

Visual Appeal of Stacked Plating in Savory Dishes

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https://github.com/mmmking504/Stacked_Plating.git

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1 Introduction

1.1 Abstract

Many are familiar with the saying, "You eat with your eyes first." This means how food looks can influence the perception of its taste. Previous research has studied the effect of plating on a diner's overall experience, finding that more visually appealing plates tend to have a better taste. [12] However, these studies did not consider using stacked plating. This study observes whether traditional plating principles, stating that balanced plates are more aesthetically pleasing than unbalanced plates, hold while using stacked plating.

1.2 Motivation

The psychology of plating is always something that's many people take for granted. Nowadays, there are so many different cooking and baking shows, including MasterChef, Hell's Kitchen, Chopped, and Great British Baking Show. In all of these shows, contestants, and especially judges, place a heavy emphasis on plating. Even cooking videos receive many comments which critique the final plating of the food.

If the visual aspect of food positively (or negatively) affects taste, there are huge implications, specifically in health. If a version of plating increases diners' taste perception, this could lead to healthier lifestyles, as this could increase motivation to eat healthier foods, which generally taste worse. Similarly, unhealthy food can purposefully be plated worse, making it less desirable to eat. Another interesting way this could be applied is in the restaurant industry. A more attractive plating with a corresponding better taste could lead to more positive reviews, which would bring more business to the restaurant. There are so many other ways this can be applied across multiple disciplines.

1.3 Literature Review

While there has been no previous research specifically studying stacked plating, researchers have studied many similar ideas in plating. Balanced plating is generally preferred over unbalanced plating[12], despite recent trends that lean heavily towards unbalanced plating. In addition, balanced plates are more positively associated than unbalanced plates, and the context in which food is plated (casual or high end) seems to have no significant effect on diners' preferences.[6] Balanced and colorful plates are seen as more creative than unbalanced, monotone plates.[10] Even rotating items on a plate, or changing their distribution on the plate can vastly affect diners' perceptions. [7,9] A common misconception is that plating an odd number of items makes dishes look better, but this has been disproved.[13]

Many different elements are shown to affect the taste of a dish. A dish's overall visual aesthetics have impacts on its taste[4], where dishes with more attractive presentations tend to taste better than the same dish with an unattractive presentation.[15] Even changing one element about the plate, such as its size, material, or color, can affect the overall dining experience, including taste.[11] For example, there is significant evidence that the size of a plate can influence its perceived portion size, similar to the Ebbinghaus Illusion¹. This also can affect the consumer's appetite after consuming the dish[14]. Something as insignificant as the material of the utensil that food is eaten with can have an impact on its taste [8].

In addition, a lot of evidence points to a link between all senses, but especially sight and taste. All senses are found to have varying impacts on taste. Without senses like sight and smell, the brain has a much harder time differentiating different tastes.[5] For example, the color of food (or drink) can cause the brain to associate a certain taste with it, impacting its perceived taste on consumption.[2] In an experiment done on monkeys, it was found that hunger and sight are both controlled by the hypothalamus, which could partially explain the link between sight and taste.[1]

2 Research Question

This research project aims determine how the position of food on a plate affects its visual appeal when using stacked plating in savory dishes. Specifically, this focuses on whether stacked plating is preferred centered or offset on the plate, while keeping as many variables constant between the 2 plating styles as possible.

¹ See https://en.wikipedia.org/wiki/Ebbinghaus_illusion

3 Methods

3 main steps were taken to gather the results for this research. First, pictures were taken of stacked plated dishes differing only in the position of the food on its plate. Second, an online survey was constructed, to gather participants' preferences. Lastly, the survey data was analyzed using a binomial test.

3.1 Pictures

There were 2 dishes chosen for this survey, a chicken wing over white rice and sirloin steak over spinach and mashed potatoes. The chicken wings were ordered from a restaurant, while all other foods were cooked in-house. Prepared ingredients were then divided into relatively equal portions, that passed the eye test, to use for plating. For each dish, eight different plates were constructed using stacked plating, keeping portion size consistent while varying only in the position and orientation of the food. Half of the plates were plated with stacked plating, and placed in the center of the plate, identical except for the food's orientation. The other half of the plates were corresponding offset versions of the centered dishes, with offsets upward, downward, rightward, and leftward. Dishes were presented on white porcelain plates for consistency, as well as being very common in presenting savory dishes. Photos were placed on a dark wooden background, to act as a contrast for the plates. Two photos were taken of each plate using both a cell phone clip, to keep a consistent angle and distance, and the camera of an iPhone 12 mini. Of the 32 total photos, eight of the best photos were selected for use, keeping in mind to include corresponding centered and offset plates. These eight pictures included four pictures of the chicken dish and four pictures of the steak dish.

