

## Research Article

### THE ECOLOGY OF EATING: Smaller Portion Sizes in France Than in the United States Help Explain the French Paradox

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**Abstract**—Part of the “French paradox” can be explained by the fact that the French eat less than Americans. We document that French portion sizes are smaller in comparable restaurants, in the sizes of individual portions of foods (but not other items) in supermarkets, in portions specified in cookbooks, and in the prominence of “all you can eat” restaurants in dining guides. We also present data, from observations at McDonald’s, that the French take longer to eat than Americans. Our results suggest that in the domain of eating, and more generally, more attention should be paid to ecological factors, even though their mechanism of operation is transparent, and hence less revealing of fundamental psychological processes. Ironically, although the French eat less than Americans, they seem to eat for a longer period of time, and hence have more food experience. The French can have their cake and eat it as well.

Unlike smoking, eating is a necessity. Quitting eating is not a health strategy for reducing the risks of obesity. Although it seems to be easy to restrict food intake, dieting has, on the whole, been an unsuccessful strategy for most Americans (Wadden & Foster, 2000). Despite medical advice that promotes weight loss, a wide range of dietary regimes and low-fat products, and the fact that Americans (especially women) generally perceive that they would be more attractive if thinner, average American weight went up consistently across the last half of the 20th century (Harnack, Jeffery, & Boutelle, 2000).

In psychology, almost all research related to food intake, in animals and humans, has focused on internal regulatory systems, and much of the focus of the largely unsuccessful therapy for obesity has been on internal modifications. However, there is much evidence that at least part of the “obesity epidemic” in humans is induced by an environment that promotes eating of large amounts of highly palatable food (e.g., Brownell, 2002).

In this context, the French provide an instructive example. France and the United States are both affluent Western countries, and both have a major fashion industry and concern with appearance. A look at diet and health in the two countries, however, leads to what has been called the French paradox: The mortality rate from heart disease is substantially lower among the French than Americans (Richard, 1987; Renaud & de Lorgeril, 1989, 1992), yet the French have, if anything, a higher blood cholesterol level (Renaud & de Lorgeril, 1992). The French eat what most people would consider a highly palatable diet, containing more total fat and saturated fat than the American diet (Drewnowski et al., 1996), and consume less of fat-reduced foods (Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999). The indisputably higher intake of wine by the French in comparison with

Americans has been by far the favorite explanation of the French paradox (Renaud & de Lorgeril, 1992).

The French paradox is a paradox only if one assumes that level of fat or saturated fat in the diet (or blood cholesterol) is the major cause of cardiovascular disease. Recent analyses suggest that the importance of fat intake as a risk factor for cardiovascular disease has been greatly exaggerated (Taubes, 2001). There are many other possible accounts of the French paradox (Rozin, 1999), including (a) genetically based metabolic differences; (b) the possibility that life in France may be generally less stressful, or in particular that life around food may be less stressful (Rozin, 1999; Rozin et al., 1999); (c) differences in attitudes to illness (the French are less focused on outside influences such as germs, toxins, and fat; Payer, 1988); (d) the fact that the French have a different daily pattern of eating; and (e) the possibility that the French get more exercise than Americans.

There is another very striking difference between the French and Americans—the French are leaner than Americans. The mean body mass index (BMI; averaged across males and females) is 24.4 for French adults (personal communication, S. Hercberg, 2002), as compared with 26.6 for American adults (National Center for Health Statistics, 2002, data for 1988–1994). In contrast to the 22.3% of Americans who qualify as obese (BMI  $\geq$  30), only 7.4% of French so qualify. This lower weight is explained, at least in part, by the law of conservation of energy: Although the French eat more fat than Americans, they probably eat slightly fewer calories (Drewnowski et al., 1996; National Center for Health Statistics, 2002, data for 1988–1994; personal communication, S. Hercberg, 2002). Very small daily differences, compounded over years, can amount to substantial differences in weight.

This article addresses one potentially important reason why the French are thinner than Americans: They seem to eat less. Although there is some sort of energy regulation in humans, it is quite clear that in a given meal, there are determinants of intake that are more powerful than energy deficit (Pliner & Rozin, 2000). Probably the single most important determinant of meal intake is how much is served. If food is moderately palatable, people tend to consume what is put in front of them and generally consume more the more food is put in front of them (Booth, Fuller, & Lewis, 1981; Engell, Kramer, Zaring, Birch, & Rolls, 1995; Rolls, Engell, & Birch, 2000; Siegel, 1957). Of course, food palatability and cultural traditions about the size and appropriateness of meals are also important, as is memory for the time elapsed since the last meal was eaten (Rozin, Dow, Moscovitch, & Rajaram, 1998).

