

Emotional Ambivalence in Daily Life: Implication for Depression, Anxiety, and Stress

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Abstract

Emotional ambivalence—the simultaneous experience of positive and negative emotion toward the same target—is associated with affective outcomes such as depression and anxiety across various life-changing events. However, existing studies often examined it as a trait, leaving its everyday dynamics understudied. Across five experience sampling datasets (Study 1: 110 adults, 2,060 observations; Study 2: 447 adults, 16,128 observations; Study 3: 40 adults, 4,542 observations; Study 4: 299 adults, 3,796 observations; Study 5: 756 adults, 7,378 observations), this study examined (a) the short-term variability of emotional ambivalence, and (b) the association between emotional ambivalence and momentary affective outcomes (i.e., depression, anxiety, and stress) in daily life. Results showed that emotional ambivalence varied significantly throughout the survey period. Higher levels of emotional ambivalence at both state and trait levels were associated with increased depression, stress, and anxiety in most studies. After controlling for mean positive and negative emotions, higher emotional ambivalence remained significantly associated with higher depression and anxiety in most studies, though many trait-level results were insignificant. A mini meta-analysis further indicated that emotional ambivalence at both trait and state levels was significantly associated with

these affective outcomes across five studies, except for the association between emotional ambivalence at the trait level and stress. This comprehensive examination highlights the need to consider the fluctuations in emotional ambivalence. The insights gained also underscore the importance of considering the multifaceted nature of emotional experiences for a better understanding of emotional experience and well-being.

Keywords: emotional ambivalence, depression, anxiety, stress, experience sampling methods

Emotional Ambivalence in Daily Life: Implication for Depression, Anxiety, and Stress

Ambivalence is characterized by simultaneous, oppositional positive and negative orientations toward an object (Ashforth et al., 2014; Rothman et al., 2017). Different forms of ambivalence include attitudinal (Cacioppo et al., 1997; Thompson et al., 1995; van Harreveld et al., 2015), emotional (Fong, 2006), relational (Uchino et al., 2014), trait (Sincoff, 1990), and expressed ambivalence (Fourie, 2003). Despite slight variations in definitions, they share the key feature of simultaneously experiencing strong yet opposite feelings or attitudes. A systematic review focusing on ambivalence (Rothman et al., 2017) indicated that the impact of ambivalence on cognitive, behavioral, emotional, and physical responses, both positively and negatively (Armitage & Conner, 2000; Emmons & King, 1988; Fong, 2006; Larsen et al., 2003). However, these studies confused

emotional ambivalence with other forms of ambivalence, leaving how emotional ambivalence plays a role in affective outcomes unknown.

Ambivalence and Psychopathology

Research has concluded that ambivalence has significant implications for psychopathology (Rothman et al., 2017). Common psychopathology associated with ambivalence included schizophrenia, depression, and obsessive-compulsive disorder (OCD, Bhar & Kyrios, 2007; Sincoff, 1990). For example, higher internalized ambivalence is associated with feelings of depression, guilt, and worthlessness (Sincoff, 1990). Bhar and Kyrios (2007) found that, compared to other anxiety disorders and non-clinical participants, OCD participants exhibited higher ambivalence in self-perception. Further, this study highlighted that ambivalence in self-perception might exacerbate feelings of guilt, depression, and worthlessness, which are often prevalent in individuals with OCD.

While ambivalence can negatively impact psychological health, some research suggests it may foster psychological resilience in certain contexts. In a longitudinal psychotherapy study, Adler and Hershfield (2012) found that patients who experienced a blend of happiness and sadness showed enhanced psychological well-being. Similarly, expressions of positive emotions during grieving were associated with reduced distress over time (Bonanno & Keltner, 1997). Thus, these studies highlight that ambivalence plays a significant role in psychopathology and affective outcomes.

However, we do not know whether ambivalence plays a dynamic role rather than a static role, which remains understudied.

Previous studies have shown that employing real-time monitoring techniques, such as the experience sampling method (ESM), to study daily emotional experiences can significantly enhance ecological validity. ESM offers a unique perspective on the complexities of psychological processes by capturing them as they naturally unfold (Hamaker & Wichers, 2017; Newman & Nezlek, 2022). Given our interest in emotional ambivalence, we aim to examine the association between emotional ambivalence and different affective outcomes in ecological momentary assessments (EMAs).

Emotional Ambivalence

The present study used Fong's (2006) definition of emotional ambivalence: the simultaneous experience of positive and negative emotions about the same target (e.g., person, situation, object, symbol, or idea). This definition focuses on the state of emotional conflict rather than the conflict between the desire and ability to express emotions (King & Emmons, 1990). Among the few existing studies that adopt Fong's conceptualization, none have explored its relationships with affective outcomes (Fong, 2006; Gabriel et al., 2022; Pratt & Doucet, 2000; Pratt & Rosa, 2003; Rees et al., 2013; Wang et al., 2023).

We use the Griffin formula to assess emotional ambivalence, a widely validated and the most common formula for studying ambivalent attitudes and emotions (Rothman et al., 2017; Thompson et al., 1995). Specifically,

ambivalence scores can be obtained by subtracting the absolute difference between positive (P) and negative (N) affect (i.e., Similarity Component) from their averaged intensity (i.e., Intensity Component). Therefore, emotional ambivalence can be mathematically represented by the equation:

$$\textbf{\textit{Emotional Ambivalence}} = - |\textbf{P-N}|$$

Higher values represent higher levels of emotional ambivalence. For example, on a scale from 1 to 5, an individual who scores a 5 on both positive and negative emotions shows high intensity (averaged intensity: 5) yet low difference (0) between positive and negative emotions. Therefore, this individual is high in emotional ambivalence (5). However, someone who reports a 5 on positive emotion and a 1 on negative emotion (or vice versa) is not as emotionally ambivalent ($3 - 4 = -1$) because the divergent emotions differ in intensity. Following a previous study (Gabriel et al., 2022), we used the items from the Positive and Negative Affect Scale (PANAS, Watson et al., 1988) to assess positive and negative emotions and compute the emotional ambivalence index.

