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Using plate mapping to examine sensitivity to plate size in food portions and meal composition among college students

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Abstract

People eat meals rather than nutrients or food groups. Plate size may influence meal size, meal composition, and food type. To examine effects of plate size on meals, we developed a method we label plate mapping. A quasi-experimental study asked university students to accurately draw what they would like to eat for dinner on either a 9" or 11" paper plate. Coding plate drawings for total meal size revealed that students drew an average of 26% more food on larger plates. When plates were coded for meal composition we found that the biggest three food portions drawn by students were bigger on 11" plates, with 70% of the overall difference in food area occurring in the biggest food. Participants drew bigger portions of vegetables on larger plates, while other food types showed little change in mean size. Gender moderated plate sensitivity for food types: women drew 36% bigger vegetable portions than men on larger plates. Smaller plates may lead to smaller meal sizes, but plate size may differentially influence composition of meals for men and women. These findings suggest plate mapping can be used to reflect meal conceptualizations and assess sensitivity to plate size.

Keywords

Consumption; Decisions; Dinner; Eating; Food; Gender; Meal; Plate; Portions; Vegetables

Introduction

Nutritionists promote and educate the public about calorie counts, serving sizes and food guidelines such as the MyPlate dietary tool (Post, Haven, & Maniscalco, 2012). Despite their efforts to engage people in maintaining healthy diets, however, the prevalence of obesity has continued to rise (Ogden, Carroll, Kit, & Flegal, 2012) and a majority of Americans are not meeting federal dietary recommendations (Krebs-Smith, Guenther, Subar, Kirkpatrick, & Dodd, 2010). In addition, methods for assessing food intake, such as the 24-hour food recall and food frequency questionnaires, remain the usual technique for obtaining eating data in spite of their known limitations and time demands on participants

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(IOM, 2005). These disparities suggest an incongruity between data collection and recommendations about eating practices. Nutrition education focuses on food groups and nutrients, but eating practices primarily occur as individually constructed meals.

A 'proper' meal in Western cultures traditionally consists of one core food and two secondary foods, usually defined in Britain and America as a protein dish, a starch dish, and a vegetable dish (Douglas, 1972). This meal structure is embedded in our culture yet many nutrition assessment methods focus on individual food items or food groups. Nutrition interventions promote adding healthy foods that may be new or unusual for the participant without acknowledging the meal context in which each of these individual foods are embedded. Our study develops a method for eliciting an individual's personal conceptualization of a meal while being sensitive to influences from internal scripts and external environmental cues.

Previous studies have found that government recommended serving sizes often do not match estimated or actual portions consumed (Bolland, Ward, & Bolland, 1990; Bolland, Yuhas, & Bolland, 1988; Harnack, Steffen, Arnett, Gao, & Luepker, 2004) and that students made substantial errors in reporting food consumption (Rumpler, Kramer, Rhodes, Moshfegh, & Paul, 2008). Two thirds of the portions consumed in a study of college aged adults were substantially bigger than the recommended portion sizes (Burger, Kern, & Coleman, 2007). A self-served portions experiment revealed that only 45% of portions at breakfast and 32% of portions at lunch or dinner were either 25% bigger or 25% smaller than the recommended portion size, with a majority of those portions being bigger (Schwartz & Byrd-Bredbenner, 2006). People who serve themselves bigger portions or who are served bigger portions tend to consume more (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004; Levitsky & Youn, 2004; Raynor & Wing, 2007; Rolls, Morris, & Roe, 2002; Rolls, Roe, Kral, Meengs, & Wall, 2004) and food choice is important when determining the preferences (Zampollo, Kniffin, Wansink, & Shimizu, 2012) and number of foods available at a meal (Levitsky, Iyer, & Pacanowski, 2012).

