FOOD PERCEPTION BIAS: BODY MASS INDEX AND SNACKING BEHAVIORS

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By

Bliss Wilson

San Marcos, Texas

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FOOD PERCEPTION BIAS: BODY MASS INDEX AND SNACKING BEHAVIORS

Approved:

Dr. Heather C. Galloway
Director, University Honors Program

Approved:

Dr. Harvey Ginsburg
Department of Psychology
Supervising Professor

Dr. Roque Mendez
Department of Psychology
Second Reader

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Bliss Wilson

Texas State University – San Marcos

Abstract

It is possible that overweight people have greater perceptual biases of food and drink than people of healthy weight and has been suggested that current diet may affect dietary memories. I hypothesized that (1) there would be a significant negative correlation between participants' body mass index and accuracy of perception of cheese puff amounts, (2) participants’ estimates of food amounts would be significantly more accurate when the cheese puffs were visually present compared to participants’ estimates when the cheese puff containers were occluded from view, and (3) participants’ estimates would be significantly more accurate for containers having fewer, large cheese puffs compared to participants’ accuracy estimates for containers having more, smaller cheese puffs. After surveying 51 Texas State University undergraduate psychology majors, using 10 identically cylindrical, clear, glass containers of identical weight displaying varying amounts of large cheese puffs and small cheese puffs, it was found that BMI was unrelated to accuracy of cheese puff estimates, the manipulation had no effect on the accuracy of estimates, and overall, amounts of large cheese puffs were estimated more accurately than small cheese puffs.

Food Perception Bias: Body Mass Index and Snacking Behaviors

There are a variety of perceptual factors that play a role in how much we eat. Kral's review (2005) indicated that large portion sizes elicit greater consumption than when the portion size is smaller. In a 2004 study by Kral, participants self-reported they were served larger-than-usual portions, but subjects still continued to eat more than normal, which suggests that being able to decipher food amounts does not lead to an appropriate adjustment in amount consumed (Kral, 2005). When shown two equal amounts of food were presented to appear as unequal amounts, young adults were able to verbally identify that the food amounts were in fact equal, but they preferred to consume the amount that appeared to be greater (Singer & Kornfield, 1973). This discrepancy may be a factor in the food choices of normal and overweight or obese individuals.

Further research by Geier, Rozin, and Doros (2006) examined the consumption of different sized snacks placed in a bowl that were free for any passer-by to grab. People were exposed to alternating small and large amounts of M&Ms, pretzels (whole or halved), and Tootsie Rolls. The results were significant; when a greater number of units of food were present there was greater consumption. An analysis of multiple food studies considered how visibility of food may affect consumption. One study showed that snacks placed in a clear jar were eaten 46% faster than the snacks in a near-by opaque jar. The mere sight of food can stimulate hunger, which could then influence our perception of the portion size (Wansink, 2004). This again illustrates that when a portion appears greater, greater consumption will occur.

The shape of the container also has an influence on food perception. In a study done by Wansink & Van Ittersum (2003), experienced bartenders were asked to pour an unmeasured 1.5 ounces of a drink into different sized glasses. On average, the bartenders over-estimated when pouring into short, wide glasses by over 27% than when pouring into a taller, slimmer glass. Additionally, Wasnik, & Van Ittersum 2003 had adults pour their own serving of juice in either a short, wide glass or a tall, thin glass. They consumed significantly more juice when poured into a short, wide glass than a tall, thin glass although the participants believed the opposite to be true. Those who poured into a short, wide glass perceived themselves to have poured less than those who poured into a tall, thin glass. Although 98% of participants finished their glass of juice, those given short, wide glasses poured and consumed significantly more. The container size and shape can influences perceptions and consumption of food serving sizes.

Hunger can also affect one's perception of portion size. Beasley, Hackett, Maxwell, and Stevenson (2004) measured the effect of the level of satiation on participants' estimates of normal portion size. Satiated and non-satiated subjects were shown photographs of two different portion sizes and asked which amount they would rather eat. They found that subjects with greater hunger were more prone to choosing larger-than-normal portion sizes. Significant differences were found in 4 out of the 6 foods that they tested.

In a single-blind study consisting of only female participants, subjects were classified as either on a low-fat diet (maintaining below 25 percent calories from fat) or on a normal or high-fat diet (consuming at or above 35 percent calories from fat). Participants were presented with eight different types of snack foods and allowed to consume as much as would be desired. The women were then telephoned approximately 24 hours later and asked what foods and how much of each they had consumed the previous day. Those maintaining a low-fat diet recalled fewer of the foods (particularly the low-fat foods) but when reminded which food items were consumed, they recalled the quantity consumed more accurately than those maintaining high-fat diets. Participants were found to generally underestimate food amounts consumed (especially those on high-fat diets) and also reported greater liking for the foods which they accurately recalled. And as the quantity of food items consumed increased, so did the discrepancy between the amount reported and the amount actually consumed (Fries, Green, Bowen, 1995).

