PERSON-LEVEL PREDICTORS OF AGREEMENT AMONG WEEKLY PEAK AND END REPORTS OF POSITIVE AND NEGATIVE AFFECT: EGO RESILIENCE AND BIG FIVE PERSONALITY TRAITS

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LIST OF ABBREVIATIONS

PA: Positive Affect
NA: Negative Affect

ABSTRACT

Retrospective evaluations of emotional experiences often diverge from momentary reports. The present study investigated whether personality traits and resilience predict individual differences in peak and end biases when recalling positive and negative affect. Using ecological momentary assessment (EMA) over five weeks with 196 college students, we collected momentary reported and weekly evaluated affect ratings, alongside baseline measures of personality and resilience. Contrary to hypotheses, multilevel models showed that extraversion and neuroticism did not moderate peak bias in retrospective recall of emotions. Resilience was not associated with stronger peak bias in positive affect but was linked to fewer peak bias in negative affect, suggesting a buffering effect. Additional mediation models revealed that resilience predicted more positive recall of emotions through greater typical positive affect. These findings highlight the nuanced role of person-level factors in shaping individuals' recall of affective experiences.

Person-Level Predictors of Agreement Among Weekly, Peak, and End Reports of Positive and Negative Affect: Ego Resilience and Big Five Personality Traits

People experience different emotions in their daily lives. Emotion plays an important role in how people view their past and make decisions to pave the way for their future. However, studies have found that people often show bias when recalling their affective experiences (e.g., Barrett, 1997; Conner & Barrett, 2012; Kardum & Daskijevic, 2001). When asked to report their past emotions, people might overestimate or underestimate their emotions depending on the specific emotions they are asked to report. Nonetheless, these inaccurate recollections of past emotions may serve specific functions that are essential to everyday life.

The current study aims to investigate how individuals' bias in retrospective recall of emotions is associated with personality and trait resilience. Specifically, we examine the peak and end bias, the tendency to rely on the most intense and most recent emotions respectively when evaluating past experience (Fredrickson & Kahneman, 1993), and how this bias manifests differently among individuals' reports of past positive and negative emotions. In the following section of the introduction, we will review research on the retrospective recall of emotions, existing findings on person-level predictors of recall bias, and the potential links between recall bias and resilience.

Retrospective Recall of Emotions

Peak and end bias

Emotions are crucial to how experiences are remembered. People remember emotional events better and with more detail compared to non-emotional experiences (Kensinger, 2004; Kensinger, 2009). However, past research has discovered that there

was often a discrepancy between people's average experience of emotions and retrospective evaluation, referred to as the memory-experience gap (Miron-Shatz, 2009). Numerous studies have demonstrated the gap in different types of events (e.g., Kemp et al., 2008; Stone et al., 2005), valence of emotions (e.g., Miron-Shatz, 2009), and using different assessment methods (e.g., Kahneman et al., 2004; Schwarz, 2007). In addition, specific moments within the experiences might contribute to how people evaluate their affect retrospectively (Kahneman, 2000). Research has investigated the tendency of people to evaluate past events based on the peak (i.e., the most intense) and end (i.e., the most recent) intensity of their affective experiences, known as the peak and end bias (Fredrickson & Kahneman, 1993; Kahneman, 1993). Among different individual moments that comprise the events, the peak and end moments were found to have a disproportionate influence on how people remember and evaluate their experiences (e.g., Kahneman, 2000).

The peak and end bias was first explicitly tested by Fredrickson and Kahneman (1993). In the laboratory experiment, participants were asked to watch film clips that were either pleasant or unpleasant and indicate their intensity of positive or negative emotion continuously through a response slider while watching the clips. Later, participants rated how they remembered their overall emotional valence for the clips. Results showed that the most intense rating and most recent rating of emotion provided the best prediction for the retrospective rating of emotional valence. When the peak and end experiences were considered, neither the average retrospective rating of emotion nor the duration of the experience provided information over and above the peak and end points. The phenomenon that the duration of events does not play an important role in

retrospective evaluation is often referred to as duration neglect, which sometimes leads people to make decisions that seem irrational (Fredrickson & Kahneman, 1993; Kahneman, 1993). When asked to repeat one of two trials in which participants had to keep their hands in cold water, the majority of participants would rather choose the trial that lasted longer and more painful but with a higher water temperature at the end than the trial that was shorter but had constant water temperature (Kahneman, 1993). The result indicated that how participants felt at the end was weighed more than the total duration of their experience when evaluated retrospectively, further suggesting the influential power of the specific moments on the evaluation of the overall experience.

Since their initial discovery, peak and end biases have been tested in various contexts outside of the laboratory setting. One study investigated how peak and end bias affected people's pain perception during colonoscopy and lithotripsy and found that the total pain people remembered was strongly associated with the most intense pain and the pain experienced over the last three minutes (Redelmeier & Kahneman, 1996). Another study tested the recall over longer periods and asked participants with rheumatoid arthritis to report their momentary pain over a week and recall overall pain afterward (Stone et al., 2000). Results showed that both peak and end momentary ratings of pain were better predictors of overall pain than the average of all momentary ratings. Besides negative experiences such as pain perception, studies also examined the peak and end effects of positive experiences. For instance, several studies examined the peak and end effect when recalling hedonic experiences (e.g., Do et al., 2008; Geng et al., 2013; Scheibehenne & Coppin, 2020) and well-being (e.g., Scharbert et al., 2024). In research on interpersonal relationships, peak and end bias was found in couple's conflict, where

the evaluation of the post-conflict affect was mainly predicted by the most intense emotion (either positive or negative) during the conflict and the emotional tone at the end of the conflict (Sels et al., 2019). More recently, studies applied the rule of peak and end to other fields of studies and found similar results in business investment (e.g., Jiang et al., 2019), organizational behaviors (e.g., Dalal et al., 2020), imprisonment (e.g., Raaijmakers et al., 2017), tourism (e.g., Kim & Kim, 2019), and exercise behaviors (e.g., Hargreaves & Stych, 2013; Parfitt & Hughes, 2009).

According to the systematic review by Alaybek and colleagues (2022), peak and end effects in the retrospective evaluation were stronger than other features of the events (e.g., beginning and trough) in terms of correlation to overall affect and were robust across different types of experiences (e.g., goal-directed vs non goal-directed events, positive vs negative), study designs, and levels of analysis. Although numerous studies found peak and end effects on retrospective evaluations, other studies reported inconsistent findings. For example, when examining the experience during and after the vacation, the overall evaluation of happiness was not strongly correlated with the peak and end ratings of happiness (Kemp et al., 2008). In real-life events that consist of multiple episodes, the average, instead of the peak or end, ratings of emotions were found to be the best predictors of the retrospective evaluations of previous day experiences (Miron-Shatz, 2009). As proposed by Geng and colleagues (2013), the peak and end rule best predicted the retrospective evaluation of emotions over short retention intervals which last around several weeks. These studies that failed to replicate peak and end bias suggested the existence of boundary conditions when peak and end bias is used as references in recall.

Personality and Peak and End Bias

Studies that examined processes of autobiographical memories found that people reconstruct rather than remember the details of previous experiences as they could not remember all the details (Rubin, 1996; Holland & Kensinger, 2010). During this process, moments that are more memorable might be used as references for reconstructions and therefore have a disproportionate influence on how individuals evaluate emotional episodes retrospectively (Kahneman, 2000). Theoretical work proposed that peak and end emotions of experiences were critical to individuals as they convey specific personal meanings (Fredrickson, 2001). Therefore, peak emotions may not only represent the most intense feeling of the event but also the individuals' capacity to cope and deal with the event, whereas the emotions at the end point may conclude the event with a general impression. As suggested by Fredrickson (2001), people refer to personally meaningful information and potentially reconstruct their emotional memories when they are asked to evaluate past events. For example, if someone is planning a surprise birthday party for their loved one, they may feel stressed and uncertain about their idea. However, when the party turns out to be a success and their loved one is surprised and happy, the person may later reconstruct their memory based on the emotionally meaningful moments and recall the whole experience as joyful and rewarding, despite the initial uncertainty and anxiety.

Additionally, Robinson and Clore (2002a) proposed the accessibility model of emotion to explain the discrepancies between retrospective and concurrent reports of emotional experiences. The accessibility model assumes that past emotions and feelings cannot be recalled or restored and the remembrance of emotions requires reconstruction through retrievals of either episodic memory or semantic memory. As suggested by other

research, episodic memory, the memory of event-specific moments, fades over time and becomes inaccessible quickly after the end of the experience (Tulving, 2002). According to the accessibility model, when episodic memory is no longer available, semantic memory, the memory that was not linked to specific events but was generalizations or beliefs, became the main reference source in reports of affective experience. Robinson and Clore (2002a) suggested that there are two types of semantic memory knowledge: situation-specific knowledge, the beliefs about how certain situations would influence one's emotions, and identity-related beliefs, the beliefs about one's emotions in general. Individual differences in their situation-specific knowledge and identity-related beliefs, therefore, might lead to individual differences in recall bias of affective experiences.

In addition, personality-related beliefs, as suggested by the accessibility model, serve as one source of identity-related beliefs about individual emotions that were often assessed when recalling past affective experiences (Robinson and Clore, 2002a). Research on the Big Five personality traits and emotions has consistently linked personality with individual differences in emotional dispositions and affective experiences. Among the five traits, neuroticism is characterized by a tendency to experience more frequent and intense negative emotions such as anger, fear, and anxiety, and is widely considered to have negative affectivity as its core component (McCrae & Costa, 1987; Watson & Clark, 1984). Neuroticism has been associated with higher daily negative emotions (Komulainen et al., 2014), greater negative affect reactivity to stressors (Bolger & Schilling, 1991; Zuatra et al., 2005), and potentially greater unpleasant experiences over time (Costa & McCrae, 1980). In contrast, theorists have suggested extraversion "predispose individuals toward positive affect" (Costa & McCrae,

1980, p. 673) and this robust link between extraversion and positive affect has been well established in personality literature (e.g., Smillie et al., 2015; Srivastava et al., 2008; Watson & Clark, 1997). Extraversion has been found to buffer against daily stressors and is associated with greater daily positive affect (Zautra et al., 2005). Highly extraverted individuals also exhibit greater reactivity to positive mood inductions and tend to use more positive emotion words in daily life (Chen et al., 2020; Larsen & Ketelaar, 1989). Research on personality facets, the narrower components within each Big Five trait, has provided further nuance, showing that specific facets may differentially predict emotional experiences (Schimmack et al., 2004). For example, the depression facet of neuroticism was found to be linked with higher levels of sadness, fear, guilt, and lower positive affect in momentary assessments, while the anxiety facet was only associated with fear (Johnson et al., 2012).

Given this close connection between individuals' personality and emotion, research has investigated different personality traits that contribute to individuals' bias in emotional recall. By asking participants to report their concurrent emotions for 90 days and recall their overall emotional experiences at the end of the study, Barret (1997) found that participants who were higher on neuroticism tended to overestimate their overall negative affect, whereas participants who were higher on extraversion overestimated their overall positive affect during the study period. Another study that examined the retrospective rating of emotions at different time intervals found that personality traits selectively influence different forms of positive and negative emotions over a longer time frame (Mill et al., 2016). As the Big Five personality traits convey information about individuals' emotional disposition, research has shown that neuroticism was linked with

higher daily negative affect and extraversion linked to higher daily positive affect (Costa & McCrae, 1980; Komulainen et al., 2014). However, only a few studies have investigated whether personality factors influence individuals' retrospective recall in terms of peak and end bias. To our knowledge, only one study conducted by Lay and colleagues (2017) examined emotion arousal levels and peak and end effects. Results from their studies indicated peak bias was associated with both positive and negative emotions of high arousal, whereas end bias was only associated with low arousal positive emotions. Although Lay and colleagues (2017) also measured extraversion and neuroticism in their study, they examined recall bias in terms of exaggeration and underestimation and never looked at how personality was associated with recall bias based on specific moments of emotion. Therefore, one purpose of the current study is to explore how personality factors, specifically, extraversion and neuroticism, influence individuals' bias in affective recall. In addition, the present study mainly focuses on investigating the influence of personality on peak bias. Previous research suggested that the ending of an event might not be inherently over-weighted (Tully & Meyvis, 2016). Unlike other goal-directed experiences in which the end is naturally important (Ariely & Carmon, 2003), the daily emotional experiences we tested in the current study consist of multiple episodes and do not have a distinctive end like other goal-directed behaviors in which the end was naturally overweighted. Therefore, the current study will mainly propose hypotheses about peak bias in retrospective recall, but we will still include end bias in the analyses to test its potential effects.

