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Emotion

1528-3542/16/$12.00 http://dx.doi.org/10.1037/emo0000164

BRIEF REPORT

Let's Not Be Indifferent About Neutrality: Neutral Ratings in the International Affective Picture System (IAPS) Mask Mixed Affective Responses

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The International Affective Picture System (IAPS) is a picture set used by researchers to select pictures that have been prerated on valence. Researchers rely on the ratings in the IAPS to accurately reflect the degree to which the pictures elicit affective responses. Here we show that this may not always be a safe assumption. More specifically, the scale used to measure valence in the IAPS ranges from positive to negative, implying that positive and negative feelings are end-points of the same construct. This makes interpretation of midpoint, or neutral ratings, especially problematic because it is impossible to tell whether these ratings are the result of neutral, or of mixed feelings. In other words, neutral ratings may not be as neutral as researchers assume them to be. Investigating this, in this work we show that pictures that seem neutral according to the valence ratings in the IAPS indeed vary in levels of ambivalence they elicit. Furthermore, the experience of ambivalence in response to these pictures is predictive of the arousal that people report feeling when viewing these pictures. These findings are of particular importance because neutrality differs from ambivalence in its specific psychological consequences, and by relying on seemingly neutral valance ratings, researchers may unwillingly introduce these consequences into their research design, undermining their level of experimental control.

Keywords: ambivalence, IAPS, neutrality, mixed feelings

Cited over 2,500 times (Google Scholar, April 2015), the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008) is a widely used set of emotion-eliciting stimuli. Each picture has a prerated valence score that shows how positive or negative people feel, on average when viewing it. Researchers select experimental stimuli based on these scores. Unfortunately, the scores may be systematically misleading when researchers select pictures with an apparently "neutral" score. Because the IAPS stimuli are rated on bipolar scales, neutral ratings may actually mask ambivalent responses.

Specifically, the IAPS norming procedure asked for ratings on a scale that ranges from positive (happy, pleased, satisfied, contented, hopeful) to negative (unhappy, annoyed, unsatisfied, melancholic, despaired, bored) (Lang et al., 2008). This conceptualization implies (i) that positive and negative end terms are two extremes of the same underlying emotion construct and (ii) that positive and negative feelings constitute a zero sum—The more positive respondents feel, the less negative they feel, and vice versa. However, in daily life, people may also experience instances in which they feel both positive and negative at the same time, also referred to as ambivalence (Kaplan, 1972; Larsen, McGraw, & Cacioppo, 2001; Rees, Rothman, Lehavy, & Sanchez-Burks, 2013; Thompson, Zanna, & Griffin, 1995; Sch-

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The authors gratefully acknowledge Evert-Jan van Doorn, Mark Rotteveel, and two anonymous reviewers for their useful suggestions. This work was in part made possible by the Netherlands Organization for Scientific Research Rubicon Grant awarded to Iris K. Schneider (No. 446-13-015), and in part by a Consolidator Grant from the European Research Council (ERC-2011-StG_20101124) awarded to Sander L. Koole.

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neider et al., 2015; van Harreveld, van der Pligt, & de Liver, 2009). The difference between the assumption underlying the bipolar scale and people's real-life affective experiences poses a problem for the interpretation of the neutral ratings in the IAPS.

Imagine for instance, a chair. Most people may feel relatively indifferent with regard to a chair, reflecting that they have neither positive nor negative responses to it. On a bipolar scale, the chair would have to be rated around the midpoint of the scale. However, something that evokes both strong positive and strong negative feelings (e.g., a tasty but fattening piece of chocolate cake) will also be rated around the midpoint of the scale when people are trying to do justice to both their negative and positive responses (cf. Kaplan, 1972; Thompson et al., 1995). Accordingly, a neutral rating along a bipolar scale may reflect either (correctly) the absence of positivity and negativity, or the complete opposite, the presence of relatively strong positivity and negativity (i.e., ambivalence). This renders 'neutral' scores for IAPS pictures ambiguous.

