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Pleasure, displeasure, and mixed feelings: Are semantic opposites mutually exclusive?

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Are pleasure and displeasure opposite markers of a single dimension, or are pleasure and displeasure two separate feelings? The present article argues that the existing evidence proved inconclusive for four reasons: (a) assessment of affect in unspecified situations, (b) assessment of affect at one moment in time, (c) use of inappropriate statistics, and (d) lack of theoretical predictions. The present article presents a study in which affect was assessed before and after an induction of mild displeasure via unpleasant pictures. Furthermore, pleasure and displeasure ratings are compared to ratings of feeling hot and cold. Results indicate that hot and cold ratings represent opposite ends of a single hot-cold dimension. Pleasure ratings could not be represented along a single pleasure-displeasure dimension. Methodological implications for future research on the structure of affect are discussed.

The nature of pleasure and displeasure has been a long-standing question in emotion research (e.g., Beebe-Center, 1932; Wundt, 1896). Some researchers consider pleasure and displeasure—that is, feeling good versus bad, positive versus negative, happy versus sad—as semantic opposite labels for different regions of a single dimension. Just like ''short'' and ''tall'' are opposing labels for different heights, pleasure and displeasure describe different regions of a single bipolar dimension (Beebe-Center, 1932). These researchers argue that pleasure and displeasure are mutually exclusive because they describe different quantities along a single dimension. Just as an individual cannot be short and tall, an individual should not be able to feel unpleasant and pleasant at the same time (Russell & Carroll, 1999).

Other researchers consider pleasure and displeasure as two distinct feeling qualities—just as hunger and thirst are two distinct feelings—that are sometimes experienced concurrently (Cacioppo & Berntson, 1994; Diener & Iran-Nejad,

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1986). As a consequence, it is not possible to describe experiences of pleasure and displeasure along a single bipolar dimension. Rather, pleasure and displeasure are best represented by two unipolar dimensions; one dimension ranges from the absence of pleasure to the maximum level of pleasure, whereas the other dimension ranges from the absence of displeasure to the maximum level of displeasure.

Over the past three decades numerous studies have tried to test the one-dimensional model against the two-dimensional model of pleasure and displeasure (see Cacioppo & Berntson, 1994; Eid, Notz, Schwenkmezger, & Steyer, 1994; Russell & Carroll, 1999, for reviews). The majority of studies used a seemingly straightforward approach to answer this question. A sample of participants completed an affect questionnaire without any experimental manipulation. Then individual differences in pleasure were correlated with individual differences in displeasure. Sometimes the raw correlations were interpreted directly; at other times they were submitted to a factor analysis, and the factor-loading pattern was interpreted. When correlations were close to zero (or factor analysis extracted two factors), researchers concluded that pleasure and displeasure are two separate feeling qualities. On the other hand, when pleasure and displeasure showed a strong negative correlation (or factor analysis revealed a bipolar factor), researchers concluded that pleasure and displeasure are opposite markers of a single bipolar dimension.

After thirty years, and dozens of studies, this research strategy has not been able to solve the controversy regarding the nature of pleasure and displeasure (cf. Diener, 1999). I propose that past empirical studies suffered from four weaknesses that rendered their results inconclusive.

Assessment of affect in unspecified situations

In a recent review of this literature, Russell and Carroll (1999) noted that most studies assessed feelings of pleasure and displeasure while respondents were sitting in a laboratory. In other words, researchers relied on individual differences in affective experiences that were caused by factors outside the experimenters' control and awareness. This approach has two weaknesses. First, it is difficult to separate valid variance in affect ratings from individual differences in response styles. Second, relying on natural variation of affect might be problematic because theoretically interesting experiences might be rare (cf. Cacioppo, Gardner, & Berntson, 1999). For example, Schimmack (1997) found in three separate assessments that the mean level of depressed mood ranged from 0.62 to 0.68 on a scale ranging from 0 = not at all to 6 = maximum intensity. Furthermore, about two-thirds of the participants reported not feeling a depressed mood at all. Hence, it is difficult to assess the relation between pleasure and displeasure in these situations, because individual differences in displeasure are extremely restricted. It is possible that results of past studies are

influenced by the rare occurrences of intense displeasure in everyday life. In a recent review, Russell and Carroll (1999) speculated, ''different results would occur if different occasions were selected'' (p. 26).