Today there are seemingly unlimited, inexpensive, tasty, high-calorie foods available for consumption and due to advances in technology and transportations, low levels of physical energy are required to obtain these foods. This change in lifestyle has developed only in recent decades and is not something for which our bodies are prepared. Evolutionary developments assist humans in defending against weight loss but not weight gain, and it is unlikely that there will be any improvements in environmental influences that encourage greater physical activity and decrease amount of caloric intake anytime soon (Hill & Peters, 1998). According to the U.S. Department of Health and Human Services (2007) 66% of American adults are overweight (body mass index (BMI) ≥ 25 lb/in^2) and 31.4% are obese (BMI ≥ 30 lb/in^2). A better understanding of food perceptual biases is needed to address this epidemic. It is possible that overweight people have greater perceptual biases of food and drink than people of healthy weight and has been suggested that current diet may affect dietary memories.

Hypotheses were based on findings that suggest women on low-fat diets estimated food unit amounts more accurately than those on high-fat diets, that people consumed more snack food when more was visually present, and that estimates of food units consumed became less accurate as the quantity consumed increased (Fries et al., 1995; Geier et al., 2006). The hypotheses were that (1) there would be a significant negative correlation between participants' body mass index and accuracy of perception of cheese puff amounts; (2) participants' estimates of food amounts would be significantly more accurate when the cheese puffs were visually present compared to participants' estimates when the cheese puff containers were occluded from view; and (3) participants' estimates would be significantly more accurate for containers having fewer, large cheese puffs compared to participants' accuracy estimates for containers having more, smaller cheese puffs.

Methods

Subjects

Participants included 51 Texas State University undergraduate psychology majors enrolled in two sections of a research methods psychology course, who completed the study as part of an optional class assignment. Ages varied from 18-26, with the mean at 21 years old. There were 35 female and 16 male participants, all of whom were assigned identification numbers, to ensure their anonymity.

Materials

The first 10 survey items (Part A) were self-reported and addressed participants' believed weight, height, and snacking preferences. Further questions (Part B) asked by the administrator concerning perceptions of cheese puff amounts and consumption preferences can be found in the Appendix.

To ensure that results based on perceptions of cheese puffs were not based on one specific permutation of comparisons presented, ten identically cylindrical, clear, glass containers (17 cm tall and 9.5 cm in diameter) of identical weight were used to display varying amounts of large cheese puffs (~7.76 cm circumference) and small cheese puffs

(~4.56 cm circumference). There were 5 conditions of cheese puff comparisons with varying sizes and varying percentages filled of the container:

(A) 1. 59 large cheese puffs filled to 35%

2. 181 small cheese puffs filled to 68%

(B) 3. 38 large cheese puffs filled to 65%

4. 358 small cheese puffs filled to 35%

(C) 5. 224 small cheese puffs filled to 35%

6. 38 large cheese puffs filled to 35%

(D) 7. 220 small cheese puffs filled to 35%

8. 338 small cheese puffs filled to 65%

(E) 9. 36 large cheese puffs filled to 38%

10. 60 large cheese puffs filled to 68%

Also used were 5, 3-ring, solid white binders to occlude the cheese puffs from sight for 25 of the participants. A medical scale was used to determine participants' height and weight.

Procedure

In a single-blind study, 51 students were first given a 10-question survey about participants' self-reported weight, height, and snacking preferences (Part A). Immediately after filling out the survey, half of the class was taken to complete the experiment. The first half completed the survey during one class meeting, and the second half completed the survey during the next class meeting. First, participants were taken in a private room and measured for their height and weight in order to calculate their body mass index (BMI = (Weight in pounds/(Height in inches x Height in inches)) x 703). Those with a body mass index of 18.5 to 24.9 were considered optimal and 25 and above were considered overweight.

Next, participants were taken to another area one at a time and given oral directions by the experimenter to examine two containers from either condition a, b, c, d, or e for 30 seconds. Participants' beginning conditions were counterbalanced so each began at a different station and continued in alphabetical order until all five stations were visited. After the 30 seconds were up, the cheese puffs were occluded from sight for 30 random participants by standing up a binder between the participant and the puffs or kept in front of the participants based on random assignment. If the binder was not used as a visual barrier, it was placed behind the cheese puffs as a background to provide a control. The experimenter read the students 8 to 9 questions (Part B) at each condition regarding their preferences and perceptions of cheese puff amounts. Questions included which of the two containers of cheese puffs participants would prefer as a snack, which they would consume more of, which weighs more, estimates in ounces of the weight of each sample of cheese puffs, and estimates of amounts of cheese puffs in each. Difference scores were calculated by subtracting estimations of cheese puff amounts from actual cheese puff amounts to determine accuracy of each participant's estimates for each of the five conditions. A constant of 1000 was added to the difference scores to account for overestimates, resulting in negative difference scores.

Results

To determine whether there was a negative correlation between participants' body mass index and the accuracy of estimating food amounts (hypothesis 1), Pearson correlation coefficients were calculated. Results were not significant ($p > .001$) for any of the 10 containers of cheese puffs (Table 2); there was no relationship between BMI and accuracy of amount estimates.

To determine whether estimates of food quantity were significantly more accurate when cheese puffs were visually present compared to participants' estimates when the cheese puff containers were occluded from view (hypothesis 2), a one-way *MANOVA* was performed on difference scores of amounts of cheese puffs. Results were not significant ($p > .001$) for any of the 10 presentations of cheese puffs (Figures 1 and 2). Because viewing time had no bearing on participants' estimates of cheese puffs, scores were aggregated for further data analyses.