One rating already present in the IAPS that bears on this possibility is the arousal that the pictures elicit. As previous research has shown, the experience of ambivalence is associated with increased arousal (Has, Katz, Rizzo, Bailey, & Moore, 1992; Nordgren, van Harreveld, & van der Pligt, 2006; van Harreveld, Rutjens, Rotteveel, Nordgren, & van der Pligt, 2009). If apparently neutral IAPS pictures include pictures that elicit ambivalent responses, as well as pictures that elicit neutral responses, they should show a wide range of arousal scores. Empirically, this is the case. The arousal ratings of neutral IAPS pictures (i.e., within a $\pm.05$ range around the 5.0 midpoint of the IAPS scale) range from $M = 2.00$ to $M = 6.03$ (on a 9-point scale) with an average arousal score of 3.61 ($SD = 1.05$) (Lang et al., 2008), a first indication that people may actually may feel relatively ambivalent, about at least some of them, rather than neutral.

This issue is of substantive importance for researchers, because ambivalence is associated with distinct psychological consequences, including uncertainty, biased information processing, and increased illusionary pattern perception, in addition to increased arousal (for overviews, see, e.g., Sparks, Conner, James, Shepherd, & Povey, 2001; van Harreveld, Nohlen, & Schneider, 2015; van Harreveld, Rutjens, Schneider, Nohlen, & Keskinis, 2014). Researchers who intend to induce neutral feelings but select pictures that elicit ambivalent responses run the risk of inadvertently introducing these consequences in their neutral condition. It is therefore important to investigate whether neutral, midpoint-rated pictures in the IAPS mask ambivalence.

The confusion between neutrality and ambivalence has been addressed extensively in research on ambivalence and yielded at least two ways of dealing with this ambiguity. First, because ambivalence is made up of both positive and negative thoughts and feelings, one way is to separately assess both these opposing components of the attitude and submitting them to a formula that takes into account both the strength and the similarity of the ratings. Because ambivalence and neutrality differ in the extremity of the evaluations (ambivalence is made up of strong opposing feelings, whereas neutrality constitutes a lack of strong feelings either way), this method allows distinction between the two (Kaplan, 1972; Refling, Calnan, Fabrigar, MacDonald, Johnson, & Smith, 2013; Thompson et al., 1995). Given the focus of this measure on the evaluations underlying the attitude, or its structure, it is often referred to as a measure of objective ambivalence. A second way to distinguish ambivalence from neutrality is to address the experiential component of being ambivalent, or the feelings of conflict people have, often referred to as subjective ambivalence (Priester & Petty, 1996). Given its experiential nature, arousal is more closely related to subjective rather than objective ambivalence (Newby-Clark, McGregor, & Zanna, 2002).

We hypothesize that because neutral ratings are likely to represent both relatively neutral and relatively ambivalent ratings, levels of ambivalence will differ between IAPS pictures with neutral ratings. Furthermore, we hypothesize that these differences, specifically those in subjective ambivalence, are related to the amount of arousal people experience in response to the pictures, reflecting a crucial difference between neutrality and ambivalence. Previous work on the separability of positive and negative valence processing has examined independent assessments of valence, arousal, positivity, negativity, and ambivalence (Ito, Cacioppo, & Lang, 1998). The current work goes beyond these findings by focusing exclusively on neutral pictures and relating variation in ambivalence directly to arousal.

Method

Participants and Design

Forty-one University of Amsterdam undergraduates (mean age 21.6 years, 11 men) participated in exchange for monetary reward or course credit. Participants rated selected pictures (see below) from the IAPS (Lang et al., 2008) on both original IAPS measures, as well as measures of ambivalence.

Stimuli

We selected 31 pictures from the IAPS (Lang et al., 2008) for which the valence ratings ranged from 4.95 to 5.05 (on a 9-point scale, taken from the IAPS) resulting in an average rating of 4.99 ($SD = .03$).[1] Given that the midpoint of the valence scale is 5, these pictures represent the most neutral pictures in the set. Pictures depicted a range of subjects, such as animals, objects, and people. As noted before, IAPS arousal scores for these pictures ranged from $M = 2.00$ to 6.03 (on a 9-point scale) with an average arousal score of 3.61 ($SD = 1.05$). Fn1

Measures

We measured valence and arousal with the Self-Assessment Manikin (SAM) scales as used in the IAPS. SAM scales are a visual depiction of a 9-point scale. For valence, 1 represents positive feelings, and 9 represents negative feelings. For arousal, 1 represents no arousal, and 9 represents high arousal (see Lang et al., 2008).