Resilience

People all experience stress and adversity in daily life. However, when facing similar negative situations, people tend to show different reactions and responses, which lead to outcomes that could be either adaptive or maladaptive (Masten et al., 1980; Powell & Baker, 2014). Recent research has shifted focus from the negative consequences of adversity (e.g., decreased well-being and psychological disorders) to the mechanisms that lead to better adjustment and adaptation (e.g., Fredrickson et al., 2003; Tugade & Fredrickson, 2004). Therefore, resilience, the ability to quickly "bounce back" and return to normal psychological and physical functioning from adversity, is key to understanding how individuals react differently during and after experiencing challenging life events (Bonanno et al., 2011; Herrman, 2011).

Some researchers consider resilience as an outcome or trajectory of the adjustment from adverse experiences (e.g., Mancini & Bonano, 2009). Studies that adopt this definition often measure resilience as the recovery or maintenance of psychological well-being after traumatic experiences or adversities (e.g., war, pandemic). Other researchers suggested that resilience is a relatively stable personality trait and investigated adaptive outcomes associated with resilience, such as higher global well-being, better mental health status, better career outcomes, and greater life satisfaction (Ahmad et al., 2019; Cohn et al., 2009; Cosco et al., 2017; Davydov et al., 2010). In recent literature, Waugh and Sali (2024) suggested that resilience should be viewed as an ability to sustain well-being despite challenges and adversity. Based on the allostatic active interference model (Waugh & Sali, 2024), resilient people maintain well-being through a set of "tools" such as effectively regulating emotions, appropriately adjusting beliefs about one's circumstances, and flexibly employing coping strategies

based on the situation. The underlying common mechanism between resilience and well-being is the positive appraisal of one's past, present, and future, and the primary tool resilient individuals use to maintain well-being is positive emotion (Waugh & Sali, 2024). The current study adopts the definition of resilience as an ability that could differ among individuals and will review how positive appraisal and positive emotion contribute to resilience in the following sections.

Resilience and Appraisal

According to the appraisal theory, individuals' emotional responses are determined by subject evaluation of events and situations (Lazarus & Folkman, 1984; Roseman & Smith, 2001; Scherer, 1999). That is to say, it was not the event itself but people's appraisals that led to emotional reactions, contributing to the meaning and significance of the specific event (Lazarus & Folkman, 1984; Scherer, 1988; Troy & Mauss, 2011). The appraisal process comprises evaluating multiple sources of information or stimulus and situation dimensions of the event (Kalisch et al., 2015; Scherer, 2001). These different dimensions are then appraised and produce different emotional reactions among people (Kalisch et al., 2015; Moors, 2009; Smith, 1989). Previous studies have shown that individuals exhibit different emotional responses based on their appraisal. For example, one naturalistic study examined students' evaluations of stressful encounters of midterm exams and found that their evaluations (appraisals) of the exam significantly explained both positive and negative emotions they experienced (Folkman & Lazarus, 1985). Another more recent study used laboratory tasks and found that participants' emotional intensity was predicted by their appraisals and similar

emotional response profiles corresponded to comparable appraisals in participant subgroups (Siemer et al., 2007).

Kalisch and colleagues (2015) proposed the positive appraisal style theory of resilience (PASTOR) model that emphasizes appraisal as the key mechanism to resilience. In the PASTOR model, appraisal is considered the common final path through which all resilience factors converge and convey effects. The PASTOR Model suggests that individuals tend to interpret and react to similar situations with similar appraisals and form their own appraisal styles (Kalisch et al., 2015). Positive appraisal style is defined as the dominance of positive evaluations of one or more of the dimensions of the situation (Kalisch et al., 2015). However, the positive appraisal style is not equivalent to blind optimism but allows optimal levels of stress to ensure overall cost-effective responses (Kalisch et al., 2015). When faced with adversity, the positive appraisal style protects against various negative outcomes and is considered the primary pathway to resilience. In other words, positive appraisal is considered the final mediator between all other adaptive psychological factors and resilience (Kalisch et al., 2015). Studies on resilience and related psychological factors provided abundant evidence for the PASTOR model. For instance, Veer and colleagues (2021) examined resilience factors during the COVID-19 lockdown among more than 15,000 participants and found that the positive appraisal of the consequence of the crisis was one of the strongest factors associated with psychological resilience in terms of maintaining mental health wellbeing. Another study with a longitudinal design tested the prospective association between appraisal style and resilience during COVID-19 over five weeks (Bögemann et al., 2023). Results showed a similar pattern of the strong link between positive appraisal style and resilience and how

positive appraisal style served as a mediator among other psychological factors and resilience. Together, these findings suggest that positive appraisal plays a significant role and might potentially be a necessary component in achieving resilience.

Resilience and Positive Emotions

Although research on resilience emphasizes coping to decrease negative emotions when facing negative events, some studies investigate the role of positive emotions in building resilience. For instance, among two separate groups of participants with chronic diseases, a lower mortality rate was found to be predicted by higher levels of positive affect (Moskowitz, 2003; Moskowitz et al., 2008). To better understand the potential role of positive emotions, Fredrickson (2001) proposed the broaden-and-build theory. Based on this theory, positive emotions expand people's "momentary thought-action repertoires" and "build enduring personal resources" that are adaptive in indirect ways (Fredrickson, 2001, p.220). These thoughts and actions, as well as resources, are not necessary for survival but can be saved and aggregated over time for later use and to promote adaptive changes. The broaden-and-build theory provides a theoretical framework for how positive emotions are associated with resilience. Positive emotions, while broadening individuals' thoughts and actions, might also enhance lasting coping resources that are necessary for quickly bouncing back from stressful experiences or overcoming adversity (Aspinwall, 1998; Fredrickson, 2001; Tugade & Fredrickson, 2004). At the same time, positive emotions might undo the effect of negative emotions on individuals through the broadening function (Fredrickson & Levenson, 1998; Fredrickson, 2001). To test the potential function of positive emotions during this process, Tugade and Frederickson (2004) activated the negative emotions of participants

using a speech preparation task with time limits and measured positive and negative emotions before and after the task as well as cardiovascular reactions during this process. Results indicated that high-resilience individuals experienced higher levels of positive emotions both before and after the speech preparation task. At the same time, more resilient individuals returned to their baseline cardiovascular activities faster, and this difference in recovery time was mediated by the differences in positive emotions (Tugade and Frederickson, 2004). This result suggested that high resilience people might use positive emotions to "bounce back" from stressful events through the undoing effect of positive emotions (Frederickson, 2001; Tuagde and Frederickson, 2004).

Resilience and Peak Bias in Positive Emotional Recall

One goal of the current study is to investigate whether resilient individuals exhibit peak bias when recalling past positive emotions, that is, whether they use their most intense positive emotion as a reference for their evaluation of the overall emotional experience over a period of time. In addition, we aim to explore three potential mechanisms to provide insight into how resilience as an ability might influence how people view and remember their emotional experience.

Research has investigated how resilience is associated with the daily experience of positive emotions using ecological momentary assessment (EMA). For instance, Cohn and colleagues (2011) examined participants' daily emotions for one month and found that participants with higher resilience showed greater daily positive emotions. Similar results were also found in another study by Lyu and colleagues (2017), which assessed the positive and negative emotions among a group of college students. In addition, events that contain emotional components are often remembered more effectively with higher

accuracy and vividness (Anderson et al., 2006; Kensinger, 2004; Reisberg & Hertel, 2003). In this case, one possible mechanism in which resilient individuals show more peak bias in recalling is that resilient individuals experience higher positive emotion peaks in their everyday lives, and these peaks are stickier to their memory. Therefore, resilient individuals show more peak bias when recalling their past positive emotions.

An alternative hypothesis would not assume the high daily positive emotion among resilient individuals but rather propose that resilient individuals are able to remember their peak positive emotions better. One potential construct that might explain this enhanced memory of positive emotion among resilient individuals might be savoring, which refers to the psychological process of attending to positive experiences to sustain and promote positive emotions (Bryant, 1989; Bryant & Veroff, 2007). Savoring has been shown to be an effective intervention in reducing depressive symptoms and negative affect while increasing happiness and well-being over time (Hurley & Kwon, 2012; Smith et al., 2015). In one laboratory study that examined emotional experience after social-evaluative hassle, participants who engaged in savoring the moment intervention showed higher positive emotions after the hassle induction task (Kilbert et al., 2022). Research on savoring has found that the use of specific strategies, such as focusing on the present moment, was associated with higher positive effects (Bryant & Smith, 2015; Quoidbach et al., 2010). Through attending to the momentary experiences and emotions, the "savorers" form positive memories that are more detailed and retrievable (Bryant & Veroff, 2007; Colombo et al., 2024). In one study investigating the influence of savoring on autobiographical memory, Colombo and colleagues (2024) used an EMA design, asking participants to report daily positive experiences and randomly assigned them with

a strategy to upregulate the ongoing positive emotions or the control. A surprise memory check for each experience was administered one week later to assess the intensity of positive emotions and different dimensions of the memory (Colombo et al., 2024). Results showed that using savoring strategies for ongoing positive experiences greatly increased the salience and positivity of the experience when recalled retrospectively (Colombo et al., 2024). The memories of the positive experiences were also more accessible when participants used the savoring strategies (Colombo et al., 2024). As savoring has been considered a positive coping strategy that is associated with resilience when facing stress or adversity (Sytine et al., 2019; Smith & Hollinger-Smith, 2015; Tao et al., 2024;), resilient people might potentially employ more savoring strategies for their positive experiences and thus form stickier memories with more intense emotions. When evaluating their past emotional experiences, resilient individuals might use these positive memories, which are more accessible, and therefore show greater peak bias for past positive emotions.

The third mechanism suggests that resilient individuals exhibit a greater positive peak bias in recall, not because they experience or remember more positive events or emotions but because resilience, as a personal attribute, might influence how they recall their past. This mechanism would be similar to how personality affects individuals' recall bias, as reviewed in the previous section. When reporting emotional experiences over a period of time, individuals not only try to retrieve the relevant episodic memories but also form an integrated judgment of their past, which is based heavily on their semantic memories (i.e., identity-related beliefs; Robinson & Clore, 2002a). For more proximal experiences, as episodic memory became less accessible, people relied more on semantic

memories when reporting or evaluating past affective experiences, and therefore became more biased by their personal factors (Robinson & Clore, 2002b). Resilient individuals are suggested to rely on positive appraisal when reflecting on their past (Kalisch et al., 2015; Waugh & Sali, 2024). As a result, they may be more likely to use highly positive events, those associated with greater positive emotions, as references, which in turn could lead to a stronger peak bias.

Current Study

Although previous studies have examined the personality predictors of recall bias in terms of underestimation and overestimation relative to average emotion, it would be hard to interpret the conclusion as researchers could not measure the actual emotion experience over a time period. Our current study builds on these findings and investigates how specific moments within the experience influence people's retrospective recall of emotions. As for the personality factors, we hypothesize that extraversion and neuroticism will be associated with peak bias. Specifically, extraversion is hypothesized to predict peak bias in positive emotions, whereas neuroticism is hypothesized to be associated with peak bias in negative emotions. The effect of end bias is expected to be trivial for both positive and negative emotions.

