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Confirmatory Bias under Food-Borne Risk: A Lab Experiment

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Abstract

An experiment was conducted to investigate the interaction between consumers' past eating behaviors, risk perceptions and future information processing procedure. In the study, participants were required to choose whether or not to eat chicken that was potentially be tainted with Avian Influenza (AI). Results showed that people decreased the consumption when facing ambiguous signals regarding the food quality, but would not cease to eat altogether. Due to a taste of consistency, participants updated their risk perceptions and judgments based on their eating behaviors. The more chicken individuals ate the more favorably they tended to rate the food, suggesting confirmatory bias. Even though consumers with previous experience could pick up signals faster, their judgment was not better than those non users due to a much stronger psychological bias. This study offered an explanation for why consumers were universally irresponsive to public food safety information.

Key Words

Cognitive Dissonance, Confirmation Bias, Self-compliance, Justification

JEL Code

D03, D12, D83, Q18

1. Introduction

Food safety issues have been a major concern for both public health and food industry. In general, public regulatory agencies and private food companies should be responsible to minimize the food safety risk and provide related information. However, a significant amount of control over these health risks lies in the hands of the consumers, who are the final decision makers of consumption. In this sense, it is of great importance to better understand consumers' risk perception and reaction to related information. Previous studies suggested food safety information is relatively ineffective in changing consumers' behavior (Downs, Loewenstein and Wisdom, 2009), but very few of them offered a reason. This study uses experimental evidence to identify cognitive dissonance and its subsequent behavioral impacts on consumers' risk attitudes and response to information in a food safety context. The results of the experiment provide some explanations for why typical consumers are less responsive to food safety scares.

Cognitive dissonance is a state of discomfort caused by individual holding two contradictory beliefs (Leon Festinger, 1957). By cognitive dissonance theory, past behavior and experience may induce consumers to adjust their beliefs to rationalize their behavior (Akerlof and Dickens, 1982). Wessells, Kline and Anderson (1996) used survey data and showed consumers' perceptions of seafood safety were influenced by their past experiences. Further, the perceptions influenced the anticipated changes in consumption under different information settings. However, in reality, past behavior and experience could also impact consumers' reaction to information, especially when the signals are ambiguous. Confirmatory bias is a natural tendency to reduce dissonance (Frey, 1986). For one thing, it can lead individual to selectively seek confirming evidence and neglect disconfirming evidence. For another, it causes consumers to interpret the ambiguous evidence in a more favorable way (Rabin and Schrag, 1999). Lin, Lee and Yen (2004) found evidence for the first type of confirmation bias, arguing that dietary intakes affect consumers' search of nutrient information.

Our study will extend the existing research in the following ways: First, we differentiate past experience and one-time shot behavior to investigate the short-term behavioral effect on perception and its interaction with long-term experience. Second, we introduce ambiguous external signal of the food and check how does risk perception change with the signal and past experience. Third, different interpretations of the ambiguous signal would provide evidence for the second type of confirmation bias.

The experiment used in this study was conducted in Ithaca, New York 2006, during which time there was an outbreak of bird flu within the state. 61 subjects were assigned to eat chicken wings from a local store. 29 in the control group ate the normal wings and 32 in the treatment group ate wings mixed with fish sauce. Fish sauce gave a strong smell which performed as an ambiguous external signal indicating the food being potentially tainted. Subjects were further divided by their self-reported past experience with the local store. The results showed risk perceptions were influenced by the existence of the signal, the amount of food eaten and past experience. When food was mixed with fish sauce, users perceived higher risk than non-users

conditional on the amount of chicken eaten. However, risk perception decreased as the users ate more chicken, suggesting cognitive dissonance. Further, the users' intention of interpreting the taste signal as being safe was also higher with more chicken eaten, which is consistent with the hypothesis of confirmatory bias. Other responses such as satisfaction of the food and anticipated future consumption were also investigated under different conditions.

Since food safety issues involve a lot of uncertainty, consumers' perceptions depend heavily on their experience and past behaviors. With ambiguous signals, the interpretations are also different depending on the initial perceptions. In order to devise effective communication strategies, we suggest information providers, either policy-makers or private companies, differentiate case by case when offering messages to the public.

2. Literature Review

2.1 Cognitive Dissonance

Cognitive dissonance theory was originally formulated in the mid-1950s by Leon Festinger and its first complete version was presented in 1957. It is used to refer to the uncomfortable feeling aroused from holding two contradicting attitudes, beliefs or behaviors. To put it more formally, as theorized Festinger, when an individual holds two or more elements of knowledge that are relevant to each other but inconsistent with one another, a state of discomfort is created. A person who has just bought a car but later finds that the maintenance fee could be very high will feel dissonance because of their former belief that the car is a good choice. When one holds a certain belief but is also forced to act against that, disagreement or dissonance exists between the action and the previously held belief. Motivated by the unpleasant state of dissonance people will further engage in some "psychological work" so as to reduce the inconsistency, and typically this work will support the cognition which is most resistant to change. When returning a car to the dealer is impossible, the owner tends to believe only good car requires higher maintenance fee and maybe the cost is acceptable. A person who just did something irrevocable but is opposite to his long-held belief may regard that belief as less important than before.

In general, to reduce the dissonance, individual could add consonant cognitions, subtract dissonant cognitions, increase the importance of consonant cognitions or decrease the importance of dissonant cognitions. One of the most often assessed ways of reducing dissonance is change in attitudes. Attitude change is expected to be in the direction of the cognition that is most resistant to change. In test of the theory, it is often assumed that the knowledge about recent behavior is usually most resistant to change, since if a person behaved in a certain way, it is often very difficult to undo the behavior. Thus, attitude change would be made consistent with the recent behavior.

