Do Taste Buds Trump Labels and Information?
A Sensory Test and Economic Experiment on Organic and Local Apples

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Introduction

The market for organic and local foods has grown substantially in the last decade, but no statistics can map the growing complexity of messages, issues and perceptions inherently linked to these two food niches. Given the significant attention and growth surrounding organic and local foods, research on the motivation and factors influencing consumer choices to purchase such foods is still spurious. Producers and policymakers alike have an interest in learning why and how much consumers are willing to pay for products that possess a label indicating that a product is locally and/or organically produced. However, this willingness to pay for credence attributes, and particularly how it is impacted by other factors such as taste and quality of the product, has not been examined intensively.

Our study makes an attempt to fill this void in several ways. We conducted an economic experiment to elicit willingness to pay for an upgrade from a non-local, non-organic product to its local and/or organic counterpart, initially allowing respondents to just draw from existing perceptions of these labels and claims. To explore how experience and credence attributes may affect these baseline valuations, we used a design that enables us to calculate changes in willingness-to-pay before and after subjects received additional information related to label claims about the product (verifying credence attributes), and again after their prior taste preferences for the four varieties were revealed (verifying experience attributes). In total, three subsequent auctions provide not only values, but inferences about trade-offs between a fairly complex set of factors that impact consumer choices within food niche markets, and therefore, inform industry and policy stakeholders about preferences and market dynamics playing out in the fresh produce sector.

Literature Review

Experimental auctions have been used extensively to elicit consumers' valuations; see Lusk and Shogren, 2007, as the standard reference. Our paper makes a contribution to several strands of the literature: evaluation of organic and local attributes of food; changes in consumer responses to evolving information conditions; impact of tastes on consumer preferences, and the still very small interdisciplinary literature on combining economic experiments with sensory tests. The following is not an exhaustive literature review, but rather a brief comparison of our methodology with a few recent exemplary papers in these areas to provide context for our study.

Evaluation of organic and local attributes of food

Bernard and Bernard (2009) conducted a Vickrey auction similar to ours in supermarkets with subjects from the general population, who participated in four simultaneous auctions for different kinds of organic and conventional milk. Their main finding indicates the sum of premia for rBST-free milk and milk with no antibiotics is equal to the premium for organic milk, which suggests diminishing marginal utility of additional attributes.[1]

James et al. (2009) used a survey of households in rural Pennsylvania to examine differences in willingness to pay for local and organic apple sauce and found that consumers were willing to pay more for locally-grown applesauce compared to applesauce that was labeled organic. Interestingly, they also found that respondents with more knowledge of agriculture indicate a lower willingness to pay for either attribute.

Responses to evolving information conditions and taste tests

The design of our paper is closest to that employed in Nalley et al. (2006) and Poole et al. (2007). Nalley et al. too use a "5th-price auction" (which we explain below) to evaluate

[1] Kiesel and Villas-Boas (2007) find in a hedonic study that consumers buy increasingly organic milk since the introduction of the USDA organic seal, while substituting away from milk carrying the rBGH-free label.

participants' willingness to pay for a food item (sweet potatoes) before and after they can taste it and receive additional (in their case, health) information about it. They found that valuations before and after consumption differ significantly, and that this difference is impacted by the location of origin of the potatoes.

Poole et al. (2007) employ a 2nd-price auction to examine willingness to pay for different varieties of mandarins before and after peeling them and before and after tasting them. They too find significant differences in bids between rounds.

Since both designs are similar to ours (2nd- and 5th-price auction respectively, three rounds, bidding before and after consumption, in Nalley et al. also bidding before and after receiving information about the product), it is worthwhile to point out some differences: 1) both papers' main concern is more about methodology and not about the product itself, while we have a research interest in valuations of organic and local attributes; 2) while participants in Nalley et al. taste the sweet potatoes there is no objective or subjective evaluation connected to the tasting (at least not reported in the paper); participants in Poole et al. do fill out a taste scoresheet after the auctions, but there are no objective measures; and 3) Nalley et al.'s and Poole et al.'s subject pool consist entirely and overwhelmingly of undergraduate students, respectively, while students make up only a small fraction in our sample (but that might be only a minor concern; see Depositario et al., 2009).[2]

Combining economic experiments with sensory evaluations

Combris et al. (2009) make a convincing case that sensory evaluations could be combined efficiently with economic techniques to address issues related to food choices.

[2] Recent papers that examine consumers' response to new information about food quality but use surveys instead of experimental markets include Gao and Schroeder (2009) and Markosyan et al. (2009). Umberger et al. (2009) employ experimental auctions and surveys.

Valuation without accounting for taste could be misleading, especially for products that are expected to be frequent purchases among consumers (so that experience would inform future purchases). In addition, visual inspection is often not a good substitute, particularly for apples, as reported by Schechter (2010), who finds that people often misperceive apple taste based upon visual cues, even though in systematic ways.

The novel feature in our design, however, allows not only for subjective taste description, as most other studies in this literature do, but also for objective evaluation of the quality of the food in question, and integration of this information into an auction that also elicits values on credence attributes related to local and organic food systems.

Experimental Design

To investigate the effect of varying information conditions on preferences for local and/or organic apples, we recruited student and non-student participants through ads in student and staff newspapers of Colorado State University, indicating that they would participate in a research study examining preferences for apples. Table 1 indicates that the sample, while not perfectly representative of Colorado's population, mirrors the general population more than the more typical recruited pool made up exclusively of students. The median age of 109 participants in five sessions was 27; 63 participants had at least an undergraduate degree; and 57 participants had an annual gross income of $35,000 or more. Note also that 91 participants indicated that they are the primary shopper in their respective households.[3]

The experimental design consists of nine parts, numbered from 0 to 8:

[3] While these numbers still indicate an overproportional amount of students in our sample (as would be expected), we, as other researchers in this area, are not overly concerned with that. Recent evidence indicate that students do not bid significantly differently from non-students in experimental auctions (see, for example, Depositario et al., 2009, who coincidentally also employ a 5th-price auction).

