain more efficient estimates of consumer preference and WTP.

**Experimental Design**

Each participant was randomly assigned to one of the two surveys. Two surveys are the same except that one survey contains a CE using picture labels (Survey 1) and the other survey contains a CE using verbal description of attributes (Survey 2).

The CEs are used to elicit consumer preference for attributes of fresh strawberries. To make a fair comparison between the two versions of CEs, we designed CEs carefully so that the only difference in the two CEs is the way of presenting the attributes. In the picture labeled CE

information of all attributes is presented by pictures or logos (e.g. USDA organic logo). Because picture that are similar to the labels on the clamshell of strawberries in the grocery store are used, when participants see those labels, they may better recall the scenario of purchasing strawberries in grocery store and make responses closer to reality. In the CE using verbal description, information of all attributes is presented by plain text, such as USDA organic, Certified Naturally Grown (Table 1).

There are five attributes in the CE, which are origin, production method, customer review, best use by days and price. The range of strawberry prices is consistent with the market prices and the price for each 16oz box has four levels: $ 1.99, $2.99, $3.99 and $4.99. Origin has five levels which include California, Florida, Mexico, Locally Produced and the United States. Production method has three levels including "USDA Organic", "Certified Naturally Grown" and "Conventional". Customer review has three levels, including one, two and three stars. Customer review is defined as the rating of the strawberries based on consumers' average sensory rating of flavor, taste and texture of strawberries. Three stars mean consumers are very satisfied with the strawberries, and one star indicates consumers are least satisfied with the strawberries. Best use by days has three levels, including 3 days, 5 days and 7 days, which can be an indicator of freshness of the strawberries. The full factorial design would generate 4*5*3*3*3=540 choice sets, which is impossible for one consumer to evaluate. The fractional factorial design maximizing the D-efficiency is used to generate the product profiles and a cyclical design is used to generate the choice set in the CE (Table 2). The cyclical design results in the most contrast in the attributes between the alternatives in the CE, and is one of the most efficient designs when there is no priori information on consumer preferences. In each choice set, participants are asked to choose one from the two strawberries that differ in attributes. If they are not satisfied with

either strawberries, they can choose "I would not choose either product" just like what they will do in real shopping. Decision made in each choice set is independent from others and all the choice sets are presented in random order so that order effects can be minimized.

**Methodology**

CE is based on random utility theory (Hanemann, 1984; Hanley, 1998; Hanley, Wright, and Adamowicz, 1998). Based on the econometric framework for discrete choice analysis in the context of random utility models by McFadden (1974), strawberries' characteristics can be evaluated using discrete choice models where choices are made among mutually exclusive finite alternatives within an exhaustive choice set in this study. The theoretical model shows the number of attributes changes in a consumer's utility function and their WTP for a specific attribute may also change. Assuming a linear random utility function, consumer utility can be defined as

$$U_{ij} = V_{ij} + \varepsilon_{ij} = \beta_i' \cdot X_{ij} + \varepsilon_{ij} \quad (1)$$

where $V_{ij}$ is the deterministic, $X_{ij}$ is a vector of attributes of product $j$, $\beta_i$ is a vector of parameters while $\varepsilon_i$ is unobservable stochastic error which are assumed distributed independently and identically distributed with the Gumbel distribution. The rule of choice is utility maximization: product $j$ is chosen by consumer $i$ among all alternatives iff

$$U_{ij} \geq U_{ik} \quad \forall j \neq k \quad (2)$$

Different assumptions on the structure of the stochastic component lead to a variety of specifications. In this study, we have applied the Random Parameter Logit (RPL) where a Mixed

Logit (ML) specification is obtained by allowing the set of individual preference parameters $\beta_i$ to be distributed across individuals according to a statistical distribution $\beta_i \sim f(\beta|\bar{\beta}, \eta)$ which is characterized by mean $\bar{\beta}$ and variance-covariance matrix $\eta$ . Specifically, we denote the following equation:

$$\beta_i = \bar{\beta} + \eta \cdot \mu_i , \quad (3)$$

where $\bar{\beta}$ measure the mean effect of product attributes, $\eta$ is the triangular matrix and $\mu_i$ is independently identically distributed with certain distributions (Train, 2003). The RPL model is widely applied and has already become the standard reference for Stated Choice Experiment (SCE) studies because of its ability to account for preference heterogeneity and its flexibility in accommodating a variety of model specifications (McFadden and Train, 2000).