Cognitive dissonance theory dominated social psychology from the 1950s until the 1970s. It revolutionized thinking about psychological processes, particularly regarding how actions and outcomes affect attitudes or how behavior and motivation affect perception and cognition. The most influential and widely cited classic experiments are "the post-decision dissonance" (Brehm,

1956), “the induced/forced compliance” (Festinger and Carlsmith, 1959; Freedman, 1965) and “the effort justification” (Aronson and Mills, 1959).

Brehm (1956) examined dissonance theory in post-decision process. In the experiment, participants were asked to make either an easy or a difficult choice between two alternatives. The easy choice was one in which one alternative was much more attractive than the other, whereas the difficult choice was one in which the alternatives are very close in attractiveness. Participants were also asked to evaluate the decision option both before and after the choice decision. According to the theory, after a decision, all of the cognitions that favor the chosen item were consonance, while all the cognitions that favor the rejected item were dissonance. Dissonance could be reduced by viewing the chosen alternative as more attractive and/or viewing the rejected alternative as less attractive. Brehm found that after people made a difficult decision, they changed their attitudes to become more negative toward the rejected alternative, whereas after an easy decision, their attitudes were not changed.

Festinger and Carlsmith (1959) hypothesized that dissonance should be aroused when a person acts in a way that is contrary to his or her attitudes. To test this, participants were asked to perform a boring task and then were paid either $1 (low justification) or $20 (high justification) to tell another participant that the task was interesting. Since $20 provided sufficient justification for the counter attitude behavior, according to the theory, lying for a payment of $1 should arouse more dissonance than for $20. As expected, participants in low justification group ($1) changed their attitudes to become more positive toward the task; however, those in high justification group ($20) did not change their attitudes and rated the activity boring as before.

Aronson and Mills (1959) designed the first experiment to test the effort justification idea. The idea said dissonance was aroused whenever a person engaged in an unpleasant activity to obtain some desirable outcome. The greater the unpleasant effort required to obtain the outcome, the greater the dissonance. Dissonance could be reduced by exaggerating the desirability of the outcome, since this would add consonant cognitions. In their experiment, women participants needed to undergo a severe or mild “initiation” to become a group member. In the severe initiation condition, women engaged in an embarrassing activity to join the group. In the mild condition however, women engaged only in a simple activity that is not very embarrassing. The group was made dull and boring. But women in the severe condition evaluated the group much more favorably than those in the mild condition, which supported the effort justification idea.

For more innovative experiments on cognitive dissonance, Aronson (1969) and Nisbett and Ross (1999) provide good and comprehensive summaries. Besides these, since late 20th century, there has been renewed interest in cognitive dissonance theory (Beauvois & Joule, 1996; Harmon-Jones & Mills, 1999) and implicit influences on many other contemporary theories (Aronson, 1992). More details regarding the origin and development, challenge and revision of cognitive dissonance theory over the past 50 years could be found in Harmon-Jones and Harmon-Jones (2007).

2.2 Confirmatory Bias

Another motivational process that was found in line with cognitive dissonance is called **confirmatory bias**. It is an error in information processing and belief update procedure, which refers to a tendency of selectively collecting information to reinforce the initial belief. As test of the behavior, dissonance research using a selective exposure paradigm has demonstrated that people are more willing to examine materials that confirm their beliefs than materials that dispute their beliefs (Brock and Balloun, 1967; Frey, 1986). Research using a belief disconfirmation paradigm has shown that when people are exposed to information that challenges their beliefs, they often strengthen their original beliefs (Batson, 1975; Burris, Harmon-Jones and Tarpley, 1997).

Rabin and Schrag (1999) summarize 3 different information-processing problems that will lead to confirmation bias. First, confirmatory bias arises when people have to interpret ambiguous evidence (Keren (1987) and Griffin and Tversky (1992)). A series of experiments in psychology reveal that people tend to misread evidence as additional support for initial beliefs. When facing the same ambiguous information, people with different initial beliefs can move their beliefs even farther apart. Lord, Ross and Lepper (1979) tested this polarization phenomenon. In the experiment, subjects were divided into 2 groups based on their earlier attitudes on death penalty and its deterrent effect. After reading a few randomly selected studies and criticisms on this topic, the subjects were asked to rate their change of attitude. Results showed that the proponents reported they were more in favor of the penalty and its deterrent effect, whereas the opponents reported they were even less in favor of the punishment and the efficacy. Lord, Ross and Lepper explained this as a biased assimilation possess which may include "a propensity to remember the strengths of confirming evidence but the weaknesses of the disconfirming evidence, to judge confirming evidence as relevant and reliable but disconfirming evidence as irrelevant and unreliable, and to accept confirming evidence while scrutinizing disconfirming evidence". However, Lord-Ross-Lepper experiment permits an alternative explanation: Since the two groups of people may be predisposed to interpret ambiguous evidence differently, the polarization that proves the difference in interpretation appears to be less relevant to the current beliefs, and thus does not reflect confirmation bias. Darley and Gross (1983) provides a similar but more direct test of polarization based on differing beliefs induced by two ex ante identical groups, and excludes this alternative explanation.