Part 0: Subjects were welcomed and seated, received an ID number and an envelope with show-up money ($22), had to read and sign a consent form, and received a sheet with demographic questions about age, income, etc. (see Table 1 for the summary statistics on these demographic variables).

Part 1: After answering the survey questions, Part 1 of the instructions were handed out (Appendix A shows the entire instructions). In this part, we elicited subjects' risk preferences by using a Holt-Laury (2002) table with ten choices between two lotteries. Table 2 is the table subjects faced.[4] After subjects had made ten decisions on which of two lotteries they prefer, one number between 1 and 10 was randomly chosen to determine the payoff-relevant decision, and another number between 1 and 100 was randomly chosen to determine the outcome for the lottery subjects had chosen for the relevant decision.

Part 2: In part 2, participants received six general statements on environmental perceptions of local and/or organic food, which they had to evaluate on a nine-point Likert Scale, from 1 = Strongly Disagree to 9 = Strongly Agree. Table 3 lists the six questions and their respective means and standard deviations.

Part 3: As is standard in evaluations of goods through experimental auctions (Lusk and Shogren, 2007), we first conducted practice auctions with candy bars to familiarize the participants with the auction format.[5] To mirror the design of the actual apple auctions, we endowed the subjects with a small Butterfinger and then conducted three rounds with three markets in each round. In each market the participants were asked to submit bids for upgrades

[4] Lusk and Coble (2005) in their research on attitudes towards genetically modified food use the same table. Note that subjects can always make a guaranteed $8 in addition to the $22 show-up fee, which is consistent with our recruitment ads in which we promised $30 for participating in this study.

[5] They are "practice" in the sense that we do not care about data from these auctions, but they are not hypothetical—winners of these auctions had to pay the winning bids and exchanged the small Butterfinger for the upgrade.

from a small Butterfinger to a different bar: a large Butterfinger, a Luna LemonZest bar and a large Dove bar. One of the nine auctions was randomly chosen to be binding. The auction format used here, as in the subsequent apple auctions, was a 5^{th}-price auction—the bidders of the four highest bids paid the fifth-highest bid amount to upgrade from their small Butterfinger to the larger chocolate bar. At the end of this stage, the research team focused on explaining why it is in the best interest of all participants to bid their true values.

Part 4: After the practice auctions in Part 3, members of the research team brought in four slices of Gala apples for each participant; all apples had been purchased from retail outlets prepared in a food laboratory in the same hallway. Participants were asked to blind-taste these apples, to rate their appearance, flavor, texture, and overall acceptability using a 9-point hedonic scale and to rank them (see the work sheet in Appendix C). In addition, right before each experimental session we also measured soluble solids content with a digital refractometer and quantitatively assessed texture with a TA-XT2 Texture Analyzer (a detailed analysis of the correlation between subjective and objective measures is conducted in a companion working paper targeted at the food and nutrition field).

Note that we had to make a design choice whether we let the subjects first go through two auctions before the blind-tasting or the other way around. In either case, there is a risk that participants try to "adjust" their latter numbers, either the taste ranks or the auction bids, to appear consistent with the previous numbers. We decided to conduct the blind-tasting first, so that subjects would taste the different apples without yet knowing that the experiment is about local and organic attributes.

Part 5: After participants finished the blind-tasting and filled out the Score Sheet, they were endowed with a one-pound bag of non-organic, non-local Gala apples and read definitions

of the terms “organic” and “local” (see Part 5 of the instructions and Table 4). Then we conducted the first set of auctions for upgrades to bags with organic non-local, non-organic local and organic local apples. All winning bids and the IDs of winning bidders were written on a board in front of the room.

Part 6: After the first auction round, environmental information (drawn from scientific journals and citations) related to the carbon footprint of local and non-local apples and pesticide use for organic and non-organic apples was handed out (see Part 6 of the instructions), followed by the second set of auctions for upgrades.

Part 7: In this part, the identities of the four apples from Part 5 were revealed and subjects were handed back their score sheets from Part 4, followed by the third and final round of auctions for upgrades.

Part 8: The winning auction was randomly determined; auction losers were allowed to leave right away with their money, candy bar and apples endowment; winners of both auctions had first to pay their bids and exchange their candy bars and apple bags for the respective upgrades.

Preliminary Results

We present here a broad overview of basic results from the three apple auctions. For future updates, more rigorous analyses of these results and how they are correlated with risk preferences and environmental perceptions of subjects are currently being conducted; as is a closer examination of the relationship between subjective and objective blind-tasting results and their impact on bidding in the last auction round.

First consider Table 5, the general summary of the subjective rankings from Part 4, the blind-tasting stage: the endowed non-organic and non-local apples turned out to be the least

popular apples; almost 50% of all participants ranked them last. Local and organic apples were popular, but they were outscored by non-local and organic apples, both in terms of overall acceptability and individual rankings (also, in pairwise comparison, 56% ranked the non-local and organic apples higher than its local counterpart).

Table 6 and Figure 1 present the average bids for each upgrade and over the three rounds. Clearly, the majority of participants were willing to pay a premium for local and organic attributes: in none of the nine auctions were more than 42% of the entered bids equal to $0.10 or less (see last column in Table 6).

Tables 7 and 8 exhibit the results from paired t-tests: Table 7 compares bids across varieties in each round, while Table 8 compares bids across rounds for each variety. A few results are noticeable:

Result 1: Bids were significantly higher for upgrades to apples that have both attributes, organic and locally produced, compared to bids that feature only one of these two attributes.