The probability $P_i$ that consumer $i$ may choose alternatice $j$, conditional on a given set of values of the $\beta_i$ parameters is denoted as

$$P_i(j|\beta_i) = L_{ij}(\beta_i) = \frac{exp^{V_{ij}}}{\sum_{k=1}^{m} exp^{V_{ik}}} = \frac{exp^{\beta i \cdot x_i}}{\sum_{k=1}^{m} exp^{\beta i \cdot x_k}} \quad (4)$$

To estimate consumers' WTP for product attributes, each preference parameter represents the marginal utility of the attribute need to be considered in the random utility model.

Consumer WTP for attributes $x_k$ (with corresponding coefficient $\beta_k$) can be calculated as

$$WTP_j = -\frac{\beta_j}{\beta_p} \quad (5)$$

The WTP is lognormal distrusted (Krinsky and Robb, 1986).

**Data Collection and Result**

An online survey company distributed the surveys to its national representative consumer panels in July 2014. We received 1298 and 1304 completes for Survey 1 and Survey 2, respectively. The survey respondents are adults who are 18 years and older, major household shoppers and strawberry consumers. Table 1 present the statistics of respondents' demographics of both versions.

As stated before, a random parameter logit model is applied on this study. To specify, we denote following equation:

$$U_{ij} = \alpha_1 \cdot P_{ij} + \beta_i' \cdot X_{ij} + \varepsilon_{ij} \quad (6)$$

Where P is price and X are other attributes of strawberry. The coefficient of product price $\alpha_1$ was estimated as a nonrandom parameter while others coefficients of other attributes were defined as random parameters with a normal distribution as equation (3). The reason why coefficient on price was not estimated as a random parameter is the normal distribution has density on both sides of zero that would allow some individuals to have upward sloping demand curves. This assumption assured the estimated WTPs for other strawberries' attributes are normally distributed (Lusk, Roosen and Fox, 2003).

Table 4 reposts the estimates of multinomial logit and mixed logit models for both picture CE version and text CE version. For mixed logit model, in text CE version, except the attributes " Best use with 5 days" , all others attributes are significant while all attributes in picture CE surveys are all significant. For both versions, the overall goodness of fit of mixed logit model are better than those of multinomial logit (MNL). Mixed logit model improvement statistically significant i overall on the multinomial logit model and there is a strcutral advantage in selecting

the mixed logit model. The coefficients of most strawberries were different from zero at the 0.001 siginificance level. Compare the results from two versions, we can see from the results, two versions have same siginificant variables at 0.001 significance level. The attribute "Best use with 5 days" is not significant in picture CE version but is significant at 0.05 significance level in text version. Table 5 shows the results of estimate WTPs for addtional attributes of strawberry. Repondents seems dislike the strawberry from Mexico compare to strawberries label as "Product of USA", "Product of Florida", "Produce of USA" or labelled "Locally Produced". Respondents from both group are likely to pay more for "Naturally Grown" or "Organic" strawberry. Besides, it seems they prefer strawberries are "Naturally Grown" to "Organic"strawberries because larget WTPs on "Naturally Grown" strawberry. All level of attributes of custmoers' review are significant posive in both version, suggesting respondents are more likely to purchase strawberries with higher customer reviews, the higher the review is, the more sensitive they are. For the attribute related to freshness, repondents of picture survey are only interested in "best use with 7 days" label while repondents who received text survey are likely to pay more on both "best use within 5 days" and "best use with 7 days" compare to "best use with 3 days". Compare the WTP of all attributes which have significant influence, we can see in text CE version, consumers seems are more senstive to most strawberries attributes and have higher WTPs except for attributes "Organic". The WTP of organic is the only attributes which repondents from picture survey are want to pay more than repodents from text survey.

