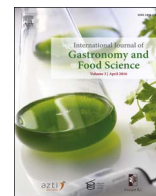




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Review article

## “Mirror, mirror on the wall”: Can visual illusions be used to ‘trick’ people into eating less?

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## ABSTRACT

Given the growing obesity crisis in many parts of the world, and given the seeming failure of conventional strategies to curb it, researchers are increasingly looking to visual illusions, and other ‘tricks of the mind’, in order to try and help convince us that we are eating more than is, in fact, the case. The hope is that such approaches may help convince people to be satisfied with less. One of the novel solutions that has been proposed recently involves the use of mirrored plateware to double the amount of food that the diner sees placed before them. But will such solutions really help curb our appetites in either the short-, or more importantly, the long-term? And how does this approach compare to other strategies involving the use of the Delboeuf illusion, crinkly curved plateware, and even augmented reality solutions to making smaller portions look a little more substantial? While the idea that mirrored plateware will make us eat less might sound fanciful to some, it is worth pausing for a moment, before dismissing the idea, to consider the effects that mirror therapy have been reported to have on the relief of phantom limb pain, chronic regional pain syndrome, etc. What is more, several published studies have demonstrated that eating in front of a mirror large enough to reflect the person eating can indeed affect taste and consumption – though the direction and magnitude of these effects appears to depend on the food (healthy or not), and who, exactly, is doing the eating (e.g., are they obese and/or concerned about their weight).

## Introduction

Given the growing obesity crisis in many parts of the world (e.g., Lifshitz and Lifshitz, 2014; World Health Organization, 1998), and given the seeming failure of conventional strategies to do much to curb it, researchers are increasingly looking to the use of visual illusions, and other ‘tricks of the mind’, in order to try and help convince us that we are eating more than is in fact the case (see Klein, 2017). The hope and, in some cases, the promise, is that such unconventional approaches may deliver long-term benefits to our waistlines, given the steady increase in portion sizes that have been documented over recent decades (Marteau et al., 2015; Nielsen and Popkin, 2003; Young and Nestle, 2002, 2012). According to estimates, nearly 70% of adults in the United States are overweight and close to 40% are considered obese (National Center for Health Statistics, 2014). One of the novel solutions proposed recently involves the use of mirrored plateware to double the amount of food that the diner sees placed before them (see Fig. 1). But could such a simple solution (a half plate, bowl or cup, with a mirror attached to the rear side) really have a meaningful effect on people's consumption over the long-term?

Over the years, mirrors have often been shown to provide an

effective means of changing people's perception of various objects, including the viewer's own body (e.g., Holmes and Spence, 2005; Stratton, 1899). Research using mirror box therapy has proven to be especially effective (at least in the short-term) in reducing phantom limb pain in those for whom conventional approaches (e.g., surgery or medicine) simply don't work (e.g., Ramachandran et al., 1995). Now, whether the benefit is attributable to what is seen in the mirror (i.e., to perception), or to the motor imagery that may be encouraged under such conditions of mirror feedback, is unclear, as is the long-term effectiveness of such approaches (see Moseley et al., 2008, for a critical view in this regard). Nevertheless, the evidence now incontrovertibly shows that mirrors can be used to convince us that our limbs are located elsewhere than they actually are (e.g., Holmes and Spence, 2005; Nielsen, 1963). Mirror therapy has also been used to help reduce the pain suffered by phantom limb patients (e.g., Chan et al., 2007; Ramachandran and Altschuler, 2009), and chronic regional pain syndrome patients (McCabe et al., 2003; Tichelaar et al., 2007) in the short-term, at least if the mirror feedback is used as part of graded motor imagery therapy.

Given such evidence, it doesn't *a priori* seem as unreasonable as perhaps at first it might that mirrored plateware could potentially also

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**Fig. 1.** Mirrored tableware designed to trick people into changing their eating habits (Anon, 2017).

be used to help trick the brain into eating less, by making it look like people are eating twice as much as is actually the case. And while the relevant research is yet to be conducted, evidence on the use of other visual illusions to curb consumption (discussed below) suggests that this might well be a promising approach, one that is worthy of empirical investigation. What is more, a growing number of chefs are now starting to challenge the norm as far as what is considered acceptable in terms of plateware (see Spence, 2017b; Spence and Piqueras-Fiszman, 2014). Indeed, some have already tried serving from mirrored plateware though, to date, the aim seems to have been more to do with the delivery of a dramatically-plated dish than necessarily with an eye on the weight control management of their diners. Nevertheless, it can be argued that the culinary landscape would, in many locations at least, now seem ready to embrace unusual plateware such as that shown in Fig. 1, in a way that was simply not the case even a few years ago.

One concern that the designers of the mirrored plateware may not have considered though is that it guarantees that there will, of course, always be an *even* number of items on the plate i.e., the food items and their mirror reflections. According to traditional kitchen folklore, odd numbers of food items are meant to be preferred over even numbers of items on the plate, and hence one might, on average, expect mirrored plateware to reduce liking somewhat. However, arguing against this putative concern, the latest online research has convincingly demonstrated that what people really care about (or prefer) is the plate with more food on it, and odd vs. even actually seems to have no effect (see Woods et al., 2016).