3.2 Survey

The survey was set up via google forms, as it is a well-known platform with very simple, user-friendly UI. Personal information was not collected, allowing participants to remain anonymous. The survey consisted of 4 questions, asking participants, "Which of these dishes looks more visually appealing?". The options presented for each question were a centered dish and its corresponding offset plate, from the photos chosen. To minimize position bias, the order of questions was randomized for each participant. The survey was posted to various RPI Discord and Webex channels, as well as a personal Instagram account that had around 100 followers. Before filling out the survey, participants were notified that the results would be used for a research project, aiming to study the effects of stacked plating on the visual aesthetics of a dish.

3.3 Statistical Analysis

Once survey results were collected from all 85 participants, a binomial test² was used to analyze the results, as this worked best with the type of data the survey collected. For this study, the null hypothesis is that there is no significant visual difference between the centered and offset plates using stacked plating. For this test, K was set to the amount of people who chose the centered plating style over the offset plate. 85 was used as the value for n, which was the amount of participants that answered the survey. The mean with which this data was compared to was 0.5, the expected mean if there is no visual preference between plates. All resulting P-values were compared to an alpha value of 0.05, which is standard for determining statistical significance.

4 Results

Centered plates (Mean = 71.5/85, Standard Deviation = 7.05) are generally preferred over offset plates (Mean = 13.5/85, Standard Deviation = 7.05). Each plate with the corresponding distribution and P-value is shown in Table 1.

5 Evaluation

As seen in the table, all P-values are less than our alpha value of 0.05, leading to the rejection of the null hypothesis. This means that participants' choice between the 2 plates was not by random chance. By varying only the position of the food on the plate, this must have some effect on the visual appeal of the dishes. Specifically, the conclusion is that savory dishes plated with stacked plating look significantly better centered on a plate, as opposed to offset.

When looking at the results, it's interesting to note the large difference in preferences between the steak dishes. The offset of the steak dishes were meant to be upward and rightward offset, but they ended up trending more towards upper left and upper right. Nonetheless, 63 people preferred the centered over the upper left one, while 80 preferred centered over upper right. One possible explanation is that a majority of people are right-handed, they prefer food that needs to be cut on the left side of the plate, which would give them more room for cutting the steak. Another possible explanation is that steak is a more high-end food compared to a chicken wing, and this may influence people into thinking that the upper left offset is more artistic and creative, while the upper right offset plate looks a little simpler. Another potential factor here could be the grain of the steak versus the grain of the wooden background. The grain of the steak in the upper right offset is almost parallel with the grain of the wooden background, which may make the steak look less appealing. Meanwhile, with

² For more information about binomial tests, see https://en.wikipedia.org/wiki/Binomial_test

Table 1. Survey Results

Offset	Frequency	Centered	Frequency	P-Value
	22		63	.00001
	15		70	<.000001
	5		80	<.000001
	12		73	<.000001

the offset upper left plate, the grain is more perpendicular to the grain of the table, which could be seen as contrasting more. Another reason for this could be the position of the spinach. Maybe it's a similar to the grain of the steak, where the more perpendicular nature of the spinach in the the offset upper left, relative to the grain of the wood, looks more appealing than the more parallel offset upper right spinach. Or maybe the spinach on the offset upper right plate looks more pronounced and jarring, which might make it look less appealing, while the spinach on the upper right offset plate is a little more hidden. These factors could be more important in the offset plates, rather than the centered ones, because the food is a lot closer to the edge of the plate, meaning there is less distance between the food and the background, making it stand out more.

In analyzing the chicken dishes, there isn't a significant difference between the two in terms of preferences. The slight differences could be caused by the orientation of the chicken wing relative to the grain of the table. Since the chicken wing more parallel to the grain of the table was preferred more than the chicken wing more perpendicular, the principle opposite to the steak might be true. This might matter because chicken wings are a finger food (more so than steak), so its orientation may be less important, as it's a lot easier to eat with hands than utensils.

6 Limitations

While this study does provide useful results, there are several flaws which should be reduced for future research in this field. These consist of the pictures, participants, and research design.

6.1 Pictures

When taking pictures and preparing the food, more precautions should have been taken to reduce bias. Firstly, these 2 dishes are definitely not indicative of all possible dishes. Perhaps different dishes look better plated in different ways. Another improvement could be choosing a better plate. While the plate chosen is very common in homes and restaurants, both starches (mashed potatoes and rice) were white and sitting directly on the plate, meaning that the contrast between the plate and starch was very low. If this is done in the future, maybe a light blue plate should be used, as it contrasts well with both the food and background. Having a different angle with which the photo is taken could affect the results, or having multiple pictures with varied angles and distances could help simulate an in-person dining setting. Using a higher quality camera would have yielded higher quality photos, which may affect results in this context. In a similar fashion, there were also some difficulties with using the cell phone clip, so ideally a tripod would be used for the same purpose.