**Dissusion and Conclusion**

More and more studies now are related to consumer perceptions and WTP for food product. The attribures of product are being conducted valuable information to growers, retailers and policy makers. CE is one of most popular method to estimate consumers' WTP. However, the limitation still exists since no real product and actual money involved in the experiment. The appearance attributes and sensory attributes can not detect during the experiment, the only recourse the respondents can rely on is the description of attributes in choice sets. The estimation of WTP is conditional on the number of product attributes which provided by the survey designers. Therefore, the information garnered from WTP studies may be inaccurate reflections of real world behavior and their actual purchase decisions. Lusk and Schroeder (2004) found the CE may result in higher WTP estimates as is typical in hypothetical conjoint analysis. Our study investigated the potential of using picture which contains real label with attributes information as alternative in choice set. The picture alternatives are similar to the real label consumers see in the grocery store may recall the scenario of shopping in grocery store and give their WTP more accurate. This study compared traditional CE and CE with picture alternative in a study of consumers' WTP for quality-differentiated strawberry. We found the respondents give picture version CE a lower WTP than that from text CE survey respondents. Among all the attributes in picture survey, we found the "organic" is the only attributes that had higher WTP than that of text survey. The possible reason for this is consumers are more familiar with the logo of "Organic" and more sensitive than other attributes. For the agribusiness applications, more picture CE could be conducted and as we show, will likely yield different results than a text CE. The picture CE could give them better understanding of each attribute and help them connect the attribute to their own shopping habit, which may provide a more accurate WTP estimation.

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**Table 1 An example of two types choice design in CE**

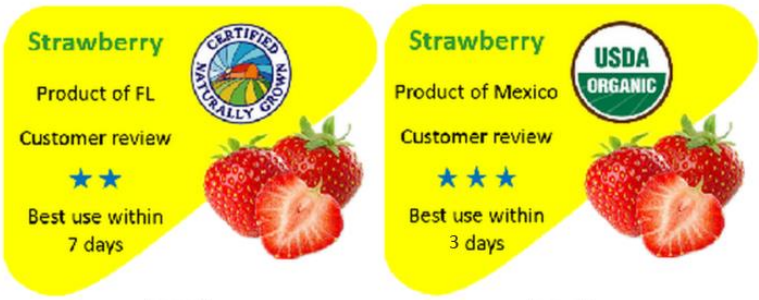
<table>
<tr>
<td>Traditional CE choice Set</td>
<td>Which of the following two choices for strawberries would you pick?<br>  <br>$4.99/box<br>Product of FL<br>Certified Naturally Grown<br>Customers Review: ★★<br>Best use within 7 days<br>  <br>$1.99/box<br>Product of Mexico<br>USDA Organic<br>Customers Review: ★★★<br>Best use within 3 days<br>I would not choose either product</td>
</tr>
<tr>
<td>Picture CE Choice Set</td>
<td>Which strawberry would you pick in grocery shopping?<br>  <br><br>$4.99/box<br>$1.99/box<br>I would not choose either product</td>
</tr>
</table>

**Table 2 Attributes in Strawberries CE design**

| Attribute | Number of Levels | Level | | | | |
|---|---|---|---|---|---|---|
| Price | 4 | 1.99 | 2.99 | 3.99 | 4.99 | |
| Origin | 5 | CA | FL | Mexico | Locally Produced | US |
| Label | 3 | Conventional | Certified Naturally Grown | USDA Organic | | |
| Review | 3 | 1 Star | 2 Star | 3 Star | | |
| Best Use Date | 3 | 3 | 5 | 7 | | |