In this study, we document what we take to be a major reason for the fact that the French are leaner than Americans: Their portion sizes are smaller. This cultural difference has to do more with the ecology of eating than with any issue of self-control, and may usefully turn attention to the value of environmental change as a means of decreasing obesity. There is at least a reasonable chance that the ecology of eating in France has something to do with the good general and cardiovascu-

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lar health of the French. We also present evidence that although they eat less than Americans, the French spend more time eating, and hence get more food experience while eating less.

We collected data in two manners, by measuring actual portion sizes and time spent eating on site in Paris and Philadelphia, during the period from January to March 2001, and through analysis of printed materials (restaurant guides and cookbooks). For each pair of observations (size; time; or for the Zagat guide, references to size), one in France and the other in the United States, we calculated the ratio of the American to the French measure.

## ACTUAL PORTION SIZES IN RESTAURANTS

### Method

We made on-site observations at comparable restaurants in Paris and Philadelphia, taking care that the restaurants were in similar neighborhoods and had similar prices and the same types of foods; in a few cases, it was possible to examine the same restaurant chain in both cities. Comparable meals were compared, item by item, by weighing the portions on a small, portable digital scale, accurate to 1 g. When the food was not easily separable from the plate it was on, the entire dish was weighed with the plate, and then the plate was weighed again after all the food was removed (eaten). We selected the items to be measured before entering the restaurants, although in some cases, the foods available in a restaurant in Paris led to the selection of a comparable menu in the paired restaurant in the United States. Lunch portions were always compared with lunch portions, and dinner portions with dinner portions.

The restaurants are listed in Table 1, along with the number of items sampled at each restaurant. The average cost of the meals was almost identical in the two countries.

### Results and Discussion

There were, altogether, 36 pairs of foods and beverages measured. In 26 cases, the portion size was smaller in Paris than in the United

States, with two ties,  $z = 3.00$ ,  $p < .01$ . If we consider each food establishment as a unit, then French portion size was smaller than American portion size in 10 of the 11 cases ( $p < .01$ ). The mean portion size in Paris was 277 g, with a range from 90 g to 685 g. The mean in Philadelphia was 346 g, with a range from 80 g to 970 g,  $t(35) = 2.816$ ,  $p < .01$ . On average, American portions were 25% larger.

The results from the food chains are of particular interest, because one might expect that the food they serve is identical in different countries. We found that this was true in McDonald's for the hamburger and six-piece portion of chicken nuggets. Both of these foods are almost certainly shipped intact to local stores. Three items for which serving sizes may be more locally determined, two sizes of French fries (medium: 90 g in Paris and 155 g in Philadelphia; large: 135 g and 200 g, respectively) and the large soda (530 g in Paris, 545 g in Philadelphia) were larger in Philadelphia. The sixth item, the grilled chicken sandwich, which is probably prepared outside of the local store, was also larger in Philadelphia (175 g to 155 g). This may be because the grilled chicken, unlike the nuggets, is made of a distinct part of the chicken, and French chickens are probably smaller than American chickens.

## PORTION SIZE AND RESTAURANT GUIDES

### Method

A second measure of restaurant portion size was determined by comparing Zagat's restaurant guides in Paris and Philadelphia (Zagat Survey, 2000a, 2000b). We examined the entire guide for the year 2000 for both cities, and recorded the number of indications of a buffet (all-you-can-eat) arrangement, comments as to portion size (either large or small), and mention of fixed-price menus. Fixed-price menus are of interest because they essentially allow the chef, as opposed to the client, to determine portion size, although it is true that frequently in France there is a choice of menus, with the more expensive having one or two extra courses. The Philadelphia Zagat Survey reviewed 637 restaurants, and the Paris Zagat Survey reviewed 891.

**Table 1.** Restaurant portion sizes

Restaurant in Paris	Restaurant in Philadelphia	No. of items sampled/ No. larger in U.S.	Mean size ratio (U.S./France)	Range of ratios
<b>Identical chains</b>				
McDonald's	McDonald's	7/5	1.28	1.0–1.94
Hard Rock Cafe	Hard Rock Cafe	2/0	0.92	0.84–0.99
Pizza Hut	Pizza Hut	2/2	1.32	1.25–1.38
Häagen Dazs	Häagen Dazs	2/2	1.42	1.37–1.48
<b>Comparable restaurants</b>				
French: local bistro	French: local bistro	1/1	1.17	—
Quick	Burger King	5/4	1.36	0.73–1.81
Local Chinese	Local Chinese	6/4	1.72	0.87–2.78
Italian: Bistro Romain	Olive Garden	3/2	1.02	0.50–1.45
Crepes: local	Crepes: local	4/2	1.04	0.70–1.39
Local ice cream <sup>a</sup>	Local ice cream <sup>a</sup>	2/2	1.24	1.08–1.41
Pizza: local	Pizza: local	2/2	1.32	1.17–1.46

<sup>a</sup>Berthillon in Paris, Bassett's in Philadelphia.