Current research about portion sizes and meal satiation generally relies upon external cues such as real foods, plastic food models, or images of foods to guide the subject into thinking about specific foods or specific portions (Herman & Polivy, 2005; Levitsky, Obarzanek, Mrdjenovic, & Strupp, 2005). These external food cues can anchor an individual's perceptions of portion size and limit their food choice responses to those based on available types and amounts of foods, instead of involving the person's cultural ideals, personal preferences, or individual experiences (Sobal & Bisogni, 2009; Wansink, Painter, & North, 2005). Size misestimating was evidenced in an experiment where participants who were influenced to be thirsty and primed with the knowledge that drinking a glass of water would achieve the goal of being satiated perceived the glass to be larger in size and thus contain more water than unprimed controls (Velkamp, Aarts, & Custers, 2008). This link between goal motivation and size misestimating has been well established and is not unique to food and eating (Brendl, Markman, & Messner, 2003; Bruner & Goodman, 1947; Bruner & Postman, 1948).

Our study asked individuals to draw the types and sizes of foods of a meal in the absence of as many food cues as possible. We then observed whether portion size, meal composition, and overall meal size vary with the size of plate provided. We used a method we call Plate Mapping to study plate sensitivity and meal composition and examined gender differences.

Plate Mapping

Plate mapping is a new method of eliciting what foods a person may eat for a meal by having them draw on a plate. This activity provides a projection of how the individual conceptualizes and represents a meal. Understanding the conceptualization of a meal requires knowledge of the cultural scripts for meals and environmental factors influencing meals. Time of day, plate and utensil size and type, eating partners, and foods available influence what we eat, how much we eat, and what priority we place on particular foods or food groups. This experiment manipulated the size of the plate to observe how it affects people's scripting of a dinner meal into large main food portions that are predominant on the plate and smaller side food portions that complement the main portion.

A review of current literature shows some justification for using food drawings as a reasonable proxy for actual food or food models. While not drawn by the adolescents being examined, Steyn et al. (2006) found that two-dimensional plate drawings could provide a better estimate of actual energy, fat, and carbohydrates than three-dimensional ones did. These drawings may have been accurate on account of individuals' perceptions of the size of an object anchoring on a single linear dimension, even if more than one dimension is available (Krider, Raghurir, and Krishna 2001) and that mathematical modeling shows that horizontal plane calculations are fairly accurate estimators of food area for moderately sized portions (Pratt, Croager, and Rosenberg 2011). Drawing on plates have also been used as a learning tool in conjunction with pictures, displays, and education as a means of enhancing the connection between nutrition theory promoting healthy eating in persons with diabetes (Camelon et al. 1998) as well as to reinforce the perceptual bias known as the Delboeuf Illusion (Van Ittersum and Wansink 2011).

Plate Sensitivity

Plate sensitivity is the concept that people select and serve themselves foods for a meal based on the eating cues provided by their plate such as size, shape, depth, and color. This concept addresses the research question "To what extent do participants draw food in proportion to their internal conception of an appropriately sized meal or in proportion to the size or form of plate?" We examine if individuals are sensitive to the size of the plate provided, specifically whether they draw a meal that corresponds to how food fits on the plate rather than the amount they want to eat or feel they should eat. Our first hypothesis, the plate sensitivity hypothesis, is that larger plates will influence participants to portray their meals as being bigger and smaller plates will influence participants to portray their meals as smaller. This hypothesis will be supported if the amount of food drawn is influenced by the amount of food the plate size can hold.

We are also interested in determining if there is a sensitivity to how much a plate needs to be filled in order for a participant to consider the drawings on their plates to be an appropriate

depiction of their dinner. When drawing a meal, participants may be sensitive to the “food appropriateness” of their dinner and will consider plates that look too empty to appear insufficient and plates too full to appear excessive. Our second hypothesis is that people have established internalized standards for the size of a meal and that the percentage of a plate covered will be independent of the size of the plate provided. If this hypothesis is supported, the mean amount of food drawn should be independent of plate size and represent a participant’s idealized meal size rather than a meal that attempts to look appropriate on the provided plate.

Plate Composition

Plate composition deals with judgments about main courses and side courses in meals. Main courses dominate the meal while being complemented or accented by secondary or supporting foods both in flavor and appearance. Based on this idea, we propose two hypotheses. The meal composition hypothesis proposes that main portions and side portions are considered differently when constructing a meal and that larger plates will cue people to draw proportionally bigger main dishes than side dishes. The food type composition hypothesis proposes that different food groups will be disproportionately influenced by plate size, with more fixed-size foods such as meats being influenced less than malleable foods such as vegetables and grains.