6.2 Participants

There were also a few potential issues involving participants. The sample size of the study should have been much greater, to get an overall better representation of the population. While with the time given the sample size makes sense, the initial goal was 150 participants, which is almost double the amount of responses received. Another factor that limits the conclusions is that the survey demographic is somewhat unknown. While the survey was primarily sent out to various RPI Communities, this doesn't mean that this was the only age group represented. Participants could have sent the survey to their friends or family, and there would be know way of knowing, since the survey collected no identifying information from participants. It is assumed that at least 90% of participants were between the ages of 18 and 22, which is important because people of different ages may differ in their opinions of plating and visual aesthetics. Thus, it's highly likely that this sample is not very diverse. In addition to age, other factors that could influence results are race, ethnicity, culture, geographic location, gender, and wealth/social status. Food varies in different places around the world, so it's safe to assume that food presentation also varies greatly. People in one area might be conditioned to a certain plating style while others simply may not be. In a similar way, race, ethnicity, and culture are other factors that can influence the type of food that participants previously have been exposed to, leading to different results. There have also been studies that males and females tend view colors differently[3], so gender might also play a role in their views on food presentation. Wealthy people likely eat higher quality food, which can bias their thoughts on food presentation. In the opposite vein, people living paycheck to paycheck likely care less about how food looks, due to budget limitations causing a lack of options. All of these factors are reasons not to generalize this data due to the participants surveyed.

6.3 Design

There are also some flaws with how this research was designed. One flaw that was overlooked was with survey settings. In Google forms, there is a setting where answers to questions can be randomized for each participant. This should have been turned on, because it would've reduced position bias even further(recall that reducing position bias was the reason that question order was randomized). In addition, there is another setting which allows for one response from each email address. Google Forms collects said email addresses, but they don't show up in survey responses, so this would have kept confidentiality while potentially reducing people who submitted the survey multiple times. While it still would be possible for people to submit the form more than once due to having multiple email addresses, this seems a lot less likely than with the survey settings used. The functionality with non-Gmail email addresses is also not known, so perhaps this setting would have limited the sample size further. This is important because it's theoretically possible that a small amount of people answered the survey multiple times, which would make the results irrelevant. Some participants may

have answered the survey in-genuinely or not seriously, which could further skew these results. Similarly, participants were told that this survey would be for a research study, which may have changed their mindset and led to skewed results. Participants likely also noticed a pattern while filling out the survey (that it compared centered plating to offset), and some may have felt the pressure to choose all one or the other, skewing the data even further. This could have been remedied by including some questions comparing different offset plates to each other, to reduce the pressure that people felt about. There was also a small issue of mindset when first designing the study. Initially, the survey was meant to be the first part of this research, where the second part would've been an in-person tasting. This caused the survey to become less detailed and thorough than if this was just the survey. With more focus on the survey, more useful data could have been collected, such as having participants rate each plate on a scale from 1 to 10 in terms of visual aesthetics.

7 Discussion

With the conclusion drawn from this research, that people prefer dishes plated with stacked plating in the center of the plate, rather than offset, there is potential for more research in this field, both in and out of the culinary field.

7.1 Culinary Field

There are a number of different ways that the culinary world can look into stacked plating. Results may differ if these dishes were presented in-person, or if participants get to choose the angle their photo is taken from. An interesting experiment would be to test whether stacked plating has a significant effect on the overall dining experience(taste, perceived healthiness, portion size, satisfaction, willingness to eat). Maybe certain plate colors, shapes, sizes, and/or materials look better (or worse) with stacked plating in general. Changing the order in which items are stacked can completely shift a diner's thoughts on a dish, as the food on top is seen most, and should have a higher visual impact. Maybe food generally tastes better with stacked plating, or there are specific dishes which taste significantly different with stacked plating. Stacked plated dishes might be thought of as more innovative, creative, or expensive. It also has yet to be seen whether this would hold in sweet dishes, as those are more commonly plated non-traditionally, which may lead to a greater preference for that type of plating.

7.2 Non-Culinary Field

There are also a lot of ways to view this through other disciplines. It would be interesting to see how plating differs among cultures and locations around the world, and if there are any health implications caused by purely plating. In biology, because animals and humans share some brain structures, they similarly

may choose to consume food that is presented to them better. In the Computer Science field, it might be possible to create an AI, using machine learning and neural networks, that could find the best way to plate a dish.

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