To measure objective ambivalence, we used two items assessing participants' negative and positive evaluations of each picture

[1] Pictures used were as follows: 1645, 2002, 2214, 2220, 2397, 2484, 2749, 2890, 4302, 4550, 4561,7000, 7002, 7003, 7004, 7012, 7020, 7034, 7035, 7041, 7045, 7160, 7161, 7185, 7235, 7185, 7476, 7484, 7640, 9070, and 9422. The range of 4.95–5.05 was chosen in order to keep as close as possible to the true midpoint.

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independently (Kaplan, 1972). Specifically, we asked participants to ignore their negative (vs. positive) evaluations and rate how positive (vs. negative) they thought the picture was. The items read as follows: "Think about this picture. When you think about the positive (negative) aspects of this picture, while ignoring the negative (positive) aspects, how positive is your evaluation of this picture?" Participants gave their ratings on a 9-point scale ranging from "not at all positive" (negative) to "very positive" (negative). To obtain an index of objective ambivalence, we submitted average scores on these items per picture to the following formula: $(P + N)/2 - |P—N|$, where P is the positive rating and N is the negative rating (cf. Thompson et al., 1995; also see Schneider et al., 2015; van Harreveld et al., 2009; van Harreveld et al., 2014), with lower scores indicating more neutrality and higher scores indicating more ambivalence. Using this formula, we are able to capture both the strength as well as the similarity of the ratings, the two core components of ambivalence (for excellent reviews of different measures of objective ambivalence, see Priester & Petty, 1996; Thompson et al., 1995).

Theoretically, this scale can range from −3 to 9. However, consider that an objective ambivalence score of 1 is the result of a rating of 1 on both the positive, as well as the negative, item, reflecting true neutrality. Conversely, an objective ambivalence score of 9 is the result of a rating of 9 on both items, reflecting extreme ambivalence. Objective ambivalence scores below 1 can only be the result of relatively univalent stimuli (i.e., stimuli that are considered clearly more positive than negative or vice versa), but univalent stimuli would not have yielded midpoint ratings in the IAPS norming procedure to begin with, and therefore are not part of our set of stimuli. Thus, because we selected only stimuli around the midpoint score in the IAPS, here the objective ambivalence scale ranges only from 1 to 9, with lower scores indicating more neutrality and higher scores indicating more ambivalence.

To measure subjective ambivalence, we asked participants to indicate for each picture the extent to which they had conflicting thoughts and feelings about it, were indecisive about it, and experienced mixed feelings, on 9-point scales ranging from *not at all* (1) to *very much* (9) (Priester & Petty, 1996; $\alpha = .97$). Finally, because we wanted to control for processing difficulty influencing arousal levels, we included four items that asked participants to rate the degree to which they thought the picture was hard to understand, had multiple meanings, was interpretable in more than one way, and was complicated, on a 9-point scale ranging from *not at all* (1) to *very much* (9) to measure complexity of the pictures ($\alpha = .96$).

Procedure

Each picture was presented for 6 s (following the IAPS manual; Lang et al., 2008), after which participants rated the picture on valence and arousal using the SAM scales. After this, all pictures were presented again and rated for objective ambivalence, subjective ambivalence, and complexity. Finally, participants were rewarded and debriefed.

Results

Because of a technical error, Picture 7004 was omitted and picture 7003 displayed twice. Excluding these pictures leaves 29 stimuli in our dataset.[2] For each picture, we computed mean scores of valence, arousal, objective and subjective ambivalence, and complexity. For the regression analyses below, we computed standardized Z scores to facilitate interpretation. Fn2

Table 1
Means (SDs) for Objective and Subjective Ambivalence, for Each of the Pictures