## Results and Discussion

Portion size was mentioned significantly more frequently in Philadelphia (59/637 = 9.3% than in Paris (31/891 = 3.5%),  $\chi^2(1, N = 1,528) = 22.409, p < .001$ . Of the mentions of portion size, in Paris 52% were comments about the large size, as opposed to 88% in Philadelphia,  $\chi^2(1, N = 1,528) = 14.677, p < .001$ . Buffet or all-you-can-eat options were mentioned in no cases in Paris (0/891 = 0%) and 18 cases in Philadelphia (18/637 = 2.8%),  $\chi^2(1, N = 1,528) = 25.477, p < .001$ . As expected, fixed-price meals were more common in Paris (73/891 = 8.2%) than in Philadelphia (6/637 = 0.9%),  $\chi^2(1, N = 1,528) = 39.834, p < .001$ . Thus, on all four measures based on the Zagat guides, Paris showed a lower concern with portions in general or large portions in particular.

## PORTION SIZES INFERRED FROM COOKBOOKS

Most meals are consumed at home. We did not directly measure portion sizes at home, but we estimated norms by examining designated portion sizes in cookbooks. We examined recipes for the same designated dish in very popular standard cookbooks in the two countries.

### Method

The cookbooks we selected were *The Joy of Cooking* (Rombauer & Becker, 1931/1975) for the United States and the roughly equivalent standard general French cookbook *Je sais cuisiner* (Mathiot, 1932/1990). Because both books present a wide range of food, not limited to their country, it is possible to find comparable recipes in the two (e.g., beef bourguignon, curried chicken), along with rather simple preparations, such as basic vegetables. Both books indicate for each recipe the number of people to be served, so a per-person estimate could be derived by simple division. However, matters are not quite so simple, because most recipes contain items whose amount is not precisely specified, such as a “bunch of parsley” or “a chicken,” or say that a given ingredient should be added until the dish achieves a certain consistency. We selected only recipes in which there is one principal ingredient (not including water), and in which the weight or volume of this ingredient is specified.

We were able to identify seven clearly comparable recipes for meat dishes that are described under the same name and have an appropriate weight or volume given for the principal ingredient. In addition, we located basic recipes for starch staples (rice, potatoes, pasta), a soup, and three vegetables. In each case, we recorded the weight or volume of the principal ingredient and divided it by the number of people to be served. After conversion of all measures to metric units, we computed the ratio of the American to the French per-person amount for each dish selected.

### Results

The mean ratios were 1.53 for the seven meat dishes, 1.05 for the three starches, and 0.76 for the three vegetables. The ratio for the soup was 1.68. These results suggest larger meat and soup portions, and smaller vegetable portions, for Americans than for the French. If we average portions (equally weighted) of these four types of food, the mean is 1.25. We conclude that, at least for some of the most calorically dense foods, French recipe portions are smaller than American recipe portions.

## SIZES OF INDIVIDUAL PORTIONS OF FOOD AND NONFOOD PRODUCTS IN SUPERMARKETS

Most items available in supermarkets are for multiple persons or use on multiple occasions, but there are a modest number of individual-portion foods for sale (e.g., ice cream bars, soda cans, yogurt cartons). After a preliminary tour of an American supermarket, we constructed a list of food items that could be purchased in individual portions. We were aware, in advance, that two interpretations were possible if portion sizes were found to be smaller in French than in American supermarket products. One, our hypothesis, was that a smaller portion size was due to the French notion of moderation and small size in food portions. Alternatively, however, the portions might be smaller because of a general tendency to package everything smaller in France. After all, rivers are less wide, cars are smaller, and people are smaller in France than in the United States. A general difference in product sizes might even be an artifact of the use of the metric system. To explore this possibility, we also sampled a wide range of nonfood products sold in food supermarkets or major nonfood supermarkets. Again, the list was constructed by initial tours of supermarkets.