Assessment of affect at one moment in time

Most studies on the dimensionality of affect appear to be modeled after studies that examine the structure and dimensionality of personality traits. This approach is unfortunate because it misses one advantage of investigations of states over investigations of traits, namely, that states can vary considerable over time. For example, Schimmack (1997; Schimmack & Grob, 2000) found low test-retest correlations (ranging from .20 to .40) for cheerful and depressed moods over a retest interval of one or two weeks. The variability in affective experiences over time has two advantages. First, researchers can investigate changes in affects over time. The one-dimensional and the two-dimensional model of pleasure and displeasure make different predictions regarding the relation between changes in pleasure and displeasure. The one-dimensional model assumes that an induction of one affect (e.g., displeasure) should eliminate the opposite affect (pleasure) because the two affects are mutually exclusive. The two-dimensional model does not make this strict prediction. Second, repeated measurement designs can be used as an effective means to control response styles (cf. Russell & Carroll, 1999; Schimmack & Grob, 2000; Watson & Tellegen, 1999). Repeated measurement designs control response styles because they are part of the stable individual differences over time. Hence, changes in pleasure and displeasure ratings are less susceptible to the influence of response styles than are affect ratings at one moment in time.

Inappropriate statistical procedures

Arguably, the biggest obstacle to progress in this area of research has been the reliance on the Pearson correlation coefficient to test the dimensionality of pleasure and displeasure. Researchers' intuition led them to believe that Pearson correlations approaching -1 would indicate that pleasure and displeasure are opposite ends of a single dimension, whereas correlations approaching 0 provided support for the separability of pleasure and displeasure.

The validity of this assumption was first challenged by Diener and Iran-Nejad (1986; see also Russell & Carroll, 1999). The authors demonstrated that the main assumption underlying the use of Pearson correlations was incorrect. When pleasure and displeasure characterise different regions of a single bipolar dimension, they do not yield a linear correlation of -1. A perfectly negative Pearson correlation requires that changes in one measure predict the same changes in the opposite direction on the other meausre. However, a one-dimensional model of pleasure and displeasure assumes that changes in one affect often have no relation to changes in the opposite affect.

For example, when somebody experiences moderate pleasure (i.e., 3), the one-dimensional model predicts that the individual does not feel displeasure at the same time (i.e., 0). When pleasure increases to a maximum level (i.e., 6), displeasure should still be absent (i.e., 0) because pleasure and displeasure are mutually exclusive. Hence, the increase in pleasure from 3 to 6 does not produce a similar decrease in displeasure, which remains at the lowest possible level (i.e., 0).

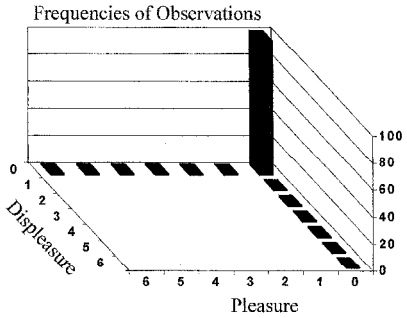
In short, the assumption that pleasure and displeasure describe opposite regions of a single bipolar dimension does not predict a perfectly negative linear relationship between pleasure and displeasure ratings. Rather it predicts that pleasure and displeasure ratings are mutually exclusive. That is, when pleasure is present, displeasure is absent, and vice versa. This prediction leads to a data pattern that Diener and Iran-Nejad (1986) called an L-shape pattern (Figures 1a and 1b).

Russell and Carroll (1999) recently added the observation that the magnitude of the Pearson correlation varies independently of the question whether the data conform to an L-shape pattern. They showed that data that do not conform to an L-shape pattern can yield a Pearson correlation of -1 (Figure 1d). On the other hand, data that do conform to an L-shape can yield Pearson correlations close to 0, namely, when most respondents report low levels of both affects (Figure 1a).

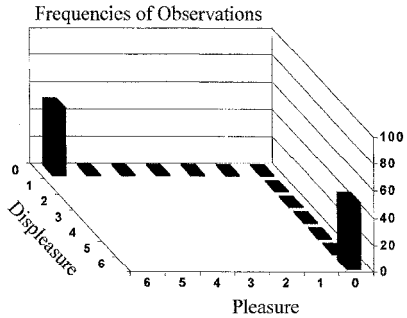
To test the dimensionality of pleasure and displeasure, Diener and Iran-Nejad (1986) suggested inspecting contingency tables between pleasure and displeasure ratings. More recently, Russell and Carroll (1999) also concluded, ''bipolarity should be examined through univariate and bivariate frequency distributions'' (p. 26). The one-dimensional model predicts that all valid reports of pleasure and displeasure fall along the L-shape in Figure 1a because these responses are consistent with the notion that pleasure and displeasure are mutually exclusive. In contrast, the two-dimensional model assumes that some valid responses fall outside the L-shape pattern, indicating that individuals sometimes feel pleasure and displeasure. Consistent with the historic literature on pleasure and displeasure, I refer to the latter experiences as *mixed feelings* (cf. Beebe-Center, 1932).

