PERCEIVED FOOD QUALITY AND PRODUCTION QUALITY IN CONSUMER EVALUATION OF AGRIFOOD PRODUCTS

by

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B.A., University of Illinois at Urbana-Champaign, 2014

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

(Resources, Environment, & Sustainability)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

December 14, 2018

Abstract

Designing agricultural systems that balance food production with environmental sustainability will be pivotal in supporting a growing population while living within planetary boundaries. Yet the literature on the demand side of food production rests largely on consumer choices driven by food safety, health, and dietary concerns. Very little work pertains to people's thinking about food production or the supply end of food systems, with the exception of some work on preferences for organics or GM-free products. The current study thus seeks to explore the fuller set of latent factors underlying consumer evaluation of food products. It seeks, in particular, to explore people's logics as to how they evaluate foods – be they driven by the perceived health attributes of food versus the quality of production of that food. A study was thus conducted to understand people's evaluation of food items. We surveyed 319 participants using Amazon Mechanical Turk. Each participant was asked to to judge 14 agrifood products on 19 attributes. These attributes spanned concepts on production, environmental impact of production, preferences, and economic value. An exploratory factor analysis revealed two discrete factors: one factor pertained primarily to the quality of the food items themselves (e.g., organics, nutrition, flavor), and the second primarily addressed the quality of food production regarding agricultural inputs and degree of environmental impact (e.g., pesticide use, biodiversity impact, climate change consequence). From the one-way between subject ANOVAs and regression analyses, we found distinct relationships between demographic variables and perceived food and production qualities. These findings suggest that quality of production figures prominently in food perception, which was not previously considered as a part of consumer food choices, at least not for the average (versus 'ethical' or 'green') consumer. The understanding that quality of agrifood production is a factor among consumers is a valuable finding with implications for

marketing, policy, and consumer decision making. The consideration of sustainable production by consumers has the potential to inform and guide the creation of food policies aimed at improved environmental sustainability, and interventions on consumer decision making regarding commensurate goals.

Lay Summary

Designing food systems that balance adequate production with environmental sustainability will be key in supporting a growing population while living within planetary boundaries. The role of consumers in effecting change is a critical one, and is the aim of this research. Academic research to date indicates that studies have shown that consumers value health, food safety, taste, and price, in that order. Some studies have also compared preferences for organic, conventional foods, and genetically modified products. This study seeks to understand other choice variables that go into the intuitive logic that consumers use to make decisions about food. Understanding the relationship between consumer attitudes and choices relating to food is a key piece in shifting towards a more sustainable food system.

Preface

This Master's thesis is the original, unpublished work of the author, Katherine Cramer. With guidance and support from her supervisors Dr. Terre Satterfield and Dr. Jiaying Zhao, she designed the overall research structure and tools. Data analysis and thesis writing was also done by the author, Katherine Cramer, with direction and edits from Dr. Terre Satterfield and Dr. Jiaying Zhao. The study conducted for this thesis was approved by UBC's Behavioural Research Ethics Board with ethics certificate #H17-01986.

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Acknowledgements

I would first like to acknowledge, and offer sincere thanks to my supervisors, Dr. Terre Satterfield, and Dr. Jiaying Zhao. You both have been endlessly supportive and patient throughout this meandering research process, for which I am so grateful. I very much appreciate the knowledge and clarity that you have helped bring to my work, and feel lucky to have shared this experience with you both.

I would also like to thank the wonderful community of staff and students at IRES, especially the Satterfield Lab for valuable feedback and encouragement throughout this process. The lifelong friends that I have made within this community also cannot go unmentioned.

Most importantly, I thank my family for their support, and for instilling the importance of a harmonious relationship with the land. In so many ways, I would not have the privilege of doing this research without you.

Lastly I would like to acknowledge the magnificent wilderness that surrounds the University of British Columbia. The coast mountains and the wonders of this province have also been invaluable to me through this research process.

1. Introduction

1.1 Problem Context - Agriculture and the Environment

Global agrifood systems lie at the intersection of some of the most dominant environmental concerns including degradation of water and soil, growing water scarcity, contributions to energy consumption and emissions, land use change and habitat loss, among other consequences (Biggs et al., 2015). Given these challenges, there is a dire need to redesign global agrifood systems and mobilize shifts in agricultural production, which has been called for by many actors, from scholars to governments, to intergovernmental organizations (Rockström et al., 2017). Creating systems that balance food production with environmental health will be pivotal in continuing to support a growing population and its increasing pressures on earth and global system (Foley et al., 2011).

As reported by the FAO, croplands cover 1.53 billion hectares, and pastures cover another 3.38 billion hectares, which means that agriculture covers about 38% of the Earth's terrestrial surface, making agriculture the largest use of land on the planet, and one of the largest contributors to climate change (Foley et al., 2011). Aside from the environmental consequences of global agriculture, approximately one billion people are chronically malnourished (Foley et al., 2011). What's more, a significant portion of the world's most vulnerable populations depend on agriculture for livelihood support, which will become increasingly threatened as more lands become marginalized with the changing climate and altered growing conditions across the globe (Christiaensen, Demery, & Kuhl, 2011; World Bank, 2008).

1.1.2 Overview of Variance Among Agricultural Systems

Within the global food system, there are distinct agricultural systems of production, which have varying environmental effects depending on the farming practices in place (Rigby & Caceres, 2001; Werf & Petit, 2002). The clearest distinction that is often made both by scholars as well as the general public is between conventional and organic production (Pimentel, Hepperly, Hanson, Douds, & Seidel, 2005; Rigby & Caceres, 2001; Seufert, Ramankutty, & Foley, 2012). The key differences typically involve inputs and outputs across systems, such as the comparison of alternative and conventional systems on dimensions such as respective yields, energy use, emissions, and the health implications for both consumers and the environment (Seufert & Ramankutty, 2017; Sundkvist, Milestad, & Jansson, 2005). This discussion is a long standing one, but is one that has become even more widespread in the last decade as organic production and sales have expanded significantly (Michaelidou & Hassan, 2008; Van Doorn & Verhoef, 2011). Interest in organic food has increased worldwide for a number of reasons, some of the primary reasons previously cited being; consumer concerns with agrifood products around the use of pesticides in conventional agricultural production, human health and food safety, followed lastly by animal welfare and environmental impact (Hughner, McDonagh, Prothero, Schultz II, & Stanton, 2007; Michaelidou & Hassan, 2008; Rana & Paul, 2017).

In addition to organics, other alternative farming systems have seen growth in recent decades. Agroecological (intensification) systems are marked by practices that seek to mimic natural ecological processes, and include a diversity of crops in co-production (Garibaldi et al., 2017; Tomich et al., 2011). Agroecological intensification as a set of principles for production has also

been influenced by agroecological activism, which supports the notion of just conditions of production and food sovereignty for regional farmers (Altieri, Funes-monzote, & Petersen, 2012; Wezel et al., 2014).

Organic and agroecological intensification are just two management systems for producing food that deviate from conventional industrialized agriculture. Though the bulk of food production falls under the umbrella of conventional, there is a wide spectrum of practices and ideals that farmers use globally. Many of these do not come with a certification label that is easy for consumers to identify, rather it is the practices and management systems present that distinguish them from conventional systems. Whether consumers understand or think about this range of practices for consideration in food choice is an open question; as few prior studies have explored production practices as a part of a suite of food attributes under consideration for consumers. For these reasons, principles and practices from systems of agroecological intensification were identified as important to include in this study for evaluation.

A good portion of the literature on different ways to express the embodied costs of foods (by which I mean the environmental and energetic costs associated with the production of food that are not apparent or reflected in the market price of the food item) has also proven relevant to informing the development of this study. These studies include those that present different life cycle analyses, inputs and outputs across a range of variables related to the production of foods under different farming systems (Roy et al., 2009). Generally, there are many studies which attempt to evaluate the relative sustainability of different foods using different metrics for

expression (Jungbluth, Tietje, & Scholz, 2000). There is some work speaking to people's perceptions of the embodied costs of different foods and how these embodied costs vary among methods of production, but this is an area of the literature that is lacking. There are very few studies that explore how people think about embodied costs in food production and those that exist draw broad conclusions lacking depth as a function of broad scopes.