Description	Number	Objective ambivalence	Subjective ambivalence
Skyscraper	7640	5.78 (3.00)	3.50 (2.50)
Boy	9070	5.73 (2.81)	4.52 (2.60)
Erotic female	4302	5.49 (2.78)	3.77 (2.60)
Hammer	7034	5.30 (2.75)	2.80 (2.14)
Male face	2220	5.09 (2.34)	3.69 (2.25)
Twins	2890	5.04 (2.55)	3.70 (2.15)
Erotic male	4550	4.68 (3.11)	3.03 (2.20)
Wolf	1645	4.49 (2.84)	4.06 (2.37)
Ramen	7476	4.21 (3.10)	2.49 (1.99)
Fan	7020	4.19 (2.57)	2.71 (2.08)
Smoking	2749	4.14 (2.29)	3.61 (2.48)
Man	2002	3.83 (2.36)	2.77 (1.96)
Abstract art	7185	3.80 (2.29)	3.36 (2.38)
Pole	7161	3.78 (2.33)	3.74 (2.47)
Rubberbands	7012	3.58 (2.62)	2.26 (1.84)
Rolling pin	7000	3.41 (3.08)	2.46 (2.03)
Mug	7035	3.38 (2.74)	2.13 (1.81)
Erotic male	4561	3.29 (2.66)	2.71 (1.98)
Fish	7484	3.15 (3.31)	2.41 (2.05)
Men	2397	3.15 (2.70)	2.88 (2.05)
NeutMan	2214	3.10 (2.36)	3.02 (2.13)
Baskets	7041	3.01 (2.82)	2.47 (2.09)
Zipper	7045	2.91 (2.52)	2.08 (1.50)
Amerindian	2484	2.86 (2.72)	3.96 (2.32)
Towel	7002	2.64 (2.81)	1.88 (1.49)
Chair	7235	2.78 (2.67)	2.08 (1.59)
Battleship	9422	2.43 (2.81)	3.15 (2.27)
Fabric	7160	2.09 (2.72)	2.80 (2.10)
Building	7242	1.80 (3.08)	2.64 (1.98)

Recall that we hypothesized that apparently neutral scores may mask underlying ambivalence. Confirming this expectation, the neutral IAPS pictures varied in objective as well as subjective ambivalence (see Table 1). The objective ambivalence scores had a mean of 3.76, a standard deviation of 1.09, and a range from 1.80 to 5.78. The subjective ambivalence scores had a mean of 2.99, a standard deviation of 0.68, and a range from 1.88 to 4.52. Scores on objective and subjective ambivalence were in accordance with previous studies in which ambivalence was experimentally manipulated (e.g., Gillebaart, Schneider, & De Ridder, 2015; Nohlen, van Harreveld, Rotteveel, Lelieveld, & Crone, 2014; Schneider et al., 2013, 2015; van Harreveld, Rutjens, et al., 2009; van Harreveld et al., 2014), supporting the notion that these pictures elicit substantive levels of conflict. The standard deviation and range indicate that the selected pictures, which were ±0.5 scale points from the neutral value of the IAPS scales, vary markedly in the extent to which they elicit mixed feelings. These differing levels of ambivalence are mirrored in the arousal ratings, which ranged AQ:3, T1 AQ: 4 AQ: 5

[2] Coding error caused picture 7424 to be displayed instead of 7185. However, due to the relatively neutral rating of 7424 (mean valence = 5.28) excluding this item did not alter the pattern of results, and was thus included in all analyses.

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from 1.54 to 6.15, with a mean of 3.19 and a standard deviation of 1.12.

As predicted, these levels of arousal were positively correlated with objective ambivalence, $r(29) = .43$, $p = .019$, and subjective ambivalence, $r(29) = .49$, $p = .007$; the more ambivalence the pictures induced, the more arousal participants experienced. Additionally, objective ambivalence was positively correlated with subjective ambivalence, $r(29) = .58$, $p = .001$, which replicates previous findings (e.g., Newby-Clark et al., 2002) and negatively related to valence, $r(29) = -.52$, $p = .004$, showing that the more ambivalent people were, the less positive they were. Finally, complexity was positively correlated with subjective ambivalence, $r(29) = .88$, $p < .001$. No other correlations were statistically significant.

We further predicted that subjective ambivalence, because of its experiential nature, would be the primary predictor of arousal. To test this, we performed a multiple regression analyses with arousal as the dependent variable and valence and objective and subjective ambivalence as predictors. We also added complexity ratings to control for influence of processing difficulty on arousal. As predicted, only subjective ambivalence showed a unique statistical significant relationship with arousal (see Table 2), such that the stronger the experience of ambivalence was, the more arousal people felt in viewing the pictures. Complexity had a marginally significant relationship with arousal, albeit negatively. The model was statistically significant and explains 40% of the variance. All predictors were added simultaneously and entering the predictors in different orders did not change the outcome of these regression analyses.

AQ:6, T2

As an exploratory analysis we assessed the correlation between the standard deviation of valence and subjective and objective ambivalence and complexity, building on the assumption that ambivalent pictures are rated more positively by some participants and more negatively by others, resulting in increased standard deviations. Results indicate that standard deviation scores of valence ratings were positively correlated with objective, $r(29) = .40$, $p = .030$ and subjective ambivalence, $r(29) = .88$, $p = .055$, but not with complexity, $r(29) = .02$, $p = .090$, revealing that the standard deviation valence ratings of IAPS pictures are moderately informative about the amount of ambivalence the picture elicits.