Several statistical coefficients can be used to summarise the degree to which a data set conforms to the L-shape pattern (see e.g., Diener & Iran-Nejad, 1986). I propose an index that is widely used in the attitude literature (cf. Priester & Petty, 1996). The index relies on the intensity of the weaker of the two affects (i.e., I[MF] = MIN[I[P],I[U]]), with I[MF] being the intensity of mixed feelings, I[P] the intensity of pleasant affect and I[U] the intensity of unpleasant affect). If pleasure and displeasure ratings conform to the L-shape pattern predicted by the one-dimensional model, I[MF] resumes a value of zero because one of the two affects is always absent. In contrast, I[MF] values greater than zero indicate that the data do not form an L-shape pattern. The difference between Pearson correlations and I[MF] values is illustrated in Figure 1. Figures 1a and 1b conform

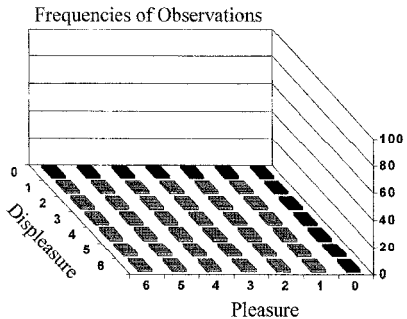
(1a) r = -.05 MIN = .00



(1b) r = -.95 MIN = .00



(1c) r = .00 MIN = 1.29



(1d) r = -1.00 MIN = 1.38

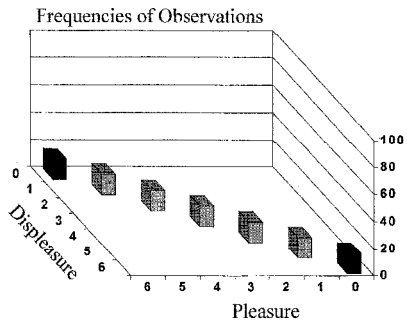


Figure 1. Hypothetical contingency tables of pleasure and displeasure.

to the prediction that pleasure and displeasure are mutually exclusive and both contingency tables yield I(MF) values of zero. Figures 1c and 1d show contingency tables that contain experiences of mixed feelings and both tables have I(MF) values greater than zero (1.29 and 1.37, respectively). In contrast, Pearson correlations are near zero for Figures 1a and 1c (−05, .00, respectively) and close to −1 for Figures 1b and 1d (−.95, −1.00, respectively). This finding demonstrates that I(MF) is better at testing whether pleasure and displeasure are mutually exclusive than the Pearson correlation.

Of course, real data will not yield I[MF] values of zero due to random measurement error and response styles. In this case, the one-dimensional model predicts that I(MF) = E, with E being a constant error term reflecting response styles and random measurement error. Values significantly greater than E would support the two-dimensional model of affect.

Lack of theoretical predictions

Previous research on this issue also suffered from the absence of theories. I propose that agreement on the dimensionality of pleasure and displeasure will only emerge when empirical findings are used to test theoretical predictions regarding the relation of pleasure and displeasure. If a theory predicts that participants should report mixed feelings in a particular situation and they do not report mixed feelings in this situation, the one-dimensional model would be strengthened. If, however, mixed feelings are reported in theoretically predicted circumstances, the two-dimensional model receives support.

Imagine walking along a beach on a sunny day watching the waves and seagulls. You feel very good and not bad at all. Then you notice plastic trash on the beach. How does this negative stimulus affect your experiences? There seem to be at least four possibilities. First, the negative stimulus might induce displeasure and fully spoil your previous good mood. As a consequence, the experience changes from pleasure without displeasure to displeasure without pleasure. A second possibility would be that the negative stimulus merely decreases the intensity of pleasure, but does not induce displeasure. As a consequence, the experience remains one of pleasure without displeasure. Both scenarios are consistent with a one-dimensional model of pleasure and displeasure. However, the next two models are incompatible with a bipolar pleasure-displeasure dimension. In one scenario, pleasure and displeasure vary independently of each other. As a consequence, pleasure remains as strong as before, whereas the feeling is now accompanied by displeasure elicited by the sight of pollution. In the other scenario, the induced displeasure inhibits the intensity of pleasure. However, the inhibition effect is reciprocal to the intensity of displeasure. If the induced displeasure is rather mild, the reduction in pleasure is not sufficient to fully eliminate pleasure. For example, if one initially feels strong pleasure (4) and no displeasure (0), and the negative stimulus induces