A one-way *ANOVA* was performed to determine whether participants' estimates were significantly more accurate when containers having fewer, large cheese puffs compared to participants' accuracy estimates for containers having more, smaller cheese puffs (hypothesis 3). Results were statistically significant for the overall difference between the sum of difference scores of large puffs and sum of difference scores of small puffs, $F(9,50) = 217.444$, $p > .001$ as well as individual containers (Table 3). Post-hoc repeated-measures t-tests on the five paired-comparisons were all statistically significant with alpha set at > .001. The differences in cheese puff number estimates were in fact due to the size and number of the cheese puff and not the volume filled. As displayed in figures 4 and 6, one can see that mean difference scores of all containers of large puffs were more accurate than mean difference scores all containers of small puffs (with 1000 being a perfect difference score). Mean difference scores based on volume appear to be random with some estimates being close to accurate and some not.

BMI was not related with participants' self-reported consumption of a favorite snack food: estimated ounces consumed in one sitting $M = 6.824$, $SD = 13.756$, $r = .004$, $p = .489$, estimated calories consumed in one sitting $M = 314.80$, $SD = 218.707$, $r = .029$, $p = .421$, and estimated frequency consumed per week $M = 5.14$, $SD = 4.968$, $r = -.032$, $p = .412$.

Discussion

The findings of this study suggest that there is no relationship between BMI and accuracy of food amount estimates. The national increase in BMI can be attributed to lack of physical activity, and an increase in energy consumption from sodas, junk food, snacking, and increased portion size. Increased consumption of junk food (fast food, sodas, and snack foods) is especially contributing to the epidemic among children and adolescents **(**Morrill & Chinn, 2004). A potential problem with this study is that BMI is a questionable measure of categorizing people as overweight and obese. BMI only considers an individual's height and weight and does not incorporate muscle mass into determining whether a person is considered to be healthy. Researchers studying relationships involving body mass should measure body fat percentage instead of height and weight alone.

Further research would be needed to unequivocally demonstrate that a difference in perception is what causes some people to overeat, leading to higher a BMI. However, it is still unknown if the two variables, BMI and accuracy of estimates, are related. While the current study does not support any correlation, past research has suggested that participants on low-fat diets provided more accurate estimates of food quantity consumed. Those on high-fat diets were more likely to under-report quantities of food consumed (Fries et al., 2005). It is unknown if being on a low-fat diet causes one to become better at estimating food amounts or if better estimating food amounts causes one to consume less or if a third variable is mediating the relationship. Maybe a perceptual difference lies in estimates of previously consumed food throughout the day, causing individuals who underestimate how much food they have consumed in a day to overeat due to this perceptual bias.

In a case study with two amnesic patients who had almost no explicit memory for events that occurred after a minute, on three occasions, both ate a second lunch when it was presented to them only 10 to 30 minutes after their first. And they would usually begin to consume a third lunch when it was presented 10 to 30 minutes after the second, suggesting that memory plays a substantial role in beginning and ending a meal (Rozin, Dow, Moscovitch, & Rajaram, 1998). Perhaps individuals with high BMI's underestimate the amounts of food they have consumed throughout the day, causing them to overeat because they don't believe they have consumed as much food as they actually have. If memory plays a more important role than appetite, perhaps memory and perception of food amounts is contributing to overconsumption of food. In fact, Schachter's Internal-External Hypothesis suggests that healthy weight people eat in response to internal cues such as hunger, and overweight people eat in response to external cues such as time of day and sight of food or other people eating food, ignoring their actual level of satiety (Gilbert, 1986).

Estimates of food quantity were not found to be more accurate when cheese puffs were visually present compared to participants' estimates when the cheese puff containers were occluded from view. It is likely that there was no difference in perception of cheese puff amounts between participants assigned to occluded and visual conditions because after viewing the first pair of cheese puffs, participants occluded from view took advantage of the 30 seconds of viewing time by approximating amount before the cheese puffs were occluded. In 2008 participants only viewed one pair of containers of cheese puffs and was truly a single-blind study. Participants in 2009 could easily anticipate the questions that were going to be asked after their first estimates, thus attempting to count during subsequent 30-second viewing periods before they were occluded.

Food quantity estimates were significantly more accurate when containers having fewer, large cheese puffs were compared to participants' accuracy estimates for containers having more, smaller cheese puffs. This finding is consistent with past literature. Women who consumed a variety of snack foods and were then asked the following day how much of each food item they had consumed, were found to be worse at estimating food quantity consumed as the quantity increased (Fries et al., 1995). It seems that regardless of whether the food was actually consumed, it is more difficult to estimate larger quantities of food. Small cheese puffs allowed more to fit in one container, increasing the absolute number of small cheese puffs compared to large, resulting in poorer estimates.

There are problems with this study that may challenge the generalizability of these results to other foods and populations. Fifty nine percent of participants were categorized as having a healthy BMI, leaving overweight and obese individuals under represented in this study. The national average of the population with a healthy BMI is less than thirty four percent. Therefore, restricted range of BMI may have influenced results. All participants were also in their 20's and attend Texas State University, further limiting the generalizability of these results to other populations. Additionally, self-reported snacking behaviors could be a confounding variable in this study because self-reports can never be considered completely accurate. Ideally, researchers should directly observe snacking behaviors or have participants keep food journals to keep track of the food they consume. However, the non-significant correlation of BMI to self-reported snacking beahviors of this study is not consistent with the results from identical weight-height measurements and snacking questions found in a previous study we performed (Wilson et al., 2008). The troubling fact is that that BMI is an unreliable predictor of self-reported snacking behaviors within the same laboratory and researchers.