This difference is a bit weaker between organic/local apples and organic/non-local apples in the last round after the identities from the blind-tasting phase were revealed, which is consistent with the observation from Table 5 that the majority of participants preferred the organic/non-local apples over the organic/local apples. However, the difference is still significant at 10%, which motivates interest in the next result, basically the answer to the question posed in the title of this paper:

Result 2: Even though the majority of participants ranked non-local, organic apples higher than local and organic apples in a blind-taste, bids were still significantly higher for the local, organic category, which suggests that at least a subset of consumers are willing to pay a premium for local produce not just in monetary but also in non-monetary tradeoffs.

Comparisons between varieties with just one of the targeted attribute do not reveal a significant difference in any round.

How did bids change over time when new information was revealed? Interestingly, scientific information about environmental impacts did have an impact on the willingness to pay for locally produced apples, even though the majority of participants previously believed, according to Table 3, that locally produced goods cause a smaller carbon footprint, even before cited research was shared.

Result 3: Presenting scientific information on environmental impacts increased bids for upgrades to local apples significantly.

However, this effect vanishes after the identities from blind-tasting are revealed—both bid averages for upgrades to local apples are not significantly higher in round 3 compared to round 1, which is a bit surprising given that the endowed apples were by far the least popular of all four. Curiously, the bid amounts for upgrades to non-organic, local apples are highly correlated between rounds 1 and 2, but not so between rounds 1 and 3, which indicates a large degree of heterogeneity in the effect of taste and information on participants' preferences for local apples.

Finally, the blind-tasting stage did have one strong impact on bidding behavior:

Result 4: Participants significantly increased their bids for the upgrade to the variety of apples they liked the most in the blind-tasting panel (non-local, organic apples) once the identity of that variety was revealed; bid amounts in round 3 were higher than in round 1 or 2. In short, information was influential, and mitigating uncertainty about experience and credence attributes appears to represent value to buyers.

Discussion and Conclusions

These preliminary results confirm the heterogeneity of consumer preferences for organic and local attributes of an agricultural product found in other studies (for example, Pozo et al., 2009): not surprisingly, for a sizable subset of consumers the willingness to pay for such attributes is heavily impacted by the quality and taste of these products. However, an also sizable subset seems to be willing to pay a premium for locality not only in monetary terms, but indirectly as well, since they knowingly forego some quality.

These preliminary findings are important for a number of reasons. First, the valuation of local and organic premia are important market information given fairly dynamic markets in each of those niches. But further extending baseline values with analysis of how information, some of which reinforced or mitigated common marketing messages shared within these niche markets, influences premia at the margin, is of particular interest in an era where marketing labels, certification programs and definitions of local may create misperceptions or confusion among buyers. Finally, allowing buyers to indirectly reveal their tradeoffs between experience attributes (eating quality, flavor, texture), credence attributes and prior opinions addresses important issues squarely positioned at the crossroads of interdisciplinary research in sustainable food systems.

Obviously, a more rigorous data analysis has to be conducted. In particular, given that the preliminary cut of the data reveal a large amount of heterogeneity in bidding behavior, the individual responses to taste differences have to be examined more carefully.

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Table 1: Summary Statistics for Demographic Variables

Number or participants	109
Median age (years)	27
Male	23%
Female	77%
Education (highest level)	
High School diploma	8%
Some college	34%
Bachelor's degree	19%
Some graduate school	21%
Advanced or graduate degree	18%
Household income (in 2009)	
Less than $20,000	39%
$20,000-$34,999	16%
$35,000-$49,999	11%
$50,000-$74,999	15%
$75,000-$100,000	15%
$100,000-$150,000	3%
Greater than $150,000	2%
Race/ethnicity	
White, non-Hispanic	81%
Black	4%
Hispanic	2%
Other	13%
Lived in Colorado	
for less than 1 year	9%
for 1-5 years	19%
for 5-10 years	10%
for 10-25 years	34%
for more than 25 years	12%
their entire lives	15%
Primary shopper in household	
Yes	84%
No	16%

Table 2: Holt-Laury Risk-Preference Elicitation Table:

Decision	Option A	Option B
1	□ **10%** chance of **$10.00**, **90%** chance of **$8.00** (1-10) (11-100)	□ **10%** chance of **$19.00**, **90%** chance of **$1.00** (1-10) (11-100)
2	□ **20%** chance of **$10.00**, **80%** chance of **$8.00** (1-20) (21-100)	□ **20%** chance of **$19.00**, **80%** chance of **$1.00** (1-20) (21-100)
3	□ **30%** chance of **$10.00**, **70%** chance of **$8.00** (1-30) (31-100)	□ **30%** chance of **$19.00**, **70%** chance of **$1.00** (1-30) (31-100)
4	□ **40%** chance of **$10.00**, **60%** chance of **$8.00** (1-40) (41-100)	□ **40%** chance of **$19.00**, **60%** chance of **$1.00** (1-40) (41-100)
5	□ **50%** chance of **$10.00**, **50%** chance of **$8.00** (1-50) (51-100)	□ **50%** chance of **$19.00**, **50%** chance of **$1.00** (1-50) (51-100)
6	□ **60%** chance of **$10.00**, **40%** chance of **$8.00** (1-60) (61-100)	□ **60%** chance of **$19.00**, **40%** chance of **$1.00** (1-60) (61-100)
7	□ **70%** chance of **$10.00**, **30%** chance of **$8.00** (1-70) (71-100)	□ **70%** chance of **$19.00**, **30%** chance of **$1.00** (1-70) (71-100)
8	□ **80%** chance of **$10.00**, **20%** chance of **$8.00** (1-80) (81-100)	□ **80%** chance of **$19.00**, **20%** chance of **$1.00** (1-80) (81-100)
9	□ **90%** chance of **$10.00**, **10%** chance of **$8.00** (1-90) (91-100)	□ **90%** chance of **$19.00**, **10%** chance of **$1.00** (1-90) (91-100)
10	□ **100%** chance of **$10.00**, **0%** chance of **$8.00** (1-100)	□ **100%** chance of **$19.00**, **0%** chance of **$1.00** (1-100)

Table 3: Environmental Perception Questions (1 = Strongly Disagree; 9 = Strongly Agree)