A second situation that may result in confirmatory bias occurs when people must interpret statistical evidence to assess the correlation between phenomena that are separated by time (i.e. hyperactivity and sugar intake, arthritis pain and weather change). Research suggests that inability to identify such correlation is one of the most robust shortcomings in human reasoning (Nisbett and Ross (1980)). Illusory correlation may play an important role in confirmatory bias. People either underestimate the true correlation when they do not perceive it or overestimate some imaginary correlation when they think it is true (Jennings, Amadibile and Ross (1982)).

Third, confirmatory bias can result from people selectively collecting or scrutinizing evidence. A simpler version of selection bias is provided in Wason (1968). In the study, subjects were shown 4 cards with "E", "4", "K" and "7" on each card, and told that each card has a number on one side and a letter on the other. The subjects were then asked which card should be turned over in order to test the hypothesis that "every card with a vowel on one side has an even number on the other". Most subjects chose "E" and "4". While choosing "E" could provide either confirming or disconfirming results depending on whether the number on the other side is even or odd, turning "4" could only provide confirming information if one finds a vowel and no information to test the hypothesis if a consonant is found. In contrast, nearly nobody chose "7". However, turning "7" could disprove the hypothesis if a vowel is found. This is an illustration of individual's willingness to select confirming evidence and to shrink away from information that might disprove the prior hypothesis. A more severe bias could happen when people experience hypothesis-based filtering, in which case, people digest information according to their prior hypotheses and further use the consequent "filtered" evidence as additional support for these hypotheses (Einhorn and Hogarth (1978), Klayman and Ha (1987), Beattie and Baron (1988), Devine, Hirt and Gehrke (1990), Hodgins and Zuckerman (1993) and Zuckerman, Knee, Hodgins and Miyake (1995)). A trader who gets an unclear report of a stock may try to understand it based on his previous impression about the stock. But he will fall into the pitfall if he in turn uses the conclusion he derives from there as further evidence for his investment decision.

Confirmatory bias was widely found in professional fields. Oskamp (1965) found that when clinical psychologists tried to make decisions, their predictive accuracy reached a ceiling in some early point in the information-gathering process. However, confidence about their decisions continued to climb steadily as more information was obtained. Darley and Gross (1983) demonstrated teachers misread performance of pupils as supporting their initial impressions. Frank and Gilovich (1988) found referees gave significantly more penalty to black-uniformed teams due to the impression that black looked more aggressive. In business management, managers tend to persist with unsuccessful policies (Staw (1976)) and CEOs are overconfident in their acquisition decisions (Bogan and Just (2006)). In finance, traders biases towards early investment (empirical review, see Shleifer (2000)).

2.3 Consumer Behavior and Future Research

Psychological biases such as cognitive dissonance and confirmatory bias have also been extensively applied to consumer behavior. Several articles have provided critical reviews of the theories and have described how the theories are related to consumer behavior (Kassarjian and Cohen, 1965; Cummings and Venkatesan, 1976; Harmon-Jones and Harmon-Jones, 2007). Empirical research generally falls into two categories: (1) effects of dissonance on attitude change and tendency to repurchase, and (2) effects of dissonance on selective information seeking by consumers. In general, studies which have examined the effects of dissonance on attitude change and tendency to repurchase have supported the predictions from the theory (Doob, Carlsmith, Freedman, Landauer and Tom, 1969; Kassarjian and Cohen, 1965). By the foot-in-the-door technique, consumers who care about consistency can make big commitment

following a small one (Freedman and Fraser (1966) and Pliner, Hart, Kohl and Saari (1974)). However, empirical findings have not supported either a general preference for supportive over non-supportive information or a greater information seeking/avoidance tendency by high dissonance subjects (Freedman and Sears, 1965; Ehrlich et al, 1957; Engel, 1963; LoSciuto and Perloff, 1967). In the marketing situation, it cannot be concluded up to this point that dissonance is relevant to post-decision information seeking. Recently, literature in food safety and public health fill this gap to some extent. Wessells, Kline and Anderson (1996) uses survey data and shows consumers' perceptions of seafood safety are influenced by their past experiences. Further, the perceptions influence the anticipated changes in consumption under different hypothetical information concerning seafood. Lin, Lee and Yen (2004) finds in field that search for fat and cholesterol information on food labels is less likely among individuals who consume more of these nutrients and thus supports the selective information avoidance tendency that has not been justified in marketing literature.

Research that will further contribute the field includes but not limits to the following directions. The first direction involves identification of the different types of confirmatory bias mentioned above and its impact on consumer risk perception and future behavior. In this study, the authors will demonstrate the contingent existence of cognitive dissonance and individual's tendency of interpreting ambiguous signals to confirm current beliefs. This study will add some new insights concerning consumer behavior in general and food safety framework in particular.

Second, few studies to date have examined the conditions under which dissonance will and will not work. In another experimental setting, we differentiated consumers' responses based on their familiarities to the food they were dealing with and identified the condition under which dissonance would occur (Cao and Just, 2009). This offered some explanations for why some certain consumers were less responsive to public information and helped to strategically design more effective policies for food safety issues.

Moreover, most studies in the marketing field adopted the free-choice paradigm and argued it was less possible to testify forced compliance paradigm since consumers would not comply with requests of buying sub-optimal goods whenever the best alternative was available. However, in the food consumption situation, we could manipulate this by assigning participants to some certain food, induce dissonance and investigate subsequent behaviors later on. This is also an innovative part of the study compared with other existing research.