The Present Study

Existing studies primarily use cross-sectional, lab experiments or long-term longitudinal designs involving participants undergoing significant life changes (Adler & Hershfield, 2012; Fong, 2006; Gabriel et al., 2022; Pratt & Doucet, 2000; Pratt & Rosa, 2003; Rees et al., 2013). The role of emotional ambivalence in daily life remains unstudied. Recent studies indicate that people frequently experience mixed feelings toward specific

stimuli in daily life (I. K. Schneider et al., 2021; Trampe et al., 2015). Thus, this prospective study examines emotional ambivalence within the context of real-time experiences and its association with daily affective outcomes. By examining emotional ambivalence, researchers can capture the nuanced and multifaceted nature of how mixed emotions influence thoughts, behaviors, and overall well-being in daily life. This could provide deeper insights into psychological health, potentially informing improved intervention strategies to enhance resilience and coping mechanisms.

We used five ESM studies to address two key questions about emotional ambivalence: (a) its short-term variability and (b) its association with daily affective outcomes in daily life. Data from five independent U.S. samples (Balban et al., 2023; Cunningham et al., 2021; Fisher et al., 2017; Umberson, 2022; Wright et al., 2023) were analyzed to assess dynamic changes in emotional ambivalence and its impact on daily affective outcomes (i.e., depression, anxiety, and stress).

Method

Transparency and Openness

Data were processed using R Version 4.3.0 (R Core Team, 2023). The data, materials, and code used to conduct the primary analyses are available online at OSF (<https://osf.io/928sx/>). Below, we report how we determined our sample size, describe all data inclusions, exclusions, and transformations, and list all measures used in the study.

Participants and Procedure

The present study utilized publicly available datasets from the Open Science Framework (OSF), the Institute for Social Research (ICPSR) at the University of Michigan, and Dryad. This paper reports on five studies that use ESM designs, capture real-time emotions using PANAS, and measure affective outcomes. The characteristics and details of the original studies can be found in the Supplemental Materials.

Study 1 (Balban et al., 2023;

<https://datadryad.org/stash/dataset/doi:10.5061/dryad.mpg4f4r0v>) is a randomized controlled study comparing three different daily five-minute breathwork exercises with an equivalent period of mindfulness meditation over one month to examine improvements in mood and anxiety, as well as reduced physiological arousal. The original study enrolled 113 participants and included 108 adult participants in the final sample ($M_{\text{age}} = 27.97$, $SD_{\text{age}} = 13.46$), with 68.5% female, 61.1% White, 24.1% Asian, 5.6% Black, 0.9% American Indian/Alaska Native, and 12.9% Hispanic.

Study 2 (Cunningham et al., 2021; <https://osf.io/gpxwa/>) is a study designed to assess individuals' daily sleep reports and their mental well-being during COVID-19. It comprised 1,662 adult participants ($M_{\text{age}} = 35.06$, $SD_{\text{age}} = 15.04$), with 77.7% female, 79.7% White, and 9.4% Hispanic.

Study 3 (Fisher et al., 2017, <https://osf.io/5ybxt/>) used a novel network methodology to explore the idiographic topology and temporal dynamics of mood and anxiety symptoms via concurrently estimated contemporaneous and temporal network models. A total of 40 individuals

with generalized anxiety disorder (GAD), major depressive disorder (MDD), or comorbid GAD and MDD were included in this study. Participants ranged in age from 18 to 65 years, with 65% female, 47% White, 8% Black, 22% Asian/Asian American, 15% Latino, and 8% Other.

Study 4 (Wright et al., 2023; <https://osf.io/su3gf/>) developed their study suitable for studying psychopathology dimensionally and hierarchically in intensive longitudinal studies. A total of 300 participants ($M_{\text{age}} = 28.00$, $SD_{\text{age}} = 6.38$), with 52.3% female, 74.7% White, 15.3% Black or African American, 5.0% Asian, and 8.3% multiracial or “Other.”

Study 5 (Umberson, 2022; <https://www.icpsr.umich.edu/web/ICPSR/studies/37404/summary>) is a study assessing how midlife couples in different-sex and same-sex marriages in the United States influence each other’s health and health behaviors. This study included 756 adult participants ($M_{\text{age}} = 48.20$, $SD_{\text{age}} = 8.42$), with 56.7% female, 86.1% non-Hispanic White, 3.6% non-Hispanic Black, 2.5% non-Hispanic Asian, 0.1% non-Hispanic Native American, and 4.4% Hispanic. Additionally, 70.8% identified as a sexual minority. Further details about these datasets can be accessed through the original OSF, ICPSR, and Dryad links provided above.

Measurements

Emotional Ambivalence

Emotional ambivalence was assessed using the Griffin formula, which reflects the balance between positive and negative affect (Fong, 2006; Reich

& Wheeler, 2016; Thompson et al., 1995). Positive and negative emotions were examined using the PANAS (Watson et al., 1988) or extracted items from the PANAS across these five studies. The average affect score was used in this study. Specific items for each study can be found in the Supplemental materials.