1.1.3 Literature Review of Food Choice

There is a robust body of literature examining decision making, sustainable behaviour and choice. Much of this work has been conducted by behavioural and social psychologists, among other fields. Major findings in this literature include the observation that personal ideals are a key driving factor influencing food choice (Furst et al., 1996). For instance, an early study posited that food choice is contingent on consumer's perceptions of food, which itself is influenced by values that shape these perceptions. In a more systematic weighing of variables, Furst and colleagues (1996) found food choice to be influenced by three main components which they identified as life course, influences, and the personal system. Their life course component speaks to the social, cultural, and physical environments that a person has been exposed to, all of which play a role in shaping values and perceptions broadly, but also with reference to food. Furst and colleagues (1996) then suggest that the second component in this suite, influences, are built from a person's life course. Influences, in this context are defined to include a person's ideals, resources, social framework, and food context (e.g. thinking around food built from culture and/or upbringing) (Furst et al., 1996). Moving through their hierarchy of components, the personal system (their third component affecting food choice) is in turn shaped by these influences. The personal system includes both conscious and unconscious value negotiations that

prove relevant in food related decision making (Furst et al., 1996). This classic study was the first to emphasize the importance of personal and cultural ideals in the decision-making process around food with specific reference to how personal relationships influence food choice.

There also exists a wealth of information on what explains the purchase of organic, local foods, and those classed as non-GMO, as these types of foods have become major points of interest. Most of these studies tend to find that preferences for different food of food types (e.g., organic) are driven by their perceived food safety, nutritive value, and to a lesser degree price, taste, and appearance (Hughner et al., 2007; Yiridoe, Bonti-Ankomah, & Martin, 2005). Authors identify these choice variables of food safety, nutritive value, and aesthetic qualities of foods as most important for consumers, above environmental considerations, even with organic and local foods (Dowd & Burke, 2013; Rana & Paul, 2017).

Consumers of organic foods have been a particular focus and so well researched in the recent period. Scotia et al. (2006) conducted a literature review of studies comparing consumer perceptions of organic and conventional foods. From this review, Scotia and colleagues (2006) identify different consumer groups, which include those posited in a classic study by Davies et al. (1995) and persist to be relevant among studies conducted over the succeeding two decades. Davies et al. classify these consumer groups based on observed behviours identified from interviews with regular consumers of organics. These groups include those who buy organic food because they are concerned about both the quality of foods as well as impacts of production on the environment, “food phobics” who buy organic because they are concerned about pesticide

and other chemical residues on foods from the perspective of human health; humanists and welfare enthusiasts who are concerned with factory farming methods from an ethical standpoint, and finally hedonists who believe that price premiums mark superior quality foods and therefore choose to buy organic (Bonti-Ankomah & Yiridoe, 2006; Davies, Titterington, Albert, & Cochrane, 1995). It is noteworthy that this latter group, which they classify as "hedonist" consumers, demonstrates a preference for higher-cost foods regardless of whether or not they are aware of the validity of the price premium (e.g., as stemming from an understanding of organic systems and correlated cost of production). Generally, these results express the idea that there exists a spectrum of organic buyers and a spectrum of knowledge about organic systems, as compared to conventional, which do not always align (Scotia et al., 2006).

Among consumers who fall into the category of irregular or casual organic consumers (as opposed to regular buyers of organics), are those who value human health and taste over other considerations (Rana & Paul, 2017). Looking specifically at each of the choice variables in order of weight, occasional buyers of organic foods tend to choose organic largely based on the perception that it is more nutritious than conventionally grown foods, for its lack of chemical residue and general use in production, and for its perceived superior taste over conventional (Hughner et al., 2007; Rana & Paul, 2017). The last and least important decision making variable on this scale is the perception that organic foods have a lesser impact on the environment (Goldberger, 2011; Hamzaoui Essoussi & Zahaf, 2009).

Working alongside the literature on organic consumers, there is a fairly large collection of research on labelling, branding, and how this shapes people's perceptions of foods. Drawing from this research on labelling, there is also research aimed at behavioural intervention and different ways to achieve a shift towards more sustainable food purchasing patterns - which is a difficult avenue to identify, with much grey area on which foods are, in fact, the more sustainable choice (Hanss & Böhm, 2013).

2. Objectives and Research Questions

The current literature on food choice has helped foster an understanding of the primary variables that drive perception that shape decision-making around foods. In particular, we have found that the features of production systems are poorly represented (e.g., are reduced to organic, fair trade, GM, or conventional agriculture only) and/or that perception itself – rapid intuitive logics of choice – are relatively under-examined. Other authors have called for further investigation with reference to a wider scope of choice variables including but not limited to price, brand, quality, nutrition, and labeling asserting, "To date, little research has assessed how consumers weigh these attributes, and which relative importance is assigned to environmental and ethical issues" (Grunert, Hieke, & Wills, 2014). As other authors have also identified, rapid judgements and intuitive logics of consumers are areas primed for investigation that can aid in forming a more complete understanding of how consumers make decisions about food (Ares, Mawad, Giménez, & Maiche, 2014; Sobal, Ph, Bisogni, & Ph, 2009).

2.1 Objectives

The overarching objective of this research is to contribute to a richer understanding of how consumers think about agrifood products, including their production, quality, and impacts. Our goal is what follows; is thus a more robust understanding of these logics as incorporates what qualities people perceive in food items, including productive processes that better represent agricultural concerns and innovation (e.g., agroecological processes).

2.2 Research Questions

Specifically, this study attempts to answer three research questions:

i. What attributes underlie consumers' perceptions of agrifood products?

ii. Do these attributes factor into coherent constructs?

iii. Do perceptions differ based on demographic, dietary, shopping and attitudinal variables?

3. Methods

3.1 Participants

A total of 319 participants (115 female, 196 male, 8 other gender, μ_{age} =31.9 years, SD= 10.1) were recruited on Amazon Mechanical Turk (MTurk) in exchange for monetary compensation ($0.50 per person) to complete the survey. Respondents were from India (34%), the United States (65%), and 1% were from other countries. Mechanical Turk is a platform commonly used in psychology research, and was chosen as the sampling method for this study for the ability to

access a large and relatively diverse subject pool with ease and for a low experimental cost (Mason & Suri, 2012).

3.2 Materials

A survey was designed to capture people's evaluations of fourteen different foods using rating scales on nineteen different constructs. Each construct was chosen based on past literature to cover a distinct dimension on the potential quality of these foods, practices of production, and effects that the production may have on health and the environment. The food items were from four categories: vegetables (corn, carrots, kale, eggplant), fruits (bananas, strawberries, mangoes), grains and beans (wheat, soybeans, lentils, coffee), and animal products (eggs, chicken, beef). These foods were chosen in accordance with crops that are discussed in the literature regarding differing agricultural practices and systems of production. Specifically, corn, soybeans, and animal products were chosen because they are discussed in the production literature as environmentally harmful as a result of the scale at which they are produced, as well as the practices commonly implemented (Foley et al., 2011; Garnett, 2009; Pimentel, Hepperly, Hanson, Douds, & Seidel, 2005). Coffee, bananas, and mangoes were chosen because they can grow in intercropped systems with the inclusion of rainforest alliance, fair trade, and bird friendly labelling schemes, as well as the variance that exists between conventional and intercropped production with implications both environmentally and socially (Clough et al., 2011; Parmentier, 2014; Tscharntke et al., 2012; Vandermeer & Perfecto, 2007). Knowing that participants would be largely from North America and India (as this is the Mechanical Turk

participant base), we chose the food items that were representative of the daily diets of both regions and that were produced fairly commonly. Eggplant, bananas, mangoes, lentils, and coffee were chosen because they are commonly consumed in both the US and India, the primary locations of participants. The remaining crops were added to complete the classes of foods represented (kale, carrots, wheat, strawberries). Beef, conversely, was chosen as it has garnered significant attention as a land and energy consumptive food. We expected (but did not find as indicated below) that beef would elicit negative responses from Indian participants whose religious afflication was Hindu.

Each food item was represented via a label and two images to give participants a visual depiction of the food item and its growing environment (see Appendix A for an example). Images portrayed the foods in its grocery store and harvested but not processed form. We also avoided any suggestion of the scale of the agriculture system pictured to avoid misleading participants (e.g. we avoided showing an image of a field of corn or wheat might lead participants to think that those crops are almost always large scale monocrops). Participants rated each food item on a 11-point scale (middle point being neutral) for each of the 19 constructs (see Figure 1). These constructs were chosen based on past literature on food production that are under-explored in consumer research. From the literature on food choice, we included the commonly examined constructs on nutritive quality, flavor, health, preference, and willingness to pay for a premium. Salient qualities in the literature on organic systems included pesticide, water, soil, trust in the farmer, relative ease of organic production, production cost, GM, and allergies. Constructs relevant to organics but more strongly resonated with agroecological systems and fair trade

included consequence to biodiverse lands, contribution to biodiversity, climate change, land to produce, ease of producing a large yield, and grower pay.