Future studies could investigate differences in perceptions of food amounts compared to perceptions of non-food amounts. Researchers could also study how differences of perceptions of food amounts or appetitive behaviors relate to consumption of those foods. Previous research has demonstrated that when a greater number of units of food were present there was greater consumption. When a bowl of snack food contained more items, individuals consumed more than when it contained fewer items (Geier et al., 2006). It is important to learn how appetitive behaviors, e.g. perceptions of foods, are specifically related to planned and spontaneous consummative eating behaviors. Approaching the obesity epidemic by further understanding the food perception may prove valuable. To date, there is a relative dearth of basic information about perceptual food quantity biases that could potentially benefit individuals suffering from obesity.

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Table 1

Mean and Standard Deviation of Difference Scores (actual number – estimated number + 1000) of Cheese Puff Estimates for Each Container

Container	*M*	*SD*
1	1105.88	48.569
2	1017.94	15.741
3	1217.90	110.279
4	1003.25	37.081
5	1161.90	51.410
6	1011.78	7.374
7	1145.94	48.673
8	1231.80	91.055
9	1011.24	6.253
10	1013.90	11.569

Table 2

Pearson Correlation of BMI and Difference Scores (actual number – estimated number + 1000) of Cheese Puff Estimates for Each Container (Hypothesis 1)

Container	*r*	*p*
1	.061	.673
2	.014	.924
3	-.048	.738
4	-.024	.868
5	-.018	.899
6	-.036	.799
7	-.077	.590
8	-.068	.633
9	-.089	.536
10	-.183	.199

Table 3

Significant Post-hoc Paired-Comparisons Difference Scores, p > .001 (Hypothesis 3). Accuracy of Estimates of Quantity of Cheese Puffs Was Significantly Different for the Following Comparisons: (Small puffs (S) and Large puffs (L))

Paired Comparisons	
1 (S)	2 (S), 3(S), 4 (S), 5 (S), 6 (L), 7 (S), 9(L) ,10 (L)
2 (L)	1 (S), 3 (S), 7 (S), 8 (S)
3 (S)	1 (S), 2 (L), 4 (L), 5 (S), 6 (L), 7 (S), 9 (L), 10 (L)
4 (L)	1 (S), 3 (S), 7 (S)
5 (S)	1 (S), 3 (S), 7 (S), 9 (L), 10 (L)
6 (L)	1 (S), 3 (S), 7 (S), 8 (S)
7 (S)	1 (S), 2 (L), 3 (S), 4 (L), 5 (S), 6 (L), 8 (S), 9 (L), 10 (L)
8 (S)	2 (L), 6 (L), 7 (S), 9 (L), 10 (L)
9 (L)	1 (S), 3 (S), 5 (S), 7 (S), 8 (S)
10 (L)	1 (S), 3 (S), 5 (S), 7 (S), 8 (S)

Figure Caption

Figure 1. Average of mean difference scores of cheese puff estimates of all containers based on occluded and visual assignment with 1000 being a perfect difference score. All difference scores for all containers were averaged and separated based on whether participants were occluded from view while estimating the quantity of cheese puffs or whether they remained in sight while estimating the quantity of cheese puffs. The farther from 1000 the difference scores deviate, the less accurate the estimate.

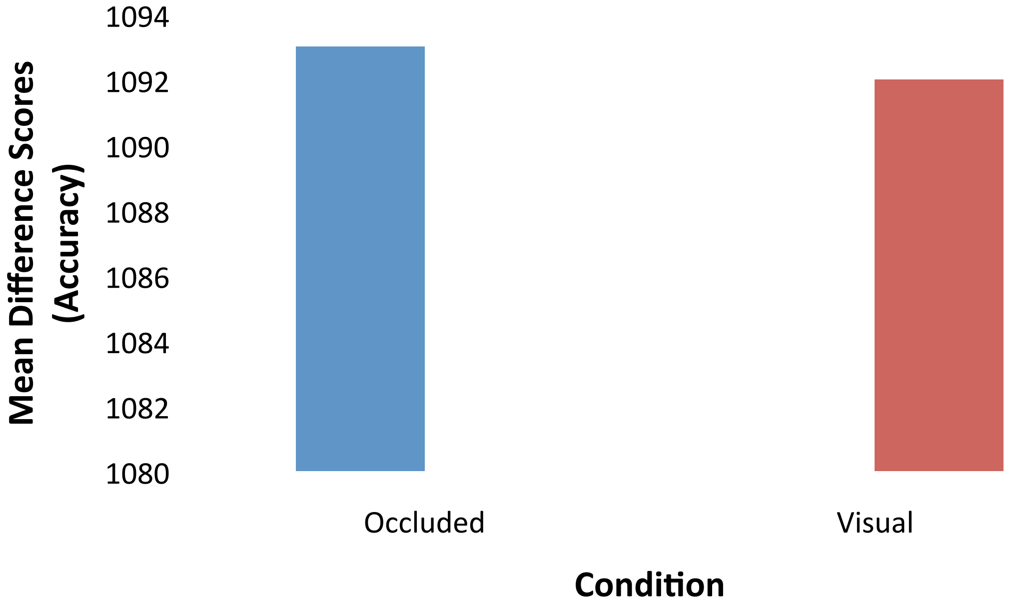
Figure 2. Mean difference scores of cheese puff estimates based on occluded and visual assignment. Difference scores were calculated per container based on whether participants were occluded from view while estimating the quantity of cheese puffs or whether they remained in sight while estimating the quantity of cheese puffs. The farther from 1000 the difference scores deviate, the less accurate the estimate.