Affective Outcomes

Study 1 (Balban et al., 2023). The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1971) comprises two parts, each with 20 items, that measure state and trait anxiety. The state anxiety form contains questions about how the rater feels at the moment, with a Likert-type scale ranging from 1 (*Not at all*) to 5 (*Very much so*). The trait anxiety form contains questions about how the rater generally feels, with a Likert-type scale ranging from 1 (*Almost never*) to 5 (*Almost always*). The sums of these two parts were used as scores for ‘state’ and ‘trait’ anxiety, assessed before and after the 5-minute breathwork exercises daily.

Study 2 (Cunningham et al., 2021). This study used a daily diary design to assess symptoms of depression using a modified version of the Patient Health Questionnaire-8 (Kroenke et al., 2009), as well as their subjective experience of overall stress.

Study 3 (Fisher et al., 2017). During the ESM phase, participants received survey prompts four times daily to rate their experience of each item over the preceding hours using a 100-point slider from 0 (*Not at all*) to 100 (*As much as possible*). Surveys contained the extant symptoms of the

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (Brown & Barlow, 2014) criteria for GAD and MDD (*down and depressed, hopeless, loss of interest or pleasure, worthless or guilty, worried, restless, irritable, difficulty concentrating, muscle tension, fatigued*).

Study 4 (Wright et al., 2023). Participants completed an 81-item list of manifestations of psychopathology in daily life (Wright & Simms, 2016; Zimmermann et al., 2019). Items were rated with the reference period of “Over the past 24 hours...” and ratings were made on a slider from 0 (*Not at All*) to 100 (*Very Much*).

Study 5 (Umberson, 2022). Levels of general life stress in daily life were measured by asking respondents to rate current stress levels: “Overall, how trying or stressful was your day?” Ratings ranged from 1 (*Not at All*) to 5 (*Extremely*).

Data Analysis

Variability of Emotional Ambivalence and Time-series Plots

Following a previous study (Kleiman et al., 2017), two statistical approaches were employed to examine variations in participants’ emotional ambivalence over time: intraclass correlations (ICCs) and root mean square of successive differences (RMSSD). ICC values were used to determine the proportion of variance attributable to between-person differences. The RMSSD metric was adopted to ascertain the average variability in measurements over time, offering an advantage over other time-variability indices, such as growth curve modeling (Ebner-Priemer et al., 2009). Higher

RMSSD values indicate greater variability between successive observations. ICC and RMSSD were calculated using functions from the *psychometric* (Bliese, 2000; McGraw & Wong, 1996) and *varian* packages in R (Wiley et al., 2014).

To enhance the visualization of emotional ambivalence variation over time, two types of time-series plots were used: group-mean centered and individual raw data plots. The group-mean-centered time-series plots illustrated variability over time for the overall sample, allowing comparison of individual trajectories relative to the group average. This involved subtracting each participant's overall (i.e., group) mean from each of their individual scores. Conversely, individual raw score time-series plots provided a detailed visual examination of each participant's data, offering insights into unique patterns of psychological distress over time. The *ggplot2* (Wickham, 2009) package was used to create these visualizations.

Emotional Ambivalence and Affective Outcomes

We built several multilevel models to examine the direct relationship between emotional ambivalence and momentary affective outcomes, as well as the relationship after controlling for both the mean of positive and negative affect. At level 1, predictors were person-centered to assess within-person deviations from the participant's mean. At level 2, they were grand-mean centered on evaluating and controlling for between-person effects (Bolger & Laurenceau, 2013). A complete case analysis method was

employed, which involves retaining only those observations without any missing values across all variables.

We also conducted a mini meta-analysis to synthesize results across five studies within this study. The advantage of a mini meta-analysis is that it allows researchers to use the synthesized effect size across studies to guide the estimation of sample size needed for a high-power replication in future investigations. Additionally, it helps detect effects that are only identifiable when data from multiple studies are combined rather than in a single study (Goh et al., 2016; Nieminen, 2022).

Results

Variability of Emotional Ambivalence

The variability of emotional ambivalence was quantified using ICCs and RMSSD, with the results detailed in Table 1. The ICCs indicated that for the Study 1, 2, and 4 samples, approximately 60% of the variability in emotional ambivalence could be attributed to within-person fluctuations, as opposed to between-person differences. For the sample in Study 3 and 5, the within-person variance accounted for approximately 40% of the variability in emotional ambivalence. The RMSSD statistics revealed substantial variability in emotional ambivalence scores, suggesting notable fluctuation in these measures across the five samples.

The short-term variations in emotional ambivalence across five studies are visualized in Figure 1. Consistent with RMSSD values, the time series plots exhibit a sawtooth pattern, indicating substantial fluctuation in

emotional ambivalence levels over the observation period. Further, individual time series plots showcasing the raw scores of emotional ambivalence for each participant, complemented by the calculation of individual means and standard deviations, are illustrated in Figure 2. Due to the large sample size, we randomly chose data from five participants to highlight in color.

Association with Affective Outcomes

The results across five studies indicated that higher levels of emotional ambivalence at both state and trait levels were significantly associated with higher levels of depression, stress, and anxiety ($ps < .001$), with the exception of Study 3, where emotional ambivalence at the trait level was not associated with depression or anxiety ($ps > .05$). Further details are provided in Table 2.