Gender

Gender is an important influence upon many aspects of food choices and eating (O’Doherty Jensen & Holm, 1999), and may be important as a moderating factor in plate sensitivity and meal composition. Men may be less mindful about food portions, less concerned about overeating, and more likely to be plate sensitive while women may be more mindful and experienced with portion sizes and less plate sensitive. Similarly, men are more likely to prefer protein foods and women more likely to prefer fruits and vegetables (Rolls, Fedoroff, & Guthrie, 1991; Wardle et al., 2004), which would lead to gender differences in how men and women construct the composition of foods on their plates into the arrangement of a platescape (Sobal & Wansink, 2007).

Methods

The study was approved by the University Institutional Review Board. A paper plate and a questionnaire were administered in a quasi-experimental design in two separate courses taken in the same department of a large Northeast U.S. university in the Spring of 2011. Both classes convened at 1:00 pm. The data for the 11” plates was collected on a Tuesday and the 9” plates data was collected on a Wednesday. The questionnaire provided brief instructions and informed consent plus asked basic demographic questions about the student’s gender and age. The instructions for completing the plate drawing activity stated for students to “please accurately draw and label the foods in a meal that you would enjoy eating for dinner tonight. Please be as realistic as possible with your drawings of the foods”. No images of food or examples of drawing styles were provided for the students nor were there food related pictures or themes in either of the two classrooms. Each of the two classes received one size of plates of identical material, design, and color, but one plate was 9” in

diameter and the other plate was 11" diameter. Plates of only one size were used in each class to avoid potential biases if students noticed that plate sizes differed within the class. An announcement was made by the professors teaching the courses at the beginning of class that researchers would be describing the research and distributing the questionnaires in the final five minutes of class and encouraged the students to participate. Students were given class time to fill out the questionnaires and allowed to stay after class as needed. Completion of the task was not compensated with course credit or any other means. Completed plates/questionnaires were collected as students exited the room.

While the researchers were not able to count the total number of students attending class that day, only three plates distributed between the two classes were returned unused or placed in one of the trash receptacles. The estimated minimum response rate was 43% (334 respondents out of 763 registered students) although since not all registered students attend each class, the response rate of attending students was higher based on researcher observation and collection of unused plates. Of the 334 returned questionnaires, a total of 270 were analyzed after excluding 56 respondents who did not accurately follow instructions, 3 who were minors under the age of 18, and 5 who did not provide an age.

Completed plates were coded to construct indicators for the concepts in the hypotheses. Drawn foods were coded into food groups (cereal, dessert, fruit, legume, meat, vegetable, and other). Drawn foods that included multiple food groups were placed into the food group that provided the most calories (a hamburger was coded in the food group meat) or into the food group that took up the most space when calories were unsure (a salad with lettuce, tomatoes, feta cheese, and shrimp was coded in the food group vegetable). Foods were rated by size to avoid presumptions about which foods were main courses or side dishes and were then sorted into largest to smallest portions for each individual based on their circumference. For each drawn food, the horizontal dimensions of circumference and area were used as an indicator of the size of drawn foods based on mathematical modeling showing that horizontal area is an acceptable estimate of overall food volume (Pratt, Croager, & Rosenberg, 2011). Dependent outcome variables for this analysis were plate coverage (percent of plate covered), food size coverage (circumference and area), food item size (largest to smallest for the five largest foods), and food item type (food groups).

Results

The 270 plates analyzed here included 38% (n=102) from the class drawing on 9" plates and 62% (n=168) from the class drawing on 11" plates. The classes differed in gender and age. The 9" class was 68% (n=77) female and the 11" class was 75% (n=134) female ($p < .05$). The mean age in the 9" class was 21 years $\pm$ 2 while the mean age in the 11" class was 19.5 years $\pm$ 2 ($p < .01$). Table 1 presents the composite data of our results. Food groups that were underrepresented in our study (fruits, legumes, roots, desserts, and other) and food courses that showed no statistically significant variation (4th and 5th largest foods) were reported in Table 1 but not further discussed.