### Method

A major chain supermarket with broad appeal was selected in each country—Acme in Philadelphia and Carrefour in Paris. We assembled in advance a list of individual-portion foods and nonfoods. In each supermarket, we simply counted the number of exemplars of each product at each available size (weight or volume), and determined the modal size (i.e., the size that had the most individual instances). If a variety of sizes were present in about equal numbers, we averaged the different sizes. We included cat food as a nonhuman food, but not dog food, because dogs vary a great deal in size, and French dogs may be smaller than American dogs. For extremely large quantities, we estimated the number by multiplying the height, width, and depth of the shelf space devoted to the product. If rows were uneven in height, we counted them as full to the maximum height, assuming that they had originally been full. If multiple items were packaged together (e.g., four cups of pudding), each cup was counted. We also eliminated any case in which the American/French size ratio was greater than 3.00 or less than 0.33, on the grounds that, in these cases, product packaging was not really oriented to the same type of use.

### Results and Discussion

We were able to obtain comparable data on 17 foods, 6 food-related products, and 20 nonfoods. The foods were (U.S./French size ratio provided after each) Nutrigrain bar (1.00), Nestle Crunch bar (1.41), Free-Dent gum (1.00), Häagen-Dazs ice cream bar (0.99), Häagen-Dazs mini cups (1.25), Snicker's ice cream (0.95), Coca-Cola (1.52); yogurt (1.82), mini cereal boxes (1.07), four oranges (1.42), four pineapples (1.29), four pears (1.17), four bananas (1.23), hot dogs (1.63), microwave cheeseburger (2.40), lasagna dinner (1.19), and cannelloni dinner (1.93). The food-related items were baby bottles (1.00), paper-towel squares (1.25), napkins (0.93), small paper plates (1.00), large paper plates (0.98), and toilet-paper squares (0.95). The nonfood items were cat food (1.04), sandpaper (0.83), paint brush (width; 1.08), paint (1.51), pliers (length; 0.91), tape measure (length; 1.87), pants hanger (width; 1.14), clothes hanger (width; 1.03), wash cloth (0.58), standard towel (0.59), bath towel (0.92), facial-tissue

square (1.06), Q-tip (length; 1.02), tooth brush (length; 0.96), Band-Aid (width; 0.88), toilet plunger (diameter; 1.02), clothespin (length; 1.06), dustpan (width; 0.72), paperback book (sheet size; 0.98), and standard paper (0.97).

In 14 of the 17 cases (counting ties as 0.5 for each category), American food portions were larger than French food portions; in contrast, American items were larger than French items for only 2 of 6 food-related items and 10 of 20 nonfoods. The mean ratio for foods was 1.37 ( $SD = 0.39$ ),  $t(16) = 3.87$ ,  $p < .01$ . The mean ratios for food-related items (1.02) and nonfoods (1.01) are barely and not significantly different from 1.00. In independent  $t$  tests, the ratio was larger for foods than food-related items,  $t(21) = 2.12$ ,  $p < .05$ , and for foods than nonfoods,  $t(35) = 3.22$ ,  $p < .01$ . The nonfoods did not differ significantly from the food-related items,  $t(24) = 0.08$ .

The results indicate a tendency for smaller individual food portions, but not smaller items in general, in France than in the United States. We cannot help but note that although Americans seem to eat more, the French toilet-paper square is larger! Furthermore, the results on cat food suggest that the French principle of moderation in eating does not seem to extend to their animals.

### TIME SPENT EATING

We have established that portion size is generally smaller in France than the United States. One consequence of this might be that the French get less eating experience, insofar as they consume less food, and this could be considered a form of privation. However, one can also make less go a longer way, by both eating more slowly and paying more attention to the food one is eating. In this study, we investigated one of these possibilities—that although they eat less, the French may eat for a longer time. We measured the time spent eating at McDonald's in Paris and Philadelphia.

#### Method

In each city, we selected a McDonald's in a central city shopping district, at the same time of year, at lunch time. Two researchers noted the time individuals remained seated with their food, by recording time of arrival at the table and time of departure. All participants were adults. At each restaurant, data were collected for approximately 2 hr.

#### Results

Mean time spent eating and sitting at McDonald's was 22.2 min ( $SD = 9.6$ ) in France and 14.4 min ( $SD = 6.3$ ) in the United States,  $t(65) = 4.371$ ,  $p < .001$ . Of course, one restaurant pairing does not decide the issue, and these observations would have to be repeated in other fast-food restaurants, and ideally, for meals in full restaurants and meals at home. In the literature, there is one interesting piece of evidence supporting the idea that meals last longer in France than in the United States. In a study of uses of time in different cultures, based on a survey methodology, Szalai (1972) reported that around 1970, the average French person spent 98.3 min a day eating and snacking, compared with 59.6 min for Americans.