Figure 1. Screenshot of survey questions for each food item

3.3 Procedure

Participants first provided informed consent and then were given the following instructions:

You will see a number of foods in the survey. For each food, there are a number of contrasting phrases used to describe the food. Mark the circle that is closest to the statement that describes how you think about that food. There is no right or wrong answer. Please answer these quickly and trust the first answer that comes to mind. [For example, if you really agree with the description on the left, mark the furthest left circle. If your agreement is a bit weaker than that, mark the next circle over, and so on.]

Past work suggests that decisions about food are largely made in a quick and more intuitive manner (Ares et al., 2014; Cohen & Babey, 2012). This rapid judgment captures intuitive, automatic evaluations, rather than deliberate, careful reflections that require analytical thinking (Cohen & Babey, 2012; Kahneman, 2011). This design captures the rapid decision processes or heuristics that occur with routine consumer choices.

After evaluating the food items, participants provided their ratings on attitudinal scales on animal rights (Rothgerber, 2015), environmental concern (Ryan & Spash, 2012), and the New Ecological Paradigm (NEP) scale (Dunlap, Van Liere, Mertig, & Jones, 2000). Views on these scales, we hoped, would shed light on how different identities and values were related to people's perceptions of food. We also asked participants to indicate where they do their grocery shopping and to indicate their dietary preferences. Participants rated their level of general knowledge about crop production and agriculture (on a scale from 5=excellent knowledge to 1=no knowledge). Lastly, participants answered demographic questions including age, gender, income, and political orientation (on an 11-point sliding scale from -5=very liberal to 5=very conservative).

4. Results

Factor analysis

All analyses were conducted in the statistical software R (R Development Core Team, 2008). We began with 350 survey responses and first removed participants from the sample who neglected to answer questions for all 14 foods, as well as those who took five minutes or less to complete

the survey. This yielded a final sample size of 319 respondents. We reverse coded some of the 19 rating scales such that the left side of the scale (-5) was least representative of the construct and the right side (+5) was the most representative of the construct. A principal component analysis was conducted to determine how many factors to extract (Hayton, Allen, & Scarpello, 2004). In addition, we conducted a parallel analysis that showed the variance explained by each factor (see Figure 2). Based on the results of these two analyses, (Figure 2 below shows eigenvalues of 11.36 for factor 1, 1.52 for factor 2, 0.59 for factor 3, from the parallel analysis) we conducted an exploratory factor analysis (varimax rotation) retaining two factors to address the first research question.

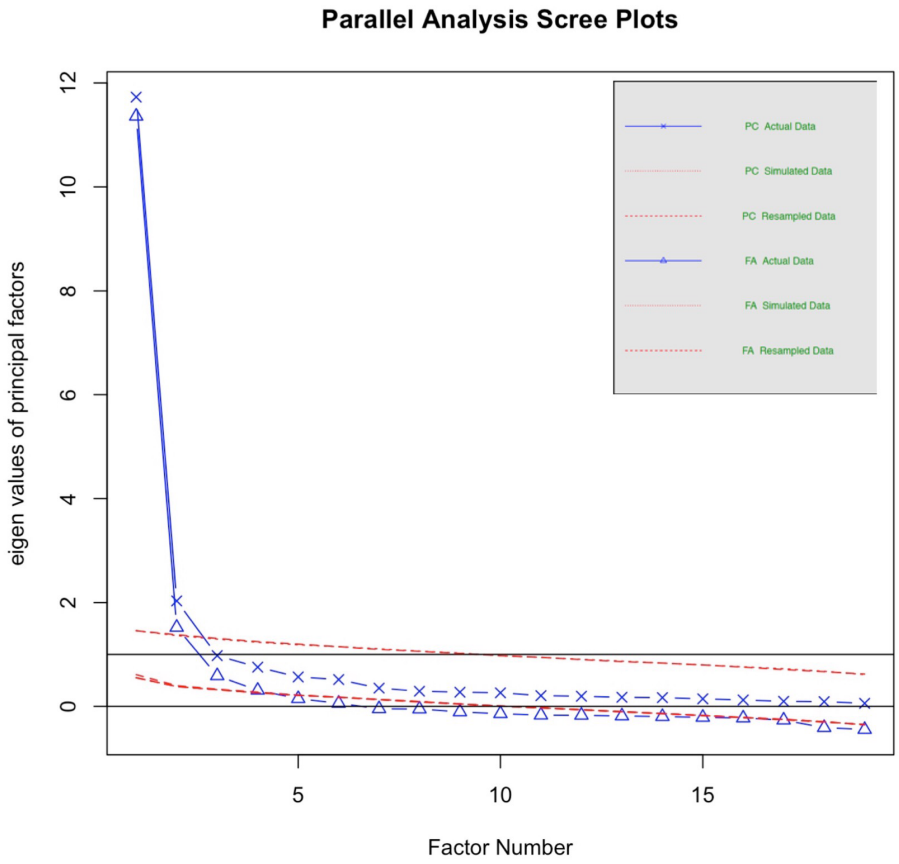

Figure 2. Parallel Analysis Scree Plot: Based on eigenvalues of 11.36 for factor 1, 1.52 for factor 2, 0.59 for factor 3, we retained two factors for the exploratory factor analysis.

The exploratory factor analysis revealed two distinct factors underlying people's perception of food (see Table 1). The first factor consisted of 11 constructs related to the quality of the food items themselves. This factor was therefore labeled "food quality." The second factor included 8 constructs that were all concerned with the production of foods, and was thus labeled "production quality."

Table 1. Exploratory factor analysis reveals two factors: food quality and production quality.

	Factor 1: Food Quality	**Factor 2: Production Quality**
Easy to produce organically	**0.74**	-0.36
Very nutritional	**0.92**	-0.17
Trust the way most of this food is produced	**0.81**	-0.21
Easy to produce in a way that also supports other plants and animals	**0.83**	-0.25
Soil recovers easily after production	**0.81**	-0.32
Rich in flavor	**0.89**	-0.22
Large yield is easily achieved	**0.90**	-0.23
A food that I like	**0.84**	-0.31
I'm willing to pay more than the market price for good quality version of this food	**0.58**	-0.47
Mostly grown locally	**0.56**	-0.29
Growers are paid well	**0.63**	-0.34
Uses minimal land to produce	-0.65	**0.45**
Requires minimal pesticide use	-0.59	**0.52**
Rarely causes allergies	-0.18	**0.75**
Producing this food has positive consequences for biodiverse lands	-0.21	**0.86**

Rarely grown in a genetically engineered form	-0.40	**0.71**
Minimal water required for production	-0.72	**0.46**
Cheap to produce	-0.52	**0.64**
Its production is not one of the causes of climate change	-0.19	**0.86**
Cumulative Variance	0.45	0.70
Cronbach Alpha	0.81	0.91

ANOVA

To examine how demographic groups differ on perceptions along these two factors (research question #3), we conducted one-way between-subjects ANOVAs between gender (female vs. male), country (USA vs. India), diet groups (vegan, vegetarian, pescatarian, or carnivore), shopping preferences (supermarkets, health food stores, farmer's markets, or one's own garden), and political orientation (liberals vs. conservatives) on the two factors (see the distribution of participants in each group in Appendix B).

First, looking at gender, we found that gender groups differed significantly at 0.5 on factor 1 scores [$F(2) = 2.93$, $p = 0.05$]. One-way between subject ANOVA for the four diet groups on factor 1 also showed significance [$F(3) = 5.46$, $p = 0.001$]. Post hoc comparisons using Tukey HSD test were next carried out to understand which of the four groups differed significantly. We found a significant difference between the diet groups of Vegan and Carnivore ($p = 0.02$) for factor 1 as well as between the groups of Vegetarian and Carnivore for factor 1 ($p = 0.005$).

ANOVA analysis also revealved that factor 1[F(3) = 9.16, p = 7.91e-06] and factor 2 [F(3) = 6.04, p = 0.04] scores both differed significantly among shopping groups. Post hoc Tukey HSD tests were carried out for both shopping groups on factor 1 scores and shopping group on factor 2 scores. We found a significant difference between health food store and farmer's market shoppers for factor 1 (p = 0.02) as well as between the groups of supermarket and health food store shoppers (p = 0.000002). Concerning factor 2, the groups of health food store and supermarket shoppers also differed significantly though at a score above 0.5 (p = 0.06).