Our first plate sensitivity hypothesis was that larger plates would invoke larger food drawings. Table 1 shows that the mean total food area on the 11" plate was 26% bigger than

the mean total food area on the 9" plate ($p < .001$). This increase meant that larger plates had about 6.6 in² more of food, which approximates the cross-sectional area of a deck of playing cards. There was no significant gender moderation of the main plate sensitivity effect.

Our second hypothesis was that participants would draw their meals without regard to the size of the provided plate. This hypothesis was not supported by the results. When comparing the overall percentage of plate space covered, we found a difference between the amount of food drawn and the amount of plate covered (Table 1). Our sample had a mean coverage of 62% for the 9" plates while the 11" plates only covered 50% ($p < .01$). The large plates, while having significantly more food drawn on them, appeared 12% less filled than the smaller plates. There was no significant gender moderation of plate coverage.

Our third hypothesis was that main portions and side portions are considered differently when constructing a meal and that larger plates will cue people to draw proportionally bigger main dishes than side dishes. This hypothesis was supported as the size of the biggest drawn food item averaged 42% bigger for the 11" plate than the 9" plate ($p < .001$) even though the foods covered a similar overall percentage, around 30%, of their respective plates (Table 1). Second biggest foods were 18% bigger in 11" plates ($p < .01$) while third foods were 16% bigger in 11" plates ($p < .05$). There were no significant interactions of gender with course and plate size, indicating that main and side dish meal composition were not modified or moderated by gender.

Our fourth hypothesis stated that not all food types are equally influenced by plate size and that some food types would be affected differently by a larger plate size. Meat and cereal portions did not differ significantly by plate size, but vegetable portions were 62% bigger on 11" plates ($p < .001$).

Gender was significant as a moderating variable in the food type hypothesis. Figure 1 compares the difference in the mean food item size, categorized by food group, across both plate size and gender. The three biggest foods on each plate were considered. The main gender moderation effect was that females drew their vegetable portion 79% bigger on 11" plates than on 9" plates ($p < .01$) and while there was no significant difference in vegetable portion size between men and women on 9" plates, women drew 52% bigger vegetable dishes than men on 11" plates ($p < .01$). While males in this study drew 44% bigger cereal portions on 11" plates, it was not statistically significant ($p < .1$), possibly because of the small sample of male respondents.

Discussion

Overall, data from this study showed that plate size can shape conceptualizations of appropriate meal and portion sizes that exist before foods are actually selected for dinner. We also found that the influence of plate size can be assessed with plate mapping in the absence of normative external cues about foods. Participants with larger plates drew significantly bigger meals than their small plate counterparts. Also, gender appeared to play a role in influencing meal composition.

Our first hypothesis, that participants would be sensitive to the size of the plate and draw bigger amounts of food on larger plates to reflect the available space, was supported by data about the average plate coverage. We found that the difference in overall mean food coverage between 9" and 11" plates was 6.6 in². A piece of lean beef this size would provide about 275 additional kilocalories while similarly sized cooked mixed vegetables would supply about 35 additional kilocalories. This overall plate coverage pattern may be useful for managing food consumption. The Delboeuf illusion may explain these plate coverage findings. Delboeuf showed that an item surrounded by similar items larger than it will appear much smaller than an item surrounded by similar items that are smaller than it (Jaeger & Lorden, 1980). For example, a big steak that appears to be an imposing food item on a small plate will appear more manageable on a large plate. This illusion of food appearing smaller on a large plate provides an explanation to justify why larger plates entice consumers to mindlessly eat more food while not feeling more full than if they had eaten an identical meal on a smaller plate (Wansink, et al., 2005). The plate and foods together create a visual platescape (Sobal & Wansink, 2007) that can influence consumption.

The second hypothesis was that individuals would not be influenced by a larger plate and would be able to draw a meal of similar size as participants with smaller plates rather than simply "filling the plate". The results of our study do not support this hypothesis as the average meal size was significantly different for each plate size.