**Table 3. Main Summary Statistics for the Sample Demographics**

| Characteristics | % of survey1 | % of survey2 | Characteristics | % of survey1 | % of survey2 |
|---|---|---|---|---|---|
| Gender | | | Children under 18 in household | | |
| Male | 45% | 43% | None | 65% | 63% |
| Female | 55% | 57% | One | 18% | 18% |
| Age | | | Two | 11% | 12% |
| 17 or below | 0% | 0% | Three | 4% | 4% |
| 18-24 | 9% | 9% | Four | 1% | 1% |
| 25-29 | 9% | 8% | Five or more | 1% | 1% |
| 30-24 | 9% | 11% | Current employment status | | |
| 35-39 | 8% | 9% | Employed full time | 44% | 40% |
| 40-44 | 10% | 8% | Employed part time | 12% | 13% |
| 45-49 | 9% | 9% | Unemployed | 10% | 11% |
| 50-54 | 10% | 11% | Homemaker | 8% | 11% |
| 55-59 | 9% | 8% | Student | 4% | 3% |
| 60-64 | 9% | 9% | Retired | 22% | 21% |
| 65-69 | 9% | 9% | Annual household income | | |
| 70-74 | 5% | 5% | Less than $14,999 | 10% | 10% |
| 75-79 | 2% | 2% | $15,000-$24,999 | 12% | 12% |
| 80 or above | 1% | 2% | $25,000-$34,999 | 14% | 13% |
| Education Level | | | $35,000-$49,999 | 14% | 16% |
| Some High School (or less) | 2% | 2% | $50,000-$74,999 | 21% | 22% |
| High school Graduate | 22% | 20% | $75,000-$99,999 | 12% | 13% |
| Some College | 35% | 36% | $100,000-$149,999 | 10% | 10% |
| Bachelor's Degree | 27% | 29% | $150,000-$199,999 | 3% | 3% |
| Post-graduate Degree | 14% | 13% | $200,000 or above | 2% | 2% |
| Race | | | Weekly food expenditure | | |
| Caucasia | 77% | 79% | Less than $49 | 10% | 11% |
| Black | 11% | 9% | $50-$99 | 32% | 31% |
| Hispanic | 8% | 9% | $100-$149 | 30% | 27% |
| Native Hawaiian or Pacific Islander | 0% | 0% | $150-$199 | 13% | 14% |
| Asia | 6% | 9% | $200-$249 | 5% | 6% |
| American Indian or Alaska Native | 2% | 1% | $250-$299 | 3% | 3% |
| Other | 1% | 1% | $300-$249 | 1% | 2% |
| Marriage Status | | | $350-$399 | 1% | 1% |
| Single | 29% | 27% | $400-449 | 1% | 2% |
| Married/Remarried | 53% | 53% | $450-$499 | 1% | 1% |
| Separated | 1% | 1% | Above $500 | 1% | 1% |
| Divorced/Widowed | 14% | 18% | Not Sure | 1% | 1% |
| Other | 2% | 1% | | | |