Finally, individual decision model that incorporates behavioral anomalies could be further refined to better understand the preferences and utility gains. Many good studies have offered fundamentals for this. Rabin and Schrag (1999) models how individual interpret ambiguous information in favor of current belief. Koszegi (1999) uses dynamic model to capture the stopping rule in the information seeking process. Yariv (2002) proposes a model that characterizes the taste of consistency, stickiness in behavior and preference over signals. Moreover, in a normative perspective, mechanism designs between behavioral decision maker, strategic information holder and rational social planner could improve the equilibrium in the

market interactive context. As of food safety issue, this could rationalize labeling regulation and many other policy interventions regarding public health.

3. Experimental Design

This food choice experiment was conducted in fall 2007 at Cornell University (Ithaca, NY). The experiment was designed to measure the actual response of participants to ambiguous signals under the background of a perceived biosecurity threat related to the discovery of bird flu at a local processor. The weight of food consumed by each participant was recorded and the feeling, expectation and perception of the food were asked afterwards. We focused on the interaction between participants' past eating behaviors, current risk perceptions and future information processing procedures. Even though the common observation suggests that individuals overestimate the probability of rare events (i.e. Kahneman and Tversky, 1979), research about food choices also reports that consumers tend to underestimate the risk of food-borne illnesses (Hayes et al., 1995). This methodology and the results provide us with an explanation for the underestimation of risk.

In this lunchtime experiment, participants were placed in a situation where they were required to choose whether or not to eat chicken that might be tainted with Avian Influenza (AI). This disease was chosen for two reasons. First, the disease has been widely reported in the news, with much of the news anticipating outbreaks in the United States and eventual transfer to humans. Yet the reporting has not been in such detail that a casual observer would know much about it. This prior level of information lends credibility to the notion that there may have been an outbreak. Secondly, the disease cannot be spread to humans through consumption of cooked chicken. Hence, we could provide a plausible explanation regarding why the contamination did not concern us.

We considered 2 by 2 conditions with a total of four different cases. First, participants were randomly assigned to two treatment groups. In one group, we mixed the chicken with fish sauce. The fish sauce gave a very strong smell and served as some ambiguous signal that the food was potentially tainted. In the other group, the participants were offered the normal chicken. In both treatment groups, the chicken was delivered by a local processor, called Ithaca Wings. Further, within each group, the participants were categorized by users and non-users, depending on whether they had previous experience of eating the food from the local processor.

We hypothesized generally that while individuals would reduce their consumption when facing some strange signals indicating the food being potentially contaminated, they would not cease to consume altogether. This hypothesis is in line with most of the food psychology literature which suggested that individuals have a very hard time resisting food that is immediately available (Boon et al, 1998; Cornell, Rodin and Weingarten, 1989) or that has already been purchased and currently in present within the household (Chandon and Wansink, 2002). In other word, a taste of consistency may cause stickiness in behavior when individuals are making food choice decisions. Further, consumers may be different in sensitivity to the signal due to

their previous eating experiences. For this reason, we hypothesized users would sense the strangeness of the food with a higher probability than non-users in the first place. However, the sensitivity would decrease as the participants eat more chicken. This hypothesis is driven from cognitive consistency and confirmatory bias that have been widely found in fields. Subjects would first update their beliefs to be consistent with their previous behaviors and then selectively collect and interpret signals as supporting evidence for their beliefs.

Participants in the experiment were recruited for a "food marketing study", and promised $5 and a meal for their participation. Each session took place at 12:30pm on a Tuesday, Wednesday or Thursday. Subjects were directly informed that the experiment would be conducted by a food psychologist who is a member of the applied economics faculty and that the experiments were not associated with the experimental economics laboratory. Participants entered a room featuring a buffet line to their left and a set of three long tables (seating up to 20 persons each) arranged in a "U" shape on their right. Participants were asked to enter the buffet line and select as much as they liked of each of the foods: boneless fried chicken tenders, French fries, pudding, apple sauce, celery, macaroni salad, soda and bottled water. Subjects were instructed to take at least a little of each item, and each item was to be placed on a separate small plate on their tray. At the end of the buffet line, all plates were weighted individually, and participants were then told to be seated at one of the three long tables on the outer edge of the "U" and to wait for instruction from the experimenter before beginning to eat. By sitting on the outside of the "U", each individual could easily see and hear all of the other participants. After the experimenter checked each tray to make sure everyone had complied with instructions, the subjects began eating. After completing their meals, the participants' plate were again weighted to determine how much of each item had been consumed. Each subject was then asked to respond to a survey. Following completing the survey, participants were debriefed in small groups and were asked to discuss their experiment with the experiment and provide their impressions.

4. Experiment Results

4.1 Summary Statistics and Treatment Groups

A total of 61 participants completed the experiment. Summary statistics could be found in Table-1. As shown in the table, we had a good control over age and the body mass index (BMI), however, the two treatment groups are slightly different in gender, height and weight, with fish sauce group having more female and thus, lower height and weight measures than the non fish sauce group. In later analysis, we controlled these factors and the further robustness check ensured that our main results did not change with these issues.

Each group was further decomposed based on participants' responses to the question "how many times did you eat at Wings (the local processor)". Those who reported non-zero visiting time were called (experienced) users. And others who had no previous experience eating at Wings were called (inexperienced) non-users. 15 out of 28 participants in the fish sauce group

were categorized as users and 17 out of 33 in the non fish sauce group were users. Since we focused on the interaction between behavior, perception and information processing, this way of organizing participants enabled us the most flexibility to test our hypotheses. While fish sauce served as an ambiguous signal of the food being potentially tainted, we still expected different sensitivities and responses to the signals due to different past experiences.