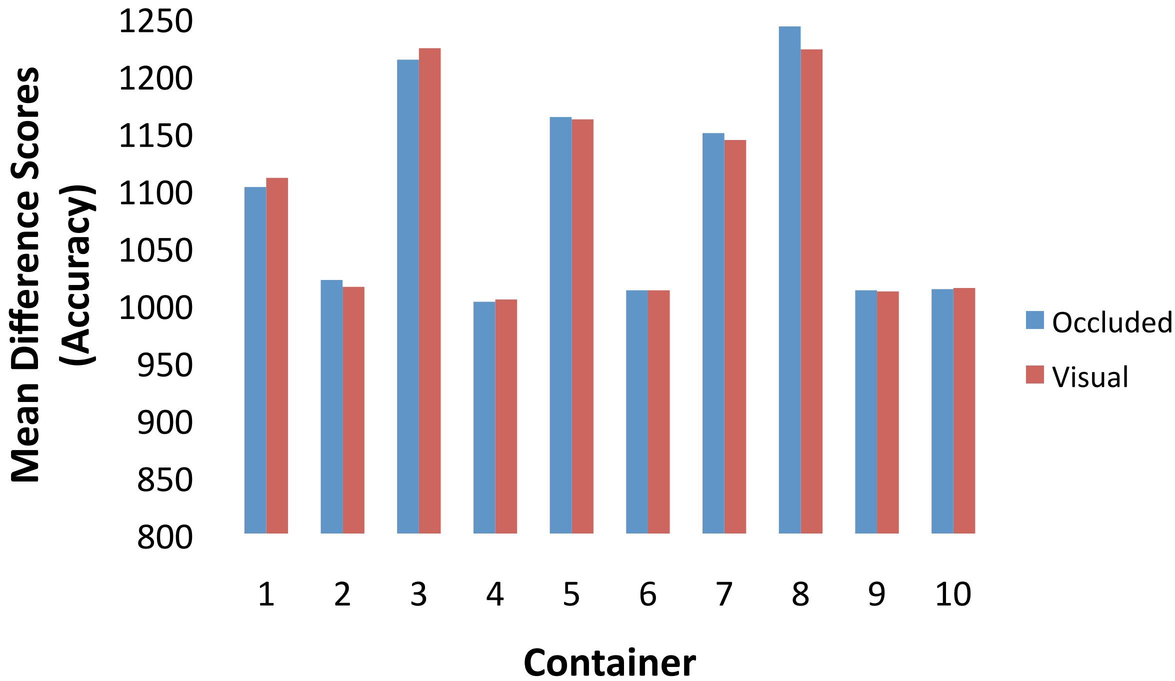
Figure 3. Average of mean difference scores of cheese puff estimates for all containers based on puff size. All difference scores for all participants were averaged and separated based on whether the visual stimuli consisted of large cheese puffs or small cheese puffs. The farther from 1000 the difference scores deviate, the less accurate the estimate.

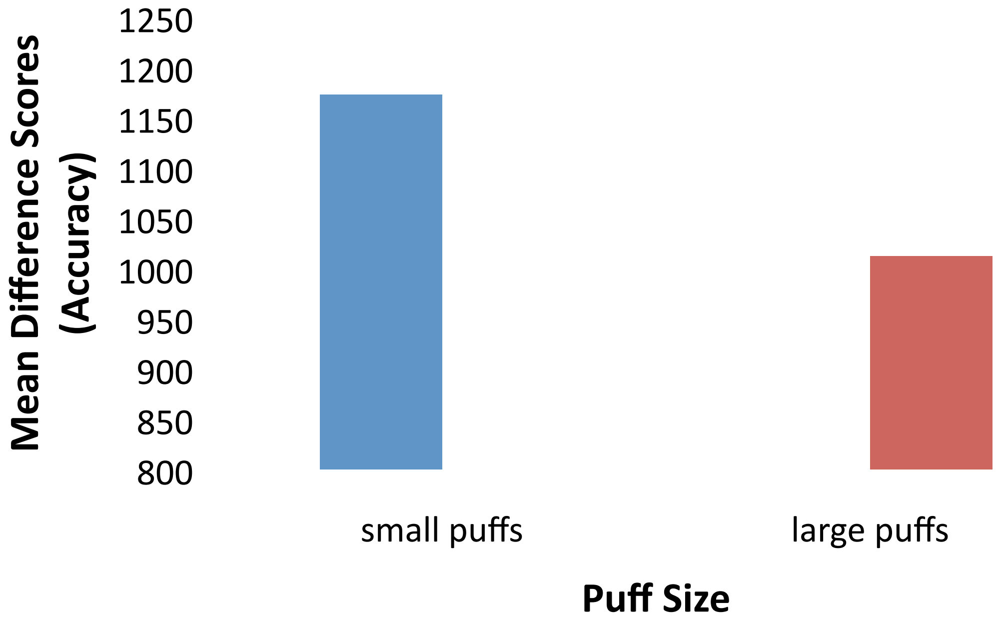
Figure 4. Mean difference scores of cheese puff estimates for containers based on puff size. Difference scores for all participants were calculated per container and coded based on whether the visual stimuli consisted of large cheese puffs or small cheese puffs. The farther from 1000 the difference scores deviate, the less accurate the estimate.