mild displeasure (2), pleasure would be reduced to mild pleasure (2). The interesting implication of this last model is that pleasure and displeasure can be reciprocally activated, and yet pleasure and displeasure are not mutually exclusive (Diener & Iran-Nejad, 1986). Nearly 100 years ago, McDougall (1905) proposed a similar model when he wrote:

> It is, I think, indisputable that a man may be unhappy while he actually experiences pleasure, and that he might make it more difficult to find pleasure and might make his pleasure thin in quality, but the two modes of experience, are though antagonistic, not absolutely incompatible and mutually exclusive. (p. 80)

OVERVIEW

The present study presents a new approach of studying the relationship between pleasure and displeasure. First, it assesses pleasure and displeasure at two moments in time to eliminate response styles by investigating changes in affective experiences. Second, the second assessment follows an experimental manipulation. Third, the experimental manipulation allowed testing predictions of different process models of changes in pleasure and displeasure. Fourth, the hypotheses were tested by exploring contingency tables of pleasure and displeasure ratings and the intensity of mixed feelings rather than Pearson correlation coefficients.

Although the main focus of the study was on pleasure and displeasure, the study also assessed other pairs of affects, namely awake-tired, interested-bored, tense-calm, and hot-cold. Hot and cold were included because typically feelings of hot and cold are mutually exclusive. Hence, the two feelings seemed to be ideal candidates to demonstrate the fact that MIN(hot,cold) is a more appropriate test of the dimensionality of two constructs than *r*(hot,cold). Second, the inclusion of hot and cold allowed estimating the influence of measurement error on MIN(hot,cold) because deviations from zero for MIN(hot,cold) can be attributed to response styles.

Method

A total of 342 students at the University of Illinois, Urbana-Champaign participated in this data collection for course credit. A total of 137 students were enrolled in an upper division psychology course. The remaining students took an introductory psychology course.

The data collection took part during the end of the fall semester and during the spring semester. It must be noted that the heating system in the psychology building is unreliable and sometimes overheated the room temperature (temperatures in the 80s; Fahrenheit), whereas the heating did not work on other days (temperatures in the 60s). As a consequence, temperatures varied across experimental conditions.

The present analyses are based on affect ratings before and after an experiment in which participants were exposed to 20 unpleasant, 10 neutral, and 20 pleasant pictures. The affect questionnaire included the adjectives pleasant, unpleasant, hot, cold, awake, tired, interested, bored, tense, calm in a mixed order. Each item was presented individually and was rated on a unipolar intensity scale. Participants were given the following instructions:

''We would like to know how you feel right now. Please answer the following questions carefully and as accurately as possible. For the following questions the response options are:

0 = I *do not* experience this feeling
1 = I do experience this feeling *very mildly*
2 = I do experience this feeling *mildly*
3 = I do experience this feeling *moderately*
4 = I do experience this feeling *strongly*
5 = I do experience this feeling *very strongly*
6 = I do experience this feeling *with maximum strength.*''

Further instructions were given to ensure that participants understood the unipolar nature of the response format (cf. Schimmack, 1997; Schimmack, & Diener, 1997; Schimmack & Hartmann, 1997). ''Please consider first whether you feel the experience. If you do not experience this feeling, respond with 0. If you experience this feeling, respond with 1 to 6.'' Each item was preceded by the sentence ''Right now, I feel...'' followed by a seven-point scale ranging from 0 to 6.

Results

Hot and cold ratings. Figure 2 shows the contingency table for feelings of hot and cold before and after the experiment. The data largely conform to an L-shape pattern: 239 responses (70%) conform to the L-shape pattern at both times, 17 (5%) conform to the L-shape only at Time 1 and 45 (13%) conform to it only at Time 2. Consistent with this observation, MIN(hot,cold) was low at time 1 ($M = 0.42$) and at time 2 ($M = 0.67$). So far, the results all support the unidimensional nature of hot and cold as opposite ends of a single dimension of temperature. However, if researchers had followed the traditional approach of using Pearson correlations, they would have come to a radically different conclusion. The Pearson correlations between hot and cold ratings were close to zero at time 1 ($r = -.10$) and at time 2 ($r = -.04$).