Question	Definition	Mean
1	The environmental impact of fruit and vegetables is greater for conventional than for organic produce.	5.95 (2.20)[a]
2	Eating organic fruits and vegetables represents a lesser health risk than eating conventional fruits and vegetables.	6.27 (2.23)
3	Locally-grown produce represents a lower risk to climate change because the carbon footprint from transportation of the produce is lower.	6.87 (2.03)
4	There are more credible assurances about produce safety direct from local farmers than for other stakeholders in the food system (US govt. agencies, food distributors, retailers).	5.28 (2.03)
5	I trust the government agencies responsible for food safety in the United States.	5.21 (2.07)
6	Pesticide residues on fruits and vegetables are at a safe level if they meet US government standards.	4.39 (2.04)

Note: Number of observations = 109

[a] Numbers in parentheses are standard deviations

Table 4: Definition of “organic” and “local”

Certified (USDA) Organic		This product meets the USDA federal requirement and is certified as organic. Foreign products sold in U.S. as certified organic are subject to USDA regulation.
Locally Grown	No Seal	This product was grown within 300 miles and a 6 hour drive of where it was purchased.

Table 5: Blind-taste rankings.

Variety (Brand, State of Orgin)	**Average overall acceptability** (9 = Highly Acceptable, 1 = Highly Unacceptable)	**Average rank** (1 = best, 4 = worst)
Non-local, non-organic (Sage, Washington)	6.74	2.98
Non-local, organic (Rainier, Washington)	7.64	2.08
Local, non-organic (TomTom, Colorado)	7.19	2.57
Local, organic (Ela, Colorado)	7.35	2.36

Table 6: Descriptive statistics: Aggregate bids for upgrades from non-organic, non-local.

	Average	Standard Deviation	Median	90th percentile	Number of "0s" (out of 109)	Number of bids less than or equal to $0.10
Round 1: Labels only						
Org[a]	.68	1.17	.30	1.50	29	38
Local	.61	.81	.50	1.42	32	39
Org/Local	1.18	1.64	1.00	2.00	10	18
Round 2: Env. Info.						
Org	.69	1.21	.25	2.00	38	45
Local	.73	1.14	.50	1.50	25	31
Org/Local	1.34	2.51	1.00	2.10	12	16
Round 3: Taste						
Org	.89	1.43	.50	2.00	31	33
Local	.74	1.39	.50	1.55	39	42
Org/Local	1.24	2.65	.75	2.06	28	34

[a] Org = Organic and non-local, Local = Non-organic and local; Org/Local = Organic and local.

Table 7: Label effects. Paired t-tests and correlations of bids.

	Round 1 (Labels only)		Round 2 (Labels plus information)		Round 3 (Labels, information and taste)	
Org vs. Local[a]	0.890	0.707[b]	-0.518	0.798	1.623	0.745
Org vs. Org/Local	-7.076***	0.919	-4.510***	0.897	-1.938*	0.750
Local vs. Org/Local	-4.835***	0.699	-4.014***	0.875	-3.352***	0.889

[a] Org = Organic and non-local, Local = Non-organic and local; Org/Local = Organic and local.
[b] First number in each cell denotes t-value from paired t-test, second number represents Pearson correlation.
(*) and (***) correspond to significance at the 1 per cent and 10 per cent levels, respectively.

Table 8: Information and taste effects. Paired t-tests and correlations of bids.

	Round 1 vs. Round 2		Round 2 vs. Round 3		Round 1 vs. Round 3	
Org/Non-Local	-0.149	0.955	-2.860***	0.841	-3.049***	0.869
Non-Org/Local	-2.196**	0.903	-0.159	0.801	-1.203	0.620
Org/Local	-1.731*	0.968	0.942	0.892	-0.404	0.851

[a] First number in each cell denotes t-value from paired t-test, second number represents Pearson correlation.
(*), (**) and (***) correspond to significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

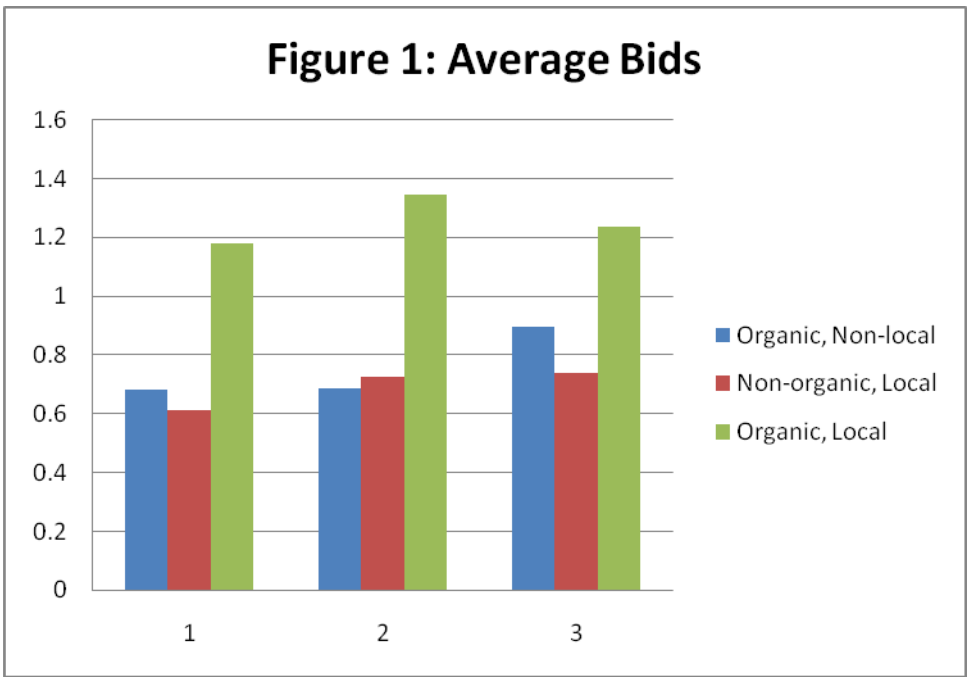
Figure 1: Average Bids
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1
2
3
Organic, Non-local
Non-organic, Local
Organic, Local

Appendix A: Full Set of Instructions (note that the different parts of the instructions were handed out sequentially, not as one set)

Instructions

Thank you for agreeing to participate in today's session. As you entered the room, you should have been given $22. A packet with an ID number in the upper right hand corner is lying on your table. During the experiment we will ask you to take sheets out of the folder and put sheets you don't turn in to our team and instructions you don't need any more back in the folder.

