



Visual exposure to large and small portion sizes and perceptions of portion size normality: Three experimental studies



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ABSTRACT

Portion sizes of many foods have increased in recent times. In three studies we examined the effect that repeated visual exposure to larger versus smaller food portion sizes has on perceptions of what constitutes a normal-sized food portion and measures of portion size selection. In studies 1 and 2 participants were visually exposed to images of large or small portions of spaghetti bolognese, before making evaluations about an image of an intermediate sized portion of the same food. In study 3 participants were exposed to images of large or small portions of a snack food before selecting a portion size of snack food to consume. Across the three studies, visual exposure to larger as opposed to smaller portion sizes resulted in participants considering a normal portion of food to be larger than a reference intermediate sized portion. In studies 1 and 2 visual exposure to larger portion sizes also increased the size of self-reported ideal meal size. In study 3 visual exposure to larger portion sizes of a snack food did not affect how much of that food participants subsequently served themselves and ate. Visual exposure to larger portion sizes may adjust visual perceptions of what constitutes a 'normal' sized portion. However, we did not find evidence that visual exposure to larger portions altered snack food intake.

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1. Introduction

Food portion sizes have increased for a number of food types in recent years (Nielsen & Popkin, 2003; Smiciklas-Wright, Mitchell, Mickle, Goldman, & Cook, 2003). This could be problematic because larger portion sizes are associated with increased energy intake (Benton, 2015; Jeffery et al., 2007). Work by Vartanian and colleagues suggests that portion size may influence food consumption because it signals a type of social norm about what is an appropriate amount to consume (Herman, Polivy, Pliner, & Vartanian, 2015; Kerameas, Vartanian, Herman, & Polivy, 2014). Recent work by Marchiori et al. also suggests that portion size may act as a cue or 'norm' which influences meal size (Marchiori, Papias, & Klein, 2014), such that when making evaluations about portion size, individuals anchor their decisions relative to the size of the portion size being evaluated. In support of this 'norm' based or 'anchoring' account, studies have shown that portion sizes can differ

significantly in size whilst still being rated as equally 'normal' or appropriate (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004; Robinson, te Raa, & Hardman, 2015).

Although we know that portion sizes of some foods have increased (Nielsen & Popkin, 2003; Smiciklas-Wright et al., 2003), little research has examined the psychological consequences of being exposed to larger portion sizes. A body of research now suggests that perceived normality of stimuli can be influenced by visual learning, otherwise known as a visual adaptation effect. There is evidence that frequent visual exposure to large variants of a stimulus type can result in a recalibration of what range of that stimulus is perceived as being 'normal' in size (Boothroyd, Tovée, & Pollet, 2012; Winkler & Rhodes, 2005), as well as a person's preferred body size (Robinson & Christiansen, 2014; Winkler & Rhodes, 2005). For example, visual exposure to obese body shapes has been shown to alter perceptions of what a normal sized body looks like, whereby normal appears larger (Oldham & Robinson, 2015; Robinson & Kirkham, 2014). Thus, based on the visual adaptation literature, one possible consequence of increases in food portion sizes is that more frequent visual exposure to larger portion sizes recalibrates visual perceptions of what a 'normal'

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sized portion of food looks like. In line with this notion are a number of studies which have examined ‘portion distortion’ (Almiron-Roig, Solis-Trapala, Dodd, & Jebb, 2013; Schwartz & Byrd-Bredbenner, 2006). Portion distortion refers to the observation that consumers have a poor understanding of what constitutes a normal or appropriate sized food serving and the direction of this distortion is often indicative of overestimation (Almiron-Roig et al., 2013; Schwartz & Byrd-Bredbenner, 2006); namely that consumers overestimate what they think of as being a normal serving of food. Importantly, social eating research consistently indicates that information and perceptions about what constitutes a normal amount of food to eat can influence how much a person eats (Robinson, Benwell, & Higgs, 2013; Robinson, Thomas, Aveyard, & Higgs, 2014; Vartanian, Sokol, Herman, & Polivy, 2013). Therefore, a further consequence of exposure to larger portion sizes is that it may affect food intake by altering perceptions of what constitutes a normal sized portion of food.

The aim of the present research was to experimentally test the effect that visual exposure to larger versus smaller food portion sizes has on perceptions of what constitutes a normal portion size (studies 1–3), self-reported ideal portion size (studies 1–2) and food consumption (study 3). We hypothesised that visual exposure to large portion sizes would alter perceptions of what constitutes a normal sized portion (to be larger) and that this may also cause participants to select larger meal sizes, as individuals can be motivated to eat in line with what they believe to be a ‘normal’ amount to eat (Robinson et al., 2013; Robinson et al., 2014; Vartanian et al., 2013).