In short, the results for hot and cold ratings revealed important facts regarding ratings of feelings that are characterised by semantic opposites. First, for the most part, participants used the rating scales as unipolar scales. When they indicated that one feeling was present, they rated the opposite feeling as absent.

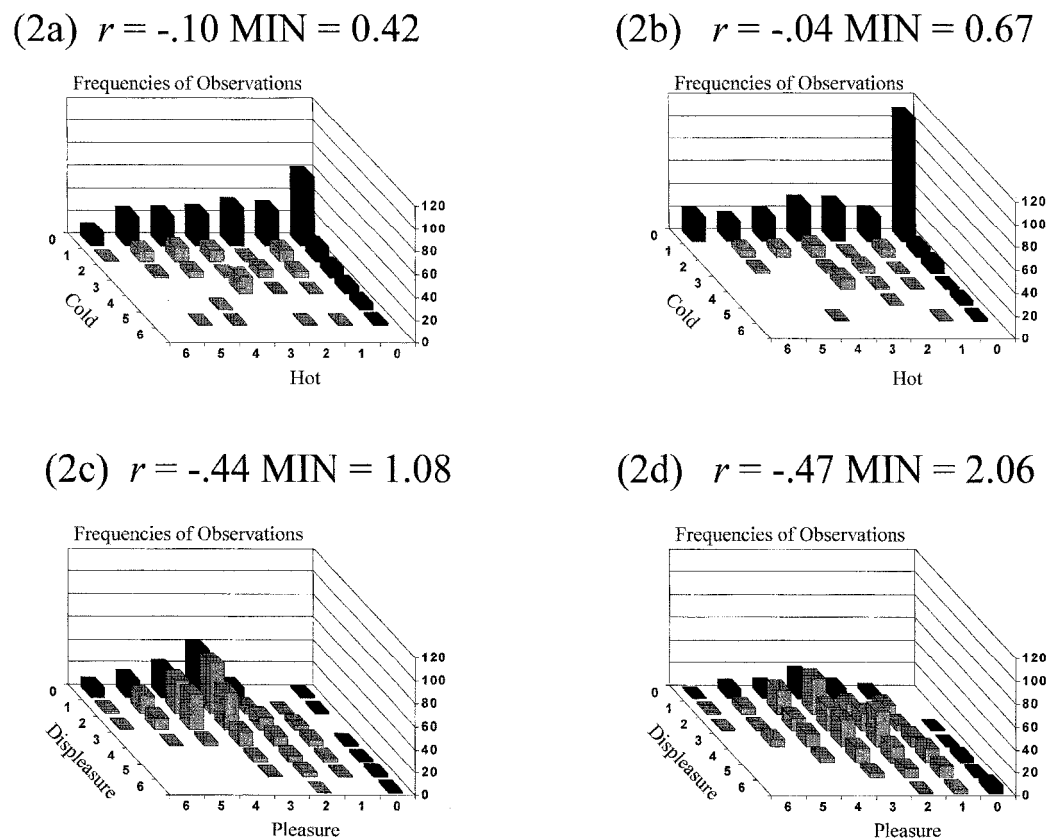


Figure 2. Contingency tables between hot and cold ratings and pleasure and displeasure ratings before and after the experiment. *Note:* (2a) hot-cold before experiment, (2b) hot-cold after experiment, (2c) pleasure-displeasure before experiment, (2c) pleasure-displeasure after experiment.

When they felt neither hot nor cold, they reported this state by using the lowest scale point for both feelings. Second, as predicted, unipolar ratings of opposite feelings produced an L-shape pattern, and MIN values close to zero. Third, as outlined in the Introduction, the Pearson correlation is unsuitable to detect an L-shape pattern. In past research, the obtained Pearson correlations close to zero would have been erroneously interpreted as counterintuitive evidence that feeling warm and feeling cold vary independently of each other.

Pleasure and displeasure. Figure 2 shows the contingency tables for ratings of pleasure and displeasure before and after the experiment. The table before the experiment is very similar to findings in experience sampling studies in which participants rate their feelings in a representative sample of everyday moments (Schimmack, Coleman, & Diener, 2000a). Pleasure forms a normal distribution with moderate levels of pleasure as the modal response. In contrast, displeasure shows a skewed distribution with the absence of displeasure as the modal response.

