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Long-term range effects in hedonic ratings

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ABSTRACT

Judgments of individual stimuli can depend on the range of stimuli in which they are included. Such range, or contrast, effects have been studied extensively for judgments made within a single session. The present study tested whether stimulus range effects for hedonic judgments might carry-over from one session to another. In two experiments participants evaluated cordials for strength relative to ideal in separate sessions up to one week apart. In Session 1 half of the participants evaluated a range of high concentration cordials (High Group), while half evaluated a low concentration range (Low Group); in Session 2 all participants evaluated the same low concentration range. Both experiments revealed long-term range effects, in that the High Group maintained a higher ideal cordial strength in Session 2. In addition, Experiment 1 showed that the effect is not influenced by inter-session interval, while Experiment 2 revealed that it can transfer across cordials of different color and flavor. This systematic demonstration of long-term range effects has important implications for any evaluation study using multiple sessions.

1. Introduction

Pleasure and perception are not absolute but are influenced by context (Parducci, 1995). One of the most salient contextual influences is the stimulus range effect (Poulton, 1977), wherein a given stimulus will be judged as lower when in the context of stimuli with a higher level of the attribute than when in the presence of stimuli with lower levels (McBride, 1985). For example, the same stimulus is judged to be weaker in the context of stronger stimuli and stronger in the context of weaker stimuli (e.g., McBride, 1985; Rankin & Marks, 1991).

Several attempts have been made to characterize stimulus range effects. Beebe-Center (1929) formulated the law of affective equilibrium, which asserts that the pleasantness of a stimulus is compared with the entire set of preceding stimuli as a single entity (context effect), rather than with the immediately preceding stimulus (sequential effect) (Schifferstein & Kuiper, 1997). Helson (1947, 1964, 1973) later developed his adaptation level theory, reconceptualizing the average of past stimuli as the adaptation level (AL) – the level of stimulation which elicits no perceptual response or is hedonically neutral.

When Helson's theory was subsequently shown to hold only where the frequency distribution of stimuli is symmetrical (Parducci, Calfee, Marshall, & Davidson, 1960), Parducci (1965) postulated his range-frequency theory, proposing that the influence on a stimulus is determined not only by the *position* of the stimulus within a range, but also by the relative *frequency* with which it and the other stimuli are presented. Certainly the importance of both factors has been widely demonstrated: From psychophysical judgments of the size of squares or circles (Parducci, Knobel, & Thomas, 1976), the number of dots, length of lines, or heaviness of weights (see Parducci, 1995), to sensory judgments of food stimuli (e.g., Riskey, Parducci, & Beauchamp, 1979; Schifferstein & Fritjers, 1992). The present study focuses on range alone, i.e., stimuli within a range occur with equal frequency.

An important but neglected aspect of range effects is their duration of impact. Neither Helson (1964) nor Parducci (1965) explicitly accounts for the temporal bounds of stimulus influence. Though both acknowledge that recent experience establishes a frame of reference against which subsequent experiences are judged, they neither define nor quantify just how recent these events need be. Intuitively, it seems that more recent events should exert greater influence than their more distant counterparts. Indeed, Frederick and Loewenstein (1999) consider a formulation which asserts that the adaptation level at any point in time can be represented by a weighted average of past stimulus levels, with recently experienced stimuli receiving greater weight than those experienced in the more distant past. This formula derives from Helson's (1973) AL theory and thus bears the same limitations as the original; nevertheless, its basic premise is pervasive: Stimulus range has been widely assumed to be restricted to evaluations made in close temporal proximity, specifically within a single experimental session. Indeed, numerous studies on range effect have employed multi-session designs on the basis that sessions are independent and free from carry-over effects (e.g., Diamond & Lawless, 2001; McBride, 1982, 1985; Rankin & Marks, 1991).

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There appear to be only two previous studies that have indicated some carry-over from one session to the next. In a conference abstract Vollmecke (1987) reported that the experience of evaluating a range of high, sucrose solutions in one week lowered the sweetness ratings of a less-sweet range rated the following week, but the reverse did not hold: Initial presentation of less sweet sucrose solutions did not elevate subsequent ratings of sweeter solutions. Vollmecke's (1987) claim was, however, weakened by the absence of appropriate control conditions in that it was based on comparing the ratings of the less-sweet range made by one group in Session 2 with those of the same range made by another group in Session 1. An experiment using capsaicin that did contain an appropriate control condition produced a more conclusive result (Stevenson & Prescott, 1994; Experiment 1). Over four training days participants sampled either a low concentration (Low Group) or a high concentration of capsaicin (High Group). In a subsequent probe test participants gave intensity ratings of 'chilli burn' to an intermediate capsaicin concentration presented 8 times. Although there was no main effect of group on these ratings, the first two ratings were higher in the Low Group prior to a decline of subsequent ratings to the same level as those made by the High Group. The authors were unable to exclude a desensitization account of their finding and thus left open the question of how specific to chilli burn this long-term effect might be (Stevenson & Prescott, 1994).