### Comparing the effects of mirrored plateware to other portion-size illusions

Should future research demonstrate that mirrored plateware really does help curb people's food consumption, two further questions will immediately arise: 1) How long-lasting are the effects? And 2) How do the benefits, in terms of reduced consumption, compare to the other visual illusions that have been shown/suggested to help reduce consumption, e.g., serving from small plates (e.g., Van Ittersum and Wansink, 2012; though see also Holden et al., 2016; Robinson et al., 2014), or varying plate/bowl rim size to induce the Delboeuf Illusion (McClain et al., 2014; Petit et al., submitted). Unfortunately, suggestive early evidence that simply reducing the size of the plateware would provide an effective means of reducing consumption (Wansink and van Ittersum, 2013; Wansink et al., 2006) have not been replicated by subsequent authors nor strongly supported by the results of the relevant meta-analyses (e.g., Ayaz et al., 2016; Hollands et al., 2015).<sup>1</sup> Finally, a Latvian designer recently developed a curved crinkly plate designed to make it look like there is more food on the plate than

<sup>1</sup> Though see also Robinson (2017); van der Zee et al. (2017); and <http://www.brianwansink.com/phd-advice/statistical-heartburn-and-long-term-lessons>.

is actually the case (see Stoppard, 2017).

One intriguing augmented reality (AR) application in this space was reported by Narumi et al. (2012). These Japanese scientists developed an AR system that is capable of modifying the visually-perceived size of a hand-held food item. The idea here was that people might eat less if it appears as if they are consuming a larger item of food than is actually the case. The results of preliminary research using this high-tech solution have been encouraging. In particular, Narumi and his colleagues were able to demonstrate (in one experiment) that people consumed less when the food that they had been given to eat (a cookie in this case) was made to look bigger than it actually was.

### Eating in front of the mirror

It is worth noting that mirrors may have another function in terms of modulating consumption. In fact, the latest research published by Nakata and Kawai (2017) has demonstrated that for those who dine alone, eating in front of a mirror can actually make food taste better as well as result in people eating *more*, not *less*! These Japanese researchers had older and younger groups of participants eat two types of popcorn (caramel-flavoured and salty) from half-filled paper bowls. The participants tasted each type of popcorn for a period of 90 s, rating the following on 6-point scales (anchored at one end with the label “not at all” and “extremely” at the other): “How good is this popcorn?” “How do you feel about the quality of the popcorn?” “How much do you like this popcorn?” “How filling is the popcorn?” “How salty is this popcorn?” “How sweet is this popcorn?” and “How bitter is this popcorn?”

The participants in Nakata and Kawai's (2017) studies evaluated the two flavours of popcorns once while sitting in front of a mirror that reflected themselves from the waist-up, and once when sitting in front of a monitor showing a picture of a wall instead. The results (see Fig. 2) revealed that regardless of the age of the participants, the popcorn was rated as tasting better and participants ate significantly more of it in the self-reflecting condition than in the monitor condition.

Nakata and Kawai (2017) explained their results in terms of the literature on the social facilitation of eating (see Boothby et al., 2014; Herman, 2015; Spence, 2017a). They related their findings to the literature showing that people tend to eat more when dining with others than when dining alone. The suggestion was that the dynamic mirror-reflection acted as a ‘virtual’ dining companion for the participants.<sup>2</sup> The latest research shows that viewing a static smiling face leads to a change in taste ratings when compared to the ratings obtained when people view an unhappy (i.e., crying) face instead (see Wang and Spence, 2017). As such, one might worry that the mirror/static self-image effects could have resulted from the participants seeing their own smiling face and this enhancing their mood (and hence their evaluation, and possibly consumption, of the food).<sup>3</sup> Importantly, however, no change in self-reported mood was documented after (as compared to before) eating the popcorn in any of the conditions/experiments, thus arguing against any kind of mood-based account of Nakata and Kawai's results.

Thus, in contrast, to the claims of those producing the mirrored-plateware (discussed earlier), Nakata and Kawai's (2017) results would appear to demonstrate that eating in front of a mirror can actually lead to an *increase* in consumption, at least if the mirror happens to be large enough for the person to see themselves eating.<sup>4</sup>

<sup>2</sup> Intriguingly, in another of Nakata and Kawai's (2017) experiments, elderly participants also consumed more popcorn when placed in front of a static picture of themselves. Who knows if the social facilitation of eating account can also help explain the phenomenal rise of Mukbang (people tuning in to other people eating over the internet while they eat alone) in Korea and other parts of Asia in recent years (see Vice Food, 2015).

<sup>3</sup> No mention of the expression adopted by participants is given in the paper itself.

<sup>4</sup> Here it is perhaps also worth noting that the latest research suggests that self-

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