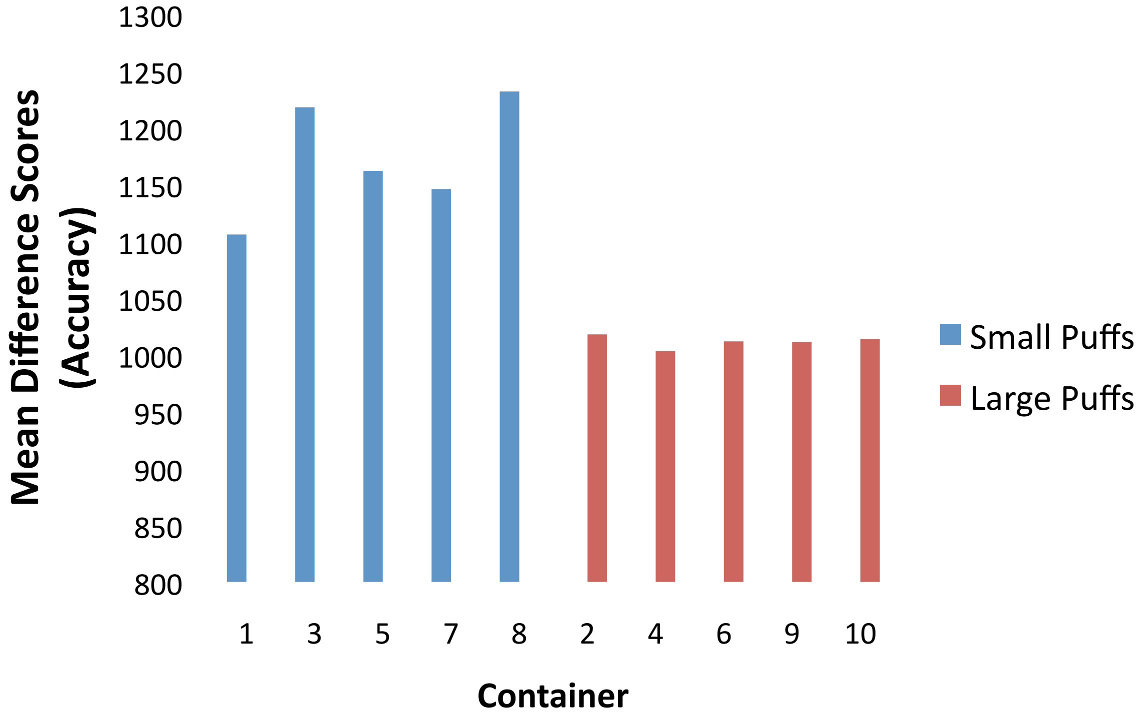
Figure 5. Average of mean difference scores of cheese puff estimates for all containers based on volume. All difference scores for all participants were averaged and separated based on whether the visual stimuli consisted of a relatively low volume or high volume of cheese puffs. The farther from 1000 the difference scores deviate, the less accurate the estimate.

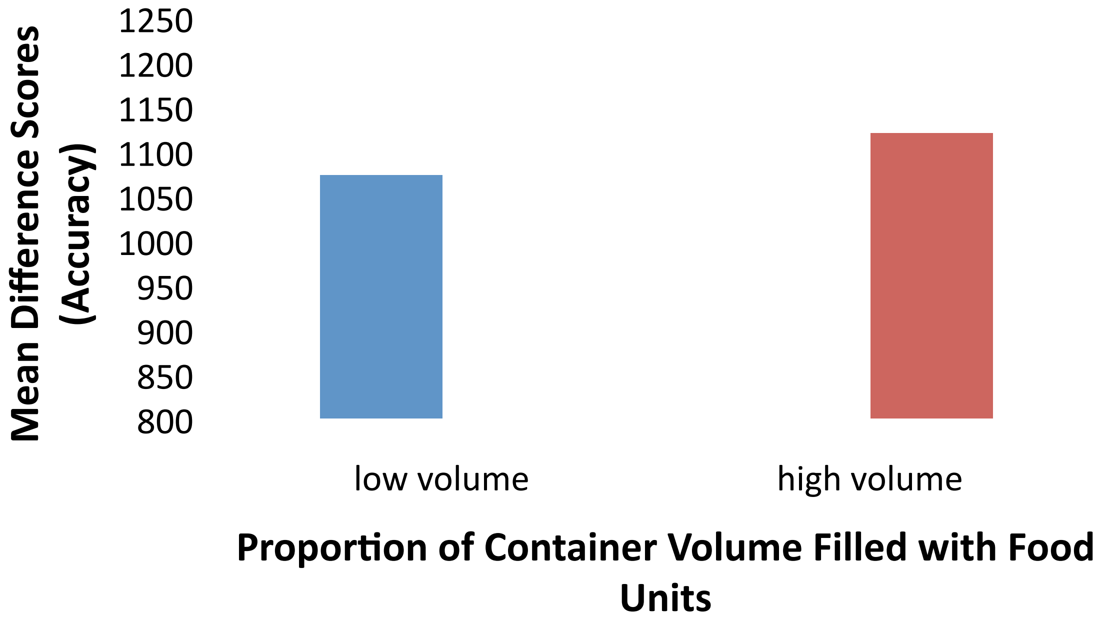
Figure 6. Mean difference scores of cheese puff estimates for containers based on volume. Difference scores for all participants were calculated per container and coded based on whether the visual stimuli consisted of a relatively low volume or high volume of cheese puffs. The farther from 1000 the difference scores deviate, the less accurate the estimate.