To our knowledge, only one study, done by Colombo and colleagues (2020), examined the association between resilience and recall bias. In their study, Colombo and colleagues (2020) used the EMA method to measure participants' positive and negative affect twice a day over a two-week period and completed the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) at the end to evaluate their overall affective experience during the past two weeks. Results suggested that resilience was

associated with an overestimation of past positive effects but not an underestimation of past negative affect (Colombo et al., 2020). In addition, Colombo and colleagues (2020) found that resilience was a significant mediator between positive affect recall bias and psychological well-being. These results suggested the effect of resilience on how people remember their emotional experiences and how this effect could further cultivate adaptive outcomes among individuals with high resilience. However, simply conceptualizing recall bias in terms of overestimation or underestimation might fail to capture the details in different components of individuals' experiences as well as how their personality level factors contribute to their retrospective evaluation. To address this gap, the current study aims to explore how resilience plays a role in individual differences in patterns of peak bias when evaluating affective experience retrospectively. We will examine resilience using the ego resilience scale (Block & Kremen, 1996) that measures resilience based on self-report of adaptive thoughts and behaviors.

Our first hypothesis pertains to the extent to which resilience strengthens the effect of peak positive affect on people's weekly retrospective ratings. Specifically, we hypothesized that resilience would be associated with peak bias in reported positive emotions but not negative emotions, such that individuals higher in resilience would rely more heavily on peak positive moments when evaluating their overall weekly affect. This first hypothesis will be tested by determining whether resilience moderates the relationship between peak positive affect and weekly overall ratings.

Our second set of hypotheses examines the broader mechanisms in which resilience influences people's recall of positive emotions. While conceptually related, the second set of hypotheses was not contingent on the first set of hypotheses and aimed to

explore how resilience shapes emotion recall more generally through multiple pathways. To test these hypotheses, we explore three non-mutually inconsistent mechanisms:

- Mechanism 1: Resilient people experience higher positive emotional peaks that are stickier to their memory,
- Mechanism 2: Resilient people experience no more positive emotional peaks than others but can memorize their positive peaks better, and
- Mechanism 3: Rather than experiencing higher positive emotional peaks or having better recall of them, resilient people tend to rely on their general perception of themselves as experiencing high levels of positive emotion when making judgments about their past emotions.

Method

Participants

The data of the current study was collected for another study investigating affective experiences and belonging among college students. Participants were recruited from Prolific, an online participant recruitment platform. Prior to participating, all applicants are prescreened and recruited based on their eligibility. Participants are only selected if they meet all three criteria: 1) within the age range of 18-26, 2) English speaker, and 3) currently attending college for the first time. Three cohorts of data collection were conducted in the fall of 2023, the spring of 2024, and the fall of 2024. The final sample consisted of 196 participants (59.2% female, 35.7% male, 5.1% other) with a mean age of 20.83 (*SD* = 1.86) and was racially diverse (39.4% White/European American, 23.2% Asian, 10.3% Latino/Hispanic, 8.9% African American, 18.2% other).

Procedures

Participants who signed up for the study on Prolific were first screened for eligibility. Selected eligible participants completed a baseline survey that measured their personality, resilience, general experiences of affect, and demographic information before the semester started. Starting the first week of the semester, participants receive two daily surveys, one in the morning and one in the evening, six days a week on ExpiWell. The daytime survey was administered at a random point between 9 a.m. and 5 p.m. in the participant's local time zone, whereas the evening survey was administered at 7 p.m. every evening. Upon receiving the survey notification for the daytime survey, participants had 90 minutes to complete it; participants had until midnight to complete the evening survey. Each daytime survey contained 23 questions, 19 of which were from the modified

Differential Emotions Scale (mDES; described below) and 4 of which were from a 4-item belonging measure (which we did not use in this study). The evening survey also included a question about whether the participant had an exam worth more than 10% of their grade that day; we do not use this indicator in the current study. On the seventh day of the week, participants received a weekly survey that asked them to recall the overall emotional experience over the whole week.

The daily and weekly surveys were administered on a weekly basis for five weeks. At the end of five weeks, participants completed a wrap-up survey. Participants were compensated up to $75 at the end of the study, with $2.50 each for the baseline and wrap-up surveys, $0.50 for each daytime survey, $0.75 for each nighttime survey, $1.00 for each weekly survey, and a $2.00 weekly bonus for completing all of the measures in a given week.

Measures

Emotional Experience

Participants' daily and weekly emotional experiences were measured using the Modified Differential Emotions Scale (mDES; Catalino et al., 2014; Fredrickson et al., 2003). The mDES consisted of 20 questions and measured participants' intensity of emotion on a 5-point scale with 0 = Not at all, 1 = A little bit, 2 = Moderately, 3 = Quite a bit, and 4 = Extremely. The positive affect and negative affect were calculated as two subscales using means of different items. The ten measured positive emotions included amusement, awe, contentment, gratitude, hope, inspiration, interest, joy, love, and pride, showing excellent reliability with Cronbach's $\alpha = 0.93$, whereas the nine negative emotions measured included anger, shame, fear, disgust, embarrassment, guilt, sadness,

contempt, and stress, showing excellent reliability with Cronbach's $\alpha = 0.90$. One example question of the mDES was "I feel grateful, appreciative, thankful."

Peak Emotion

Participants' peak ratings of emotion for each week were captured using the highest ratings of reported momentary emotion from the daytime and evening surveys. The peak rating of both positive and negative emotions will be identified separately.

End Emotion

Participants' ratings of end emotion were assessed using the final momentary ratings of positive and negative emotions from either the daytime or evening survey at the end of each week. The end emotion should be the emotion rating that is right before the participants' retrospective report of overall emotion from the weekly survey.

Average Emotion

Participants' average ratings of positive and negative emotions were measured with the mean of all the reported momentary emotion ratings from daytime and evening surveys for each week.

Typical Emotion

The typical emotional experiences of each participant were measured in the baseline survey using the mDES. Participants rate each item based on their general experience of emotions. The positive and negative affect were calculated as the average of list items measuring different positive and negative emotions. This measure showed excellent reliability, with Cronbach's $\alpha = 0.90$ for positive emotion and Cronbach's $\alpha = 0.88$.

Personality

Participants' personality was measured using the Big Five Inventory - 2 Short Form (BFI-2-SF; Soto & John, 2017). The BFI-2-SF measures extraversion, agreeableness, conscientiousness, negative emotionality (neuroticism), and open-mindedness with 30 questions. The current study only looks at traits of neuroticism and extraversion. Participants responded to each question that described characteristics on a 1 to 5 scale with 1 = Disagree Strongly, 2 = Disagree a little, 3 = Neutral, 4 = Agree a little, and 5 = Agree strongly. One sample question of BFI-2-SF was " I am someone who is emotionally stable, not easily upset." The scale showed good reliability (extraversion Cronbach's $\alpha = 0.80$; agreeableness Cronbach's $\alpha = 0.75$; conscientiousness Cronbach's $\alpha = 0.79$; neuroticism Cronbach's $\alpha = 0.81$; openness Cronbach's $\alpha = 0.74$)

Resilience

Participants' trait resilience was assessed using the 14-item Ego Resilience Scale (ER89; Block & Kremen, 1996). The scale showed good reliability with Cronbach's $\alpha = 0.84$. Each question in the ER89 asked participants to rate how well they think each characteristic applies to them on a 1 to 4 scale, from does not apply at all to applies very strongly. One sample item from ER 89 was "I enjoy dealing with new and unusual situations."

Analytic Plan

To test the influence of personal factors (i.e., extraversion, neuroticism, and resilience) on peak and end biases, the current study used a series of multilevel models to predict weekly retrospective reports of positive and negative emotions from time-specific variables due to the hierarchical structure. Models were fit using restricted maximum likelihood using the lme4 (Bates et al., 2015) package in R. In the multilevel models,

weekly measures were nested within each person, with up to five weeks of data. To test whether each person-level predictor was associated with participants' weekly rating of emotions, we began with building the two-level main effect model. At level 1, we included peak and end emotion as predictors of weekly retrospective emotion ratings. At Level 2, we included person-level predictors (i.e., extraversion, neuroticism, and resilience) to examine their associations with the intercept of weekly ratings. An example equation for extraversion is shown below.

$$Level\ 1\text{: } Weekly\ Reports_{it} = \beta_{0i} + \beta_{1i}(Peak\ PA_{it}) + \beta_{2i}(End\ PA_{it}) + r_{it}$$

$$Level\ 2\text{: } \beta_{0i} = \gamma_{00} + \gamma_{01}(Extraversion_i) + u_{0i}$$

$$\beta_{1i} = \gamma_{10}$$

$$\beta_{2i} = \gamma_{20}$$

note: *the example equations are the model measuring the effect of extraversion on reports of positive affect.* $i = person,\ t = week.$

Next, to examine whether person-level traits moderate the relationship between peak affect and retrospective ratings (i.e., whether they influence peak bias), we expanded the model by including cross-level interaction terms, allowing traits like extraversion to predict the slope of peak PA. An example β_{1i} for extraversion was shown below:

$$\beta_{1i} = \gamma_{10} + \gamma_{11}(Extraversion_i) + u_{1i}$$

Corresponding models for different personality predictors and positive and negative emotions were fitted separately. In each model, we were interested in how person-level variables (i.e., extraversion, neuroticism, and resilience) influence the peak

effect of positive and negative emotions. Therefore, the focal predictor for each hypothesis was γ_{11}. In the model of extraversion predicting positive emotion, we hypothesized that γ_{11} will convey a positive relationship from extraversion on the effect of peak positive emotion on weekly ratings. A similar pattern was expected for the model for resilience predicting positive emotion. As for neuroticism, we predicted that γ_{11} would reflect the positive relationship from neuroticism on the peak bias of negative emotion on weekly ratings.

Models for Mechanisms 1-3

Three potential mechanisms of resilience and peak bias were analyzed using multilevel models with the lme4 package (Bates et al., 2015) and multilevel structural equation models (MSEM) with the lavaan package (Rosseel, 2012; Preacher et al., 2010) in R.

Mechanism 1. To test whether resilient individuals experience greater peak positive affect, which leads to higher weekly evaluation of positive affect in mechanism 1, we fitted a series of multilevel mediation models using structural equation modeling, as shown in Figure 1. Weekly peak positive affect at level 2 was tested as a mediator of the effect of resilience at level 2 on the retrospective evaluation of positive emotion each week at level 1 (step 1).

To parse out between-person and within-person variance in peak positive affect ratings, we centered time-specific positive affect ratings around their person-specific means. In step 2, the person-specific mean (denoted as mean peak PA in Figure 1) entered the model at Level 2; the deviation around this mean (denoted as centered peak PA in Figure 1) entered the model at Level 1. Importantly, because resilience is a

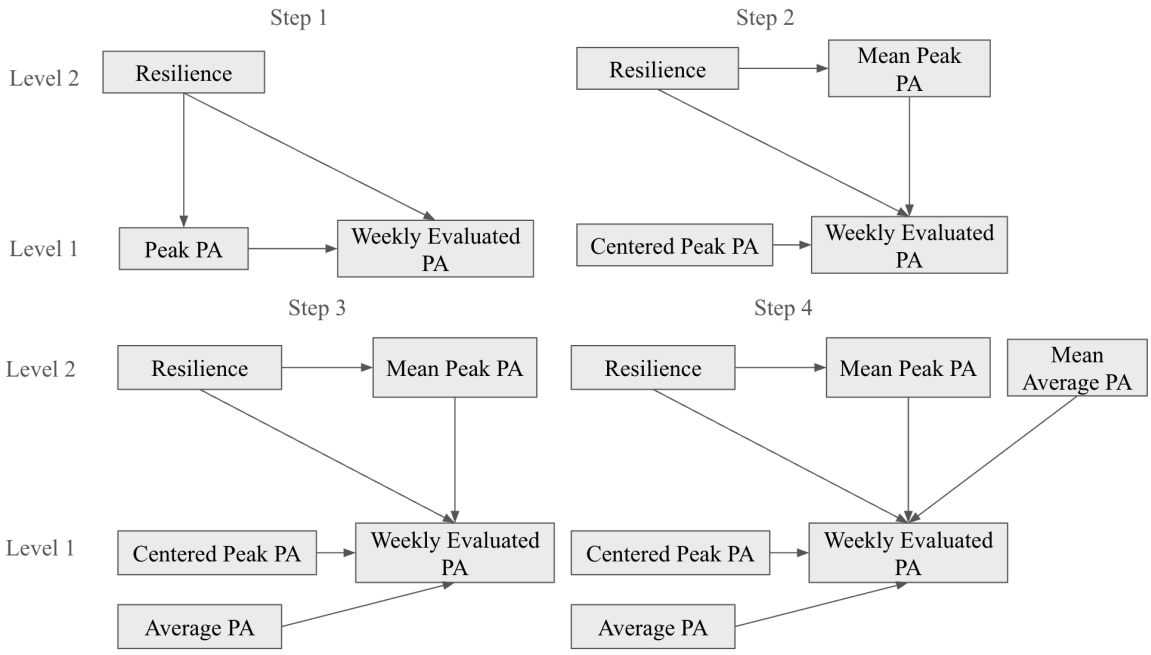
between-person variable, and centering the variables in this way removes any between-person variance from time-specific ratings of peak positive affect, only person-specific means (i.e., the mean peak positive affect rating at Level 2) could act as a mediator for the effect of resilience (Preacher et al., 2010). Therefore, we included the paths from resilience (Level 2) to person means of peak positive affect (Level 2) to weekly retrospective rating, along with a path from time-specific deviations (Level 1) to weekly retrospective rating.