Regression analysis

To examine which demographic variables predict people's perceptions of food (research question #3), we planned to conduct a regression analysis using demographic variables to predict the scores on each factor. To mitigate multicollinearity among the variables, we first conducted an exploratory factor analysis on the demographic variables (see Appendix C). Since some variables loaded onto the same factor (e.g., household income and personal income both loaded onto one factor), we chose to use one variable in each factor in the regressions to reduce multicollinearity. This narrowed the variables to NEP scores, personal income, financial stress, political orientation, age, and knowledge. The multiple regression analysis was run using z scores of the six aforementioned variables. The results are shown in Table 2.

Table 2. Multiple Regression using variables to predict Factor 1 (food quality)

	Beta Estimate	**Std. Error**	**t value**	**p value**
NEP	-0.39	0.05	-7.21	4.82e-12 ***
Personal income	0.009	0.05	0.17	0.86
Financial stress	-0.09	0.06	-1.68	0.09 .
Political orientation	-0.09	0.06	-1.65	0.10 .
Age	0.12	0.06	2.11	0.04 *
Knowledge	-0.20	0.06	-3.39	0.0008 ***

We found that NEP, age, and knowledge were associated with Factor 1. Specifically, lower scores on NEP and knowledge were associated with higher scores on Factor 1, but older age was associated with higher scores on the same factor. Finally, financial stress ($p = .09$) and political orientation ($p = .10$) were associated with Factor 1 but not significantly. In particular, lower financial stress and more liberal political leaning were associated with higher scores on Factor 1. These results suggest that those who associate strongly with attributes of food quality, are associated with less environmental concern, lesser knowledge of agriculture and crop production, and were of an older age demographic within the age range of our sample. (They may also have lower financial stress and liberal political leaning).

We also used the same demographic variables to predict Factor 2 (see Table 3). Similar to the previous results, NEP was associated with Factor 2. Political orientation was also associated with Factor 2. Specifically, higher scores on NEP and more conservative political orientation were associated with higher scores on Factor 2.

Table 3. Multiple Regression using variables to predict Factor 2 (production quality)

	Beta Estimate	Std. Error	t value	p value
NEP	0.34	0.06	5.91	9.47e-09 ***
Personal income	-0.04	0.06	-0.73	0.47
Financial stress	0.03	0.06	0.47	0.64
Political orientation	0.12	0.06	2.06	0.041*
Age	0.05	0.06	0.83	0.41
Knowledge	0.04	0.06	0.58	0.56

6. Discussion

The present study examined how consumers rapidly judge agrifood products on the grounds of food production, quality, and their environmental impacts. Analysis of psychometric scales revealed that there are two main factors that indicate consumers' underlying perceptions of food. The first factor pertained primarily to the quality of the food items themselves, and the second primarily addressed the quality of production regarding agricultural inputs and degree of environmental impact. Gender, dietary groups, and shopping groups predicted differences in perception of foods. That is, these groups held different perceptions of food quality and production quality, with specific sub groups noted below. Environmental concern, age, knowledge of food production and political orientation also reveal significant associations with perceived food quality and production quality. In the sections below we discuss the constructs within each factor group, offer explanations for these groupings, as well as insights as to what they reveal about consumer logics. This is followed by a discussion of the findings related to

demographic variables, to further build upon our understanding of how people think and make judgements about agrifood products.

Factor 1: Food Quality.

Many of the attributes grouped with food quality (Factor 1) are self-explanatory such as 'food that I like' or 'food that is rich in flavour' or 'food that I'll pay more for to achieve good quality'. Food that is organically produced also appears in this factor suggesting support for the claim that consumers perceive organics as a higher quality food. These descriptors are consistent with findings already highlighted in food-related studies (e.g., Hughner et al., 2007).

Several of the attributes highlighted in the factor group do not fit perfectly into this characterization, for which we offer possible explanations. One such construct that stands out is "Trust in the way that the food is produced." This item correlates closely with organics, and we suspect this indicates that organics is quite simply a proxy for trusted foods or 'trust in food quality' (Factor 1). Along a similar vein, "local" falls into this category of attributes that people often assimilate with high quality. This, we speculate, is because the idea of 'local foods' are often invoked in direct marketing schemes. Such languages therefore often gain favour as an intuitive indicator of a higher quality food item – especially given the sense of familiarity provided by the term 'local' (Adams and Salois, 2010).

Another attribute grouped with food quality that at first seemed counter-intuitive was 'Biodiversity support' which is our label for the rating scale that read: "Easy/hard to produce in a way that also supports other plants and animals." We interpret this as reflecting the growing

presence of Rainforest Alliance and bird-friendly labeling on food items, especially those grown in the tropics (Grunert et al., 2014; Garnett et al., 2015). Across the total set of foods, several are those that might normally include such labels, for example, coffee, bananas, and mangoes. In this sense, some indicators of production (e.g., bird friendly or the above example of organic) are likely loading onto Factor 1 precisely because they are now familiar proxies or rapid references for 'good' or 'quality' food.

Soil recovery time is another attribute grouped with food quality that we expected to see grouped with production quality. [Quality is usually determined by ammendments used, and landuse practices in terms of frequency of fallow periods, which effect soil recovery time.] Thus, because soil quality also incorporates soil recovery time after production, it is understood to be a central benefit of organic agriculture, and thus a feature that distinguishes organic versus conventional systems (Rigby & Caceres, 2001). A possible explanation for this result is that consumers (as with parallel examples above) cognitively link soil quality to food quality and thus one is equivalent to or a quick indicator of the other. It also makes sense to find (in Factor 1) that nutritional value loads with soil quality as with other studies (Hughner et al., 2007; Yiridoe et al., 2005). The literature on soil science asserts that superior nutritional content of produce is often based on soil quality, though such findings are context dependent (Yiridoe et al., 2005). Regardless, what is true here is that how consumers perceive soil corresponds with how they also perceive quality they are willing to pay for, food they trust, and food that is rich in flavour among other markers of quality.

The last variable that grouped with quality of food in a somewhat counter-intuitive manner is "the relative ease of producing a large yield." Once again, one could expect to see this item group with other, more production-related constructs (Factor 2). We suspect, however, that for consumers, producing a large yield is a de facto measure of abundance. Abundance is a construct strongly associated with quality in analogous cases (e.g., abundance of species might equal a quality environment, or abundance of fruit in an orchard might equally mean quality of both orchard and fruit).

Factor 2: Production Quality.

Unlike Factor 1, which includes a combination of both conventional and unconventional dimensions of food quality, most of the items in Factor 2 express a clear set of criteria which we have labeled "quality of production". These include the designation of quality of production as intuitively defined by requiring minimal pesticide use, rarely causing allergies, involving agricultural practices that have positive consequences for biodiversity, and involving foods rarely grown using genetic engineering or excessive water. Good production quality is also assumed by consumers to be climate change neutral or positive, and cheap to produce.

Consumers commonly think that higher quality production systems require minimal or no pesticide use, minimal water use, and a small amount of land (Bonti-Ankomah & Yiridoe, 2006). Not all of these points are accurate, as they are highly context dependent. Meaning that different growing climates, crop varieties, soil types, and soil amendments, among other variables, all dictate the optimal amount of land, water, and pesticide (or other form of pest management)

required for production (Seufert & Ramankutty, 2017). Drawing from the literature on consumer perceptions of foods, consumers are not often aware of these specifics of organic production. However, consumers generally perceive organic farming as kinder to the environment, regardless of whether this is the primary factor driving purchasing decisions (Hamzaoui Essoussi & Zahaf, 2009; Michaelidou & Hassan, 2008; Van Doorn & Verhoef, 2011). Based on this, the variables of; land for production, pesticide required for production, and water required for production, were all expected to load on to Factor group 2 as they did. The connection consumers make between organic farming and environmental impact also serves as an explanation for the grouping of, "whether the food item's production is/is not one of the causes of climate change," with Factor 2. As this variable very clearly references the environmental effects of agricultural production, we expected to see it grouped with quality of production.

We also expected that the variables of GM and allergies would group with quality of production. Because the absence of GM seeds is one of the tenets of organic agriculture, this is associated by many with a higher quality production system. Allergies are linked with the GM dialogue, as it has been widely speculated that the genetic modification of seeds, in combination with the production practices present in large scale monoculture systems (that are commonly GM), have led to the proliferation of allergies and food sensitivities among younger generations (Fairfield-sonn, 2016; Zilberman, Kaplan, Kim, Hochman, & Graff, 2013).

Another variable in factor 2 pertains to agroecological farming systems: "producing this food has positive consequence for biodiverse lands." We expected to see this variable grouped with quality of production precisely because it references the co-production of services to nature and

provision of food. It is also possible that survey respondents were unfamiliar with this variable, but that the description itself (with its connection to production's co-benefits) was inherently attractive.