The picture changes after the experiment. Now, many more participants reported displeasure at increased levels of intensity, but participants still reported pleasure. To test the significance of this change, I conducted an Analysis of Variance (ANOVA) with I(MF) values before and after the experiment. The change was highly significant, $F(1, 341) = 151.72$, $p < .001$, $\eta^2 = .31$. As predicted, I(MF) after the experiment ($M = 2.06$) was higher than I(MF) before the experiment ($M = 1.08$). To control for the influence of response styles, I compared I(MF) values to MIN(hot,cold) values before and after the experiment. Both differences were highly significant, $F(1, 341) = 124.00$, $p < .001$; $\eta^2 = .27$, and $F(1, 341) = 185.59$, $p < .001$, $\eta^2 = .35$.

Further analyses revealed that pleasure and displeasure are reciprocally activated. The intensity of displeasure increased from 1.39 to 2.32, $F(1, 341) = 102.02$, $p < .001$, $\eta^2 = .23$. At the same time, the intensity of pleasure decreased from 3.28 to 2.65, $F(1, 341) = 70.46$), $p < .001$, $\eta^2 = .17$. Hence, the results support a model of pleasure and displeasure as reciprocally activated affects that can coexist with each other.

Finally, it is noteworthy that the Pearson correlations for the contingency tables in Figure 2 were $-.44$ at Time 1 and $-.47$ at Time 2. This finding has three implications. First, these correlations are stronger than the correlations for hot and cold; yet hot and cold ratings conformed better to the prediction that hot and cold are mutually exclusive, opposite regions of a single dimension. This finding underscores the problems of using Pearson correlations to test the dimensionality of opposite affects. Second, the correlations are nearly identical at Time 1 and Time 2, whereas I(MF) values significantly increased due to the experimental induction of displeasure. This finding shows that I(MF) values are more sensitive to theoretically relevant changes in the data structure than are Pearson correlations. Finally, it is noteworthy that the correlations are similar to

TABLE 1
MIN values and Pearson correlations for pairs of antonyms at Time 1 and Time 2

	MIN		*Correlation*	
Item pair	*T1*	*T2*	*T1*	*T2*
Hot-Cold	0.42	0.67	−.10	−.04
Interested-Bored	1.06	1.60	−.23	−.28
Tense-Calm	1.14	1.93	−.42	−.41
Pleasant-Unpleasant	1.08	2.06	−.44	−.47
Wakeful-Tired	1.81	2.18	−.59	−.60

the correlations in Russell and Carroll's (1999) meta-analysis. The authors argue correctly that these correlations are compatible with an underlying L-shaped contingency table. However, the present data show that these correlations are equally compatible with data that are incompatible with an L-shape pattern. Hence, these correlations cannot be used to support the one-dimensional or the two-dimensional model.

Other pairs of affects. Table 1 reports the MIN values and Pearson correlations for all pairs of antonyms. Ratings of hot and cold showed the lowest MIN values. All comparisons with hot and cold ratings showed that other antonyms produce significantly higher MIN values. This finding shows that ratings of antonyms on unipolar scales do not necessarily produce the L-shape pattern. In other words, participants do not always treat antonym pairs as opposite markers of a unidimensional scale that is split into two halves when responses are made along unipolar scales. In addition, Table 1 shows that the weakest Pearson correlations were obtained when MIN values were smallest, whereas the strongest Pearson correlations were obtained for the pair that also yielded the highest MIN values. This finding once more shows that Pearson correlations and MIN values test different patterns in the data. Pearson correlations test the presence of linear dependencies, that is, whether changes in one variable are reflected in changes in the other variable. MIN values test whether values greater than zero on one variable are accompanied by zero values on the other variable.

DISCUSSION

The present article points out methodological problems in structural research on affect. Previous studies often assessed affect in a single, rather neutral situation, and tested structural aspects by means of Pearson correlations. The present article points out that more informative results can be obtained from studies that

explore changes in affective experiences in response to experimental manipulations. Furthermore, it was demonstrated that the intensity of the weaker affect, that is MIN(pleasure,displeasure), is a more appropriate statistic to test whether pleasure and displeasure are mutually exclusive.

The present test of the dimensionality of pleasure and displeasure supports a model that considers pleasure and displeasure as separate affects. The intensities of the two affects appear to be reciprocally related in that increases in one affect appear to reduce the intensity of the opposite affect. Yet the reciprocal relationship between pleasure and displeasure does not imply that the two affects are mutually exclusive. When one affect is strong, the inhibitory effect of the opposite affect is not sufficient to eliminate the opposite affect. In these situations, people experience both pleasure and displeasure.