In step 3, we added the average daily PA rating (denoted Average PA in Figure 1; Level 1) as a predictor of retrospective rating. The reason for adding in weekly average PA was that having high weekly positive peaks might reflect overall high levels of positive emotions. The retrospective rating of affective experience might be the representation of daily positive experience regardless of the peak emotion of each week. Therefore, the average of daily PA ratings was added to the model to account for its effect on the rating of overall PA at the end of the week.

In addition, to account for the effect of daily PA at level 2, we added in the average across all the daily reports of PA (denoted Mean Average PA in Figure 1; Level 2) as a predictor of weekly evaluated PA at step 4. This allowed us to assess whether the mediating role of mean peak PA remained significant after accounting for individuals' overall levels of positive emotion throughout the study.

Figure 1

Multilevel mediation models for mechanism 1



Mechanism 2. To test whether resilient individuals were able to remember their positive peaks better in mechanism 2, we began with a multilevel model with peak, end, and an additional time since the peak event variable at level 1, and resilience at level 2, as shown in the equations below.

$$Level\ 1\text{: } Weekly\ Reports_{it} = \beta_{0i} + \beta_{1i}(Peak\ PA_{it}) + \beta_{2i}(End\ PA_{it}) + \beta_{3i}(Time_{it}) + r_{it}$$

$$Level\ 2\text{: } \beta_{0i} = \gamma_{00} + \gamma_{01}(Resilience_{i}) + u_{0i}$$

$$\beta_{1i} = \gamma_{10}$$

$$\beta_{2i} = \gamma_{20}$$

$$\beta_{3i} = \gamma_{30}$$

Note that this is an augmented version of the models presented earlier, with the addition of time since peak variable. Time since peak variable was measured as the

number of hours between participants' report of peak positive emotion and participants' weekly evaluation of positive emotion at the end of each week. To assess the effect of memory of peak PA on evaluating PA at the end of the week, we then included cross-level interaction terms, adding resilience as a predictor for the slope of time since peak.

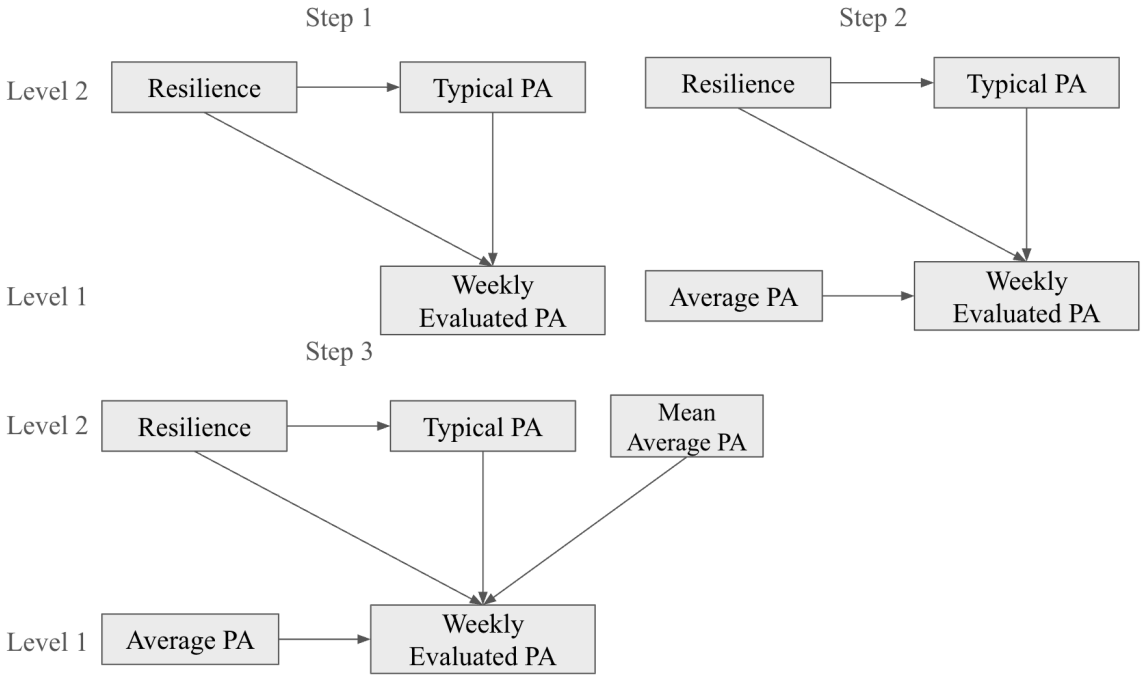
$$\beta_{3i} = \gamma_{30} + \gamma_{31}(Resilience_i) + u_{3i}$$

The effect of memory was tested through the interaction term between resilience and time since peak such that the influence of time since peak on weekly reports of positive emotion is greater for low-resilient individuals but not for high-resilient individuals (i.e., γ_{31}).

Mechanism 3. For mechanism 3, we assessed individuals' general positive affect as a mediator using a multilevel mediation model through SEM, as shown in Figure 2. Similar to mechanism 1, we tested whether the influence of resilience at level 2 on the weekly evaluation of positive affect at level 1 was mediated by participants' reports of their overall positive affect at level 2. We also added in the average daily PA rating over (denoted Average PA; Level 1) the week at step 2 and the average across all the daily reports of PA (denoted Mean Average PA in Figure 1; Level 2) at step 3 to control for their effect on the retrospective rating of PA.

Figure 2

Multilevel mediation model for mechanism 2



Result

Preliminary Models for Positive and Negative Affect

To investigate the influence of demographic variables and personal level variables on weekly reports of positive emotions, we fitted three multilevel models with random intercepts, as shown in Table 1. Model 1 included age, gender, and race as fixed effects. The results indicated that, compared to White/European American participants, participants who identified as Asian/Pacific Islander tended to show lower evaluation of positive affect (PA) at the end of the week. Neither age nor gender showed a significant effect. After adding the personality predictors and resilience into model 2, neuroticism appeared as the only significant person-level predictor for the retrospective rating of PA, while the difference between Asian/Pacific Islander and White/European American remained significant. We then added participants' typical emotion into model 3. As shown in Table 1, typical positive affect showed a significant effect on predicting retrospective rating of PA, suggesting that individuals who perceive themselves as experiencing more positive emotion tended to rate their past PA higher. Neuroticism remained significant, indicating its stable role as a predictor of people's evaluation of their past positive affective experience above and beyond typical emotion. Additionally, the difference between Asian/Pacific Islanders and White/European Americans also remained significant.

Table 1

Demographic and person-level predictors predicting weekly evaluated overall PA

	Model 1	Model 2	Model 3

Predictors	*Estimates*	*SE*	*Estimates*	*SE*	*Estimates*	*SE*
Fixed Effects						
(Intercept)	3.48***	0.62	3.04***	0.58	2.68***	0.49
Age	-0.03	0.03	-0.01	0.03	0.01	0.02
African American	-0.06	0.2	-0.06	0.18	-0.07	0.15
Asian/Pacific Islander	-0.44**	0.14	-0.41**	0.13	-0.27*	0.11
Latino/Hispanic	0.11	0.19	-0.02	0.17	-0.05	0.14
Multiracial	0.1	0.19	-0.09	0.18	-0.01	0.15
Other Race	-0.1	0.21	-0.14	0.19	0.01	0.16
Other Gender	-0.31	0.25	0.06	0.24	-0.05	0.2
Women	-0.04	0.12	0.08	0.11	0.03	0.1
Resilience			0.18	0.13	-0.12	0.11
Extraversion			0.12	0.07	0.02	0.06
Agreeableness			0.09	0.08	0.01	0.07
Conscientiousness			-0.02	0.07	-0.02	0.06
Neuroticism			-0.29***	0.07	-0.15*	0.06
OpenMindedness			0.07	0.07	0.04	0.06
Typical PA					0.68***	0.08

Note. The reference group for race was White/European American. The reference group for gender was Male. * $p<.05$, ** $p<.01$, *** $p<.001$

Similar models were fitted for weekly reports of negative emotions, and the results are shown in Table 2. None of the demographic variables (i.e., age, gender, and race) was significant in the initial model, suggesting that demographic characteristics did not substantially predict weekly evaluation of negative affective experiences. In model 2, we added personality and resilience as predictors. Neuroticism emerged as a significant positive predictor, and agreeableness showed a significant negative association with weekly evaluation of overall negative affect (NA). These findings indicated that individuals higher in neuroticism tended to report greater NA, while those higher in

agreeableness tended to report lower weekly evaluated negative emotions. Surprisingly, extraversion also appeared as a significant positive predictor, indicating that more extroverted people tended to report higher weekly overall NA.

In model 3, we added in typical NA to examine whether the effects of person-level predictors were accounted for by individuals' perception of their general emotional tendencies. Typical NA emerged as a significant positive predictor of weekly reported NA, while neuroticism became nonsignificant. This result suggested that the previously observed effect of neuroticism may be explained by individuals' general tendency to experience more negative affect. Additionally, both extraversion and agreeableness remained significant, indicating that their associations with weekly recalled NA were not solely accounted for by typical NA but may reflect their unique contributions to individuals' appraisal and recall of their past emotional experiences.

Table 2

Demographic and person-level predictors predicting weekly evaluated overall NA

	Model 1		Model 2		Model 3	
Predictors	*Estimates*	*SE*	*Estimates*	*SE*	*Estimates*	*SE*
Fixed Effects (Intercept)	0.91	0.48	1.47**	0.44	1.03*	0.43
Age	0.04	0.02	0.02	0.02	0.04	0.02
African American	-0.08	0.15	0.01	0.14	-0.02	0.13
Asian/Pacific Islander	0.03	0.11	0.07	0.1	0.06	0.1
Latino/Hispanic	-0.06	0.15	0.11	0.13	0.1	0.12
Multiracial	-0.14	0.15	-0.14	0.13	-0.08	0.13
Other Race	0.11	0.16	0.11	0.14	0.03	0.14
Other Gender	0.22	0.19	-0.1	0.18	-0.08	0.17
Women	0.05	0.09	-0.01	0.09	0.01	0.08

Resilience	-0.01	0.1	-0.11	0.09
Extraversion	0.12*	0.05	0.14**	0.05
Agreeableness	-0.19**	0.06	-0.15**	0.06
Conscientiousness	0.07	0.05	0.04	0.05
Neuroticism	0.33***	0.05	0.11	0.07
OpenMindedness	0.05	0.05	0.05	0.05
Typical NA			0.34***	0.07

Note. The reference group for race was White/European American. The reference group for gender was Male.

* $p<.05$, ** $p<.01$, *** $p<.001$

Person-level Predictors

Weekly PA

For each person-level predictor (i.e., extraversion, neuroticism, and resilience), we started with the main effect model, fitting only the predictor along with weekly peak PA and weekly end PA to see whether each of the personality predictors was associated with weekly evaluation of PA. Results are shown in Table 3. Mean peak PA, centered peak PA, and end PA appeared to be significant positive predictors of weekly recall of PA for all three models, suggesting that momentary emotional experiences played a critical role in how individuals evaluate their overall affective experiences. Among the three person-level predictors, only neuroticism emerged as a significant predictor in its respective model. Specifically, individuals higher in neuroticism reported lower weekly positive affect, indicating a more negative retrospective evaluation of emotional experience. In contrast, neither extraversion nor resilience showed significant main effects, suggesting that these personality traits did not independently predict weekly recalled positive affect when controlling for momentary emotion reports.