Before we begin, I want to emphasize that your participation in this session is completely voluntary. If you do not wish to participate in the experiment, please say so at any time. Non-participants will not be penalized in any way. I want to assure you that the information you provide will be kept strictly confidential and used only for the purposes of this research.

This experiment consists of seven parts, and we are ultimately interested in your preferences for several different types of apples. But before we get to the apples, we want to collect some other information on you and your behavior.

Part 1:

In this Part 1, you can win money in addition to the original $22. After reading the instructions for this part, we will ask you to take out Sheet 1 (printed on **blue** paper). On Sheet 1, you will see a table, with ten decision scenarios. Each decision is a choice between two lotteries shown as Option A and Option B. You must make a choice in <u>each</u> of the ten scenarios. The table is shown below:

Decision	Option A	Option B
1	□ **10%** chance of **$10.00**, **90%** chance of **$8.00** (1-10) (11-100)	□ **10%** chance of **$19.00**, **90%** chance of **$1.00** (1-10) (11-100)
2	□ **20%** chance of **$10.00**, **80%** chance of **$8.00** (1-20) (21-100)	□ **20%** chance of **$19.00**, **80%** chance of **$1.00** (1-20) (21-100)
3	□ **30%** chance of **$10.00**, **70%** chance of **$8.00** (1-30) (31-100)	□ **30%** chance of **$19.00**, **70%** chance of **$1.00** (1-30) (31-100)
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5	□ **50%** chance of **$10.00**, **50%** chance of **$8.00** (1-50) (51-100)	□ **50%** chance of **$19.00**, **50%** chance of **$1.00** (1-50) (51-100)
6	□ **60%** chance of **$10.00**, **40%** chance of **$8.00** (1-60) (61-100)	□ **60%** chance of **$19.00**, **40%** chance of **$1.00** (1-60) (61-100)
7	□ **70%** chance of **$10.00**, **30%** chance of **$8.00** (1-70) (71-100)	□ **70%** chance of **$19.00**, **30%** chance of **$1.00** (1-70) (71-100)
8	□ **80%** chance of **$10.00**, **20%** chance of **$8.00** (1-80) (81-100)	□ **80%** chance of **$19.00**, **20%** chance of **$1.00** (1-80) (81-100)
9	□ **90%** chance of **$10.00**, **10%** chance of **$8.00** (1-90) (91-100)	□ **90%** chance of **$19.00**, **10%** chance of **$1.00** (1-90) (91-100)
10	□ **100%** chance of **$10.00**, **0%** chance of **$8.00** (1-100)	□ **100%** chance of **$19.00**, **0%** chance of **$1.00** (1-100)

After you have made all ten choices in Table 1, we collect your decision sheets. Then we will pick two random numbers:

- The first random number is between 1 and 10 and chooses one of the ten decision scenarios. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision scenario will be used. Note that each decision scenario has an equal chance of being used.
- The second random number is between 1 and 100 and decides the outcome of the lottery you chose in the relevant decision scenario. If this second random number is smaller than the chance of the outcome happening, you end up with the first outcome of the lottery; if the random number is larger than the chance of the outcome happening, you end up with the second outcome of the lottery. Note that the numbers in parentheses are the winning numbers: for example, in decision 6, if the random number is between 1 and 60 you win the higher amount for the option you choose, and if the random number is between 61 and 100 you win the lower amount.

The following example might clarify the situation. Note that the numbers are different than the ones we actually use in the experiment:

Decision	Option A	Option B
1	√ **10%** chance of **$13.00**, **90%** chance of **$6.00** (1-10) (11-100)	**10%** chance of **$15.00**, **90%** chance of **$1.00** (1-10) (11-100)
2	√ **20%** chance of **$13.00**, **80%** chance of **$6.00** (1-20) (21-100)	**20%** chance of **$15.00**, **80%** chance of **$1.00** (1-20) (21-100)
3	√ **30%** chance of **$13.00**, **70%** chance of **$6.00** (1-30) (31-100)	**30%** chance of **$15.00**, **70%** chance of **$1.00** (1-30) (31-100)
4	√ **40%** chance of **$13.00**, **60%** chance of **$6.00** (1-40) (41-100)	**40%** chance of **$15.00**, **60%** chance of **$1.00** (1-40) (41-100)
5	**50%** chance of **$13.00**, **50%** chance of **$6.00** (1-50) (51-100)	√ **50%** chance of **$15.00**, **50%** chance of **$1.00** (1-50) (51-100)
6	**60%** chance of **$13.00**, **40%** chance of **$6.00** (1-60) (61-100)	√ **60%** chance of **$15.00**, **40%** chance of **$1.00** (1-60) (61-100)
7	**70%** chance of **$13.00**, **30%** chance of **$6.00** (1-70) (71-100)	√ **70%** chance of **$15.00**, **30%** chance of **$1.00** (1-70) (71-100)
8	**80%** chance of **$13.00**, **20%** chance of **$6.00** (1-80) (81-100)	√ **80%** chance of **$15.00**, **20%** chance of **$1.00** (1-80) (81-100)
9	**90%** chance of **$13.00**, **10%** chance of **$6.00** (1-90) (91-100)	√ **90%** chance of **$15.00**, **10%** chance of **$1.00** (1-90) (91-100)
10	**100%** chance of **$13.00**, **0%** chance of **$6.00** (1-100)	√ **100%** chance of **$15.00**, **0%** chance of **$1.00** (1-100)

Assume that in this example you choose Option A for Decisions 1, 2, 3 and 4; and you choose Option B for Decisions 5, 6, 7, 8, 9, and 10 (see the √ signs in the table).