Several questions were asked as manipulation check for the fish sauce treatment and the division of user and non-user. In response to the question "I ate more chicken than usual", fish sauce group reported a significant decrease (an average difference of 1.8 out of 9-point scale, F=13.64, P=0.00). For "the chicken tastes better than usual", participants in non fish sauce group reported higher rates (F=8.64, P=0.00). More participants in fish sauce group agreed with the statement "the chicken didn't' taste quite right" (F=9.19, P=0.00). For all the questions above, there was no significant difference between users and non-users, which implied our division of group is independent between each other. In order to check the correctness of users and non-users, we further asked questions such as "how many times did you eat carryout from Wings", "how many times did you eat last year at Wings" and "when is the last time you ate at Wings" etc. All the results were consistent with the ones from the original question "how many times did you eat at Wings". Once again, checking the responses to these questions, there was no significant difference due to the fish sauce treatment and the independence was verified.

4.2 Main Results

In order to investigate the impact of past behavior on perception and dissonance feeling, variables were organized as different stages in the cognitive procedure. We started with a group of measures called "*Behavior*", which included the amount of food taken, remaining and eaten and the percentage of the food eaten by each individual. The amount of food eaten was then used as control over the intensity of the behavioral impact, with more food eaten representing stronger behavior. The second group of variables "*Perception*" measured the general feelings, such as how tasty the chicken was, how high the quality was, did the chicken taste right or tainted and the expectation of the last piece eaten, etc. The third group "*Dissonance*" further linked the feelings with potential food safety risk (AI), and measured how individual felt about the risk and their judgments on the related issues. The last group "*Future Behavior*" elicited the participants' willingness to pay (WTP) based on their past eating behaviors and their influenced risk perceptions.

4.2.1 Behavior

Table-2 gave the food choice behavior between groups. On average, people took 150.35 grams of chicken and ate 127.85 grams. For the fish sauce effect, in general, people ate less when the chicken was mixed with fish sauce (F=8.16, P=0.00). This trend could also be found separately in both user group (125.5 vs. 154.75) and the non-user group (87.82 vs. 154.2, F=7.64, P=0.01), even though the difference in the user group is not significant. This finding was consistent with our hypothesis that when the food was a little bit strange, consumers would decrease their

consumption, but would not stop eating it altogether. For the user effect, users ate slightly more than non users (138.04 vs. 118.94). Comparing choices between groups, in the fish sauce group, users took and ate significantly more chicken than the non-users (F=3.48, P=0.07), but in the non fish sauce group, users and non-users were not different from each other significantly (F=0.00, P=0.98). This phenomenon could be explained in this way. Experience did not play much role when the food was normal (as in the non fish sauce group). But as the condition of the food changed (as in the fish sauce group), users had higher tolerance to the conditions of the food due to their past experiences.

4.2.2 Perception

Table-3a listed a few measures of perceptions and their changing patterns with the eating behaviors. Each column represented a perception measure, with individuals' agreement in a 9-point scale. Regressing each of the perception measures on the treatment dummies *fish sauce* and *user*, and behavior variables *chicken eaten*, in addition to the interaction terms between fish sauce and chicken eaten (*fschick*), and user and chicken eaten (*usechick*), table-3a recorded all the estimated parameters for each perception. Based on the results, participants could sense the fish sauce treatment correctly in the first place, but their perceptions were influenced in an opposite way as they ate more chicken. For example, for the statement "the chicken is very tasty" (*chicken2*), people in fish sauce group reported 2.78 points lower than those in the non fish sauce group, but as they ate more chicken, their agreement to this statement was increasing with an additional slope of 0.0157. Similarly, participants behaved the same trend for other statement like "the chicken is of high quality" (*chicken3*), "the chicken is better than typical" (*chicken4*) and "the expectation of the last piece of chicken you ate" (*expect2*), etc. In contrary, for some statement regarding the negative perception of the food, such as "the chicken doesn't taste quite right" (*chicken5*) and "the chicken tastes tainted" (*chicken6*), participants in fish sauce group on average reported a higher agreement in the constant term (3.34 and 2.32 respectively), but an additional lower slope (-0.0156 and -0.0114) implying that the more they ate, the less negatively they rated the food. These findings suggested that people did feel cognitive dissonance and confirmatory bias. On the one hand, eating chicken with fish sauce made them feel that the food was somewhat strange. This raised a dissonance feeling in their mind as oppose to their cognition that they always ate something safe. On the other hand, individuals would have a tendency to reduce the dissonance feeling. The more they ate the more dissonance they felt, the stronger the tendency was. Since people could not change their past eating behavior, the only way feasible for them to reduce the dissonance was to perceive the food in a more favorable way. And this is just what we found in the data.

In table-3b, regressions were run separately for users and non-users. The pattern that had been found in the pooled regression in Table-3a was even stronger for the users. Users reported huge jumps in their perceptions when they were in the fish sauce group, meaning that previous experiences made them being sensitive enough to the change of the food condition. However, they were also subject to stronger cognitive dissonance and confirmatory bias in the sense that as they ate more chicken, they tended to rate the chicken more favorably (with significant

slopes for the interaction term *fschick*). This behavior did not exist for users in the non fish sauce group. A possible explanation is that experiences could help consumers to notice the change of the food, but an ambiguous changing in the food condition also triggered the tendency to interpret the changing as favorably as possible. For the results regarding non-users, compared with users, non-users did not show significant responses to the fish sauce treatment (treatment term *fish sauce* not significant), however, as people ate more, they still performed the same bias as to interpret the signal in a more favorable way. The discussion generated up to this point is whether previous experience could make the consumers better off or worse off. Based on the findings here, experience helped consumers to notice the signals. But the strength of previous experience (the amount of food they had eaten) could also mitigate the sensitivity due to psychological biases in the judgment. Compared with non-users, experienced consumers could recognize the changing in the food status with a higher possibility so long as they had not eaten too much of the food before.