We then examined the association between emotional ambivalence after controlling for the mean of positive and negative affect to assess the robustness of the association between emotional ambivalence and affective outcomes (see Table 2). After controlling for the mean of positive and negative affect, the results were mixed, but some studies showed a similar pattern across the five studies.

For anxiety (examined in Study 1, 3, and 4), higher emotional ambivalence at the state level was associated with higher anxiety in Study 3 ($\beta = .06, p = .005$) and Study 4 ($\beta = .07, p < .001$). At the trait level, higher emotional ambivalence was associated with higher both pre-anxiety ($\beta =$

.09, $p = .037$) and post-anxiety ($\beta = .15$, $p = .003$) in Study 1, as well as in Study 4 ($\beta = .24$, $p < .001$).

For stress (examined in Study 2 and 5), results in both Study 2 ($\beta = .05$, $p < .001$) and 5 ($\beta = .06$, $p < .001$) showed higher emotional ambivalence at the state level was associated with higher stress. However, only Study 2 showed that higher emotional ambivalence at the trait level was associated with higher stress ($\beta = .09$, $p = .001$).

In contrast, the findings of depression (examined in Study 2, 3, and 4) were less consistent. For depression, higher emotional ambivalence at the state level was associated with lower depression ($\beta = -.05$, $p < .001$) in Study 2. However, in Study 3, higher emotional ambivalence at the state level was associated with higher depression ($\beta = .04$, $p = .027$). Higher emotional ambivalence at the trait level was significantly associated with higher depression ($\beta = .15$, $p < .001$) in Study 2 and Study 4 ($\beta = .13$, $p < .001$).

A mini meta-analysis across five studies shows that higher levels of emotional ambivalence were related to depression and anxiety at both state and trait levels, even controlling for the mean of positive and negative affect. However, emotional ambivalence was only associated with stress at the state level (See Table 2).

Overall, though the findings across the five studies were mixed, they show that emotional ambivalence was related to affective outcomes. Especially after controlling for the mean of positive and negative affect and

conducting the mini meta-analysis, the results indicate that higher emotional ambivalence is generally associated with increased anxiety, depression, and stress at the state level, highlighting the dynamic impact of emotional ambivalence on these affective outcomes.

Discussion

This study addressed two key questions regarding emotional ambivalence: (a) its short-term variability and (b) its association with daily affective outcomes in dynamic settings. Our findings underscore the importance of understanding emotional ambivalence dynamically rather than statically. By demonstrating significant day-to-day and moment-to-moment variations in emotional ambivalence and its association with depression, anxiety, and stress, we provide evidence that emotional ambivalence has considerable variations over time that can influence dynamic emotional experiences and psychopathology. To our knowledge, this is the first study of within-person dynamics in emotional ambivalence. Such information underscores the importance of considering the multifaceted nature of emotional experiences for improved emotional regulation and well-being.

Dynamic Process of Emotional Ambivalence

The first objective of this study was to elucidate the short-term variability in emotional ambivalence. Our results revealed significant day-to-day/moment-to-moment variations in emotional ambivalence. Specifically, emotional ambivalence, with an ICC of .70 (average ICC pre- and post-

exercise) in Study 1, .59 in Study 2, .34 in Study 3, .61 in Study 4, and .42 in Study 5, indicated that 70%, 59%, 34%, 61%, and 42% of the variance is due to within-person variability in the five studies, respectively. Delving deeper into the variations of emotional ambivalence over time, our utilization of time series plots across different study contexts identify heterogeneous patterns of change, identifying both upward and downward trends at the individual level. This analysis provides a clearer understanding of the temporal dynamics of emotional ambivalence, revealing how its intensity can vary considerably from one day to the next within the same individual.

Our study's focus on short-term variability and its within-person dynamics opens new avenues for research. Future studies could explore the potential mechanisms underlying the dynamic changes in emotional ambivalence and the contextual factors, including environmental influences, personal events, characteristics of situations, and the use of emotion regulation strategies (Chen et al., 2024; Gabriel et al., 2022; Newman & Nezlek, 2022; Rothman et al., 2017).

The findings of this study highlight the potential of leveraging real-time assessments and personalized therapeutic interventions targeting emotional ambivalence to improve affective outcomes. By pinpointing moments of increased vulnerability—such as specific days or times when an individual's emotional ambivalence is particularly high—mental health professionals can tailor strategies and interventions to help regulate

emotions and increase resilience in real-time using digital technologies (Bettis et al., 2022; Bögemann et al., 2024; Nahum-Shani et al., 2018). This approach allows for the delivery of timely and efficient care optimized to the individual's needs across situations. Such personalized intervention strategies not only promise greater effectiveness but also emphasize the importance of ongoing monitoring and adaptive care in mental health practice (Bettis et al., 2022; Bögemann et al., 2024; Nahum-Shani et al., 2018).

Emotional Ambivalence and Its Association with Affective Outcomes and Psychopathology

The results across five studies indicated that higher levels of emotional ambivalence were significantly associated with higher levels of depression, stress, and anxiety at both state and trait levels. However, Study 3 showed inconsistent results compared to the other four studies, indicating that emotional ambivalence was not associated with depression and anxiety at the trait level. In line with previous research using lab experiments and cross-sectional design on emotional ambivalence (Adler & Hershfield, 2012; Bhar & Kyrios, 2007; Bonanno & Keltner, 1997; Sincoff, 1990), the current findings corroborate evidence that higher momentary emotional ambivalence is associated with worse affective outcomes. The possible explanation for the inconsistent results in Study 3 might be its study design. Compared to the other four daily diary designs, Study 3 used the EMA design, asking participants to answer questions four times daily

for 30 days. According to Koval and Kalokerinos (2024), momentary self-reports (e.g., EMA) capture real-time experiential knowledge, such as current feelings and thoughts, while short-term retrospective reports (e.g., daily diaries) collect episodic knowledge, which includes memories of recent experiences and events. These different methods might yield different results. Future studies should examine how heterogeneity in study design may yield different findings.