This model is consistent with several findings in the literature. The finding of a predominance of pleasant feelings and an absence of unpleasant feelings at the beginning of the experiment is consistent with numerous findings that affective experiences are predominantly positive (Cacioppo et al., 1999; Diener & Diener, 1996; Flügel, 1925). The reciprocal relation between pleasure and displeasure is consistent with Diener and Iran-Nejad's (1986) observation that people are more likely to report mixed feelings at low to moderate levels of intensity, whereas experiences of intense pleasure and intense displeasure are rare (see also Schimmack et al., 2000a). The infrequent experiences of intense mixed feelings can be explained by the reciprocal relation between pleasure and displeasure. Even in the presence of a strong pleasant and a strong unpleasant stimulus, the two affects will inhibit each other, yielding only moderate levels of pleasure and displeasure. Experimental support for the inhibition effect stems from a study by Schimmack and Colcombe (1999). The authors presented pleasant or unpleasant pictures either in isolation or concurrently. When pleasant pictures were presented alone, they elicited strong pleasure. When the same pictures were presented in combination with an unpleasant picture, displeasure increased and pleasure decreased. Similarly, adding a pleasant picture to an unpleasant picture increased pleasure and decreased displeasure.

Limitations, clarifications, open question, and future research

Semantics and feelings. The appeal of the one-dimensional model rests on the analogue between pleasure and displeasure to other pairs of antonyms such as hot and cold or short and tall. If the antonyms hot and cold are opposite ends of a single continuum, this should also be the case for pleasure and displeasure. As noted by Beebe-Center (1932) ''from the linguistic point of view pleasantness and unpleasantness are opposites. This has led a good many psychologists to consider the variables which they represent as positive and negative phases of a single more general variable'' (p. 3).

However, later on Beebe-Center (1932) points out that the matter is more complex. Semantic opposition seems to predict experiential opposition only if pleasure and displeasure are global aspects of consciousness. If, however, feelings are localised and attached to particular thoughts or sensations, semantic opposition only makes predictions for each *localisation* of pleasure or displeasure (see also Reisenzein, 1992). However, semantics do not preclude the possibility that one feels pleasure with regard to one object and displeasure with regard to another object. Hence, whether one can feel pleasant about a sunny day on the beach and displeasure about pollution is not a matter of semantics. This question needs to be addressed in empirical investigations of the consequences of multiple affective causes on affective experiences.

The importance of the localisation of feelings can be easily seen with regard to feelings of warmth and cold. Typically these feelings can be described along a single dimension. However, it is possible to experience warm and cold when different body parts are exposed to different temperatures (Geldard, 1953; Wohlgemuth, 1919). These feelings are experienced as localised feelings, for example, warm on the left hand and cold on the right hand.

Independence vs. *bipolarity.* The present article avoided several common concepts in affect structure research. In particular, I did not use the notions of *bipolarity* and *independence*. Both concepts have been used inconsistently in the literature and have added to the confusion and controversy. Independence can have at least three different meanings. First, it could mean that changes in pleasure occur without changes in displeasure. Second, it could mean that the Pearson correlation between ratings of pleasure and displeasure is not significantly different from zero. Third it could mean that pleasure and displeasure are independent affective experiences. It is possible that pleasure and displeasure are independent in one sense, but not in a different sense. Hence, it seems preferable to avoid this ambiguous concept in writing about the structure of affect.

Similarly, bipolarity has been used inconsistently. Russell and Carroll (1999) use bipolarity in the present sense that pleasure and displeasure are opposites ends of a single bipolar dimension. Others used bipolarity to refer to a perfect inverse relation between pleasure and displeasure (e.g., Green, Goldman, & Salovey, 1993). The present article demonstrates that data can conform to bipolarity in one sense, but not to bipolarity in the other sense.

For this reason, the notions of independence and bipolarity should be avoided. The notion of mutually exclusive states is less ambiguous and seem to be a direct test of the question of whether two concepts represent opposite ends of a single continuum or not. However, it should be noted that mutual exclusion is necessary, but not sufficient, for two concepts to be opposite ends of a single continuum. For example, being a grandfather and a daughter are mutually exclusive concepts, yet the two concepts are not opposite ends of a bipolar

dimension. Similarly, pride and hopelessness might be mutually exclusive feelings, yet they do not describe opposite ends of a single dimension.