Table 3

Results from Multilevel Analysis Predicting Weekly Evaluation of PA with Main Effects

	Extraversion Model		Neuroticism Model		Resilience Model	
Predictors	*Estimates*	*SE*	*Estimates*	*SE*	*Estimates*	*SE*
(Intercept)	0.21*	0.1	0.3**	0.1	0.22*	0.1
Centered peak PA	0.39***	0.06	0.39***	0.06	0.39***	0.06
Mean peak PA	0.82***	0.03	0.79***	0.03	0.81***	0.03
End PA	0.1**	0.04	0.1**	0.04	0.1**	0.04
Extraversion	0.02	0.03				
Neuroticism			-0.12***	0.03		
Resilience					0.07	0.05

Note. * $p<.05$, ** $p<.01$, *** $p<.001$

To examine whether these person-level predictors were positively associated with peak positive bias, we fitted three multilevel models with cross-level interaction terms between the person-level predictors and peak PA, as shown in Table 4. Contrary to our hypothesis, results from the extraversion model showed that neither extraversion nor the interaction between extraversion and peak PA was a significant predictor of weekly reported overall PA. Instead, mean peak PA, centered peak PA, and end PA appeared to be significant predictors. Similar results were shown in the models for neuroticism and resilience. Neither the main effect of neuroticism and resilience nor their interaction term with peak PA appeared to be a significant predictor of the weekly evaluation of PA. Within each model, mean peak PA, centered peak PA, and end PA were the only significant predictors. These results, together, suggested that both the peak and end emotional experience were the consistent predictors of how people retrospectively evaluate their overall positive affect. In contrast, individual differences in personality

traits, such as extraversion, neuroticism, and resilience, did not significantly influence individuals' peak bias or their retrospective evaluations of positive affect.

Table 4

Results from Multilevel Analysis Predicting Weekly Evaluation of PA with Interaction

	Extraversion Model		Neuroticism Model		Resilience Model	
Predictors	*Estimates*	*SE*	*Estimates*	*SE*	*Estimates*	*SE*
(Intercept)	0.25*	0.11	0.29**	0.1	0.22*	0.1
Centered peak PA	0.39***	0.06	0.39***	0.06	0.38***	0.06
Mean peak PA	0.81***	0.03	0.79***	0.03	0.81***	0.03
End PA	0.1*	0.04	0.1**	0.04	0.1**	0.04
Extraversion	0.2	0.12				
Extraversion × Centered peak PA	0.01	0.07				
Extraversion × Mean peak PA	-0.06	0.04				
Neuroticism			-0.01	0.12		
Neuroticism × Centered peak PA			-0.03	0.06		
Neuroticism × Mean peak PA			-0.04	0.04		
Resilience					0.12	0.18
Resilience × Centered peak PA					0.01	0.11
Resilience × Mean peak PA					-0.02	0.06

Note. * $p<.05$, ** $p<.01$, *** $p<.001$

Weekly NA

Similar to the models predicting weekly reported PA, we started with only including the main effects of person-level predictors along with the peak and end negative emotion in the models predicting weekly reported NA. The results, shown in Table 5, revealed that across all three models, both mean peak NA and centered peak NA

consistently emerged as significant positive predictors of weekly recalled NA. In contrast, end NA was not significant in any of the models. This pattern suggested that, unlike the recall of positive emotions, the end point of the emotional experience played a minimal role in retrospective evaluations of negative affect, whereas peak experiences were more influential. Among the personality predictors, neuroticism was the only trait that showed a significant main effect, indicating that individuals higher in neuroticism tended to report greater NA when evaluating their past week. In contrast, similar to the findings for positive affect, neither extraversion nor resilience were significant predictors of weekly recalled NA in their respective models.

Table 5

Results from Multilevel Analysis Predicting Weekly Evaluation of NA with Main Effects

	Extraversion Model		Neuroticism Model		Resilience Model	
Predictors	*Estimates*	*SE*	*Estimates*	*SE*	*Estimates*	*SE*
(Intercept)	0.27***	0.06	0.33***	0.07	0.27***	0.06
Centered peak NA	0.32***	0.04	0.32***	0.04	0.32***	0.04
Mean peak NA	0.72***	0.03	0.69***	0.03	0.72***	0.03
End NA	0.03	0.04	0.03	0.04	0.03	0.04
Extraversion	0.01	0.02				
Neuroticism			0.07**	0.02		
Resilience					<.005	0.04

Note. * $p<.05$, ** $p<.01$, *** $p<.001$

Building on the main effect model, we added the cross-level interaction term for the person-level predictors within each model to investigate whether personality and resilience influenced individuals' peak bias when reporting past NA. As shown in Table 5, mean peak NA and centered peak NA showed significant effect across three models.

For extraversion and neuroticism models, neither the main effects nor interaction terms were significant predictors of weekly recalled NA. These findings suggested that similar to the evaluation of past positive emotion, individuals' retrospective evaluations of negative affect were more strongly influenced by the intensity of their peak negative emotions rather than by trait-level differences in neuroticism and extraversion.

Table 6

Results from Multilevel Analysis Predicting Weekly Evaluation of NA with Interaction

	Extraversion Model		Neuroticism Model		Resilience Model	
Predictors	*Estimates*	*SE*	*Estimates*	*SE*	*Estimates*	*SE*
(Intercept)	0.27***	0.06	0.34***	0.07	0.25***	0.06
Centered peak NA	0.32***	0.04	0.31***	0.04	0.31***	0.04
Mean peak NA	0.72***	0.03	0.68***	0.03	0.73***	0.03
End NA	0.03	0.04	0.03	0.04	0.03	0.04
Extraversion	<.005	0.07				
Extraversion × Centered peak NA	-0.04	0.05				
Extraversion × Mean peak NA	0.01	0.03				
Neuroticism			0.03	0.07		
Neuroticism × Centered peak NA			0.07	0.04		
Neuroticism × Mean peak NA			0.02	0.03		
Resilience					-0.27*	0.12
Resilience × Centered peak NA					-0.19*	0.08
Resilience × Mean peak NA					0.11*	0.05

Note. * $p<.05$, ** $p<.01$, *** $p<.001$

Importantly, resilience, along with its interaction terms with mean peak NA and centered peak NA, appeared to be significant predictors. The significant negative

coefficient of resilience suggested that resilient individuals tended to evaluate their overall weekly NA as less negative. In addition, the model testing resilience predicting individuals' peak negative bias showed a significant negative effect of interaction between resilience and centered peak NA. As shown in Figure 3, individuals who reported higher resilience showed a weaker association between their negative emotion peaks within each week and evaluation of overall NA at the end of the week. This result suggested that more resilient people tended to show fewer negative peak biases when asked to report their overall negative affective experience retrospectively. Interestingly, the interaction between resilience and mean peak NA appeared to be positively significant, as shown in Figure 4. This result indicated that resilient individuals showed a stronger association between their general tendency to experience high peak NA and their overall evaluation of NA. In other words, while resilience buffered against the emotional impact of specific peak NA, the accumulated influence of consistently experiencing high peak NA might still be reflected in the retrospective recall of the overall emotional experience.

Figure 3

Interaction Between Centered Peak NA and Resilience on Evaluation of Weekly NA

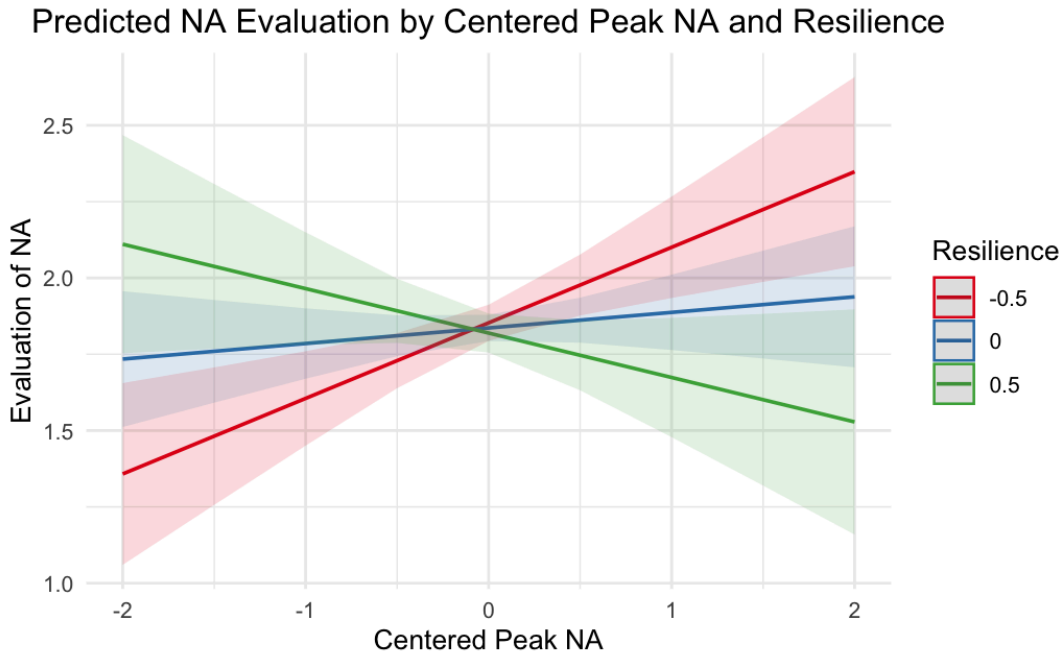
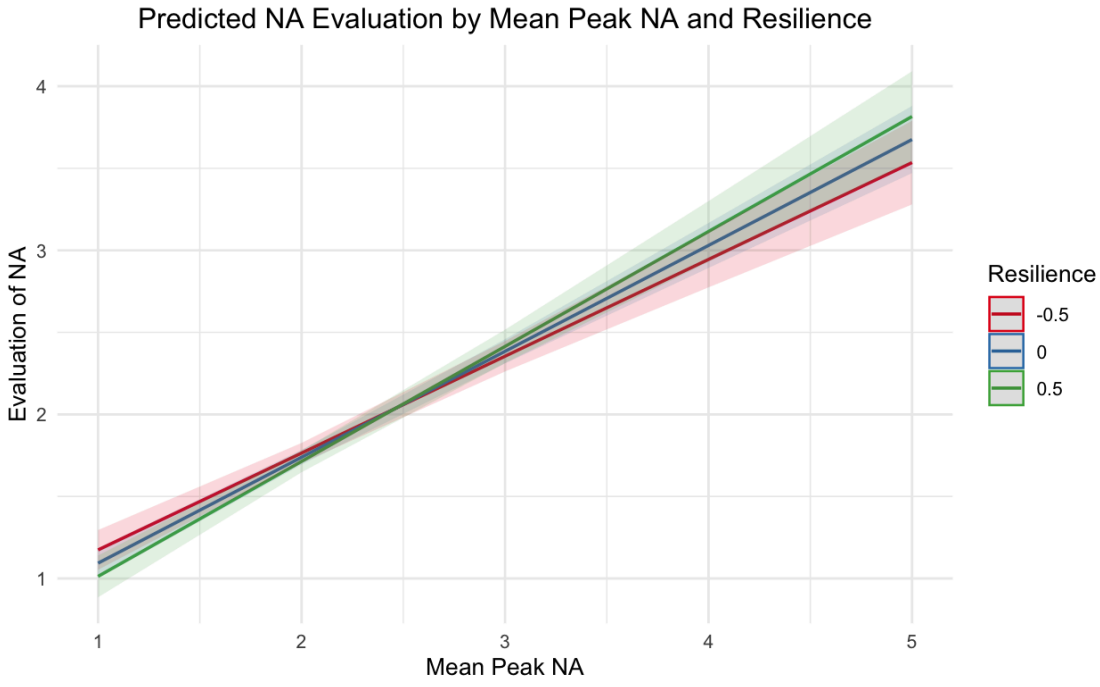


Figure 4

Interaction Between Mean Peak NA and Resilience on Evaluation of Weekly NA



Resilience Mechanisms

Mechanism 1: Weekly peak positive affect mediates the association between resilience and retrospective evaluation of overall positive affect

Path coefficients of the mediation models for testing mechanism 1 were presented in Figure 5. In step 1, the mediation model with peak PA as mediator explained 61.1% of the variance in the weekly evaluation of PA, with 7.6% variance explained by the peak PA. At level 2, path a indicated that high resilience was linked with higher levels of peak PA. This suggested that more resilient individuals tend to have higher peak PA each week. Path b showed that peak PA had a significant positive effect on retrospectively evaluated PA at the end of the week, indicating that having high peak PA was associated with more positive ratings of the past week's affective experiences. Importantly, the significant indirect path ($\beta = .365$, $SE = .088$, $z = 4.140$, $p < .001$) showed that peak PA mediated the relationship between resilience and the weekly evaluation of PA. This result suggested that resilience influences people's retrospective recall of past positive emotions by increasing the likelihood of experiencing higher positive peaks.