After controlling for both the mean of positive and negative affect, higher levels of emotional ambivalence were significantly associated with higher levels of depression and anxiety in most studies. However, many results were insignificant at the trait level. This finding supports previous studies that emotional ambivalence plays its role dynamically rather than at a trait level (I. Schneider et al., 2022; I. K. Schneider et al., 2021; Wang et al., 2023). While traditional methods of studying emotional ambivalence undoubtedly capture important information (e.g., attitudes and self-perceptions toward a specific object, target, or goal), such understanding is likely still too simplistic. Experience sampling methods offer a more direct assessment of emotional ambivalence in the time and place it occurs, as well as its association with affective outcomes and psychopathology in everyday life (Rothman et al., 2017). Furthermore, emotional ambivalence at the state level is more strongly and consistently associated with affective outcomes, underscoring the need to study emotional ambivalence from both a within- and between-person framework.

Limitations and Future Directions

Our study has several limitations. First, the five studies we used are all based in the U.S., so the generalizability of the findings to other countries and cultures remains unknown. Replication in more diverse samples would strengthen the conclusions and better understand emotional ambivalence. Additionally, further study should consider the relationship between emotional ambivalence and emotional granularity, which refers to the degree to which people use discrete emotion labels such as anger or sadness to describe their feelings (Barrett et al., 2001; Erbas et al., 2015; Kashdan et al., 2015). A previous study found that higher levels of momentary emotion differentiation were positively related to positive outcomes and negatively related to negative outcomes (Erbas et al., 2022), which share similar results with the association between ambivalence and emotions found in this study. These two constructs might have potential relationships that could be further discussed.

In light of these limitations, our findings have significant implications, potentially advancing emotional ambivalence research in several ways. First, compared with previous studies that primarily use cross-sectional, lab experiment, or longitudinal designs involving participants undergoing significant life changes (Adler & Hershfield, 2012; Bhar & Kyrios, 2007; Bonanno & Keltner, 1997; Sincoff, 1990), we used five publicly available datasets to capture dynamic emotional ambivalence and its implications for affect outcomes. Though the present study used five ESM studies to capture

real-time emotional ambivalence adequately, future research should incorporate passive sensing data, such as heart rate and geolocation, which could provide temporally specific information as to when emotional situations occur, thus enabling more precise emotional ambivalence and situation assessments (Bettis et al., 2022; Jacobson & Chung, 2020).

Second, as emotional ambivalence plays a role in psychopathology both in the short and long term, understanding when and why emotional ambivalence increases or decreases is crucial for developing better strategies to regulate emotion effectively. In addition, as Rothman and her colleagues (2017) indicated that there are many forms of ambivalence; it is also important to examine how emotional ambivalence is linked to other forms of ambivalence and other psychopathology outcomes (e.g., suicide).

Lastly, future studies should also consider studying emotional ambivalence from different perspectives to understand its comprehensive role. For example, they could look more at emotional ambivalence and pathways to risk and resilience following critical life events (e.g., losing loved ones). A previous study indicated that mixed emotional expression could enhance individuals' resilience during bereavement (Bonanno & Keltner, 1997), but we do not fully understand the role emotional ambivalence plays in this context. Having a better understanding of emotional ambivalence could help psychological professionals develop better treatments for addressing ambivalent states, such as using

motivational interviewing (Miller & Rose, 2015) to help clients resolve ambivalence and promote behavioral change to improve their well-being.

Declaration of competing interest

None.

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Tables and Figures

Table 1.

Descriptive and Variability Statistic for Emotional Ambivalence across Five Studies

| | | Emotional Ambivalence Score | | | | |
|-------|------|-----------------------------|-----------|-------------|------------------------|-------|
| | | Descriptive Statistics | | | Variability Statistics | |
| | | <i>M</i> | <i>SD</i> | Score range | ICC (95% <i>CI</i>) | RMSSD |
| Study | Pre- | 0.74 | 0.76 | -1.0 - 3.8 | 0.67 (0.61 - | 0.59 |

| | | | | | | |
|-------|----------|------|------|------------|--------------|-------|
| 1 | Exercise | | | | 0.73) | |
| | Post- | 0.56 | 0.77 | -1.0 - 3.7 | 0.73 (0.67 - | 0.55 |
| | Exercise | | | | 0.78) | |
| Study | | 0.85 | 0.73 | -1.0 - 4.1 | 0.59 (0.56 - | 0.56 |
| 2 | | | | | 0.63) | |
| Study | | 9.34 | 21.1 | -50.0 - | 0.34 (0.25 - | 19.73 |
| 3 | | | 7 | 81.5 | 0.46) | |
| Study | | -5.0 | 19.1 | -50.0 - | 0.61 (0.57 - | 17.78 |
| 4 | | 8 | 6 | 62.0 | 0.65) | |
| Study | | 0.52 | 0.88 | -1.0 - 4.3 | 0.42 (0.39 - | 0.90 |
| 5 | | | | | 0.45) | |

Note. *CI* = confidence interval; *ICC* = intraclass correlation; *RMSSD* = root square of successive differences (average of each participant's individual *RMSSD*).

Table 2.