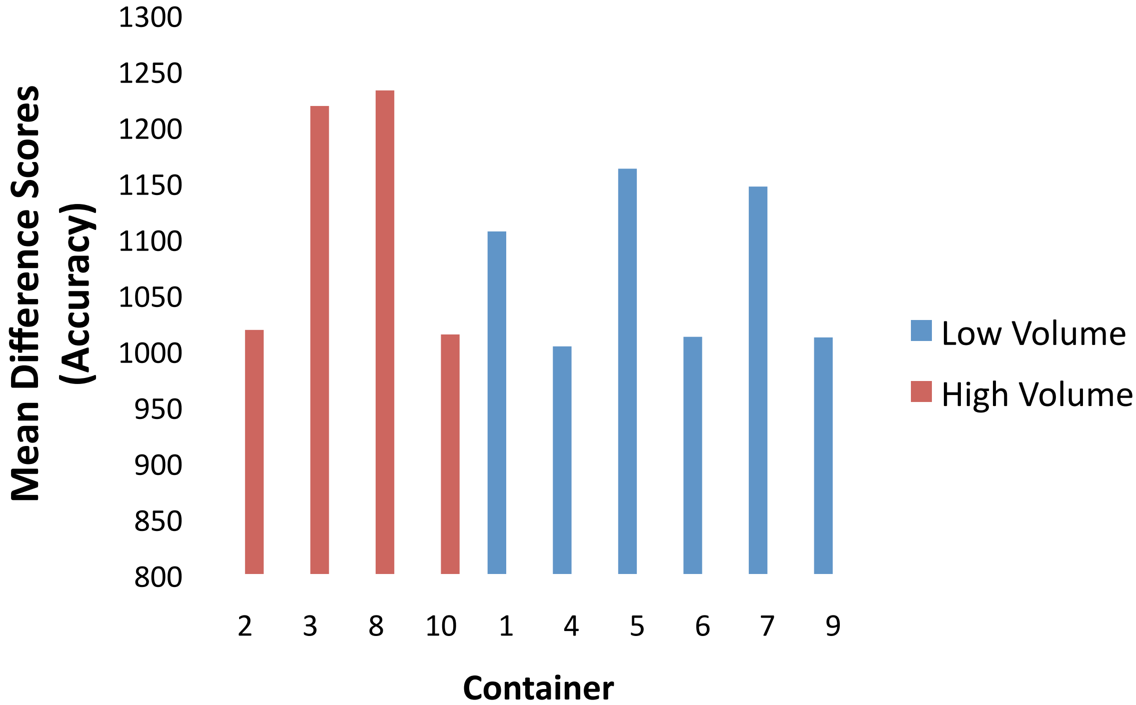

1094
1092
1090
1088
1086
1084
1082
1080
Mean Difference Scores (Accuracy)
Occluded
Visual
Condition


Mean Difference Scores (Accuracy)
1250
1200
1150
1100
1050
1000
950
900
850
800
1
2
3
4
5
6
7
8
9
10
Container
Occluded
Visual


Mean Difference Scores (Accuracy)
1250
1200
1150
1100
1050
1000
950
900
850
800
small puffs
large puffs
Puff Size


1300
1250
1200
1150
1100
1050
1000
950
900
850
800
Mean Difference Scores (Accuracy)
1
3
5
7
8
2
4
6
9
10
Container
Small Puffs
Large Puffs


Mean Difference Scores (Accuracy)
1250
1200
1150
1100
1050
1000
950
900
850
800
low volume
high volume
Proportion of Container Volume Filled with Food Units


1300
1250
1200
1150
1100
1050
1000
950
900
850
800
Mean Difference Scores (Accuracy)
2
3
8
10
1
4
5
6
7
9
Container
Low Volume
High Volume

Appendix

#_____ Part A. Biographic Information, Food Perception Data Sheet

Health Status: Do you feel that you have any medical or psychological problems that may preclude your participation in this research (e.g., estimating the quantity of cheese puffs in containers and being weighed and measured in a private room with only an experimenter present)? If yes, you may still obtain full credit by completing a written assignment on perceptual aspects of food preferences.