The only construct that grouped with Factor 2 that was slightly counter-intuitive was the cost of production. Those scoring high on this variable indicate, that is, that good production equals cheap production -- "cheap to produce [this food]." Though most consumers are looking for cheap but high quality foods, the expectation was that most consumers would associate foods that are costly to produce with a higher quality production system. This prediction was based on the fact that high quality foods are often costly to produce, which we thought would figure into consumer logics. Some of the main drivers of these increased costs for high quality foods include more labor intensive production practices, higher costs for quality crop varieties, or costs associated with high quality soil ammendments as just a few examples (Rigby & Caceres, 2001). Participants did, in fact, link cost of production with quality of the production system (Factor 2), but rather than linking high cost with high quality, participants linked cheap production with high quality system of production. This counter-intuitive result could be explained by respondents having an incorrect understanding of production, and therefore thinking that high quality production systems are more efficient or 'naturally occurring' and possibly therefore yielding food that was inexpensive to produce. The addition of knowledge questions to the survey would be beneficial in aiming to better understand this result and possible misconceptions driving participant responses related to the construct of 'production cost.'

Looking lastly at the cumulative variance explained by the factor analysis, production quality holds much more weight than food quality. Production quality has a cumulative variance of 0.70 where food quality has a cumulative variance of only 0.45. This finding suggests that production quality figures more prominently for consumers in the rapid judgement of foods than food quality. This is contrary to what could be expected based on conclusions drawn in prior studies, which all put major emphasis on health and food safety over environmental and production related qualities of food.

Demographic Variables

Overall we found distinct relationships between demographic variables and perceived food and production qualities, based on the one-way between subject ANOVAs and regression analyses. We found that: (1) gender, diet, and shopping groups had a significant effect on perceived food quality; (2) shopping groups had a marginally significant effect on perceived production quality; (3) perceived higher food quality was associated with less environmental concern, lesser knowledge of agriculture and crop production, and were of an older age demographic within the age range of our sample (with lower financial stress and more liberal political leaning also associated with higher food quality, albeit only marginally significant); and (4) greater environmental concern and more conservative political orientation were associated with perceived higher production.

Prior studies attempting to draw connections between demographic groups and food purchasing patterns have identified the significance of gender, attitudes and values relating to foods. Women are often cited as more likely to purchase organic foods, as well as holding greater concern for both personal and environmental health (Hughner et al., 2007; Tobler, Visschers, & Siegrist, 2011; Wandel & Bugge, 1997). It is therefore fitting that gender groups differ significantly in regard to perceived food quality.

Diet groups that differed with significance on perceived food quality were vegan and vegetarian as compared with the carnivore group. This finding is also consistent with prior studies that examine how attitudes, values, and perceptions differ among diet groups with regard to both quality and ethical considerations of foods. As one example, within the literature on organic consumers, identification with vegan and vegetarian groups is a key predictor of organic purchasing behavior (Onyango, Hallman, & Bellows, 2007). With organic (relative ease of organic production) and other attributes closely related to organics (e.g. nutrition, trust, and willingness to pay premium) loading strongly within the construct of food quality, it follows that diet groups would differ with significance on this factor. Many people cite health related priorities as reason for following a more plant based diet, which also closely mirrors organic buying intentions for some consumers, which could be another explanation for the significant difference found between diet groups for perceived food quality (Funk & Kennedy, 2016).

Perceived food quality as well as production quality both differed with significance across shopping groups based on findings from the ANOVA and post hoc Tukey HSD test that followed. Interestingly, perceived food quality differed between those who purchase the

majority of their food from health foods stores and those that primarily shop at farmer's markets or get most of their food directly from farmers ($p = 0.02$). The difference here could be explained by the more intimate understanding of food quality gained from interacting closely with farmers or the direct sourcing of foods. Of even stronger statistical significance was the difference in perceived food quality between groups regularly shopping at supermarkets as compared to health foods store shoppers ($p = 0.000002$). This same difference in sub groups was revealed for effect on perceived production quality as well (marginal significance, $p = 0.06$). These results were not unexpected, as this difference in perception shaped by exposure to different marketing and food environments is logically consistent and finds support in prior studies (Hughner et al., 2007). Consumers driven to shop at health foods stores predominatly have very clear priorities and values that align with food quality and a quality in the way foods are produced as compared to regular supermarket shoppers. Prior studies have similarly shown that retail channels have a direct effect on purchasing intention (Dowd & Burke, 2013). These purchasing intentions among consumers who are regular patrons of specialty markets are predominantly health or environmentally focused.

Turning to findings from the regression analysis, part of our third major finding was that greater environmental concern was associated with lower perceived food quality, but higher perceived production quality. This result, we think, is an indication that those who show more concern for the environment ascribe to the attributes that make for production quality; that is, production practices most related to the environmental impact of producing foods. Because a greater level of environmental concern among participants is associated with lower perceived food quality, this indicates that participants who think highly of attributes related to high production quality

conversely rate attributes related to food quality low on the psychometric scale. This result could reflect that those concerned with the environmental impact of producing foods, as expressed by attributes of production quality, relate attributes of food quality as against this environmental value alignment. On the contrary, those rating food quality attributes highly, and who show less environmental concern, likely represent those with health-related priorities. This sub group of participants is consistent with conclusions drawn from prior studies on food choice – which attest that consumers priorities include health, food safety, and aesthetic qualities of foods, followed by environmental concern in order of weight (Bonti-Ankomah & Yiridoe, 2006; Hughner et al., 2007; Rana & Paul, 2017). It's important to note that the present study shows that not all participants organize their priorities and thinking in this way, but merely a sub group of participants.

Again concerning the third major finding from the regression analysis, lesser knowledge of agriculture and crop production is associated with higher perceived food quality. Otherwise stated, these results show that those who have a (self-reported) low level of knowledge about agriculture and crop production will score highly on Factor 1. This indicates that higher level of consumer knowledge of agricultural systems and crop production is not a predictor for greater amount of concern for food quality. A possible explanation for this finding could be that a shallow understanding of agriculture systems fosters a romanticized and inacurrate perception of what is involved in achieving high food quality. This finding could also suggest that consumers who think highly of attributes related to food quality (e.g. nutritional, rich in flavor, willing to pay premium for high quality) rank these attributes favorably because they are uninformed about other attributes related to agriculture and crop production, which they in turn rate unfavorably.

This finding is also consistent with the understanding that consumers are often uninformed, and are driven therefore more strongly by personal values, needs, motivations, and social norms than knowledge in many contexts, including food purchasing decisions (Vermeir & Verbeke, 2006). Lastly, this finding does also signal the value of survey questions capturing a true level of knowledge over self-reported knowledge, which was the sole measure of this variable in the present study.

The fourth finding from the regression analysis shows that older age is associated with higher perceived food quality. The mean age of participants for this study was 31.9 years (SD= 10.1). Prior studies have pointed to a middle-aged more-affluent consumer group as those who are also loyal buyers of organics (Funk & Kennedy, 2016). The age distribution for this study includes the 153 participants within the age range of 20-29, 108 within the 30-39 range, and a cumulative 46 participants over 40. Because the age range for this study is relatively narrow or young, the older end of the age distribution for this study matches this middle aged group of participants identified in prior studies as regular buyers of organics, with health concerns cited as priority (Appendix D for age distribution figure) (Bonti-Ankomah & Yiridoe, 2006; Hughner et al., 2007). There was also a statistically significant correlation between age and personal income within our sample, showing that older age is correlated with higher income ($r = 0.22$, $n=319$, $p = 0.0001$) (Appendix E). This too is consistent with demographic findings from prior studies, which identify a middle age affluent demographic as those most concerned with variables related to food quality, especially organics (whether the reason for concern be health realted or environemtal).

Finally, we found that political orientation was also a significantly associated with Factor 2. In particular, a more conservative political orientation was associated with higher scores on production quality. This finding could be explained by a more conservative leaning among those with greater familiarity and therefore more favorable ratings of production related attributes, which is a common political orientation for rural populations in the U.S.

In sum, this study offers a novel contribution to how we understand consumer perception of both food and production quality, as well as the variables that are a part of the logics and considerations made by agrifood consumers. Over recent decades, we have witnessed a shifting of values and thinking around the production of food and its sourcing, as this dialogue has grown in prominence among the general public (Michaelidou & Hassan, 2008). With this, it will become increasingly important to shape market dynamics accordingly to encourage a deviation from the norm of conventional production systems - that mark an environmentally harmful method of production.