Response styles. The present article used two methods to control response styles that could produce spurious deviations from the L-shape pattern and the complementary MIN values of zero. First, the study included a pair of antonyms that was theoretically predicted to conform to the L-shape pattern. Hence, these ratings could be used to estimate the amount of error variance in participants' ratings. This approach is consistent with the definition of response styles as contentless preferences for certain response categories (Rorer, 1965). As a consequence, response styles should manifest themselves in ratings across different content domains. However, one might object to this approach by arguing that response styles are content-specific. One could argue that pleasure and displeasure ratings are more susceptible to response styles than are ratings of feeling warm and cold.

The second method of controlling response styles avoids this problem. It controlled response styles for ratings of pleasure and displeasure by analysing changes in pleasure and displeasure ratings. By demonstrating that the intensity of mixed feelings increased, it is no longer possible to attribute the more intense mixed feelings at Time 2 to response styles unique to pleasure and displeasure ratings. However, one could argue that response styles are not only content-specific, but also situation-specific. Accordingly, pleasure and displeasure ratings after the experiment were more susceptible to response styles than were pleasure and displeasure ratings before the experiment. Of course, at present the assumption of content-specific and situation-specific response styles is purely speculative, and traditional methods of controlling response styles are unable to differentiate these styles from valid responses. The fact that the intensity of mixed feelings increased in a theoretically meaningful way suggests that the finding is substantive rather than a response artifact.

Measurement issues. Some readers might feel uncomfortable with the reliance on single item indicators. It is well known that single item indicators are more susceptible to random measurement error that can be reduced by using multiple items. However, the main empirical contribution of the present article was the demonstration that the intensity of mixed feelings significantly increased in response to an experimental manipulation. This finding was obtained despite random measurement error. The use of multiple item scales could only produce stronger effect sizes for this effect. Furthermore, multiple item scales that use the same format are unable to control for systematic measurement error. Hence, nothing is gained from using multiple items for this purpose.

Some authors have argued that using multiple items with different response formats can be used to control systematic measurement error (Green et al.,

1993). However, Russell and Carroll (1999) recently pointed out that these studies included response formats that were interpreted by participants as bipolar scales. Of course, bipolar scales cannot be used to test whether pleasure and displeasure are mutually exclusive. Hence, one would need to construct different unipolar response formats. To do so, Schimmack, Bockenholt, Reisenzein, and Diener (1999) used a verbal and a numerical intensity scale. They found that the use of multiple formats failed to detect systematic measurement error. They also found that the ratings of unrelated content were better able to detect systematic measurement error than did multiple response formats. In the present study, the hot and cold ratings served this purpose.

The lacking absence of pleasure. One of the major reasons for the experience of mixed feelings in the present study appears to be that participants felt moderately pleasant at the beginning of the experiment. This finding is consistent with affect ratings in everyday life. Schimmack et al. (2000) found that participants reported the absence of pleasure in less than 5% of random moments. This finding is generally consistent with daily diary data and retrospective assessments of the times people experience pleasure (Schimmack, Oishi, Diener, & Suh, 2000b). Future research needs to explore the causal factors that maintain the near constant experience of pleasure even in the presence of negative stimuli. The dominance of pleasure is also important for the understanding of clinical depression. Frequent reports of the absence of pleasure might be more diagnostic of depression than frequent reports of the presence of displeasure.

Explorations of other affects. The present article focused on affects that are characterised by semantic opposites. However, the methodological problems of the Pearson correlation coefficient also apply to other research questions. For example, many specific emotions are defined as pleasant or unpleasant feelings (Ortony, Clore, & Collins, 1988). For example, if fear is an unpleasant emotion, and pride is a pleasant emotion, and pleasure and displeasure were mutually exclusive, then one would expect fear and pride to be mutually exclusive as well. Inspections of contingency tables of specific emotions are needed to test this prediction.

CONCLUSION

In sum, affect researchers have a lot of work to do. It is becoming increasingly clear that the excessive reliance on Pearson correlations and factor analysis has been a dead end for enquiries into the structure of affect (cf. Cacioppo et al., 1999). A few key articles have sketched new approaches to structural analysis of affect (Cacioppo & Berntson, 1994; Diener & Iran-Nejad, 1986; Russell & Carroll, 1999). The present article suggests that investigations of changes in

affective experiences in combination with appropriate statistical coefficients provide more conclusive evidence regarding the structure of affect. The present study also presented initial evidence that pleasure and displeasure are two separate affects that are reciprocally related, yet not mutually exclusive. Future research needs to submit this model to more rigorous tests.

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