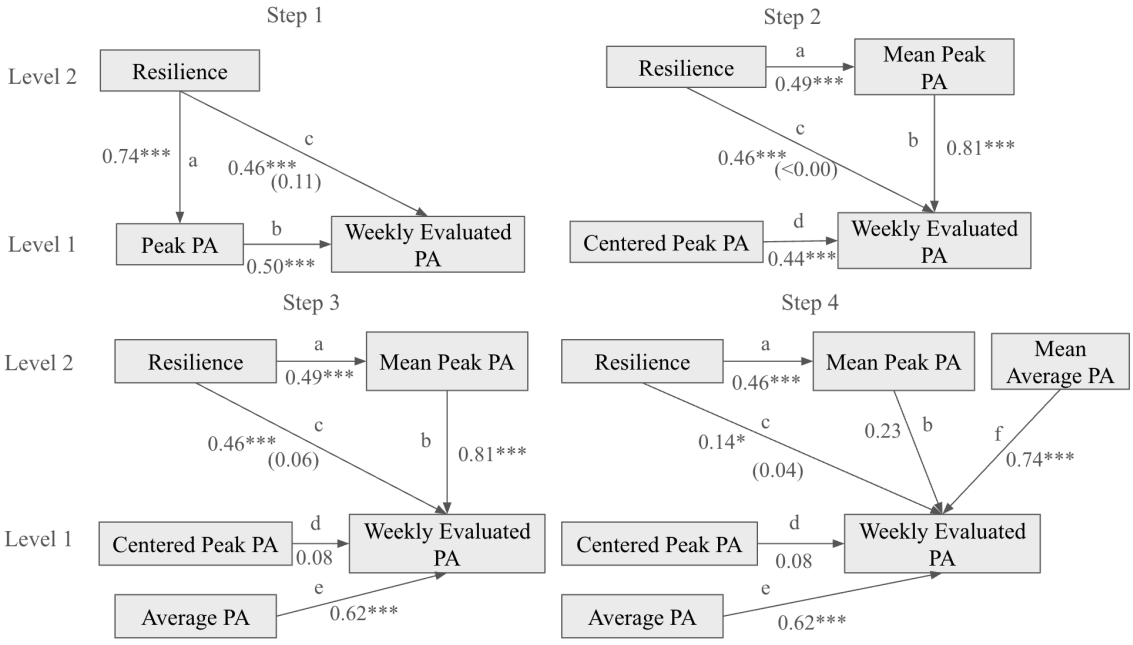
In step 2, we decomposed the peak PA into mean peak PA and centered peak PA in the model and examined mean peak PA as a mediator between resilience and retrospective rating of PA. The mediation model now explained 63.1% of the variance in weekly recalled PA, and mean peak PA as a mediator explained 9.2% of the variance. The mean peak PA showed a significant mediation effect on the association between resilience and weekly evaluated PA, $\beta = .399$, $SE = .097$, $z = 4.124$, $p < .001$. This result further supported the interpretation that resilience contributes to more positive emotional

recall by increasing individuals' general tendency to experience strong positive emotional peaks across time.

To test whether the mediation effect of mean peak PA held true when controlling for individuals' average daily PA rating, we added in weekly average PA as a predictor of mean peak PA and reported overall PA in step 3, as shown in Figure 4 on the bottom left. The model included the average daily PA rating explained 65.2% of the variance in the evaluation of overall PA, with mean peak PA explained 9.2% of the variance. At level 1, the average daily PA rating predicted weekly retrospective PA (path e), which rendered the effect of centered peak PA on weekly retrospective PA non-significant (path d). The indirect effect of mean peak PA remained significant ($\beta = .399$, $SE = .097$, $z = 4.124$, $p < .001$), which further suggested that the tendency to experience high peak PA during the week plays a critical role in how individuals retrospectively evaluate their overall PA, beyond the influence of average weekly PA.

Figure 5

Multilevel mediation models for mechanism 1 with coefficients



Note. The figure shows standardized regression coefficients for the relationship between resilience and weekly evaluated PA mediated by mean peak PA, controlling for centered peak PA (Step 2), both centered peak PA and average PA (Step 3), and additional mean average PA (Step 4). The values in parentheses represent the direct effect of resilience on weekly evaluated PA after accounting for the mediating effect of mean peak PA.

*** $p < 0.001$ ** $p < 0.01$ *$p < 0.05$

To account for the effect of average PA at level 2, we added the average of all momentary reports of PA (mean average PA) as a predictor of retrospectively recalled PA in the model in step 4. The model with additional mean average PA now explained 61.1% of the variance of recalled PA, and the mean peak PA explained 7.9% of the variance. Mean average PA emerged as a significant predictor of weekly evaluated PA, as shown in

path f in Figure 4. Interestingly, the mediation effect of mean peak PA became nonsignificant after controlling for mean average PA. This result suggested that the previously observed mediation pathway, from resilience to recalled PA via mean peak PA, may actually reflect individuals' overall emotional experiences rather than the influence of emotional peaks specifically. In other words, resilient individuals may report more positive retrospective evaluations not because they rely more heavily on peak moments, but because they generally experience higher levels of positive affect throughout the week. Together, these results partially supported mechanism 1.

Mechanism 2: Time since peak X resilience significantly predicts weekly overall PA

Multilevel analysis was conducted to investigate whether resilient individuals could better memorize their peak PA and, therefore, report higher weekly overall PA. We first examined the model with only mean peak PA, centered peak PA, end PA, resilience, and time since peak, as shown in Model 1 in Table 7. Mean peak PA, Centered peak PA, and end PA were significant predictors of weekly evaluated PA. In addition, time since peak also appeared as a significant predictor with negative coefficient, suggesting that the longer the time gap between the occurrence of the peak PA and the end-of-week evaluation, the lower participants rated their overall weekly PA. This finding indicated that emotional peaks may become less salient or accessible over time, thereby weakening their influence on retrospective judgments.

To test whether this effect of time on retrospective recall of PA was weaker for resilient individuals, we added in cross-level interaction between resilience and time since peak, as shown in model 2. Mean peak PA, Centered peak PA, end PA, and time since peak remained significant. However, the interaction term between time since peak

and resilience was not significant. The result suggested that the effect of time on remembering positive peaks did not differ between resilient and non-resilient individuals, and resilient individuals might not necessarily remember their positive peak PA better.

Table 7

Multilevel Model for Mechanism 2

	Model 1			*Model 2*		
Predictors	*Estimates*	*SE*	β	*Estimates*	*SE*	β
Fixed Effects						
(Intercept)	0.32**	0.11	0.01	0.32**	0.11	0.01
Resilience	0.07	0.05	0.04	0.04	0.09	0.04
Mean peak PA	0.81***	0.03	0.76	0.81***	0.03	0.76
Centered peak PA	0.39***	0.06	0.17	0.39***	0.06	0.17
End PA	0.08*	0.04	0.05	0.09*	0.04	0.05
Time since peak	<.005*	<.005	-0.05	<.005*	<.005	-0.05
Resilience × time to peak				<.005	<.005	0.01

Note. * p<.05, ** p<.01, *** p<.001

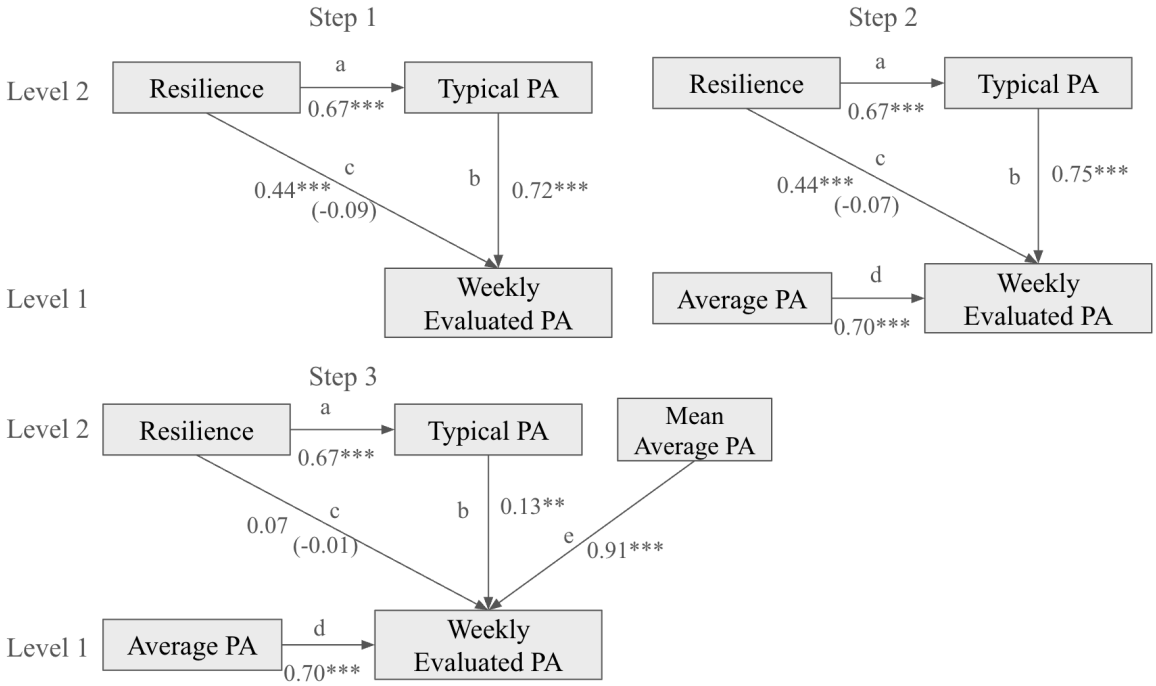
Mechanism 3: Typical PA mediates the association between resilience and weekly overall PA

The model including typical PA as a mediator explained 33.5% variance in weekly reported overall PA. As shown in Figure 6, path a indicated that resilience was positively linked with individuals' typical positive emotionality. Similarly, having greater typical PA was found to be associated with higher ratings of PA retrospectively (path b). The mediation analyses revealed a significant indirect effect, indicating that typical PA mediated the association between resilience and weekly overall PA (β = .504, SE = .095, z = 5.302, p < .001). This result suggested that the influence of resilience on individuals's

recall of their positive emotional experiences may operate through their perception of their overall tendency to experience positive affect.

Figure 6

Multilevel Mediation Models for Mechanism 3 with coefficients



Note. The figure shows standardized regression coefficients for the relationship between resilience and weekly evaluated PA mediated by typical PA (Step 1), after controlling for average PA (Step 2), and after controlling for average PA and mean average PA (Step 3). The values in parentheses represent the direct effect of resilience on weekly evaluated PA after accounting for the mediating effect of mean peak PA.

*** p < 0.001 ** *p* < 0.01 **p* < 0.05

In Step 2, we added weekly average daily PA as a predictor to test whether the mediation effect of typical PA held after accounting for the average of participants' momentary reported affective experience during the week. The model now explained 39.1% of the variance in the weekly evaluation of positive PA, and the mediation effect of typical PA on the association between resilience and recalled past PA remains significant ($\beta = .503$, $SE = .095$, $z = 5.303$, $p < .001$). This result supported that resilience exerted influence on people's overall evaluation of PA in the past week through their stable pattern of PA, even after accounting for the average level of PA within a specific week.