4.2.3 Dissonance

A further investigation of the dissonance measures showed that even though people perceived some objective characteristics of the food in a right way (table-3a & b), they still performed biases when making judgment involving risk. In table-4, the statement "the chicken is partially infected with bird flu" (*because6*) was tested. Similar as before, users still reported a higher rate (1.41) than non users, implying that previous experience enabled them to be more sensitive. But once again, the amount of the food eaten had an opposite effect on the judgment. For each 1 more gram of chicken they ate, the users lowered their level of agreement by 0.008. Given the fact that on average, people ate more than 150 grams, this effect was large enough to offset their original sensitivity (the 1.41 points higher in the constant term). Further, fish sauce treatment had an additional negative effect of 1.43, which means that in fish sauce group, people were even more reluctant to admit the food was partially infected.

Moreover, the amount of food eaten also had significant positive impact on the judgment such as "I didn't believe it (bird flu) would hurt me" (*because7*) and "the food was safe" (*because10*). The statements "I ate chicken because I am hungry" (*because4*) and "I usually eat what's in front of me" (*because5*) could be used as arguments to justify previous eating behaviors to some extent. And for these, the amount of food eaten also had the same effect. The more participants ate, the higher the desire they wanted to justify. Regarding "I ate chicken because it was a study" (*because9*), even though one could observe significant effects, the interpretation could be a bit ambiguous.

4.2.4 Future Behavior

In addition to the perceptions and dissonance feelings, variables regarding future behaviors were also collected. First, participants were asked about their WTP for the whole meal (*limit*). Table-5 showed the results. While fish sauce decreased the users' WTP by $1.88 (close to be significant, t=-1.45), it did not have strong effect for non-users. The amount of food eaten

increased the WTP by the users, but once again had no effect on non-users. Comparing the fish sauce effect (constant term) and the effect of eating amount (marginal effect on the slope term), one could observe that among users, the later effect could overweight the former ones, given that on average, people ate 150 grams chicken. This could reflect a real life case when some food was potentially tainted, due to past eating behaviors, people might still be willing to pay roughly the same amount to purchase. If further, the food was already available at home, consumers would be incapable to correctly interpret the ambiguous signals and stop eating the food that was immediately available.

The participants were also given a chance to trade their $5 payment to a larger amount in gift certificates redeemable for food at Wings over Ithaca, the local processor which offered the food in the experiment. The procedure was that participants first chose whether to trade or not. If yes, they were then asked to pick an integer number that they would be willing to trade ranging from $5 to $20. Then a 16-sided die with sides numbered 5 to 20 was rolled. If the roll was greater than the amount the participant picked, he/she would be given the amount of the roll in gift certificate. If the roll is less than his/her willingness to accept, he/she would still keep the $5 in cash.

General hypothesis would be people chose to trade if they liked the food. Given they chose to trade, people claimed for lower amount in gift certificate if they liked the food more. Moreover, by the design of the game, people would make trade-off between the amount they were willing to accept and the possibility they could win. If a participant valued $1 certificate to be the same as $1 in cash, he/she should claimed for $9, which was the optimal choice considering the trade-off. However, in the experiment, on average, users claimed for about $10.5 and non-users claimed for $13.4, both higher than $9. This implied participants valued $1 in gift certificate less than $1 in cash, which was normal.

44 out of 61 participants chose to trade, among whom 23 were users (with 11 in fish sauce group and 12 in non fish sauce group) and 21 were non users (with 11 in fish sauce group and 10 in non fish sauce group). Pooled regression of willingness amount to trade (*trade1*) in table-5 suggested non-users were more possible to be impacted by the eating behaviors. The more they ate, the higher the amount their willingness to accept was. Users didn't bear the same effect. Using Tobit model with data censored between 5 and 20 gave the same results as OLS regression. Further, the amount of chicken eaten positively impacted the possibility to trade (*trade0*) among non-users. As the participants ate more chicken, it was more likely for them to choose to trade the $5 cash for a larger amount of gift certificate, implying a taste of consistency among consumers, especially when they were new customers. However, given participants chose to trade, non-users tended to claim almost $3 higher than users. Being lack of previous experiences among non-users could be an explanation for this gap.

5. Discussion

This study suggested consumers had a taste of consistency in choosing what to eat and would also be subject to confirmatory bias when making judgments. When facing an ambiguous signal about the food quality, consumers were more likely to neglect the signal and rate the food as more favorable if they ate more. Even though consumers who had previous experience with the food would notice the signal with a higher probability, their judgments were also mitigated by a larger magnitude depending on the amount they ate before. This finding offered an explanation for why consumers were universally irresponsive to the food safety information. Non-users might overlook the food safety issue due to inexperience. But the users could also misperceive the potential risk so as to justify their previous eating behavior and reduce the dissonance feelings in their mind.

A few caveats need to be pointed here. First, we did have significant difference in gender, height and weight across groups. But the main results did not change when the demographics were included in the model.