Association between Emotional Ambivalence and Affective Outcomes and Psychopathology Symptoms

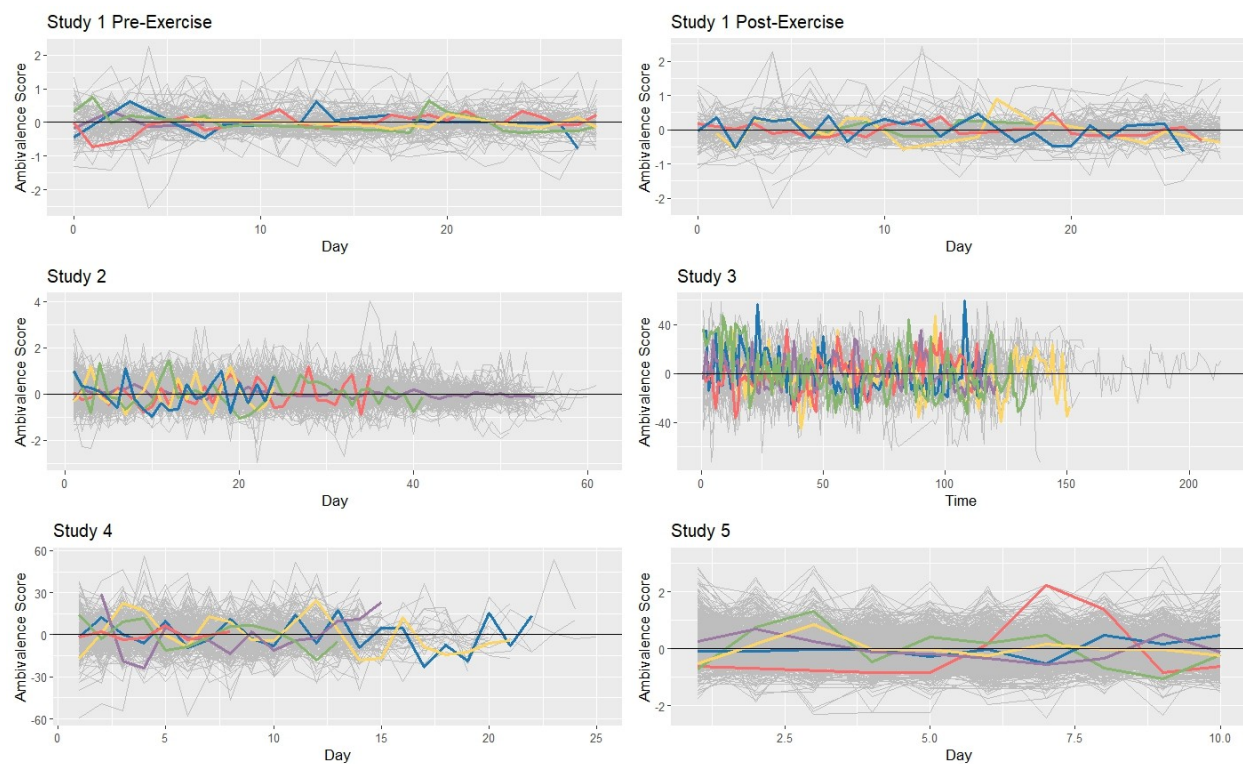
| | | Reduced Model | | | Full Model ^a | | | |
|---|------------------------------|---------------|------------|-------------------------|-------------------------|------------------|---------------------------|----------------------|
| | | β | 95% CI | p | β | 95% CI | p | |
| Study 1 (N = 110, 2,060 observatio ns) | Pre- Exercise Anxiety | Interce pt | .01 | [-0.07, 0.09] | .843 | .00 | [-0.08, .08] | .965 |
| | | Trait | .67 | [0.59, 0.76] | < .001 | .09 | [0.01, 0.17] | .037 |
| | | State | .36 | [0.32, 0.40] | < .001 | .03 | [0.00, 0.07] | .083 |
| | | PA | / | / | / | -.3 4 | [-0.37, -0.30] | < .001 |
| | | NA | / | / | / | .66 | [0.62, 0.70] | < .001 |
| | Post- Exercise Anxiety | Interce pt | .02 | [-0.06, 0.11] | 0.54 6 | .02 | [-0.06, 0.10] | .593 |
| | | Trait | .74 | [0.65, 0.82] | < .001 | .15 | [0.06, 0.25] | .003 |
| | | State | .32 | [0.27, 0.37] | < .001 | .02 | [-0.02, 0.07] | .307 |
| | | PA | / | / | / | -.3 5 | [-0.40, -0.29] | < .001 |
| | | NA | / | / | / | .59 | [0.54, 0.64] | < .001 |
| Study 2 (N = 447, 16,128 observatio ns) | Depressi on | Interce pt | .01 | [-0.06, 0.08] | .753 | .01 | [-0.05, 0.07] | .650 |
| | | Trait | .40 | [0.33, 0.47] | < .001 | .15 | [0.09, 0.21] | < .001 |
| | | State | .07 | [0.05, 0.09] | < .001 | -.0 5 | [-0.06, -0.04] | < .001 |

