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Is it possible to dissociate 'liking' and 'wanting' for foods in humans? A novel experimental procedure

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Abstract

Berridge's model (e.g. [Berridge KC. Food reward: Brain substrates of wanting and liking. Neurosci Biobehav Rev 1996;20:1–25.; Berridge KC, Robinson T E. Parsing reward. Trends Neurosci 2003;26:507–513.; Berridge KC. Motivation concepts in behavioral neuroscience. Physiol Behav 2004;81:179–209]) outlines the brain substrates thought to mediate food reward with distinct 'liking' (hedonic/affective) and 'wanting' (incentive salience/motivation) components. Understanding the dual aspects of food reward could throw light on food choice, appetite control and overconsumption. The present study reports the development of a procedure to measure these processes in humans. A computer-based paradigm was used to assess 'liking' (through pleasantness ratings) and 'wanting' (through forced-choice photographic procedure) for foods that varied in fat (high or low) and taste (savoury or sweet). 60 participants completed the program when hungry and after an ad libitum meal. Findings indicate a state (hungry–satiated)-dependent, partial dissociation between 'liking' and 'wanting' for generic food categories. In the hungry state, participants 'wanted' high-fat savoury > low-fat savoury with no corresponding difference in 'liking', and 'liked' high-fat sweet > low-fat sweet but did not differ in 'wanting' for these foods. In the satiated state, participants 'liked', but did not 'want', high-fat savoury > low-fat savoury, and 'wanted' but did not 'like' low-fat sweet > high-fat sweet. More differences in 'liking' and 'wanting' were observed when hungry than when satiated. This procedure provides the first step in proof of concept that 'liking' and 'wanting' can be dissociated in humans and can be further developed for foods varying along different dimensions. Other experimental procedures may also be devised to separate 'liking' and 'wanting'.

Keywords: Liking; Wanting; Food reward; Human; Incentive salience

1. Introduction

Neuropsychological research has done much to help our understanding of the brain substrates mediating food reward. For example, research at the University of Michigan led by Kent Berridge (e.g. [1–3]) has led to a model proposing that there are two distinct components involved. The first hedonic/affective component (termed 'liking') is the result of a central process incorporating not only sensory properties but also the individual's physiological state and associative history. The second incentive salience/motivation component (termed 'wanting') refers to an underlying implicit and objective drive process and can be seen as the directed impulse or demand for a targeted food stimulus. In operational terms this reflects the neural process that mediates a change in behaviour from active seeking of an object to ignoring it. The distinction of two neural substrates for 'liking' and 'wanting' components of food reward has fundamental implications for ingestive behaviour in humans. If food reward is determined by a dual process, the relative contribution of each component must be identified before changes in consumption can be fully understood. Unfortunately, direct study of these components in humans (i.e. by asking them in terms of liking and wanting to say how they feel) may not always be accurate or valid. In the case of 'wanting', problems are encountered when people fail to dissociate affective aspects from motivational aspects of the process (e.g. "It's pleasant so I want it"). Indeed, the attribution of 'wanting' to an external stimulus transforms its basic sensory elements into incentives that are desired and alluring, but critically this, on its own, does not equate to pleasure. Furthermore, people assume that 'wanting' is a process they are consciously aware of. However, the subjective perception of such feelings could be argued to be the product of an 'active reconstruction' by cognitive mechanisms, and this could lead to

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significant inaccuracies in the tracking of this process. This is particularly important, if incentive salience is to be isolated from other, more cognitive, forms of wanting. Introspective measures of 'liking' can also lead to potential inaccuracies. In human studies, these measures most commonly take the form of numerical scales with discrete labels at the beginning and end or at each point, or visual analogue scales where judgements are marked along a line, anchored by statements at each end. Such measures can be misleading as even subtle differences in the question or statement presented can affect responses. For example Rogers and Blundell [4] reported differences in the change in rated pleasantness across a meal depending on whether subjects rated the pleasantness of the taste of food or the pleasantness of eating that food. Indeed, the most striking, differences in interpretation are noted when the stable, intrinsic palatability of a food is confounded with the aggregate response elicited by ingesting the food, which may fluctuate [4–6] and could be attributed to changes in either palatability or motivation. 'Liking' is essentially an affective reaction reflecting the acute hedonic impact of a stimulus. For this reason, ultimately an introspective measure of 'liking' should be capable of tracking changes in the potency of the underlying neural reaction to the immediate reward of an external stimulus. A further problem arises when similar forms of measurement for 'liking' and 'wanting' are taken sequentially. If a person is tempted to perceive them as the same question, they might adjust their responses to be consistent and avoid dissonance. Therefore, an integrated measure of these processes must be constructed so as to treat the processes differently, and discourage the contamination of one conscious judgement by the other.