Second, as shown in table-6, 47.5% of the non-users and 31.25% of the users in the fish sauce group ate all of the chicken, which were slightly lower than the percentage in the non fish sauce group (54% of the participants ate all the chicken). Of all those participating in the experiment, only 2 out of 33 (6%) in the fish sauce group refused to eat any of the chicken they had taken. On the one hand, people decreased eating amount when facing ambiguous signals and the amount decreased depended on their previous experiences. On the other hand, very few would cease to eat the chicken altogether. In terms of policy concern, some existing estimation of the changes in consumption due to food safety issues might be exaggerated in the field. However, given the behavioral pattern found in this study, substantial efforts would be needed to fully eliminate the recalled food.

For the experimental design, since there was no other meat immediately available, participants might have eaten some chicken when they otherwise would have avoided. Future work could address this potential interaction with substitutes by adding more choices.

Moreover, the food served in the study was delivered by a local restaurant just prior to consumption. Thus, the level of consumption might reflect an inherent trust that a food retailer would not provide tainted food due to liability concerns. Even though without the local food processor, participants' eating behaviors might also to some extent reflect their original perceptions regarding the food. Being unable to tease out those effects would yield potentially biased results.

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Table-1: Summary Statistics for All Treatments

Variable	All	fishsauce	non-fishsauce	P-value
Gender (Female=1)	1.525	1.667	1.357	0.015
	(0.50)	0.48	0.49	
Age	19.721	19.727	19.714	0.977
	(1.69)	1.42	2.00	
Height	67.697	66.682	68.893	0.008
	(3.31)	3.10	3.19	
Weight (lbs.)	145.377	139.879	151.857	0.080
	(26.65)	22.42	30.03	
BMI	22.166	22.020	22.338	0.648
	(2.68)	2.37	3.04	
No. obs.	61	28	33	

Table-2: Food Choice Behavior between Groups

Variable	All col0	fs=0 user=0 col1	fs=0 user=1 con2	fs=1 user=0 con3	fs=1 user=1 col4	t(user) fs col4-col3	t(user) nfs col2-col1	t(fs) user col4-col2	t(fs) nuser col3-col1
ChickenTaken	150.350	174.400	165.750	113.118	155.813	1.87	-0.29	-0.36	-2.46
	(73.35)	(84.45)	(68.71)	(49.65)	(77.74)				
Remaining	22.131	20.200	10.154	25.294	30.313	0.35	-1.00	1.62	0.41
	(35.26)	(34.18)	(17.04)	(35.19)	(46.04)				
Eaten	127.850	154.200	154.750	87.824	125.500	1.87	0.02	-1.25	-2.68
	(69.09)	(78.38)	(63.94)	(58.68)	(57.22)				
% Eaten	0.826	0.900	0.943	0.730	0.770	0.35	0.83	-2.20	-1.70
	(0.27)	(0.17)	(0.10)	(0.37)	(0.29)				
No. obs.	61	15	13	17	16				

Table-3a: Impact of Food Choice Behavior on Perception

VARIABLES	chicken1	chicken2	chicken3	chicken4	chicken5	chicken6	expect2
fishsauce	-0.1	-2.777***	-2.750***	-1.962*	3.343***	2.317*	-2.323*
	(-0.0849)	(-2.808)	(-2.715)	(-1.744)	(2.74)	(2.00)	(-1.997)
user	0.00675	1.34	1.005	-0.528	0.414	0.18	-0.722
	(0.01)	(1.30)	(1.01)	(-0.478)	(0.33)	(0.15)	(-0.633)
chickeneaten	0.0105*	-0.00183	-0.00262	-0.00132	0.00461	0.00173	-0.00847
	(1.71)	(-0.363)	(-0.487)	(-0.225)	(0.74)	(0.29)	(-1.414)
fschick	0.0055	0.0157**	0.0159**	0.0111	-0.0156*	-0.0114	0.0136*
	(0.67)	(2.28)	(2.26)	(1.42)	(-1.845)	(-1.424)	(1.70)
userchick	-0.00127	-0.00521	-0.00522	0.00438	-0.00428	-0.00296	0.00604
	(-0.161)	(-0.755)	(-0.761)	(0.58)	(-0.504)	(-0.367)	(0.78)
Constant	4.206***	6.712***	6.077***	5.433***	2.435**	2.597**	5.621***
	(4.14)	(8.02)	(6.94)	(5.60)	(2.36)	(2.65)	(5.66)
Obs.	60	59	59	60	59	59	59

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Chicken1: The chicken looked appealing.

Chicken2: The chicken is tasty.

Chicken3: The chicken is high in quality.

Chicken4: The chicken is better than usual.

Chicken5: The chicken doesn't taste quite right.

Chicken6: The chicken tastes tainted.

Expect2: Your expectation of the last piece you ate?

Table-3b: Impact of Food Choice Behavior on Perception between Group Regressions

	user=1						user=0					
VARIABLES	chicken1	chicken2	chicken3	chicken5	chicken6	expect2	chicken1	chicken2	chicken3	chicken5	chicken6	expect2
fishsauce	-1.405	-4.504***	-4.679***	5.369**	4.163*	-4.821***	0.54	-2.062	-1.717	2.511*	1.557	-0.992
	(-0.613)	(-3.211)	(-3.228)	(2.40)	(2.06)	(-2.862)	(0.43)	(-1.554)	(-1.220)	(1.80)	(1.12)	(-0.634)
chickeaten	0.00551	-0.0111*	-0.0143**	0.005	0.00305	-0.0102	0.0124**	0.000253	0.000763	0.00221	-0.00047	-0.00445
	(0.51)	(-1.865)	(-2.093)	(0.53)	(0.36)	(-1.281)	(2.13)	(0.04)	(0.12)	(0.34)	(-0.0735)	(-0.626)
fschick	0.00999	0.0218**	0.0268***	-0.0224	-0.0178	0.0251**	0.00584	0.0169*	0.0104	-0.0177*	-0.0131	0.00992
	(0.67)	(2.37)	(2.83)	(-1.524)	(-1.344)	(2.28)	(0.63)	(1.72)	(0.99)	(-1.713)	(-1.267)	(0.86)
Constant	5.147***	9.133***	8.298***	1.559	1.611	6.576***	3.623***	6.028***	5.385***	3.259***	3.340***	4.620***
	(2.86)	(9.23)	(7.29)	(0.99)	(1.13)	(4.97)	(3.63)	(5.71)	(4.80)	(2.94)	(3.01)	(3.78)
Obs.	28	27	28	27	27	28	32	32	31	32	32	31

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Chicken1: The chicken looked appealing.