| | | | | | | | | |
|---|----------------|---------------|------|------------------|-----------|----------|-------------------|-----------|
| Study 3 (N = 40, 4,542 observatio ns) | Stress | PA | / | / | / | -.2 7 | [-0.29, -0.25] | < .001 |
| | | NA | / | / | / | .32 | [0.31, 0.33] | < .001 |
| | | Interce pt | .00 | [-0.06, 0.06] | 0.96 2 | .00 | [-0.05, 0.05] | .906 |
| | | Trait | .37 | [0.31, 0.42] | < .001 | .09 | [0.03, 0.14] | 0.00 1 |
| | | State | .20 | [0.18, 0.22] | < .001 | .05 | [0.03, 0.07] | < .001 |
| | | PA | / | / | / | -.2 7 | [-0.22, -0.18] | < .001 |
| | Depressi on | NA | / | / | / | .44 | [0.43, 0.46] | < .001 |
| | | Interce pt | .00 | [-0.20, 0.21] | .992 | .01 | [-0.14, 0.16] | .916 |
| | | Trait | .09 | [-0.07, 0.24] | .251 | .14 | [-0.02, 0.30] | .077 |
| | | State | .17 | [0.08, 0.27] | < .001 | .04 | [0.00, 0.08] | .027 |
| | | PA | / | / | / | -.3 7 | [-0.39, -0.35] | < .001 |
| | | NA | / | / | / | .41 | [0.39, 0.44] | < .001 |
| | Anxiety | Interce pt | -.01 | [-0.24, 0.22] | .932 | -.01 | [-0.17, 0.16] | .949 |
| | | Trait | .00 | [-0.15, 0.16] | .970 | .04 | [-0.12, 0.20] | .578 |
| | | State | .18 | [0.10, 0.26] | < .001 | .06 | [0.02, 0.10] | .005 |
| | | PA | / | / | / | -.2 4 | [-0.26, -0.22] | < .001 |

| | | NA | / | / | / | .40 | [0.37, 0.43] | < .001 |
|--|------------|-----------|------------|---------------------|------------------|-------------|-----------------------|------------------|
| Study 4 (N = 299, 3,796 observations) | Anxiety | Intercept | -.02 | [-0.09, 0.05] | .623 | -.01 | [-0.07, 0.05] | .760 |
| | | Trait | .47 | [0.40, 0.55] | < .001 | .24 | [0.17, 0.30] | < .001 |
| | | State | .21 | [0.19, 0.24] | < .001 | .07 | [0.05, 0.10] | < .001 |
| | | PA | / | / | / | .40 | [0.36, 0.44] | < .001 |
| | | NA | / | / | / | -.06 | [-0.10, -0.03] | .001 |
| | Depression | Intercept | -.02 | [-0.09, 0.05] | .631 | -.01 | [-0.06, 0.05] | .849 |
| | | Trait | .48 | [0.41, 0.55] | < .001 | .13 | [0.08, 0.19] | < .001 |
| | | State | .19 | [0.16, 0.23] | < .001 | .00 | [-0.03, 0.03] | .910 |
| | | PA | / | / | / | .46 | [0.42, 0.50] | < .001 |
| | | NA | / | / | / | -.18 | [-0.21, -0.15] | < .001 |
| Study 5 (N = 756, 7,378 observations) | Stress | Intercept | .00 | [-0.03, 0.03] | .911 | .00 | [-0.03, 0.03] | .923 |
| | | Trait | .41 | [0.38, 0.44] | < .001 | -.01 | [-0.04, 0.03] | .723 |
| | | State | .40 | [0.37, 0.42] | < .001 | .06 | [0.04, 0.08] | < .001 |
| | | PA | / | / | / | -.26 | [-0.29, -0.23] | < .001 |
| | | NA | / | / | / | .47 | [0.44, 0.50] | < .001 |
| Mini meta-analysis results | | | | | | | | |

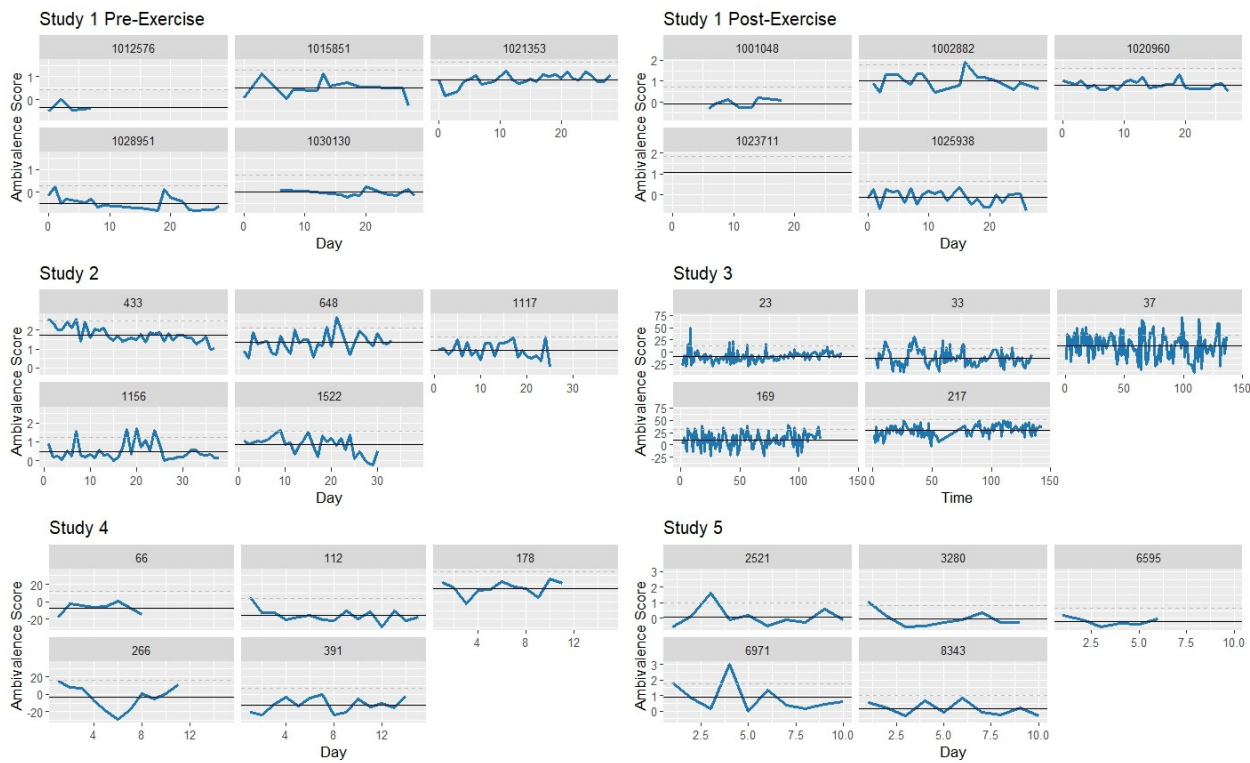
| | | Reduced Model | | Full Model ^a | |
|------------|-------|----------------|---------------------|-------------------------|-----------------------|
| | | Pooled β | 95% CI | Pooled β | 95% CI |
| Anxiety | Trait | .55 | [0.51, 0.60] | .16 | [0.12, 0.20] |
| | State | .25 | [0.23, 0.26] | .05 | [0.04, 0.07] |
| Depression | Trait | .41 | [0.36, 0.46] | .14 | [0.10, 0.18] |
| | State | .11 | [0.09, 0.13] | -.04 | [-0.05, -0.03] |
| Stress | Trait | .40 | [0.38, 0.43] | .01 | [-0.02, 0.04] |
| | State | .20 | [0.18, 0.22] | .06 | [0.04, 0.07] |