The present study consisted of two experiments with the same basic design. Experimental groups ('High') received a range of high concentrations in Session 1 and low concentrations in Session 2, whereas control groups ('Low') received the low concentrations both in Sessions 1 and 2. In each session participants were asked to rate cordials on a just-right (JR) scale (e.g., McBride, 1982), also known as the "just-about-right scale" (Gacula, Rutenbeck, Pollack, Resurreccion, & Moskowitz, 2007). The JR scale is used to measure the acceptability of a particular sensory attribute in relation to a perceived ideal point (Gacula et al., 2007). Thus, for perceived strength, the JR scale would be labeled "Too weak" and "Too strong" at the respective endpoints, with "Just right" at the centre. Gacula et al. (2007) have confirmed that the users do equate the scale with general acceptability and preference.

Several studies have found the JR scale to be susceptible to range effects, whereby the mid-point rating (here, the just-right score) tends to be attributed to the stimulus at the middle of the range presented. For example, in determining the ideal glucose levels of a flavored milk drink, McBride (1982) found that a specific concentration was judged as not sweet enough when presented as the weakest concentration, but as too sweet when presented as the highest; hence the estimated ideal concentration varied with the presented range. Similar range effects have been found where JR ratings were obtained for sweetness in lemonade (Epler, Chambers, & Kemp, 1998; Johnson & Vickers, 1987), concentration of artificial orange drinks (McBride, 1985), and saltiness of soup and bread (Booth, Thompson, & Shahedian, 1983).

There were two reasons for choosing to use the JR scale in the present study. First, it is an obvious fit for cordial stimuli since perception of food stimuli automatically evokes hedonic judgments, certainly more so than the perceived size of circles or the heftiness of weights. Second, it affords practical relevance. In consumer sensory research, assessors are commonly presented with a series of similar food products to evaluate in a single sitting, in which both liking and JR scales may be used to identify attributes that need improvement and to estimate the optimum attribute level (Bower & Boyd, 2003). Thus the present study also aimed to provide further understanding into how the evaluation of a product may be affected by the context in which it is assessed.

2. Experiment 1: the effect of inter-session interval

The primary aim of the first experiment was to test for a long-term range effect on hedonic judgments. In addition it sought to determine whether or not such an effect might vary with the length of the inter-session interval.

According to Berlyne (1973), the hedonic value of a stimulus depends, in part, upon memory traces of similar experiences in the past. As noted above, such traces may be more influential for more recent versus more remote events (see Frederick & Loewenstein, 1999). In a study of immediate range effects, using auditory stimuli and magnitude estimation, DeCarlo (1992) found that the influence of a previous stimulus on a subsequent response decreased as the inter-stimulus interval increased. The present experiment sought to determine whether this might also apply to long-term range effects: Is the residual memory or influence of a range of high concentrations stronger with a shorter inter-session interval?

The experiment employed a mixed factorial design, with Inter-session Interval (ISI: 1 day or 1 week) and Range Condition (High or Low) as between-subject factors, and Cordial Concentration (5 levels) as a within-subject factor. Each participant attended two sessions. In the first session, half the participants evaluated a range of high concentration cordials (High Condition), while half evaluated a low concentration range (Low Condition). In the second session, all participants rated the same low concentration range, either one day or one week after Session 1.

The predicted effects were as follows. With respect to an immediate range effect, it was expected that the single concentration included in both ranges, the target concentration, would tend to be judged as 'Too weak' within the context of higher concentrations and as 'Too strong' amid lower concentrations. In accordance with previous findings (e.g., Morris & Rule, 1988; Parducci & Wedell, 1986; Vollmecke, 1987), this context effect was expected to increase with repeated exposure to the stimulus range. Regarding long-term range effects, it was predicted that participants who tasted a range of high concentration cordials in Session 1 (High Group) would assign lower ratings to the range of low concentration cordials in Session 2 than participants who received low concentrations in both sessions (Low Group). Accordingly, the estimated ideal concentration should remain stronger for the High Group than for the Low Group. On the basis that more recent stimuli exert greater influence than earlier counterparts (Frederick & Loewenstein, 1999), such a long-term effect was anticipated to be more marked with a one-day than with a one-week interval and was also predicted to wane during the course of Session 2.

2.1. Method

2.1.1. Participants

Sixty participants (29 men, 31 women; *Mean Age* = 37.27, *SD* = 15.53) were recruited by telephone from the database of a private consumer research company in Sydney, with which they had voluntarily registered. On recruitment, participants elected to return either one day or one week after Session 1. Allocation into either the High or Low Range Condition was based on order of arrival, yielding an approximately even distribution across conditions. All were naïve with respect to experimental expectations, free of any known food allergy, and reimbursed for participation at the end of Session 2. They were not assessed for familiarity with the kind of cordial used in the experiment.

2.1.2. Materials

2.1.2.1. Stimuli. The stimuli consisted of raspberry-flavored cordial concentrate (Cottee's cordials, Cadbury Schweppes Ltd., /www.cottees.com.au/), diluted in filtered tap water to nine logarithmically-