In step 3, we added the level 2 variable, mean average PA, as a predictor of weekly evaluated PA in the model from step 2. After adding in the mean average PA, the model now explained 66.6% of the variance of weekly recalled PA. In addition, mean average PA appeared as a strong and significant predictor of retrospective rating of PA, as shown in path e, indicating that individuals who experienced higher positive affect across the study period tended to evaluate their overall positive emotions higher. Importantly, even after accounting for the mean average PA, the mediation effect of typical PA, although decreased in magnitude, remained significant, $\beta = .086$, $SE = .036$, $z = 2.354$, $p < .05$. This result indicated that resilient individuals reported higher retrospective evaluation of positive emotion through having higher typical PA, or perception of greater overall positive emotionality. This mediation effect provided a unique explanation of resilient individuals' emotional functioning that contributes to their more favorable evaluation of past affective experience, above and beyond the cumulative average of experienced emotion.

Discussion

The current study investigated how person-level predictors influence the tendency of individuals to use peak bias when reporting their past affective experiences. By combining ecological momentary assessment (EMA) of emotion and self-reported survey, we examined the influence of extraversion, neuroticism, and resilience on people's peak bias in recall of their positive and negative emotions. Contrary to our hypothesis, higher levels of resilience and extraversion were not associated with more peak bias in recalling positive affective experiences. Moreover, higher levels of neuroticism were not associated with more peak bias in reporting past negative affect (NA). Interestingly, resilience was found to be associated with lower peak bias in retrospective ratings of NA, suggesting a potential buffering effect. We also explored potential mechanisms in which resilient individuals might experience greater peak bias when recalling positive past emotions. Results supported mechanism 3, which proposed that resilient individuals recall greater overall positive emotions through relying on their perception of their overall emotionality. Additionally, mechanism 1 was partially supported, indicating that highly resilient individuals potentially tend to experience higher positive peaks than others and therefore reported higher evaluation of their positive affect (PA).

Predictors for retrospective evaluation of Positive and Negative Affect

Preliminary models examining the demographic and personality variables that typical emotionality was a persistent predictor for the recall of affective experience. Specifically, self-reported typical PA and NA were significantly associated with participants' evaluations of positive and negative emotional experiences at the end of

each week, respectively. This finding suggested that individuals' perceptions of their general emotional tendencies influence how they retrospectively evaluate their overall emotional experiences over time. This result aligned with the accessibility model of emotion (Robinson & Clore, 2002a), which posited that identity-related beliefs, such as one's general emotional disposition, serve as a reference when assessing past affective experiences.

As for personality predictors, neuroticism was found to be negatively associated with the retrospective rating of PA and positively associated with the retrospective rating of NA. This pattern aligned with the previous research, which linked neuroticism with lower reported PA and higher reported NA (Lay et al., 2017; Miller et al., 2016). After adding typical NA to the model in step 3, neuroticism became nonsignificant, suggesting that the relationship between neuroticism and greater retrospective NA may be accounted for by individuals' overall perception of their typical negative emotional experience. In addition, consistent with the previous study (Miller et al., 2016), agreeableness was negatively linked with recalled NA, suggesting that more agreeable individuals reported reduced negative emotions when reflecting on past events. Contrary to the majority of existing literature linking extraversion to higher PA and lower NA, our analysis revealed a significant positive association between extraversion and retrospective rating of NA, indicating that individuals who were high on extraversion reported greater overall NA when reflecting on past experiences. Among the demographic variables, racial difference was found in the retrospective rating of PA. Compared to White/European Americans, participants who identified as Asian/Pacific Islanders reported lower PA retrospectively. This result showed a consistent pattern with previous research (e.g., Diener et al., 2000;),

and implied the potential influence of socio-cultural factors on the evaluation of past emotional experience (Nasabe et al., 2000).

Personal-Level Predictors for Peak Bias

One of the primary purposes of the current study was to examine the influence of personality and resilience on individuals' bias in recalling past affective experiences. Contrary to our hypotheses, neither extraversion nor neuroticism was found to be associated with peak bias in recalling weekly PA or NA. Therefore, although personality traits have been linked to the tendency to overestimate or underestimate emotions retrospectively (Barret, 1997; Mill et al., 2016), these effects may not necessarily stem from the influence of personality traits on the tendency to reference peak emotional experiences. Notably, across all six multilevel models assessing the influence of personality on the evaluation of PA and NA, both mean peak affect and centered peak affect emerged as persistent significant predictors. This finding was consistent with previous research on peak bias in evaluating past experience (e.g., Alaybek et al., 2022; Do et al., 2008). In addition, although we didn't make specific hypotheses about end bias, we found s consistent end effect in predicting weekly recalled PA but not NA. This result was in line with the previous study on retrospective reports of happiness (Scharbert et al., 2025), suggesting potential differences in the information individuals replied to when recalling past positive and negative emotions.

In addition, by breaking down the peak affect into person-specific mean to capture between-person variance and the deviation around mean to capture within-person variance, the current study assessed the effect of both individuals' tendency to experience higher or lower peaks (i.e., mean peak affect) and the effect of having specific higher or

lower peaks (i.e., centered peak affect). For resilience models, our hypothesis that resilience positively linked with peak bias in recalling past positive emotions was not supported. Specifically, high resilience was not found to be associated with having more peak bias in the retrospective rating of PA. Interestingly, our result showed that resilience not only appeared as a significant main effect on weekly NA evaluations but also significantly interacted with both within-person and between-person components of peak negative affect. The negative interaction between resilience and centered peak NA suggests that resilient individuals were less influenced by momentary peaks in negative emotion, that is, they showed reduced negative peak bias when recalling their emotional experience at the end of the week. This result suggested that when experiencing high negative peaks, resilient individuals were less likely to recall their experiences as negatively as those with lower resilience. Consistent with previous literature on resilience as a protective factor against negative experiences and challenges (Lee et al., 2014; Seery & Quinton, 2016), this finding further supported the notion that resilience played a critical role in shaping how individuals recall and interpret negative emotional experiences, particularly through buffering the impact of intense negative peaks on overall affective evaluations.

In contrast, the positive interaction between resilience and mean peak NA revealed that resilient individuals showed a stronger association between their general tendency to experience peak NA and their overall weekly NA evaluations. This finding suggests that resilience might not involve ignoring or distorting individuals' emotional patterns, but rather potentially reflecting the ability to cope or regulate momentary intense negative emotion while staying aware of individuals' overall emotional

experiences. Together, the findings on these interactions suggested a nuanced role of resilience in retrospective recall of affective experiences. Resilience may potentially buffer against intense reactivities to peak negative emotion, while still allowing individuals to recognize and integrate their general patterns of emotional experience when evaluating the past.

Resilience Mechanisms

Another primary focus of the current study was to investigate the potential mechanisms through which resilience influences how people recall and evaluate their past affective experiences. Our findings partially supported mechanism 1, which proposed that resilience influences retrospective recall of positive affect through its association with emotional peaks. Initially, the mediation model showed that peak PA significantly mediated the relationship between resilience and weekly retrospective reported PA, suggesting that resilient individuals may recall their week more positively because they tend to experience higher positive emotion peaks. Additionally, this mediation remained significant even after controlling for individuals' average PA within each week, suggesting that peak emotional experiences potentially offered unique explanatory value beyond overall emotional experience during a given week.

However, in the final model, the mediation effect of mean peak PA became nonsignificant after controlling for mean average PA, an indicator of individuals' overall positive affect across the study period. This pattern suggested that the previous mediation pathway may reflect resilient individuals' broader emotional tendencies, rather than references to specific peak PA. In other words, while resilient individuals may indeed experience higher PA peaks, their positive rating of retrospective PA may be better

explained by their actual experiences of high positive affect. This result aligned with previous research demonstrating a strong association between resilience and higher levels of daily positive emotions (Gloria & Steinhardt, 2016; Lyu et al., 2017). These studies have consistently shown that resilient individuals tend to experience greater positive affect, even in the face of stress or adversity (Ong et al., 2006; Tugade & Fredrickson, 2004), which may contribute to more favorable retrospective evaluations of emotions.

The second proposed mechanism that resilient individuals were able to memorize their peaks better and, therefore, tended to refer to the positive peaks when recalling past positive emotions was not supported. To test this mechanism, we examined whether the time since peak PA influenced the way individuals evaluated their past affective experiences differently for high- and low-resilience individuals. Results showed that longer delays between a person's peak PA and the end-of-week recall were associated with less positive evaluations of overall PA. Consistent with previous research, this finding suggested that emotional peaks may become less salient or accessible over time and therefore provide weaker influences on retrospective judgments (Levine & Pizarro, 2004). However, the lack of significant interaction between resilience and time since peak suggested that resilience may not influence emotional recall through enhanced memory for specific peak moments, and more resilient individuals were not necessarily more likely to recall or be influenced by positive peak moments that occurred earlier in the week. Together, our results indicated that the effect of resilience on emotional recall is unlikely to operate through improved memory for positive emotional peaks.

In addition to supporting mechanism 1, our results also provided evidence for mechanism 3, suggesting that resilient individuals might rely on their perception of their

overall emotionality when evaluating past positive emotions. The robust mediation effect of typical PA, which remained significant even after controlling for weekly average PA and mean average PA, indicated that resilient individuals evaluate their week more positively not simply because they experienced more positive affect overall, but also potentially due to greater perception of positive emotional disposition. This finding was consistent with the idea that resilient individuals possessed stable and enduring positive emotionality (Robinson et al., 2014), which might influence not only their real-time emotional responses but also how they reconstruct and interpret past emotions (Robinson & Clore, 2002a). In other words, resilient individuals might be more inclined to interpret and remember past events through a positive view, reflecting a more generalized positive memory bias. This perspective aligned with the finding from the study by Colombo and colleagues (2020), in which they suggested that resilient individuals tended to overestimate their past positive experiences and, therefore, achieve higher well-being. Such adaptive bias allowed resilient individuals to maintain a more optimistic view, even when faced with past challenges or adversities (He et al., 2013).

Limitations & Future Directions

While the current study offered valuable insights into the relationship between person-level predictors and affective recall bias, several limitations should be considered.

First, the current study was based on secondary analysis of an existing dataset, which primarily sampled college students and may limit the generalizability of the findings to other populations. College students often experience unique stressors and developmental challenges, which could influence resilience and emotional processing differently compared to older or more diverse demographic groups. Future research

should include participants from varied backgrounds to better understand the influence of personality and resilience on affective recall across different life stages and contexts. In addition, the current study did not record the specific events participants used when evaluating their overall affective experience. Future studies could collect more detail on the information or memory participants referred to when assessing past emotions.

Second, while the current study primarily focused on positive affect when examining potential mechanisms for resilience, we found an interesting interaction between resilience and negative emotional peaks, suggesting that resilience may buffer against the effect of negative peak experiences on retrospective evaluation of overall emotional experience. This unexpected finding highlights the need for future research to further investigate the relationship between resilience and negative affect. Understanding how resilient individuals process and remember intense negative emotions could provide deeper insights into the adaptive function of resilience in coping with adversity.

Third, the current study did not find evidence for associations between personality traits (i.e., extraversion and neuroticism) and peak bias. Due to the limitation on the scope of the study, we did not explore whether specific facets of personality traits would be associated with patterns of emotion recall. Future research could explore these fine-grained associations to gain a more nuanced understanding of personality influences on recall bias.

Lastly, the study's relatively short temporal window of one week might limit our ability to detect potential long-term effects of resilience on emotional recall. Since memory for emotional experiences could decay over longer periods, future studies could consider extending the timeframe to examine whether the observed mechanisms persist

over weeks or months. Additionally, examining longer periods might help identify whether resilience plays a more significant role when memory decay becomes more prominent.