Chicken2: The chicken is tasty.

Chicken3: The chicken is high in quality.

Chicken4: The chicken is better than usual.

Chicken5: The chicken doesn't taste quite right.

Chicken6: The chicken tastes tainted.

Expect2: Your expectation of the last piece you ate?

Table-4: Impact of Food Choice Behavior on Dissonance

VARIABLES	All birdflu6	All because9	fishsauce=0 because9	fishsauce=1 because9	All because4	user=0 because4	user=1 because4	All because5	user=0 because5	user=1 because5	All because7	All because10
fishsauce	-1.426**	1.168			2.029**	1.898*	2.352	0.628	1.024	-0.12	-0.0315	-0.276
	(-2.007)	(1.14)			(2.13)	(1.74)	(1.25)	(0.45)	(0.70)	(-0.0416)	(-0.0999)	(-0.537)
user	1.409**	2.010*	2.500*	0.764	-0.596			2.351				
	(2.02)	(1.87)	(1.90)	(0.45)	(-0.599)			(1.58)				
chickeaten	-0.00359	0.00678	0.00891*	-0.0109	0.0125**	0.0121**	0.0204**	0.0164**	0.0181**	-0.0048	0.00423*	0.00652*
	(-0.970)	(1.29)	(1.95)	(-1.353)	(2.58)	(2.41)	(2.57)	(2.30)	(2.66)	(-0.399)	(1.81)	(1.68)
fschick	0.00759	-0.0106			-0.00603	-0.00662	-0.00691	-0.00371	-0.0142	0.00713		
	(1.54)	(-1.486)			(-0.913)	(-0.819)	(-0.562)	(-0.383)	(-1.307)	(0.38)		
userchick	-0.00805*	-0.00961	-0.0158*	0.005	0.00718			-0.0180*				
	(-1.687)	(-1.340)	(-2.020)	(0.38)	(1.08)			(-1.830)				
Constant	2.112***	6.349***	6.226***	7.953***	4.653***	4.793***	3.842***	3.738***	3.816***	6.159***	7.568***	6.594***
	(3.45)	(7.29)	(7.93)	(9.47)	(5.78)	(5.53)	(2.90)	(3.15)	(3.27)	(3.08)	(17.88)	(9.57)
Obs.	60	59	27	32	59	32	27	58	32	26	59	58

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Birdflu6: The chicken is partially infected with bird flu.

Because4: I ate chicken because I am hungry.

Because5: I usually eat what's in front of me.

Because7: I didn't think it (bird flu) would hurt me.

Because9: I ate chicken because it was a study.

Because10: I ate chicken becauce it was safe.

Table-5: Impact of Signal vs Experience on Future Behavior

VARIABLES	All limit	user=1 limit	user=0 limit	fishsauce=1 limit	fishsauce=0 limit	All trade1	All trade0	user=1 trade0	user=0 trade0	If Trade trade1	If Trade trade1
fishsauce	-0.308	-1.878	1.281			-0.478					
	(-0.253)	(-1.450)	(0.64)			(-0.257)					
user	-1.588			0.0213	-1.234	3.792				-2.517*	-2.981**
	(-0.627)			(0.01)	(-0.250)	(0.97)				(-1.832)	(-2.160)
chickeaten	0.0143	0.0209*	0.0191	0.0365**	0.00798	0.0335*	0.00172**	0.000703	0.00236**	-0.00848	
	(1.30)	(1.95)	(1.42)	(2.30)	(0.47)	(1.86)	(2.07)	(0.48)	(2.32)	(-0.847)	
usechick	0.00973			-0.0195	0.0173	-0.0463*					
	(0.56)			(-0.848)	(0.59)	(-1.701)					
Constant	4.479**	4.223**	3.068	2.824*	4.782	5.961**	0.496***	0.617***	0.438***	14.52***	13.41***
	(2.47)	(2.21)	(1.25)	(1.71)	(1.62)	(2.11)	(4.11)	(2.78)	(3.07)	(8.99)	(13.91)
Obs.	60	28	32	33	27	59	60	28	32	42	43

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Limit: The maximum amount of money you are willing to pay for the meal

Trade1: The amount you would be willing to trade in gift certificate ($5-$20)

Trade0: 1 if the particiant chose to trade; 0 otherwise.

Table-6: Distribution of Participants Consuming All, Some or None of the Chicken by Groups

Chicken Consumed	fishsauce=0 user=0	fishsauce=0 user=1	fishsauce=1 user=0	fishsauce=1 user=1
All	8 (54%)	7 (54%)	8 (47.5%)	5 (31.25%)
Some	7 (47%)	6 (46%)	8 (47.5%)	10 (62.5%)
None	0 -	0 -	1 (6%)	1 (6.25%)
Obs.	15	13	17	16