_____ YES, I do have a condition that I feel would preclude my research participation.

____ NO, I do not have a condition that I feel would preclude my research participation.

1. Age: _____

2. Circle One - Sex: (1) female (2) male

3. Estimate your weight (in pounds): _______

4. Estimate your height: ____ ft. ____ in.

5. Do you currently desire to lose, maintain or gain weight? (check one.)

1. Lose _____ 2. Maintain ____ 3. Gain ____

6. If you desire to gain or lose weight, about how many pounds?

1. Lose pounds _____

2. Gain pounds _____

7. Starting with your favorite, list 3 foods you are most likely to eat when you snack:

1. _______________________

2. _______________________

3. _______________________

8. Estimate in ounces how much of your favorite snack (1 above) you typically might eat in one sitting. ________ (amount in ounces)

9. Estimate how many calories you typically consume at one sitting when you eat your favorite snack ________ (amount in calories)

10. Estimate how frequently you eat your favorite snack in a one week (7 days). _________ (times per week)

PARTICIPANTS STOP. Congratulations. You have completed the first part of the study. DO NOT TURN THE PAGE. TURN BACK TO PAGE 1.
WAIT FOR FURTHER INSTRUCTIONS!

Measurements:

11. Height__________

12. Weight __________

13. BMI __________

Condition A

#_____Part B - To be read to participants and completed by examiners:

Look at these 2 containers. Suppose that these are your favorite snacks and they are made of identical ingredients by the same manufacturer. Except for the size, everything is the same, including the containers. The only thing that differs is the snack size. (allow 30 seconds of examination).

14. Suppose that if these represented your favorite snack and if you had to choose one, point to the one would you prefer as a snack?

1. ___ small puffs 2. ___ large puffs

15. Why would you prefer that one?

____

____

16. Would you consume more or less of the one you selected, compared to the other?

1. ____ less 2. ____ more

17. Why?

____

____

18. Estimate which of these 2 weighs more.

1. _____ small puffs 2. _____ large puffs

19. Estimate in ounces how much the container of small puffs weighs ______

20. Estimate in ounces how much the container of large puffs weighs ______

Estimate how many numbers of cheese puffs are in each container.

21. ____ container with small ones 22. _____ container with large ones

Condition B

#_____Part B - To be read to participants and completed by examiners:

Look at these 2 containers. Suppose that these are your favorite snacks and they are made of identical ingredients by the same manufacturer. Except for the size, everything is the same, including the containers. The only thing that differs is the snack size. (allow 30 seconds of examination).

23. Suppose that if these represented your favorite snack and if you had to choose one, point to the one would you prefer as a snack?

1. ___ small puffs 2. ___ large puffs

24. Why would you prefer that one?

____

____

25. Would you consume more or less of the one you selected, compared to the other?

1. ____ less 2. ____ more

26. Why?

____

____

27. Estimate which of these 2 weighs more.

1. _____ small puffs 2. _____ large puffs

28. Estimate in ounces how much the container of small puffs weighs ______

29. Estimate in ounces how much the container of large puffs weighs ______

Estimate how many numbers of cheese puffs are in each container.

30. ____ container with small ones 31. _____ container with large ones

Condition C

#_____Part B - To be read to participants and completed by examiners:

Look at these 2 containers. Suppose that these are your favorite snacks and they are made of identical ingredients by the same manufacturer. Except for the size, everything is the same, including the containers. The only thing that differs is the snack size. (allow 30 seconds of examination).

32. Suppose that if these represented your favorite snack and if you had to choose one, point to the one would you prefer as a snack?

1. ___ small puffs 2. ___ large puffs

33. Why would you prefer that one?

____

____

34. Would you consume more or less of the one you selected, compared to the other?

1. ____ less 2. ____ more

35. Why?

____

____

36. Estimate which of these 2 weighs more.

1. _____ small puffs 2. _____ large puffs

37. Estimate in ounces how much the container of small puffs weighs ______

38. Estimate in ounces how much the container of large puffs weighs ______

Estimate how many numbers of cheese puffs are in each container.

39. ____ container with small ones 40. _____ container with large ones

Condition D

#_____Part B - To be read to participants and completed by examiners:

Look at these 2 containers. Suppose that these are your favorite snacks and they are made of identical ingredients by the same manufacturer. Except for the **amount**, everything is the same, including the containers. The only thing that differs is the snack size. (allow 30 seconds of examination).

41. Suppose that if these represented your favorite snack and if you had to choose one, point to the one would you prefer as a snack?

1. ___ small amount   2. ___ large amount

42. Why would you prefer that one?

____

____

43. Would you consume more or less of the one you selected, compared to the other?

1. _____ less   2. _____ more

44. Why?

____

____

45. Estimate in ounces how much the small amount weighs ______

46. Estimate in ounces how much the large amount weighs ______

Estimate how many numbers of cheese puffs are in each container.

47. ____ container with small amount   48. _____ container with large amount

<u>Condition E</u>

#_____Part B - To be read to participants and completed by examiners:

Look at these 2 containers. Suppose that these are your favorite snacks and they are made of identical ingredients by the same manufacturer. Except for the **amount**, everything is the same, including the containers. The only thing that differs is the snack size. (allow 30 seconds of examination).

49. Suppose that if these represented your favorite snack and if you had to choose one, point to the one would you prefer as a snack?

1. ___ small amount 2. ___ large amount

50. Why would you prefer that one?

____

____

51. Would you consume more or less of the one you selected, compared to the other?

1. _____ less 2. _____ more

52. Why?

____

____

53. Estimate in ounces how much the small amount weighs _______

54. Estimate in ounces how much the large amount weighs _______

Estimate <u>how many</u> numbers of cheese puffs are in each container.

55. ____ container with small amount 56. _____ container with large amount