7. Conclusion

7.1 Strengths and Limitations

The present study's greatest strengths are, we would suggest, the factors themselves. The distinction they offer on food quality and food production quality are relatively novel, and offer evidence to suggest that people think more fully about food production in ways not yet entirely recognized. This is revealed in two ways: first, several conventional features of quality food (e.g., preference for that food, flavor richness, high nutritional content, or willingness to pay

higher amounts for quality version) are coupled in Factor 1 with features of production that have come to 'mean' quality. Thus, we find quality linked to organics, trust in production, soil quality, or yield/abundance, which have come to be a part of more conventional measures of quality. Second, we find that Factor 2, which elaborates a consistent set of production-centric variables (minimal pesticide, positive consequences for biodiversity, etc.), is also the stronger factor from the point of view of proportion of variance explained.

These strong factor groupings and novel findings were produced, in large part, as a result of the careful thought and intention dedicated to the design of this study. This study was designed to mirror the manner in which people make food related decisions. The design aimed to elicit responses that closely represent rapid judgments about foods that might occur as part of one's daily routines and purchases, and as has been suggested by those interested in food logics, values and preferences (Asp, 1999; Sobal et al., 2009). This involved a design that was thus consistent with quick or 'intuitive' decisions rather than careful and more laborious consumer purchasing. Much of the research that has been done previously on how consumers perceive food and its environmental costs has been based on explicit question formats that encourage respondents to think carefully – more intentionally than they would during daily routines and purchasing decisions.

Our design also covered a broader range of variables than is often addressed, including different food-production systems. In doing this, our design yields a much more comprehensive study of consumer perception of foods, and provides insights into the logics and heuristics employed in the decision-making process considering a range agrifood products. Previous studies have drawn

conclusions based on a substantially more narrowed field of inquiry, which is perhaps why there is still a need for investigation into consumer logics.

There are several limitations to this study, which relate to online survey samples. Quality control was exercised for this data set by eliminating outlier respondents as well as incomplete responses. Even so, overall quality of the data is still a concern with any study conducted online. Another limitation related to online samples is whether participants, in fact, represented the desired group for the study. Though, because we aimed to sample from a general public participant base that was as diverse as possible, which was the logic behind chosing Mechanical Turk for our survey platform, it seems that we have reached the desired group for study.

Demand characteristics could be considered another limitation in this study. This idea represents the phenomenon of participants forming an interpretation of the experiment's purpose and unconsciously changing their behaviour to fit that interpretation (Orne, 2002). It's possible that participants formed an opinion of how they thought about the 19 variables they were prompted with, and followed this pattern of response across the different foods. There was very little distinction found among the fourteen foods in this survey, which could be explained in part by this phenomenon. Though despite the possibility of this, responses would still reflect the ways that a participant thinks about foods (i.e. the two-factor solution) regardless of a lack of variation among the fourteen foods prompted in the survey. Were this study improved and redesigned, we would also revisit the possibility that the reverse coded items in the psychometric scales may have introduced a response bias, since all the items loading onto Factor 1 were reverse coded.

Although reverse coding was traditionally thought to mitigate blind responding across items; recent research suggests that reverse coding itself may introduce a response bias, creating a factor that reflects the way participants respond to reverse-coded items (Sonderen, Sanderman, & Coyne, 2013). Future replications of the current work can avoid reverse coding in the survey to test the robustness of the two factors.

A final limitation relates to the images chosen for each of the fourteen foods shown on the survey - we chose one image to represent a 'grocery store view' of the food and the second image to give the participants a visual of the food as it is grown (Appendix A). It is possible that participants may have noticed the pattern in the visual representation of food quality and production from the images, but could equally have gained this pattern simply from seeing the scale of attributes fourteen times. Participants were not informed that this was the logic behind the selection of the two images, and this is not immediately apparent from the images themselves. It would be interesting to see if differences in the results appear with the absence of images altogether, but their presence does little to invalidate responses in the present study.

7.2 Relevance to Food Policy

The results of this study have shown that people are likely to be receptive to more environmentally focused food policies. Policy development in the form of improved focus on organics and other systems that incorporate high quality production measures into their practices, includes one possible area of focus. The finding that quality of production figures prominently into people's underlying perceptions of food (which in turn can influence behaviours) can be

considered influential in the support of organic systems, as well as other alternative (to conventional) high quality systems of production.

With organics in particular, support in the form of funding for targeted research for organic production would be largely beneficial. Research initiatives to receive more adequate support could include; the development of crop varieties, research exploring conditions specific to organic management, as well as optimization of pest management and soil amendment options. These are only a few research initiatives that would prove supportive to organics. There are many cruxes that organic farmers face, as well as separate barriers to uptake of organic practices for conventional farmers that would benefit from support.

Regulation measures for organics also deserves more attention, as does certification amendment and development. It is well understood that labor costs for organics deserves more attention as well. Subsidy programs to offset higher labor costs associated with higher quality production would be largely beneficial to the support and expansion of the organic movement. Ideally, moving forward, practices from organics will trickle over into conventional farming systems for improved soil health, pesticide and fertilizer usage, and the potential for overall lesser environmental impact. Increased support for organics would certainly work to encourage this trickle over to conventional systems and perhaps an even more substantial shift in production practices and norms among large scale agriculture systems.

The accessibility of organics for the average consumer has been vastly improved over the last decade, as shown by the amount of growth in the organic market (Bonti-Ankomah & Yiridoe, 2006; Yiridoe et al., 2005). Clearly, this has led to a greater awareness among consumers. Despite this growing consciousness, continued broadening of awareness around the production of foods and importance of employing a higher standard of practices would be advantageous to the advancement of food systems sustainability. The results from this study highlight these facts, and call for movement supporting high quality agriculture systems that advance food system sustainability.

7.3 Future research directions

Given the findings of this study, beneficial future research could include a deeper investigation of which factors attract consumers towards the consumption of organic food from a marketing perspective. A follow up study could also yield greater differentiation, if any exists, among different demographic and value groups. For instance, it would be interesting to further investigate how the 'conscious consumer' or loyal buyer of organics, as target groups for study, would speak to their values system related to foods. Using the data that this might yield in combination with the findings from this study would get at both rapid judgements as well as deliberated responses, which could be quite informative when coupled. This would be interesting to explore, especially given the increased availability and awareness of food options aimed at quality and greater environmental sustainability. In recent years, the conscious consumer is presented with an array of high quality food options that are both more affordable and available in a wider variety of markets; no longer solely niche markets (Rana & Paul, 2017). This could be

contributing to an expansion of the 'conscious consumer' group, or encouraging the purchase of foods grown in higher quality systems of production subconsciously, simply through exposure to these options among the general public. With this, our understanding of consumer logics has room to expand as the landscape changes over time.

A final thought on how to build upon how people think about food in relation to the environmental crisis would be to investigate more deeply how people conceptualize the connection between consumption of animal products and effects on the environment. We included animal products in this study for examination but were unable to draw any conclusions about these products in comparison to other food items included. Understanding whether awareness about the environmental impacts of animal agriculture is growing, as well as how quickly and to what degree is instructive for the shifting of market dynamics. As shifting diets in a lot of ways means more than choosing foods that are grown in a way that's environmentally sustainable, these are important questions to investigate.

7.4 Closing

In sum, the claims that consumer decisions are made primarily based on health and food safety concerns are overstated in the literature. The findings from this study show that consumers do not think only in terms of food quality, but also take variables related to production quality into consideration when making decisions about food. In turn, this result should be explored in greater depth, as well as considered in the shaping of food policies, and creation of support systems for organic farmers.

Organic aims to be a system that achieves, "optimal agroecosystems which are socially, ecologically and economically sustainable" (Seufert & Ramankutty, 2017). Another way to think about organics is a system that, "aims to reflect the profound interrelationship that exists between farm biota, its production and the overall environment" (Rigby & Caceres, 2001). These tenants of organic agriculture provide hope for the future of food production. With the proper support and incentives in place through the development of progressive food policies, expansion of organics would be a step in the right direction.