2. Study 1

In study 1 participants were visually exposed, via an internet-delivered questionnaire, to ten images of large or small portion sizes of spaghetti bolognese or non-food objects (control). After this initial exposure phase participants were shown an intermediate portion size of spaghetti bolognese and indicated whether they believed a ‘normal’ serving of spaghetti bolognese was smaller or larger than the intermediate portion size presented. They then reported what their ideal portion size of spaghetti would be (relative to the intermediate portion size presented). Participants also made the same evaluations about an intermediate portion size of a different food (chicken curry and rice), to allow us to examine whether any visual exposure effects may transfer to a different (non-congruent) food type.

2.1. Participants

One hundred and fifty (113 female, 37 male) university students and staff (M age = 39.0 yrs, SD = 11.6) completed an online study about ‘Personality and Perception’ and were entered into a small prize draw as reimbursement (M BMI calculated from self-report weight/height² = 25.0, SD = 4.9 kg/m²). The study was approved by the University of Liverpool Research Ethics Committee (as was study 3).

2.2. Design and portion sizes

A between-subjects design was used, with participants randomized into one of the three conditions. In the portion size exposure conditions participants were exposed to ten standardised photographs of the same plate containing either small or large servings of spaghetti bolognese. In the small portion size exposure condition the servings were between 340 and 420 kcal (M = 380 kcal) and in the large portion size exposure condition the servings were between 920 and 1000 kcals (M = 960 kcal). See

Fig. 1 for example images. In the control condition participants were exposed to photographs of everyday objects (e.g. a sofa). We included this control condition for comparative purposes in order to detect the direction of any observed effect; e.g. it is feasible that visual exposure to small, but not large portion sizes could alter perceptions of the size of a normal portion of food. The intermediate portion size of spaghetti bolognese that all participants later evaluated was 520 kcal, as this portion size was approximately half way (in terms of food volume by the eye, as agreed upon by the research team) between the portion sizes in the small and large exposure conditions, as shown in Fig. 1.

2.3. Procedure

After logging onto the online study site and providing informed consent, participants were instructed that they would be rating a series of images and completing self-report measures. Participants were then randomized to one of the three conditions and rated ten images on consecutive pages. In the portion size conditions participants evaluated each image on dimensions unrelated to portion size (e.g. ‘how exotic does this look’) using a 0 (not at all) to 10 (extremely) visual analogue scale (VAS). In the control condition participants made similar ratings about everyday objects. After participants made each rating they continued onto the next image using a cursor on screen. Thus, the duration of exposure to each image was not pre-defined. In order to examine the effect of exposure to everyday objects (control) and small or large portions of spaghetti bolognese, the 11th and 12th images for all three conditions were always of the intermediate portion size of spaghetti bolognese. To measure *ideal portion size*, participants rated the 11th image using the same VAS: ‘If I were to eat this for an evening meal, I would want a portion size that was’, anchors: a lot smaller and a lot bigger. On the next page (12th image), to measure *perceived normality of portion size*, participants used the same scale to make the following rating: ‘A normal serving of spaghetti bolognese would be’, anchors: a lot smaller and a lot bigger. The 13th and 14th images presented were of an intermediate serving of the different food: chicken curry and rice (420 kcal). Participants made the same ratings as for images 11 and 12.

Participants next reported their age, gender, weight and height, as well as being asked ‘think back to just before you were about to start the study, how hungry were you? Options: not at all hungry, a little hungry, moderately hungry, and extremely hungry. These measure were included to examine whether the conditions were balanced for these variables. Finally, participants completed a shortened five-item version of the Restraint Scale of the Three Factor Eating Questionnaire (Stunkard & Messick, 1985), e.g. ‘I count calories as a conscious means of controlling my weight’ which we included to check that conditions were balanced for dietary restraint (the 5 items were selected by the research team). At the end of the study participants were asked to guess the aims of the study, were offered the opportunity to be entered into the prize draw and were debriefed.

2.4. Analysis

One way ANOVA was used to check that conditions were balanced for baseline variables (Chi Square for gender) and to examine whether the exposure condition that participants were assigned to impacted on their evaluations of the intermediate portion sizes of spaghetti bolognese (congruent food) and chicken curry and rice (incongruent food). If an effect was observed in the ANOVA, planned pairwise comparisons were used to examine between condition differences.

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