### GENERAL DISCUSSION

The impression that people have of food in France, other than that it is of excellent quality, is that portions are small and that people lin-

ger at meals, pay attention to eating, and do a minimum of snacking. This article provides substantial evidence supporting the impression of small portion size, and some evidence supporting the impression of long meals. Other impressions remain to be verified.

The existence of smaller portions in France than in the United States does not guarantee lower caloric intake. Smaller portions of more calorically dense foods can yield more calories, as can meals that have a larger number of small portions. Some of our data (e.g., the restaurant data from McDonald's and the individual-portion sizes of supermarket foods such as yogurt), as well as what we know informally about the structure of eating in France and the United States, suggest that the French do not in fact eat more calorically dense foods or more portions. Rather, the results suggest, perhaps surprisingly, that if served somewhat less than they would normally eat, people may be satisfied.

An important point of the findings we report is that it is the ecology of eating that has much to do with American-French differences. With respect to portion size, there is yet another effect, not measured in this study. Wansink (1996) has shown, for both food and nonfood products, that people take more out of larger containers than out of smaller containers. Thus, when pouring oil to fry chicken, they pour more out of larger containers, and when pouring laundry soap into a washing machine, they pour more from larger containers. American supermarkets are well known for the money-saving mega-sizes they promote. An unintended (or perhaps intended) consequence of this is that people consume more of the products. It is our impression that mega-sizes are less common in French supermarkets, an impression supported by an informal survey of a few products, which yielded a mean U.S./French ratio of 1.37 for the largest sizes of seven particular American foods or beverages and a mean ratio of 1.46 for seven nonfoods. It is possible that although individual-sized nonfood products are not smaller in France than in the United States, mega-sizes of nonfood products are.

Our results reported here depend to some extent on our sampling strategies. When it was possible (as with the Zagat Surveys), we were exhaustive, but in other cases, we had to select products, recipes, or restaurants to sample. We tried to make our selections before any data were collected, but in some cases, the realities of availability forced us to drop or add an item. In general, we tried to create an unbiased sample set of items.

This study is the second in our attempt to understand the different functions, uses, and framings of food in France versus the United States. Our prior report (Rozin et al., 1999) demonstrated that the attitude toward food is more positive in France and less compromised by worry about the health consequences of consuming particular foods, and that during the eating experience, the French pay more attention to the sensory as opposed to nutritional properties of food. In this report, using more behavioral or ecological measures, we have identified smaller portion size as a likely contributor to the lower weight (BMI) of the French, and longer eating time as an indicant that the French have a greater total amount of eating experience. We believe that all of these French-American differences play some role in explaining the French paradox. Other differences, such as those in activity level, are likely to add to the multiple existing accounts of the paradox. Behind all of this may be some fundamental differences between French and American culture, including a difference in the dominant religion (Catholic vs. Protestant; Rozin, 1999) and the difference between the dominant principles of moderation in France and abundance in the United States (Stearns, 1997).

Perhaps the major contribution of this report is to emphasize the ecology of eating as an important aspect of health and weight control. This is not a novel idea: Hill and Peters (1998), Young and Nestle (2002), and Brownell (2002), among other researchers, have pointed to the importance of the American eating environment in promoting obesity. These authors included portion size, and the prevalence of palatable foods offered between as well as within meals, as part of the obesity-promoting ecology of food in America. Brownell, in accounting for the increase in obesity in the United States in the face of extensive dieting and medical warnings, referred to the "toxic environment" that Americans have created around their world of food. Young and Nestle reported evidence for increasing portion size in the United States in recent decades, paralleling the increase in obesity. The French, with smaller portion sizes and probably lower levels of snacking, have created a friendlier environment oriented toward moderation. The American emphasis on changing the individual to control weight has been generally unsuccessful. Perhaps people should pay more attention to changing the environment. Both halves of Newton's law of conservation of energy can be influenced by an environment that discourages overeating and encourages more activity.

One message of this report is that if researchers wish to understand human eating, and other human activities, they would be well advised to pay more attention to the environment that cultures have created. The linkages between food palatability or portion size and intake are scientifically less glamorous than the issues involving internal regulation of food intake, but may account for more of the variance.

A second message of this report is that although the French may eat less than Americans, they spend more time eating. Thus, they have more food experience. It looks like the French can have their cake and eat it as well.

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