Greater focus on intercropped systems, and a better mirroring of natural ecosystem functioning on agriculturally productive lands, is also called for when considering the ways in which the production of food can become more environmentally sustainable. Agroecological practices are those that work alongside natural ecosystem functioning, and they therefore have the potential to increase agricultural productivity while mitigating or eliminating some of the typical detrimental effects of agricultural systems on the environment (Altieri, 1999; Clough et al., 2011). As discussed, this is seen in labeling as "shade grown" or "bird friendly," most commonly shown on coffee, as well as tropical fruits. Though this label does not perfectly encapsulate the values and benefits of agroforestry systems, it comes closest of the labelling schemes that exist. Ecologically, coffee systems with a diversified shade tree canopy have higher biodiversity than conventional coffee farming systems (Méndez, Bacon, Morris, & Shattuck, 2010). And what's more with these systems; there are measured higher levels of biodiversity within the farm as well as surrounding. This biodiversity present in shade coffee systems is able to provide added benefit to farmers by lowering or eliminating the need for chemical inputs, and producing other valuable

goods such as wood, food, and medicinal products (Méndez et al., 2010). Greater support for such systems where they thrive, will also have great impact, especially when considering the high rate of import for these tropically grown food staples.

Following the support for agroecological systems, and these relatively new labels, greater energy could certainly be put into the development of labelling schemes to better reflect production quality. As these points are already a consideration for consumers, as shown by the results of this study, nudges in this direction with well designed labels combined with updated marketing strategies would seemingly be quite effective in shifting market demand. Further support for high quality production systems in the form of consumer demand would be a positive wave of change. Global agrifood systems lie at the intersection of some of the most dominant environmental concerns including degradation of water and soil, growing water scarcity, contributions to energy consumption and emissions, land use change and habitat loss, among other consequences. Given these challenges, there is a dire need to redesign global agrifood systems and mobilize shifts in agricultural production. Though these shifts that need to occur are daunting in scale, there are many hinge points for change, consumer values, attitudes, and logics being one of them.

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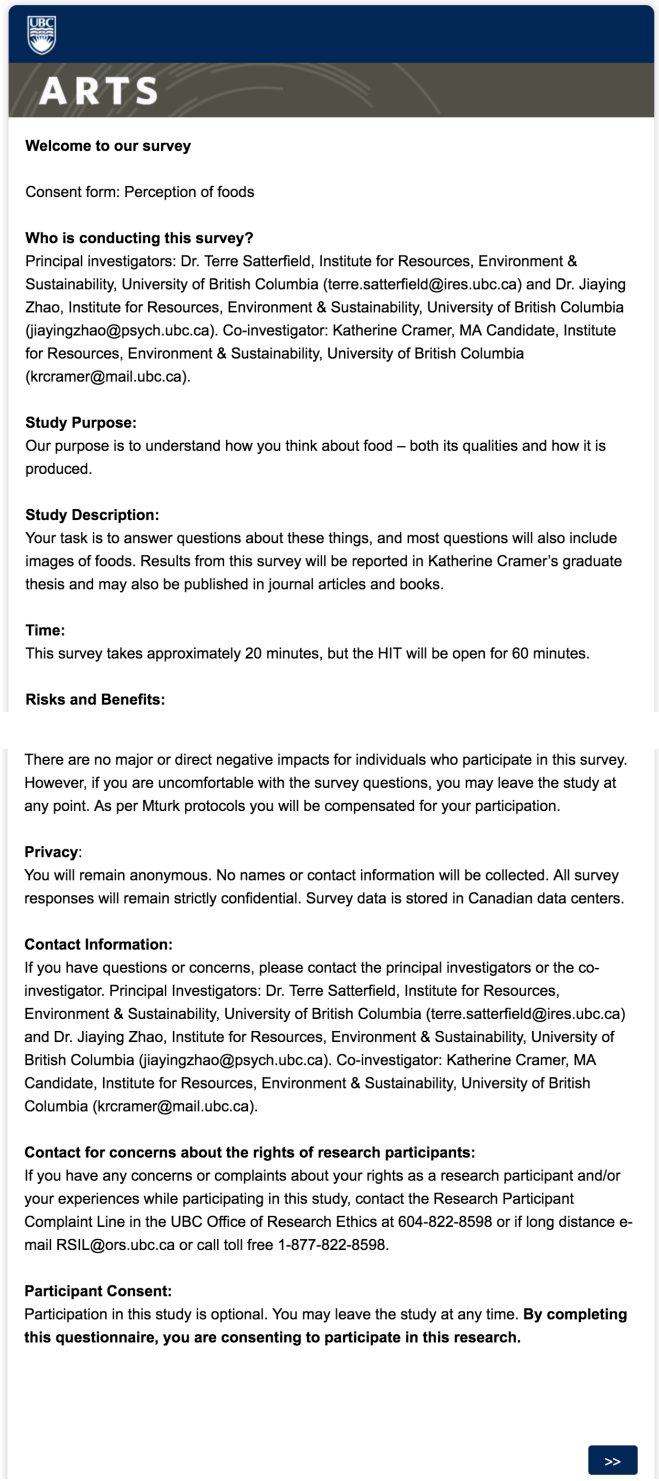
Appendices

Appendix A Sample survey questions and food images



ARTS

Welcome to our survey

Consent form: Perception of foods

Who is conducting this survey?
Principal investigators: Dr. Terre Satterfield, Institute for Resources, Environment & Sustainability, University of British Columbia (terre.satterfield@ires.ubc.ca) and Dr. Jiaying Zhao, Institute for Resources, Environment & Sustainability, University of British Columbia (jiayingzhao@psych.ubc.ca). Co-investigator: Katherine Cramer, MA Candidate, Institute for Resources, Environment & Sustainability, University of British Columbia (krcramer@mail.ubc.ca).

Study Purpose:
Our purpose is to understand how you think about food – both its qualities and how it is produced.

Study Description:
Your task is to answer questions about these things, and most questions will also include images of foods. Results from this survey will be reported in Katherine Cramer's graduate thesis and may also be published in journal articles and books.

Time:
This survey takes approximately 20 minutes, but the HIT will be open for 60 minutes.

Risks and Benefits:

There are no major or direct negative impacts for individuals who participate in this survey. However, if you are uncomfortable with the survey questions, you may leave the study at any point. As per Mturk protocols you will be compensated for your participation.

Privacy:
You will remain anonymous. No names or contact information will be collected. All survey responses will remain strictly confidential. Survey data is stored in Canadian data centers.

Contact Information:
If you have questions or concerns, please contact the principal investigators or the co-investigator. Principal Investigators: Dr. Terre Satterfield, Institute for Resources, Environment & Sustainability, University of British Columbia (terre.satterfield@ires.ubc.ca) and Dr. Jiaying Zhao, Institute for Resources, Environment & Sustainability, University of British Columbia (jiayingzhao@psych.ubc.ca). Co-investigator: Katherine Cramer, MA Candidate, Institute for Resources, Environment & Sustainability, University of British Columbia (krcramer@mail.ubc.ca).

Contact for concerns about the rights of research participants:
If you have any concerns or complaints about your rights as a research participant and/or your experiences while participating in this study, contact the Research Participant Complaint Line in the UBC Office of Research Ethics at 604-822-8598 or if long distance e-mail RSIL@ors.ubc.ca or call toll free 1-877-822-8598.

Participant Consent:
Participation in this study is optional. You may leave the study at any time. **By completing this questionnaire, you are consenting to participate in this research.**

>>

ARTS

You will see a number of foods in the survey. For each food, there are a number of contrasting phrases used to describe the food. Mark the circle that is closest to the statement that describes how you think about that food. There is no right or wrong answer. Please answer these quickly and trust the first answer that comes to mind. [For example, if you really agree with the description on the left, mark the furthest left circle. If your agreement is a bit weaker than that, mark the next circle over, and so on.]

Bananas

Mangoes

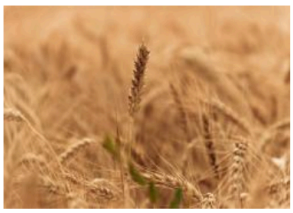
Corn

Eggplant

Lentils

Soybeans

Wheat

Eggs


Strawberries


Chicken


Kale


Coffee


Beef


Carrots



Neutral
Mostly grown locally
Mostly imported
Uses a lot of land to produce
Uses minimal land to produce
Requires heavy pesticide use
Requires minimal pesticide use
Easy to produce organically
Difficult to produce organically
Very nutritional
Not very nutritional
Commonly causes allergies
Rarely causes allergies
Trust the way most of this food is produced
Distrust the way most of this food is produced
Easy to produce in a way that also supports other plants and animals
Hard to produce in a way that also supports other plants and animals
Producing this food has negative consequences for biodiverse lands
Producing this food has positive consequences for biodiverse lands
Soil recovers easily after production
Soil recovers slowly after production
Rich in flavor
Empty in flavor
Mostly grown in a genetically engineered form
Rarely grown in a genetically engineered form
Large yield is easily achieved
Large yield is difficult to achieve
Growers are well paid
Growers are poorly paid
Lots of water required for production
Minimal water required for production
Costly to produce
Cheap to produce
Its production is one of the causes of climate change
Its production is not one of the causes of climate change
A food that I like
A food that I do not like
I am willing to pay more than the market price for good quality version of this food
I am unwilling to pay more than the market price for good quality version of this food

Please rank the following factors in order of their importance when you purchase foods

Price

Freshness

Healthfulness

Locality

Organic, non-GMO

6 Appearance

Please rate your general level of knowledge about crop production and agriculture?