Assume now that the first random number we pick is 1. You prefer Option A for Decision 1. That means that if the second random number is between 1 and 10, you get $13.00 in this example; if the random number is between 11 and 100, you get $6.00.

What if the first random number is 8 instead of 1? In that case, you prefer Option B—if the second random number is 80 or below, you receive $15.00, and if it is larger than 80, you receive $1.00.

The other decisions (and the decisions in the real table on Sheet 1) are similar. Note that as you move down the table, the chances of the higher payoff for each option increase. In fact, for Decision 10 in the bottom row, the second random number does not matter since each option pays the highest payoff for sure, so your choice here is not between two lotteries, but between $13.00 and $15.00 in this example, and between $10.00 and $19.00 in the real table.

To summarize, you will make ten choices: for each decision scenario you will have to choose between two lotteries. You may choose Option A for some decision rows and Option B for other rows, and you may change your decisions at any time before the random numbers are chosen, and make the decisions in any order.

Part 2:

In this part we would like to get some information about you and your perceptions of food. Remember that all information you provide will not be linked to your name.

Please take Sheet 2 (printed on **green**) out of your packet and answer the questions. For each of the six statements, mark one response on the scale, which ranges from 1 if you Strongly Disagree to 9 if you Strongly Agree. Choose your box on the scale noting that the closer you are to 1, the more strongly you disagree with the given statement; and the closer you are to 9 the more strongly you agree with the given statement.

Part 3: Auction for candy bars.

There should be a small Butterfinger bar at your seat. This small Butterfinger bar is yours to keep, but please do not eat it just yet. Here in the front of the room, we have other candy bars: four large Butterfingers, four Doves and four Luna LemonZests. We are interested in your preferences for upgrading your small Butterfinger to each of the three other candy bars.

We will now conduct an auction for each of the upgrades, where you will have the opportunity to win *one* of the three other candy bars in exchange for your small Butterfinger and additional money. In a moment, you will be asked to indicate the *most* you are willing to pay (if anything) to purchase each of the upgrades to the other candy bars by writing bids on the enclosed bid sheet and slip. Let me explain how the auction will proceed.

1) First, each of you has been given a bid sheet (Sheet 3, on yellow paper) in your packet with three additional slips. There are three auction rounds. On the sheet and on a slip you will, in a moment and only for Round 1, write the **most** you are willing to pay for each of the following: a) an upgrade from the small Butterfinger to the large Butterfinger, b) an upgrade from the small Butterfinger to the Dove bar, and c) an upgrade from the small Butterfinger to the Luna LemonZest bar. Note: in each of the three rounds (which means, on each slip) you will write three bids, one for each candy bar upgrade. Your bids are private information and should not be shared with anyone.
2) After you have finished writing your bids on the Sheet and on the slip for the respective round, a person from the team will go around the room and collect the bid slips. You keep the Sheet. Make sure that the bids on your Sheet and on the slips are identical.
3) In the front of the room, bids will be ranked from highest to lowest for each candy bar upgrade.
4) The people with the *four highest* bids for each candy bar upgrade will win the auction and pay the ***5th highest*** bid amount for that upgrade. In the case of ties between, for example, the 4th and 5th highest bidder, we will randomly choose one of the two as auction winner.
5) For each candy bar upgrade we will write the winning bidder numbers and the winning price on the chalkboard for everyone to see.
6) After posting the price, we will re-conduct the auction for two additional rounds.
7) At the completion of the 3rd round, we will randomly draw a number between 1 and 3 to determine the winning round. For example, if we randomly draw the number 2, then we will ignore outcomes in all other rounds and only focus on the winning bidders and price in round 2. It is important to note that all three rounds are equally likely to be drawn.
8) After the binding round has been determined, we will randomly draw a number 1 through 3 to determine which candy bar upgrade to actually auction (either the upgrade form the small Butterfinger to the larger Butterfinger (1), to the Dove bar (2), or to the Luna LemonZest (3)). For example, if we draw the number 1, we will focus on bids for upgrades from the small Butterfinger to the large Butterfinger, and we will ignore bids for the other two candy bar upgrades. Importantly, all candy bar upgrades have an equally likely chance of being drawn.
9) Once the binding round and candy bar upgrade have been randomly determined (step 7 and 8), we will write down the winning four bidders who at the end of today's experiment will be asked to pay the 5th highest bid amount and receive the winning candy

bar in exchange for the small Butterfinger. All other participants will leave with the small Butterfinger.

Important notes

- You will have the opportunity to win an auction for only ***one*** candy bar upgrade. Because we randomly draw a binding round and binding candy bar, you *cannot* win more than one candy bar upgrade. That is, under no bidding scenario will you take home more than one candy bar from this experiment.
- The winning bidders ***will actually pay money*** and return the small Butterfinger to obtain the winning candy bar. This procedure is **not** hypothetical.
- In this auction, the best strategy is to bid ***exactly*** what it is worth to you to obtain each of the upgrades to the three other candy bars. Consider the following: if you bid *more* than an upgrade to another candy bar is worth to you, you may end up having to buy a candy bar upgrade for more than you really want to pay. Conversely, if you bid *less* than the candy bar upgrade is worth to you, you may end up not winning the auction even though you could have bought an upgrade at a price you were actually willing to pay. Thus, your best strategy is to bid *exactly* what each candy bar upgrade is worth to you.
- It is acceptable to bid $0.00 for any candy bar upgrade in any round.