Our third hypothesis stated that the overall area of the biggest food on the plate would be influenced differently than the rest of the foods on the plate. This hypothesis was supported as the total area of the biggest food was about 6.6 in² larger on 11" plates than 9" plates, while second and third foods were respectively only 1.2 and .8 in² bigger. There were no significant differences in size of fourth or smaller foods. The majority of difference in food sizes between the 11" and 9" plates occurred on what was already the biggest food item. This difference was about 70% of the change in total food area.

While drawings on smaller plates suggest that individuals drew smaller overall meals, overall size of a meal should not be confused with the composition of a meal. What is interesting is how these foods appeared as a meal when seen in the context of their plate. Relative to their respective plate, the biggest foods on both 11" and 9" plates covered about the same percentage and appeared to be the same size despite being calorically different from each other. When comparing the second and third biggest foods, these foods covered a smaller percentage of the 11" plate compared to the 9" plate; however, they covered a greater area. This difference suggests that the second and third foods on 11" plates would provide a greater total amount of calories while still appearing to be a moderate or light serving size in the context of its full platescape. The importance of the biggest item on the plate may provide an avenue for interventions as choice of the biggest food may drive the overall meal composition and caloric intake of a meal.

The fourth hypothesis posited that food groups would be disproportionately bigger for larger plates. While meat and cereal dishes were similar in size across plate sizes, vegetables showed considerable variation between plate sizes and gender moderated this relationship with female participants drawing significantly bigger amounts of vegetables when provided

additional plate size area. In the present study we found that women portrayed their meals to include significantly more vegetables when the plate size allowed it while meat and cereal portions remained fairly constant. Given the healthfulness of vegetable consumption, simply decreasing plate sizes in order to limit caloric intake or prevent obesity is not entirely supported by our findings. This examination of food group size creates a conundrum in plate size recommendations because decreasing plate size for women appears to disproportionately diminish vegetable consumption more than any other food group. These findings suggest the importance of analyzing not just the size of the whole meal but also its composition. Recommending a reduction in plate size to assist in weight loss (Story, Neumark-Sztainer, & French, 2002; Wansink & van Ittersum, 2007) may reduce overall food consumption but may also decrease the overall healthfulness and diversity of meals for some individuals by disproportionately reducing vegetable consumption with respect to the other food groups. Since meat portions did not differ significantly across plate sizes, a smaller plate led to smaller non-meat portions in order to appear full. This finding suggests that portion control plays a different role than meal composition for both small and large plates (Franco, 2007; Pedersen, Kang, & Kline, 2007). With 68% of our sample drawing a meal that contained a meat product, the overall structure of these drawn meals reinforces the cultural importance of meat (Douglas, 1972; Mann, 2000; Swatland, 2010) and changing meal structure offers health professionals an additional dietary change strategy. By targeting educational interventions about appropriate meat portions, environmental cues from plate size, and the interactions between plate size and meal composition, nutrition professionals may be able to improve dietary outcomes without changing established tastes.

Implications

Dietary advice may have the capacity to lead to large social impacts, so our results suggest that care must be taken when selecting strategies designed to encourage individuals to eat a healthier, more varied, or lower calorie diet in order to improve short- and long-term health goals. Reduced portion size can lead to reduced food intake (Freedman & Brochado, 2010) and external food cues can anchor perceptions of portion size and influence responses (Fedoroff, Polivy, & Herman, 1997; Jansen & van den Hout, 1991; Koh & Pliner, 2009), but these recommendations must be offered in a way that achieves the primary goal without unintended consequences. One unintended consequence could be found in the current images presented in the MyPlate graphic used for dietary guidance by the USDA in the United States (Center for Nutrition Policy and Promotion, 2011).