Excellent

Very good

Average

Poor

Non-existant

Where do you get the majority of your food?

Supermarket

Health foods store

Farmer's market or directly from farmers

My own land or garden space

What best describes your diet?

Vegan

Vegetarian

Pescatarian

Carnivore

>>

People often express concern about environmental problems, but some people differ as to which consequences concern them the most. Please read the list of different areas where environmental problems could have harmful consequences, and for each please rate how concerned you are about them.

I am concerned about environmental problems because of the consequences for:

	Not at all concerned						Extremely concerned
Plants	○	○	○	○	○	○	○
Me	○	○	○	○	○	○	○
People in my country	○	○	○	○	○	○	○
Marine life	○	○	○	○	○	○	○
My lifestyle	○	○	○	○	○	○	○
All people	○	○	○	○	○	○	○
Birds	○	○	○	○	○	○	○
My health	○	○	○	○	○	○	○
Children	○	○	○	○	○	○	○
Animals	○	○	○	○	○	○	○
My future	○	○	○	○	○	○	○
My children	○	○	○	○	○	○	○

Listed below are a number of questions about how you think about animals. Please indicate whether you *strongly agree; agree; neither agree nor disagree; disagree; or strongly disagree* with the following statements.

	Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree
Humans have no right to displace wild animals by converting wilderness area into things like farmlands designed for people	○	○	○	○	○	○	○
Animal research cannot be justified and should be stopped	○	○	○	○	○	○	○
It is morally wrong to wear leather jackets	○	○	○	○	○	○	○
Most medical research done on animals is unnecessary	○	○	○	○	○	○	○
I have seriously considered becoming a vegetarian in an effort to save animal lives	○	○	○	○	○	○	○
Pet owners are responsible for preventing their pets from killing other animals, such as cats killing mice or snakes eating live mice	○	○	○	○	○	○	○
We need more regulations governing the use of animals in research	○	○	○	○	○	○	○
It is morally wrong to eat beef and other "red" meat	○	○	○	○	○	○	○
Insect pests (mosquitoes, cockroaches, flies, etc.) should be safely removed from the house rather than killed	○	○	○	○	○	○	○
Animals should be granted the same rights as humans	○	○	○	○	○	○	○
It is wrong to wear leather belts and shoes	○	○	○	○	○	○	○
I would rather see humans die or suffer from disease than to see animals used in research	○	○	○	○	○	○	○
Having extended basic rights to minorities and women, it is now time to extend them also to animals	○	○	○	○	○	○	○
God put animals on earth for man to use	○	○	○	○	○	○	○
There are plenty of viable alternatives to the use of animals in biomedical research	○	○	○	○	○	○	○
Research on animals has little or no bearing on problems confronting people	○	○	○	○	○	○	○
New surgical procedures and experimental drugs should be tested on animals before they are used on people	○	○	○	○	○	○	○
I am very concerned about pain and suffering of animals	○	○	○	○	○	○	○
Since many important questions cannot be answered by doing experiments on people, we are left with no alternatives but to do animal research	○	○	○	○	○	○	○
It is a violation of an animal's rights to be held captive as a pet by a human	○	○	○	○	○	○	○
It is wrong to wear animal fur (such as mink coats)	○	○	○	○	○	○	○
It is appropriate for humans to kill animals that destroy human property, for example, rats, mice, and pigeons.	○	○	○	○	○	○	○

Most cosmetics research done on animals is unnecessary and invalid	○	○	○	○	○	○	○
It is morally wrong to eat chicken and fish	○	○	○	○	○	○	○
Most psychological research done on animals is unnecessary	○	○	○	○	○	○	○
Hunters play an important role in regulating the size of deer populations	○	○	○	○	○	○	○
A human has no right to use an animal as a means of entertainment	○	○	○	○	○	○	○
It is morally wrong to drink milk and eat eggs	○	○	○	○	○	○	○

>>

Listed below are statements about the relationship between humans and the environment. For each one, please indicate whether you STRONGLY AGREE, MILDLY AGREE, are UNSURE, MILDLY DISAGREE, or STRONGLY DISAGREE with it.

	STRONGLY AGREE	MILDLY AGREE	UNSURE	MILDLY DISAGREE	STRONGLY DISAGREE
We are approaching the limit of the number of people the earth can support	○	○	○	○	○
Humans have the right to modify the natural environment to suit their needs	○	○	○	○	○
When humans interfere with nature it often produces disastrous consequences	○	○	○	○	○
Human ingenuity will insure that we do NOT make the earth unlivable	○	○	○	○	○
Humans are severely abusing the environment	○	○	○	○	○
The earth has plenty of natural resources if we just learn how to develop them	○	○	○	○	○
Plants and animals have as much right as humans to exist	○	○	○	○	○
The balance of nature is strong enough to cope with the impacts of modern industrial nations	○	○	○	○	○
Despite our special abilities humans are still subject to the laws of nature	○	○	○	○	○
The so-called "ecological crisis" facing humankind has been greatly exaggerated	○	○	○	○	○
The earth is like a spaceship with very limited room and resources	○	○	○	○	○
Humans were meant to rule over the rest of nature	○	○	○	○	○
The balance of nature is very delicate and easily upset	○	○	○	○	○
Humans will eventually learn enough about how nature works to be able to control it	○	○	○	○	○
If things continue on their present course, we will soon experience a major ecological catastrophe	○	○	○	○	○

In this last section of the survey, we would like to learn more about your background and your current household characteristics. You can be assured that all your answers will be kept confidential. We will only report data in the aggregated form. We will never identify individuals or households with these responses.

Please indicate your total annual household income (in US Dollars).

- Less than $20,000
- $20,001-$40,000
- $40,001-$60,000
- $60,001-$80,000
- $80,001-$100,000
- $100,001-$120,000
- $120,001-$140,000
- $140,001-$160,000
- More than $160,000

How many people live in your household including you?

Where do you currently live? (Please specify your city or town, state, and country)

In general, how much financial stress do you feel on a day-by-day basis?

No financial stress at all ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ Considerable amount of financial stress

Consider your wealth level and social status, how do you perceive yourself relative to other people in your area?

I feel much worse off than most people ○ ○ ○ ○ ○ ○ ○ ○ ○ ○ I feel better off than most people

What is your age (in years)?

What is your gender?

- Male
- Female
- Other

Where do you currently live? (Please specify your city or town, state, and country)

What is your religious affiliation?

- Mormon
- Muslim
- an Orthodox Church such as Greek or Russian Orthodox Church
- Buddhist
- Catholic
- Protestant
- Jewish
- Jehovah's Witness
- Hindu
- Atheist
- Agnostic
- Other

What is your political orientation? Rate from a scale from -5= very liberal (left wing) to 5= very conservative (right wing)

Left wing Right wing

-5 -4 -3 -2 -1 0 1 2 3 4 5

Political orientation

>>

Appendix B Different demographic groups for ANOVA

We examined diet groups, which were prompted by the question, "What best describes your diet?" Respondents were reportedly 16% vegan, 5% vegetarian, 14% pescatarian, and 65% carnivore. Groups based on shopping preference were made from responses to the question, "where do you get the majority of your food?" Results indicated that 62% of respondents get the majority of their food from Supermarkets, 17% from health foods stores, 17% from farmer's markets or directly from farmers, and 4% from their own land or garden space. Respondents were 37% female and 63% male, 34% were from India, 65% from the United States, and 1% other countries.

Appendix C Factor analysis on demographic variables to reduce multicollinearity

	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Annual Household Income	**0.88**	-0.05	0.02	-0.02
Personal Income	**0.97**	0.00	-0.24	-0.09
Animal Rights	0.03	**0.77**	-0.10	0.03
NEP	-0.04	**0.78**	-0.08	0.02
Perceived Social Status	0.31	-0.14	**0.54**	-0.20
Political Orientation	0.01	0.00	**0.62**	0.07
Financial Stress	-0.09	-0.12	0.21	**0.97**
Environmental Concern	0.05	-0.38	-0.11	0.14
People per Household	-0.14	0.06	0.32	0.10
Age	0.12	0.03	-0.45	-0.07

Appendix D Age distribution and income of participants