**Table 4. Summary of Multionalmial Logit Model and Mixed Logit Model Results**

| Variables | Picture CE | | Text CE | |
|---|---|---|---|---|
| | Multinomial Logit | Mixed Logit | Multinomial Logit | Mixed Logit |
| *Price* | -0.538*** | -0.729*** | -0.475*** | -0.641*** |
| | (0.011) | (0.015) | (0.011) | (0.014) |
| *California* | 0.696*** | 1.009*** | 0.716*** | 0.933*** |
| | (0.047) | (0.064) | (0.046) | (0.061) |
| *Florida* | 0.719*** | 0.918*** | 0.620*** | 0.731*** |
| | (0.039) | (0.060) | (0.038) | (0.054) |
| *Own-State* | 0.897*** | 1.359*** | 0.913*** | 1.236*** |
| | (0.434) | (0.070) | (0.043) | (0.065) |
| *US* | 0.650*** | 0.991*** | 0.585*** | 0.790*** |
| | (0.048) | (0.076) | (0.047) | (0.070) |
| *Naturally Grown* | 0.225*** | 0.248*** | 0.250*** | 0.255*** |
| | (0.030) | (0.041) | (0.029) | (0.039) |
| *Organic* | 0.191*** | 0.211*** | 0.140*** | 0.125*** |
| | (0.028) | (0.044) | (0.029) | (0.042) |
| *Review 2 Stars* | 0.338*** | 0.522*** | 0.389*** | 0.549*** |
| | (0.030) | (0.043) | (0.030) | (0.041) |
| *Review 3 Stars* | 0.571*** | 0.763*** | 0.714*** | 0.923*** |
| | (0.030) | (0.049) | (0.030) | (0.047) |
| *Best Use within 5 days* | 0.005 | 0.096** | 0.027 | 0.062 |
| | (0.033) | (0.041) | (0.033) | (0.040) |
| *Best Use within 7 days* | 0.210*** | 0.223*** | 0.229*** | 0.253*** |
| | (0.029) | (0.036) | (0.028) | (0.035) |
| *Constant for None Option* | -1.618*** | -0.223*** | -1.392*** | -2.163*** |
| | (0.059) | (0.036) | (0.058) | (0.072) |
| Standard deviations of random parameters | | | | |
| Std. *California* | | 1.092*** | | 1.060*** |
| | | (0.057) | | (0.055) |
| Std. *Florida* | | 1.294*** | | 1.171*** |
| | | (0.053 | | (0.050) |
| Std. *Own-State* | | 1.524*** | | 1.473*** |
| | | (0.061) | | (0.059) |
| Std. *US* | | 1.695*** | | 1.515*** |
| | | (0.064) | | (0.062) |
| Std. Naturally Grown | | 0.711*** | | 0.657*** |
| | | (0.049) | | (0.055) |
| Std. *Organic* | | 0.937*** | | 0.943*** |
| | | (0.047) | | (0.077) |
| Std. *Review 2 Stars* | | 0.722*** | | 0.656*** |
| | | (0.059) | | (0.067) |
| Std. *Review 3 Stars* | | 1.067*** | | 1.147*** |

| | | | | |
|---|---|---|---|---|
| | | (0.062) | | (0.082) |
| Std. *Best Use within 5 days* | | 0.335*** | | 0.326*** |
| | | (0.051) | | (0.053) |
| Std. *Best Use within 7 days* | | 0.300*** | | 0.394*** |
| | | (0.054) | | (0.059) |
| Log Likelihood | -16402 | -14437 | -16595 | -14705 |
| No. of Sample | 1298 | 1298 | 1304 | 1304 |

Note: *** indicates statistically significant at 1% significant level; ** indicates statistically significant at 5% significant level.

**Table 5. Statistics of WTP estimates of repondents for two versions**

| WTP for | Picture CE | Text CE |
|---|---|---|
| *California* | 1.375 | 1.517 |
| | (1.269) | (1.392) |
| *Florida* | 1.249 | 1.207 |
| | (1.511) | (1.555) |
| *Locally Produced* | 1.854 | 2.012 |
| | (1.756) | (1.933) |
| *USA* | 1.337 | 1.323 |
| | (2.016) | (2.029) |
| *Naturally Grown* | 0.338 | 0.457 |
| | (0.787) | (0.852) |
| *Organic* | 0.316 | 0.259 |
| | (0.894) | (1.088) |
| *Review 2 stars* | 0.688 | 0.891 |
| | (0.841) | (0.865) |
| *Review 3 Stars* | 1.018 | 1.490 |
| | (1.214) | (1.491) |
| *Best Use within 5 days* | 0.125 | 0.115 |
| | (0.370) | (0.342) |
| *Best Use within 7 days* | 0.303 | 0.411 |
| | (0.298) | (0.385) |
| Total WTP | 8.604 | 9.682 |

Note: Total WTP is the sum of WTP for all attributes.