The principle goal of the MyPlate image is to encourage Americans to eat healthfully. An issue that has largely been overlooked, however, is that the MyPlate plate is drawn to appear almost completely full. In order to estimate the size of the MyPlate plate image, we measured 20 forks and found the average fork to be about 7.25 inches long. When scaling the MyPlate image based on a 7.25" fork, the MyPlate plate appears to represent a plate that is 10.5 inches in diameter and that food covers about 70% of MyPlate. The area of the plate, assuming no plate lip, is 78.5 in². Using the same method of analysis we used to measure our participant generated data, the MyPlate appears to have protein covering 11.5 in² (15% of the plate), vegetables covering 16 in² (20%), grains covering 14.7 in² (19%), and fruit covering 12.6 in² (16%). The area of food on the plate totals about 55 in², which is 72%

more food than the average area drawn by students in this study on 11" plates and more than twice the area of food drawn on 9" plates. In our study, college students drew their dinners with the plates on average 55% to 63% covered and were influenced by the size of their plate. In their MyPlate image, the USDA may have provided a powerful external cue to not just eat healthful combinations and relative portions of food groups, but also to fill plates more than they previously may have been in order to achieve the sizes of food groups portrayed in MyPlate. Is it a benefit to achieve a healthier balance of food groups if the cost of it is higher caloric consumption? If the nutritional guidelines promote an image of a highly loaded dinner plate, there should be a concern that attempts of individuals to make their dinner look "like the guidelines" may result in adding underrepresented food groups to a plate to match the overall plate graphic rather than removing some overrepresented food groups to match suggested serving sizes and food group proportions.

Applications

For nutrition interventions, the plate mapping technique can be used to ascertain which portions of a meal are most important to an individual. Asking a participant to draw what they would like to eat for dinner may offer keen insight into their views about the various food groups. Plate mapping warrants future development and evaluation as a new nutritional assessment method.

Plate mapping procedures can be incorporated into food recall, dietary management, and food intervention studies and may provide a rapid, inexpensive method for collecting data. Plate mapping may also enhance the connection between dietary theory and practice for participants by offering them personalized visual representations of meal routines (Camelon et al., 1998).

The composition of a meal, as the MyPlate dietary guidance suggests, may be a useful avenue for nutrition researchers to pursue rather than only influencing an individual to select specific portions of foods or a smaller plate to eat from. Reducing large plates may not be an appropriate intervention for weight loss if the biggest food item drawn is a salad, vegetable, or fruit, but could be appropriate if that item is a cereal, starch, or a high-fat meat product. Alternatively for underweight individuals seeking to gain weight, increasing the size of a plate may not substantially increase caloric intake on its own.

Limitations

There are several limitations in this study. Our first limitation is that Plate Mapping is a new method of measuring meal and portion size and the results should be interpreted in that context. The quasi-experimental design did not use random assignment or include a baseline assessment, which reduces the overall strength of these findings (Shadish, Cook, & Campbell, 2001). The college student sample may limit the generalizability of these findings to other populations. The low number of male participants in the sampled classes limits statistical power for gender comparisons. A measurement limitation is the extent that a drawn meal validly represents an actual meal. While an actual meal can be observed to see if participants finish all of the food that they serve themselves or if they take second portions, a

drawn plate relies both on participants being accurate in their drawn portions and that the drawing accurately reflects a meal that will be completely consumed.

There are also some potential alternative explanations that challenge the importance of plate size for caloric intake. Steenhuis and Vermeer (2009) claim that the effects of plate size may only occur when the participant does not consider the food as a meal but is instead a snack like ice cream or popcorn. Others suggest that energy intake is only statistically significantly associated with container size when people self-serve from a bowl rather than a plate (Rolls, Roe, Halverson, & Meengs, 2007; van Kleef, Shimizu, & Wansink, 2011). These other hypotheses need to be examined in future research.

Future Studies

This study used plate mapping as a method to avoid the influences of external environmental, social, and economic factors that may influence reporting about meal choices. Replicating this study with other samples that allow between-group age and within-group gender equivalence would assist in confirming the findings. Other factors influence eating, such as second helpings, group eating settings, food sharing, and variations in silverware, serving utensils, and total available food; and measuring the role of these other factors on meal perception would provide additional insight into their effect as alternative predictors or moderating factors. Studies examining the correspondence between drawn meals and actual meals are also needed to strengthen the potential applicability of this study in nutrition interventions, food policy promotions, and clinical care.