The 'liking'/'wanting' model indicates that there may be a functional significance to the involvement of two systems of food reward in humans. If this is the case, then it is critical that valid ways to measure 'liking' and 'wanting' are established. It is logical for these measures to be applied simultaneously, and for the outputs to be compared. Additionally, the procedures should prevent subjects from discerning the nature of the enquiry, and therefore prevent the elicitation of heavily cognitively mediated responses. The present report describes the development of an experimental procedure to separate 'liking' and 'wanting' for foods in humans. The main objectives were to develop a paradigm that: a) is theoretically capable of measuring the concepts of 'wanting' (incentive salience) and 'liking' (hedonic response), b) uses dissimilar methodology to measure each process, c) is sufficiently sensitive to detect changes in and dissociations between these processes, and d) can be simply administered and efficiently computed.

2. Methods

2.1. Subjects

Subjects were recruited from the staff-student population of the University of Leeds. 30 males and 30 females aged 18–30 were selected from over 500 volunteers who responded to an e-mail requesting non-vegetarian subjects, willing to eat to fullness and complete a computerised questionnaire. These subjects were the first to meet the inclusion and exclusion criteria. Of the 60 participants tested, data from 7 were not included in the final analysis. One participant withdrew due to nausea and six were excluded because experimental procedures were not followed correctly. Data are presented for the remaining 53 subjects (26 male and 27 female) who completed all parts of the study. The subjects mean age was 21.4 years (S.D. = 3.3), and mean BMI was 22.2 kg/m^2 (S.D. = 2.5). All subjects were instructed about the procedures before giving their written consent. The study was approved by the Ethics Committee of the Institute of Psychological Sciences, University of Leeds.

2.2. Measures

2.2.1. Subjective state measures and meal intervention

Ratings of hunger and fullness were measured immediately pre and post meal using 100 mm visual analogue rating scales anchored at each end by 'not at all' and 'extremely'. The meal consisted of a commercial brand of cheese and tomato pizza and a jug of chilled water, supplied ad libitum. No particular criteria were applied to the selection of this meal since the manipulation was designed only to ensure a transition from a hungry to a satiated state. Energy intake was calculated by weighing the food before and after consumption (to the nearest 0.1 g) and with reference to the manufacturers energy values (see Appendix A).

2.2.2. 'Liking' and 'wanting' stimuli

Measures of 'liking' and 'wanting' were assessed by means of photographic food stimuli varying along two dimensions – fat (high or low) and taste (savoury or sweet). High resolution (1024 × 768) digital colour photographs of 20 foods were used which could be organised either equally into separate generic categories of high-fat (HF), low-fat (LF), savoury (SA) and sweet (SW) or combined categories of high-fat savoury (HFSA), low-fat savoury (LFSA), high-fat sweet (HFSW) and low-fat sweet (LFSW). See Appendix B for details of food stimuli used. By measuring mean scores of 'liking' and 'wanting' for generic food categories, a simultaneous assessment of both processes was possible. The experimental examination of 'liking' and 'wanting' was configured by administering the stimuli (food items) on a PC. Stimuli were presented on a 17 in. flat screen monitor and measured 150 × 100 mm^2 or 120 × 80 mm^2 depending on whether single or paired presentation was required. The experimental presentation of foods (in random order for ratings of 'liking', and in randomized combinations for the forced choice measures of 'wanting') was programmed automatically, and the responses logged on-line.

2.2.3. Measurement of 'liking'

The hedonic impact of each food was assessed using a 100 unit visual analogue scale anchored at each end with 'not at all' and 'extremely' combined with the statement "How pleasant would it be to experience a mouthful of this food now?" The rating scale was presented on the monitor beneath each food stimulus. Participants used the mouse to move a centred cursor along the line to indicate their response. When a rating had been made, a continue button cycled the program to the next stimulus. The program was also designed to assess whether the respondent