Discussion

Despite selecting the most neutrally rated IAPS pictures, within a ±.05 range around the 5.0 midpoint of the IAPS scale, our findings show marked variation in the degree to which people experience ambivalence when viewing these pictures. Moreover, the differing levels of ambivalence were predictive of the arousal viewers reported. This highlights that some of the supposedly neutral IAPS pictures do not elicit neutral responses. Instead, the apparently neutral rating sometimes masks mixed feelings. This is unavoidable on bipolar rating scales that conceptualize neutral as the midpoint between polar opposites—Participants who want to express "a bit of both" cannot be distinguished from participants who want to express "neither." This is important for researchers who select neutral IAPS pictures for use as a neutral comparison condition in their research. Ambivalence has well-documented specific consequences for affect and cognition, including feelings of uncertainty, biased information processing, and increased illusionary pattern perception (e.g., Sparks et al., 2001; van Harreveld et al., 2014, 2015). Unknowingly introducing these factors into a research design may lead to many surprises and unwarranted conclusions.

Table 2
Predicting Arousal From Valence, Complexity, Objective, and Subjective Ambivalence Using Multiple Regression Analyses, All Predictors Entered Simultaneously

Predicting arousal	*beta*	*t*	*p*
Valence	.18	.97	.344
Objective ambivalence	.1	.38	.706
Subjective ambivalence	1.14	2.59	.016
Complexity	−.75	−1.99	.058
Model	$F(4, 24) = 4.00$, $p = .013$		
Explained variance (R^2)	40%		

Our results showed a strong positive correlation between subjective ambivalence and complexity, reflecting that the more complex an attitude is (i.e., has more attributes), the more likely it is also experienced as ambivalent (cf. van Harreveld, van der Pligt, de Vries, Wenneker, & Verhue, 2004). Notably, in the regression analyses, complexity seemed negatively related to arousal. Potentially, this reflects that when variance related to complexity as a result of ambivalence is removed, the remaining variance reflects complexity due to having to express an attitude toward something completely neutral. This may in itself be a complex endeavor, but not one that is related to strong arousal.

With regards to our measure of objective ambivalence, one might argue that participants interpreted the low ends of our unipolar scales valence (*not at all negative*, *not at all positive*, respectively) as the opposite of the high ends (i.e., *not at all positive* implies *negative*), making the scale essentially bipolar, which could have potentially inflated participants' responses (Russell & Carroll, 1999), and consequently, levels of objective ambivalence. However, in relation to our unipolar scales, we instructed participants to ignore evaluations of the opposite valence while making their judgments, which has been shown to lead to an underestimation of objective ambivalence (Refling et al., 2013). As such, we do not believe that our levels of objective ambivalence are inflated per se, but future work may examine differences in ambivalence depending on methodological approach. More to the point, the goal of the current work is to show (i) that levels of both objective and subjective ambivalence vary in neutral IAPS pictures and (ii) that subjective ambivalence is positively related to experienced arousal.

AQ: 7

Related to this, in our studies participants first rated all pictures on the original IAPS scales, and only then rated ambivalence. Although this makes conceptual sense, future work could rule out any potential effects (e.g., fatigue) of this specific sequence by counterbalancing the order in which these measures are administered.

A straightforward way to identify neutral pictures is to use multiple unipolar scales, thus allowing respondents to express their mixed feelings (as used in our objective ambivalence measure, cf. Kaplan, 1972; Refling et al., 2013; Thompson et al., 1995). For the pictures used in the present study, Table 1 presents the scores for objective and subjective ambivalence. Because subjective ambiv-

alence is dependent on both the presence of negative and positive evaluations as well as on situational factors (e.g., Nordgren et al., AQ: 8 2006; Schneider et al., 2013; van Harreveld, Rutjens, et al., 2009) and individual differences (e.g., Newby-Clark et al., 2002), objective ambivalence scores represent a relatively stable representation of the structure of the evaluations. A selection based on these scores reduces the risk that effects observed under supposedly neutral control conditions are contaminated by the cognitive and affective consequences of ambivalence.

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Received April 16, 2015
Revision received December 22, 2015
Accepted December 30, 2015 ■