Conclusion

Aggregate observational data suggests that the average size of dinner plates has been increasing (Klara, 2004) and points to a historical parallel between the increases of portion size and body weight (Young & Nestle, 2003). Mathematical modeling of plate sizes and portion sizes indicate that increasing or decreasing plate size has the potential to lead to substantial changes in caloric intake (Pratt, Croager, & Rosenberg, 2011). We observed that plate size alone was enough to influence the estimated amount, proportions, and types of foods that participants drew as a selection for a dinner. Eating behaviors and food choice may be structured activities, but easily integrated environmental changes such as changing plate size could be a method for better understanding meal preferences and encouraging more appropriate eating habits (Camelon et al., 1998).

Many external and internal factors influence what individuals eat. This study suggests that people can portray dinner size and composition by drawing a meal, that plate maps differ between larger and smaller plates, and that plate maps may also differ between genders. Drawings on larger plates appeared emptier while actually portraying a greater area of food than drawings on smaller plates. This visual illusion may prompt an individual to consume more food. The results of this study suggest that conceptualizations of dinner can be influenced by plate size even if actual food is not smelled, seen, or touched.

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Figure 1.
Mean Size of Food Item by Plate Size and Gender

Table 1
Demographic, Plate Sensitivity, Food Portion, and Food Type Results from 11" and 9" Plate Respondents

	Total Sample % or Mean $\pm$ SD	n	11" Plates % or Mean $\pm$ SD	n	9" Plates % or Mean $\pm$ SD	n
Male (%)	22%	59	20% *	34	24% *	25
Female (%)	78%	211	80% *	134	76% *	77
Age (Mean)	20 $\pm$ 2	270	19.5 $\pm$ 2 ***	168	20.9 $\pm$ 1.7 ***	102
Drawing Coverage						
Total Food Area (Square inches)	29.2 $\pm$ 13	270	31.8 $\pm$ 13.8 ***	168	25.2 $\pm$ 10.5 ***	102
Plate Coverage (%)	54.4 $\pm$ 24	270	50 $\pm$ 21.7 ***	168	61.8 $\pm$ 25.8 ***	102
Drawn Foods Type (Square Inches)						
Meat	8.25 $\pm$ 4.6	176	8.4 $\pm$ 5	110	8.1 $\pm$ 3.9	66
Cereal	11.4 $\pm$ 9.1	229	11.8 $\pm$ 9.4	151	10.8 $\pm$ 8.3	78
Vegetable	11.1 $\pm$ 9.1	251	13 $\pm$ 10.4 ***	158	8.2 $\pm$ 4.7 ***	93
Root	7 $\pm$ 3.6	53	7.6 $\pm$ 4.3	25	6.6 $\pm$ 3	28
Fruit	7.1 $\pm$ 5.1	48	7.3 $\pm$ 5.6	32	6.7 $\pm$ 4	16
Legume	9.7 $\pm$ 5	20	9.6 $\pm$ 5	12	9.8 $\pm$ 5.4	8
Dessert	4.5 $\pm$ 2.3	29	4.7 $\pm$ 2.3	15	4.2 $\pm$ 2.4	14
Other	4.8 $\pm$ 2.9	14	5.4 $\pm$ 3.2	5	4.4 $\pm$ 2.8	9
Drawn Food Item Size (Square Inches)						
Largest	15.9 $\pm$ 9.8	270	17.9 $\pm$ 10.6 ***	168	12.6 $\pm$ 7.1 ***	102
Second	8.5 $\pm$ 4.1	233	9 $\pm$ 4.4 **	144	7.6 $\pm$ 3.5 **	89
Third	6.1 $\pm$ 3	198	6.4 $\pm$ 3.2 *	121	5.5 $\pm$ 2.6 *	77
Fourth	4.2 $\pm$ 2.2	95	4.25 $\pm$ 2.1	61	4.2 $\pm$ 2.3	34
Fifth	3.5 $\pm$ 2.3	20	3.5 $\pm$ 2.3	12	3.4 $\pm$ 2.4	8

* p < .05

** p < .01

*** p < .001