Notes. ^a = adjusted for the mean of positive and negative affect.

Figure 1.*Time Series Plots of Emotional Ambivalence*

Note. All variables are group-mean centered. Colored (thicker) lines represent participants randomly selected (to enhance the clarity of the figure).

Figure 2.
Individual Time Series Plots of Raw Emotional Ambivalence Scores



Supplemental Materials**Table S1.***Study Characteristics across Five Studies*

| | Author(s), year | Sample size | Sample type | Sample ages (range, M, SD) | Sample characteristics |
|---------|-------------------------|----------------|----------------|-------------------------------------|--|
| Study 1 | Balban, et al., 2023 | 108 | General | 18-81 years, M (SD) = 27.97 (13.46) | Participants were 68.5% female, 61.1% identified as White, 24.1% as Asian, 5.6% as Black, 0.9% as American Indian/Alaska Native, and 12.9% as Hispanic. Additionally, 73.1% of participants identified as single/never married. |
| Study 2 | Cunningham et al., 2021 | 1,662 | General | 18-90 years, M (SD) = 35.06 (15.04) | Participants were 77.7% female, 79.7% identified as White, 9.4% as Hispanic, and 21.5% identified as sexual minority. |
| Study 3 | Fisher et al., 2017 | 40 | Clinical | 18-65 years, (no mean provided) | Participants were 65% female, 47% identified as White, 8% as Black, 22% as Asian/Asian American, 15% as Latino, and 8% as other. The mean number of years of education in the sample was 15.5 (SD = 2.29), and the mean household income was \$42,973.47 (SD = \$58,385.49). |
| Study 4 | Wright et al., 2023 | 300 | General | 18-40 years, M (SD) = 28.00 (6.38) | Participants were 52.3% female, 74.7% identified as White, 15.3% as Black or African American, 5.0% as Asian, and 8.3% as multiracial or "Other." Two individuals declined to answer this item. Most |

| | | | | | |
|------------|--------------------|-----|-------------|--|---|
| Study 5 | Umberso n, 2022 | 756 | Gener al | 35-65 years, M (SD) = 48.20 (8.42) | <p>of the sample (64.3%) had a lifetime history of mental health treatment, 61.8% of whom were currently receiving treatment at baseline.</p> <p>Participants were 56.7% female, 86.1% identified as non-Hispanic White, 3.6% as non-Hispanic Black, 2.5% as non-Hispanic Asian, 0.1% as non-Hispanic Native American, and 4.4% as Hispanic. Additionally, 70.8% identified as a sexual minority.</p> |
|------------|--------------------|-----|-------------|--|---|

Table S2.*Positive and Negative Affect Items across Five Studies*

| | Positive Affect Items | Negative Affect Items | Answering scale |
|---------|--|--|---|
| Study 1 | active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, strong | afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, distressed | 5-point scale from 1 (<i>Slightly</i>) to 5 (<i>Extremely</i>) |
| Study 2 | active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, strong | afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, distressed | 5-point scale from 1 (<i>Slightly</i>) to 5 (<i>Extremely</i>) |
| Study 3 | positive, energetic, enthusiastic, content | angry and afraid | Slider scale from 0 (<i>Not at all</i>) to 100 (<i>Very much</i>) |
| Study 4 | confident, content, excited, happy | angry, ashamed, guilty, nervous, sad | Slider scale from 0 (<i>Not at All</i>) to 100 (<i>Extremely</i>) |
| Study 5 | calm and happy | frustrated, worried, tired, sad, irritable, angry, upset | 5-point scale from 1 (<i>Not at All</i>) to 5 (<i>Extremely</i>) |