Example

Suppose there were six people participating in an auction just like the one you are about to participate in. Suppose that these individuals participated in three auction rounds, as you will, and that the 3rd round was randomly selected to be binding. Also, assume that the upgrade to a Dove bar was randomly selected to be the binding candy bar upgrade. Now, suppose in round 3, participant #1 bid $0.00 for the upgrade, participant #2 bid $0.10, participant #3 bid $0.25, participant #4 bid $0.40, participant #5 bid $0.50 and participant #6 bid $0.60.

Who would win the auction? Participants #3-6 would win the auction because they bid the highest amounts. How much would they have to pay for the upgrade to the Dove bar? They would pay the 5th highest bid amount, which was $0.10 (plus hand in their small Butterfingers). Thus, we would write down the ID numbers of participants #3-6, and the end of the experiment we would receive $0.10 and the small Butterfinger from each of them and give them each a Dove bar. Participants #1 and #2 would pay nothing and would leave with the small Butterfinger.

Note: these dollar amounts were used for illustrative purposes only and should not in any way reflect what the candy bar upgrades may be worth to you.

Do you have any questions before we begin?

Please use the **yellow** bid sheet with the bid slips, marked "Sheet 3: Candy Bar Auction."

Part 4: Blind-tasting of four slices of apples with subsequent ranking.

We now ask you to take Sheet #4, printed on **gray** paper, out of your packet.

You will be given four samples of fresh apple and a score sheet to complete. Please eat at least one piece of each sample and cleanse your palate with water and crackers between samples.

Taste each of the numbered samples and check the box that best describes your evaluation of each sample for appearance, flavor, texture, and overall acceptability. You can also refer to the whole apples displayed on the cart for evaluating the appearance. Please list specific comments about each sample, such as sweetness, off-flavor, mouthfeel, aftertaste, and anything else you liked or did not like.

After tasting all samples, please rank the samples in order of your preference. If you have any questions, please ask.

Part 5: Apple Auction Set 1.

Now that you have had the chance to learn how the auction will work, we are interested in your preferences for four different kinds of Gala apples—non-organic/non-local apples; non-organic/local apples; organic/non-local apples; organic/local apples.

Certified (USDA) Organic		This product meets the USDA federal requirement and is certified as organic. Foreign products sold in U.S. as certified organic are subject to USDA regulation.
Locally Grown	No Seal	This product was grown within 300 miles and a 6 hour drive of where it was purchased.

At the end of today's experiment, each of you will leave with a bag of non-organic/non-local apples unless you win an auction to upgrade to one of the three other kinds. We will now hand each of you a bag of non-organic/non-local apples. Then we will give you the opportunity to participate in an auction to purchase *one* upgrade. We have four bags of each of the three other kinds of apples. Everybody except for the winners of the auction will take home a bag of non-organic/non-local apples. The winners of the auction will take home one of the other three bags. Other than differences in the labeled characteristics, the apple bags are the same weight, packaging, etc.

	Non-Local	**Locally Grown**
Non-Organic	What you have right now.	Upgrade 2
Certified Organic	Upgrade 1	Upgrade 3

In a moment, you will be asked to indicate the *most* you are willing to pay (if anything) for each of the upgrades by writing bids on the enclosed bid sheets and the corresponding slips for each of three rounds. The procedures for this auction are exactly the same as the candy bar auction, except that this time we will not write down the winning bid and the winning bidders on the board.

To refresh your memory as to how the auction works, I will briefly go through the instructions again:

1) First, each of you has been given a bid sheet in your packet (Sheet 5). On this sheet you will, in a moment and only for Round 1, write the ***most*** you are willing to pay for each of the three upgrades. Note: in each round you will write three bids, one for each upgrade, on your sheet and on the slip. Your bids are private information and should not be shared with anyone.
2) All bids will be ranked from highest to lowest for each upgrade.
3) The people with the *four highest* bids for each upgrade will win the auction and pay the 5^{th} *highest* bid amount for the upgrade. As before, ties will be broken randomly.
4) The main difference to the candy bar auctions: we will not post the prices for each round. There will be three rounds as was the case with the candy bar auction.

5) At the completion of the 3rd round, we will randomly draw a number between 1 and 3 to determine the binding round. Importantly, all rounds have an equally likely chance of being binding.
6) After the binding round has been determined, we will randomly draw a number 1 through 3 to determine which upgrade to actually auction. Importantly, all upgrades have an equally likely chance of being binding.
7) Once the binding round and upgrade have been determined, we will write down the winning bidders' ID numbers, and at the end of today's experiment, those participants will pay the 5th highest bid amount in that round and obtain the upgraded bag of apples in exchange for the non-local/non-organic apples. All other bidders will pay nothing and receive their original bag of non-organic/non-local apples.

Important notes:

- You will have the opportunity to win an auction for only *one* upgrade. Because we randomly draw a binding round and binding upgrade, you *cannot* win more than one auction. That is, under no bidding scenario will you take home more than one bag of apples.
- The winning bidders ***will actually pay money*** to obtain the upgrade. This procedure is **not** hypothetical.
- As in the candy bar auction, the best strategy is to bid **exactly** what each upgrade is worth to you. Consider the following: if you bid *more* than the upgrade is worth to you, you may end up having to buy an upgrade for more than you really want to pay. Conversely, if you bid *less* than the upgrade is really worth to you, you may end up not winning the auction even though you could have bought an upgrade at a price you were actually willing to pay. Thus, your best strategy is to bid *exactly* what the upgrade is worth to you.0
- It is acceptable to bid $0.00 for any upgrade in any round.

Do you have any questions before we begin?
Please use the bid sheet and clips marked "Sheet 5: Apples Auction" (printed on **white** paper).

Part 6: Apple Auction Set 2.

We just finished the first auction round; before we proceed with additional auction rounds, we would like to give you some information about the four different kinds of apples to help you make an informed bid.