Conclusion

The primary goal of this study was to examine how personality traits and resilience influence the recall bias of positive and negative affect, specifically focusing on peak bias in ecological momentary assessments. Contrary to our hypotheses, neither extraversion nor neuroticism was significantly associated with peak bias for weekly positive or negative affect. Instead, both peak and end affect emerged as significant predictors of retrospective evaluations for both positive and negative emotions. This pattern further supported the robustness of the peak and end rule in emotion recall.

Regarding resilience, we did not find evidence that resilience enhances peak bias in recalling positive emotions. Instead, we found that resilience moderated the relationship between negative peak affect and weekly overall negative affect. More resilient individuals exhibited a weaker link between negative peaks and retrospective negative evaluations, suggesting that resilience buffers against the impact of intense negative emotions. This highlighted the protective role of resilience in mitigating the impact of negative experiences and adversities. Among the potential mechanisms in which resilience influences people's evaluation of past emotions, our result partially supported mechanism 1. While resilient individuals reported higher levels of past positive affect potentially through experiencing greater positive peaks, this effect was accounted for by individuals' overall emotional experience across the study period. Additionally, we found support for mechanism 3, indicating that resilient individuals evaluated their past

emotional experiences more positively through their belief in having a generally positive emotional disposition.

In conclusion, our findings showed that resilience and personality traits play a more nuanced role in how people remember and evaluate their affective experience. Given the complex nature of emotional experiences and memory, understanding how individuals reconstruct their past emotions and the factors that shape these processes would be crucial for promoting adaptive outcomes.

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CURRICULUM VITE

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EDUCATION

August 2023 - May 2025 **Wake Forest University**
Master of Arts, Psychology
Advisor: Veronica Cole, Ph.D.
Thesis title: Person-level Predictors of Agreement Among Weekly Peak and End Reports of Positive and Negative Affect: Ego Resilience and Big Five Personality Traits

August 2019 - May 2023 **William & Mary**
Bachelor of Science, Double major in Psychology and Applied Mathematics
Summa Cum Laude, Phi Beta Kappa
Advisor: Janice Zeman, Ph.D.
Thesis Advisor: Joanna Schug, Ph.D.
Thesis title: The Influence of Relational Mobility and Social Esteem on Experienced Loneliness in Asian International Students Studying in the United States

PEER-REVIEWED PUBLICATION

Chu, X., Givens, T. V., Liu, Y., Hessong, A. C., Zapffe, L., Zhang, Q., Boyd, S., & Cole, V. T. (2024). Parsing the Prospective Links from Externalizing and Internalizing Symptoms to Substance Use: A Systematic Review and Meta-Analysis. *Current Addiction Reports.* https://doi.org/10.1007/s40429-024-00608-5

MANUSCRIPT IN PREPARATION

Chu, X. & Kennedy, C. A Scoping Review on Artificial Intelligence Application in Emergency Psychiatry.

Chu, X. & Kennedy, C. Predicting Suicide Attempts after Emergency Department Visits using Machine Learning Methods.

CONFERENCE PRESENTATION

Chu, X., Cole, V., & Givens, T. (May 2024) *Internalizing and Externalizing Pathways to Substance Use Disorders: A Systematic Review.* Presented at the 2024 Association for Psychological Science Annual Convention, San Francisco, CA.

Chu, X., Pham, T., Homenya, R., & Schug, J. (February 2024). *The Role of Societal and Personal Relational Mobility in Predicting Loneliness in a Sample of Domestic and International Students in the United States.* Presented at the 2024 Society for Personality and Social Psychology, San Diego, CA.

Chu, X., Zeman, J. L., Hale, M. E., & Marzougui, J. B. (May 2023). *Friendship Quality in Close Friendships: The Role of Gender Composition in Friendship Dyads.* presented at the 2023 Association for Psychological Science Annual Convention, Washington D.C.

Chu, X., Labella, H. M., (January 2023). *Do difficulties in Emotion Regulation Predict Different Aspects of Self-Monitoring?* presented at the Third Annual Network for Undergraduate Research in Virginia Conference, Christopher Newport University, Newport News, VA.

Chu, X. & Zeman, J. L., (April 2022). *Late Adolescent Boys' and Girls' Friendships: Does Gender Dyad Composition Matter for Friendship Quality?* Poster presented at the L. Starling Reid Undergraduate Psychology Conference at the University of Virginia, Charlottesville, VA.

Marzougui, J. B., Zeman, J. L., **Chu, X.**, & Gershefski, M. R., (April 2021). *Cognitive Emotion Regulation Strategies Predict Friendship Quality in Young Adolescents.* Presented at the biennial meeting of the Society for Research in Child Development (held virtually).

SCHOLARSHIPS & AWARDS

Wake Forest University:

- Full Tuition Scholarship $42,184 and Stipend $13,500 per year — 2023-2024, 2024-2025
- Jombock Travel and Research Fund $200 — May 2025

William & Mary:

- International Student Opportunity Scholarship $700 — March 2023
- Charles Center Semester Research Grant $500 — December 2022
- Student Leadership Development Conference Funding $250 — December 2022

RESEARCH EXPERIENCE

Massachusetts General Hospital Center for Precision Psychiatry — July 2024 - Present
Summer Intern, Research Assistant — *Boston, MA*
Advisors: Becky Fortgang, Ph.D., Chris Kennedy, Ph.D.

- Conduct a scoping review on the use of AI in emergency psychiatry; utilize large language model (Llama) to evaluate articles and extract ratings in Rstudio
- Develop predictive models using LASSO regression in R to model suicide risk outcomes in ED-discharged patients based on electronic health records (EHR) data
- Design interactive mobile application interface with Balsamiq to facilitate just-in-time interventions for enhanced patient safety plan adherence
- Test complex Qualtrics surveys incorporating decision tree logic to guide through suicide risk assessment calls for ED-discharged patients.

Master's Independent Project — August 2023 - June 2024
Advisor: Veronica Cole, Ph.D. — *Winston-Salem, NC*

- Conducted a systematic review of the internalizing and externalizing pathways to substance use among adolescents, synthesizing key findings into a peer-reviewed publication
- Led and trained a team of six students to complete eligibility screening of 13,000 + articles
- Utilized R to clean and preprocess data; prepared study materials, including data screening protocols and tracking systems
- Constructed random effect models using the metafor package in R to estimate pulled effect sizes

One Talk at a Time — September 2023 - present
Asian American Family Coding Team Leader — *Winston-Salem, NC*
Principal Investigators: Gabriela Stein, Ph.D., Stephanie Coard, Ph.D., and Lisa Kiang, Ph.D.

- Collaborate with principal investigators and team leaders to design and refine dyadic interview coding schemes

- Train and supervise a team of seven students in coding racial-socialization interviews, assessing their reliability using weighted Cohen's kappa in R to maintain high data quality
- Lead weekly team meetings to address and resolve coding discrepancies

Center for Research on Abroad and International Student Engagement August 2023 - present
Research Assistant *Winston-Salem, NC*
Advisor: Patrick Bingham, Ph.D., Director, Research Assistant Professor

- Conduct systematic literature search and organize article data for the Academic Research on Abroad Education (AREA) Database, updating entries quarterly to ensure accuracy and relevancy
- Transition the AREA Database to an online searchable platform using Caspio, overseeing regular updates and platform maintenance to enhance user accessibility
- Perform qualitative coding on the interviews for the LGBTQIA+ Students Navigating Identity and Community Abroad Project, employing grounded theory to extract meaningful themes

Senior Honor Thesis at William & Mary August 2022 - May 2023
Advisor: Joanna Schug, Ph.D. *Williamsburg, VA*

- Investigated the impact of personal and societal relational mobility on experienced loneliness among international and domestic college students
- Drafted IRB proposal, developed Qualtrics survey, administered the survey through SONA platform, and analyzed data using R and SPSS
- Wrote and submitted a grant proposal and received a $500 semester research grant from W&M's Charles research center

Resilience In Stressful Environments Lab June 2022 - May 2023
Research Assistant *Williamsburg, VA*
Principal Investigator: Madelyn Labella, Ph.D.

- Contributed to a study examining stress, self-regulation, and parenting dynamics in parent-toddler dyads
- Processed and cleaned heart rate variability (HRV) data using MindWare, identifying and resolving discrepancies collaboratively during weekly review sessions to maintain data accuracy
- Created data cleaning manual, leveraging prior experience with physiological data to streamline the processes
- Co-developed a Python program for automating data organization in Timeline Follow Back (TLFB) interviews, which was later adopted by another lab at William & Mary

Stress and Emotion Lab Jan 2022 - May 2023
Research Assistant *Williamsburg, VA*
Principal Investigator: Meghan Quinn, Ph.D.

- Worked on the research project examining college students' emotion regulation and executive function in stressful situations
- Processed and cleaned electrodermal activity (EDA) data using MindWare, tracking data cleaning process on spreadsheets, and ensuring data consistency through weekly meetings
- Assisted in training new research assistants on data cleaning, ensuring adherence to lab protocols

Disposition, Goals, & Ideology (DiGI) Lab Jan 2022 - June 2022
Research Assistant *Williamsburg, VA*
Principal Investigator: Xiaowen Xu, Ph.D.

- Involved in research investigating the political tendency in branding advertisement and how it influences consumers' opinions
- Conducted literature reviews collaboratively and organized details in Google sheets

Social and Emotional Development Lab Sept 2019 - May 2021, Jan 2023 - May 2023
Research Assistant *Williamsburg, VA*
Principal Investigator: Janice Zeman, Ph.D.

- Contributed to a daily diary study investigating college students' distress tolerance and emotion regulation
- Performed participant recruitment on SONA, updating research information and replying to lab incoming emails
- Guided in-person research visits following an experimental protocol; recorded research data on Excel sheets and kept daily tracking
- Participated in the peer-reviewing process of academic research articles during weekly meeting discussions

TEACHING EXPERIENCE

Wake Forest University January 2024 - May 2024
Teaching Assistant, Contemporary Global Studies (CGS) *Winston-Salem, NC*

- Supported course instruction by preparing class materials and grading assignments
- replied to students' emails and provided timely feedback to the professor for two class sessions

Modern Language Department at W&M January 2021 - May 2021
Teaching Assistant, Chinese Class *Williamsburg, VA*

- Taught weekly TA sessions to reinforce class content and improve students' language skills
- Developed comprehensive teaching plans and PowerPoint presentations under the supervision of the course professor
- Maintained records of class progress and provided detailed weekly feedback to the professor

WORK EXPERIENCE

Ernst & Young June 2021 - August 2021
Audit intern, Minmetal Land Limited Interim Review *Beijing, China*

- Performed substantive procedures and completed audit working papers for four subsidiaries, ensuring compliance and accuracy
- Conducted risk assessment procedures (walk-through test and TO) and collaborated with clients to gather and verify financial documentation

AidData Research Lab June 2020 - December 2021
Senior Research Assistant *Williamsburg, VA*

- Compiled and verified data from China's Foreign Yearbook on elite visits and student flows, and reviewed global data on Confucius Institutions, ensuring accurate and comprehensive datasets for client use
- Developed and maintained consolidated data records in Google Sheets, enhancing data accessibility and reliability

LEADERSHIP & COMMUNITY ENGAGEMENT

Wake Forest University Graduate School Honor Council September 2024 - Present
Psychology Graduate Student Representative *Winston-Salem, NC*

- Responsible for attending hearing panel if an Honor Code violation is reported

Wake Forest University Office of Wellbeing January 2024 - May 2024
Student Wellness Ambassador *Winston-Salem, NC*

- Participated and completed mental health prevention workshops and online NAPSA Certified Peer Educator (CPE) training
- Attended and co-facilitated the peer group-based intervention to promote mental health wellbeing

Reves Center for International Students June 2021 - May 2023
Peer Leader *Williamsburg, VA*

- Facilitated international student orientations by sending out emails and holding virtual sessions
- Volunteered at in-person events hosted by the Center, fostering a welcoming environment for international students

Student Culinary Committee January 2021 - December 2021
Committee Member *Williamsburg, VA*

- Attended weekly meetings and participated in discussions about dining events
- Provided feedback on dining services and developed solutions for existing problems

SKILLS

Programming & Software	Python, R, SPSS, Jamovi, LaTeX, AMPL, MS Office
Language	Chinese (Native) English (Fluent) Japanese (Conversational)