Non-local vs. Local produce

1. *Carbon footprint of Washington apples*
   Apples transported from Washington to Colorado travel about 1500 miles, and carbon footprints level from transportation account for about 39% of total carbon emissions.[6] This is equivalent to 50 to 55 grams of carbon emission levels per pound of product from transportation so the total footprint is 120 grams per pound of apples.

2. *Carbon footprint of locally grown apples*
   Locally grown apples produced in Colorado travel approximately 300 miles from the farm gate to the consumer. Since the carbon footprint from transportation accounts for about 39% of total carbon emissions, and the average apple travels 1500 miles, locally grown apples reduce carbon emission levels from 120 grams per pound to between 80-95 grams per pound.

   As a way to compare this difference, note that driving a mid-size car for one mile produces about 320 grams carbon dioxide.

Conventional vs. Organic produce

1. *Pesticides residues and conventional vs. organic*[7]
   Results from four independent studies suggest that conventional produce contain pesticides residues at least 3 to 4 times higher than organic produce. Also, organic produce have been shown to possess lower nitrates residues (a toxic contaminant from chemical fertilizers). However, no evident threat to consumers' health from consumption of conventional produce has been documented. Occupational exposure to pesticides (for farm workers) is a much greater health risk than consumers' exposure to pesticides from conventional produce.

2. *Nutrients, naturally occurring toxins and microbiological safety*[8]
   Several studies have shown that organic produce may contain higher levels of beneficial plant secondary metabolites (antioxidants), but also may have higher content of naturally occurring toxins. Some studies also suggested potentially increased microbiological hazards (*E. coli* and *Salmonella*) from organic produce.

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[6] Webber C. and Matthews S.,2008. Food-Miles and the Relative Climate Impacts of Food Choices in the United States. *Environmental Science & Technology* / Vol. 42, No. 10, 3508-3513.

[7] Winter C. and Davis S, 2006. Scientific Status Summary—Organic Foods. *Journal of Food Science* —Vol. 71, Nr. 9, 2006.

[8] Winter C. and Davis S, 2006. Scientific Status Summary—Organic Foods. *Journal of Food Science* —Vol. 71, Nr. 9, 2006.

Part 7: Apple Auction Set 3.

Before we conduct the last auction round, we would like to remind you of your blind-tasting before we started the auction. We will now reveal which apple is which. Please take out Sheet 4 **(gray)** with your ranking again.

Apple ___ is non-organic/non-local.
Apple ___ is organic/non-local.
Apple ___ is non-organic/local.
Apple ___ is organic/local.

Appendix B: Risk Perception Questions

Please rate each of the following items on a scale of 1 to 9, where 1 means "I strongly disagree" and 9 means "I strongly agree."

1. The environmental impact of fruit and vegetables is greater for conventional than for organic produce.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

2. Eating organic fruits and vegetables represents a lesser health risk than eating conventional fruits and vegetables.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

3. Locally-grown produce represents a lower risk to climate change because the carbon footprint from transportation of the produce is lower.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

4. There are more credible assurances about produce safety direct from local farmers than for other stakeholders in the food system (US govt. agencies, food distributors, retailers).

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

5. I trust the government agencies responsible for food safety in the United States.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

6. Pesticide residues on fruits and vegetables are at a safe level if they meet US government standards.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

Appendix C:
Score Sheet for Fresh Apples

Please eat the entire sample and cleanse palate with water and crackers between samples. Under the corresponding sample number, please check the box that best describes your evaluation of each sample for appearance, flavor, texture, and overall acceptability.

APPEARANCE					FLAVOR				
	Sample Number					Sample Number			
	187	926	445	603		187	926	445	603
Highly Acceptable	☐	☐	☐	☐	Highly Acceptable	☐	☐	☐	☐
Acceptable	☐	☐	☐	☐	Acceptable	☐	☐	☐	☐
Moderately Acceptable	☐	☐	☐	☐	Moderately Acceptable	☐	☐	☐	☐
Slightly Acceptable	☐	☐	☐	☐	Slightly Acceptable	☐	☐	☐	☐
Neither Acceptable nor Unacceptable	☐	☐	☐	☐	Neither Acceptable nor Unacceptable	☐	☐	☐	☐
Slightly Unacceptable	☐	☐	☐	☐	Slightly Unacceptable	☐	☐	☐	☐
Moderately Unacceptable	☐	☐	☐	☐	Moderately Unacceptable	☐	☐	☐	☐
Unacceptable	☐	☐	☐	☐	Unacceptable	☐	☐	☐	☐
Highly Unacceptable	☐	☐	☐	☐	Highly Unacceptable	☐	☐	☐	☐

TEXTURE					OVERALL ACCEPTABILITY				
	Sample Number					Sample Number			
	187	926	445	603		187	926	445	603
Highly Acceptable	☐	☐	☐	☐	Highly Acceptable	☐	☐	☐	☐
Acceptable	☐	☐	☐	☐	Acceptable	☐	☐	☐	☐
Moderately Acceptable	☐	☐	☐	☐	Moderately Acceptable	☐	☐	☐	☐
Slightly Acceptable	☐	☐	☐	☐	Slightly Acceptable	☐	☐	☐	☐
Neither Acceptable nor Unacceptable	☐	☐	☐	☐	Neither Acceptable nor Unacceptable	☐	☐	☐	☐
Slightly Unacceptable	☐	☐	☐	☐	Slightly Unacceptable	☐	☐	☐	☐
Moderately Unacceptable	☐	☐	☐	☐	Moderately Unacceptable	☐	☐	☐	☐
Unacceptable	☐	☐	☐	☐	Unacceptable	☐	☐	☐	☐
Highly Unacceptable	☐	☐	☐	☐	Highly Unacceptable	☐	☐	☐	☐

Please write in the sample number in the space provided by ranking the samples in order of your preference (1 = Liked most; 4 = Liked least):

1) _____ 2) _____ 3) _____ 4) _____

Please provide specific comments for each sample (i.e. sweetness, crispness, mouthfeel, what you liked or did not like)

187_____

926_____

445_____

603_____