STILL SMILING?: THE IMPLICATIONS OF POSITIVE AFFECT CONTINUITY AND DISCONTINUITY DURING EMERGING ADULTHOOD

By

MOLLY FAYE DAVIS

(Under the Direction of Cynthia Suveg, Ph.D.)

ABSTRACT

This study sought to describe patterns of positive affect (PA) stability and instability during emerging adulthood and to compare psychosocial functioning among those exhibiting distinct PA patterns. A theory-driven model was also tested to determine longitudinal links between PA, executive functioning, internalizing problems (i.e., anxiety and depression), and substance use problems (i.e., drug and alcohol use). A total of 102 emerging adults (*M* age at time one = 18.95 years; *SD* = 1.14, 81% female) reported on their PA at two time points (i.e., at baseline and 18-24 months later). Participants also reported on their internalizing and substance use problems and completed an executive functioning task at time two. Results indicated that participants followed five patterns of PA stability/instability: Stable Low PA, Stable Moderate PA, Stable High PA, Increasers, and Decreasers. The Stable Low PA grouped exhibited greater internalizing and drug use problems compared to peers. Indirect effects of PA on internalizing and substance use problems via executive functioning were nonsignificant. Findings can aid in the refinement of theoretical models regarding temperament development, and its psychosocial implications, during emerging adulthood. The present results can also facilitate assessment, prevention, and intervention efforts for promoting well-being in this developmental period.

INDEX WORDS: Positive affect, Stability, Internalizing problems, Substance use, Executive functioning

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MOLLY FAYE DAVIS

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MOLLY FAYE DAVIS

Major Professor: Cynthia Suveg

Committee: Ronald Blount
Anne Shaffer

Electronic Version Approved:

Suzanne Barbour
Dean of the Graduate School
The University of Georgia
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CHAPTER 1

STILL SMILING?: THE IMPLICATIONS OF POSITIVE AFFECT CONTINUITY AND DISCONTINUITY DURING EMERGING ADULTHOOD

While enduring individual differences in reactivity and regulation (i.e., temperament; Rothbart, 1989) seem to become increasingly stable with age, such traits can certainly still evolve into adulthood (e.g., Kandler, Riemann, & Angleitner, 2013). Given the many changes that occur throughout the emerging adulthood years such as new living situations, instability in romantic relationships and occupations, and identity exploration (Arnett, 2000; Arnett, 2015), it is to be expected that at least some subset of individuals during this period will experience notable shifts in their temperamental traits that will potentially impact their ongoing development. Studying continuity and discontinuity in positive affect (PA), the temperament dimension reflecting the experience of pleasant emotions such as happiness (Evans & Rothbart, 2007), is particularly important for understanding individual differences in psychosocial functioning given the critical role PA plays in diverse indices of adaptation and maladaptation, ranging from cognitive functioning to psychopathology (for a review, see Davis & Suveg, 2014). Thus, the primary aims of this study were threefold: 1) to describe patterns of PA stability/instability during emerging adulthood; 2) to examine links between patterns of PA stability/instability and psychosocial functioning, and 3) to test a theory-driven model of how PA relates to adjustment via cognitive processes. Findings from the present study have the potential to inform theoretical models regarding temperament development in emerging adulthood and the role of temperament in the development of psychopathology during this period.

PA Continuity and Discontinuity

Though the body of research on PA stability and change is relatively small in late adolescence and early adulthood compared to earlier in the developmental spectrum, the research that does exist has shown that PA and related characteristics (e.g., extraversion) tend to exhibit stability over time (Hopwood et al., 2011; McGue, Bacon, & Lykken, 1993; Vaidya, Gray, Haig, & Watson, 2002; Watson & Walker, 1996). Despite considerable evidence for PA stability, change is possible across the lifespan. In fact, mean- and individual-level shifts in PA can occur even in the context of rank-order stability (Vaidya et al., 2002), which refers to the extent to which participants keep their relative standing on PA within the sample over time. Individual-level analyses capture the magnitude and direction of PA change for each participant whereas mean-level analyses indicate the degree to which the entire sample changes, on average, from time one to time two. On the one hand, some researchers have documented age-related declines in PA (e.g., Hudson, Lucas, & Donnellan, 2016). On the other hand, literature has found evidence of mean-level PA increases during emerging adulthood (e.g., Vaidya, et al., 2002). At the individual-level, Vaidya et al. (2002) found that while most participants did not experience significant changes in self-reported PA, others did demonstrate either increases or decreases.

There are a host of reasons why PA may fluctuate during the college years in particular. Vaidya et al. (2002) demonstrated that life experiences can impact the stability of PA. In particular, they found that undergraduates who had experienced a higher number of positive events exhibited less stability in PA. As students advance in their undergraduate careers and presumably achieve greater progress towards their occupational and interpersonal goals, it is likely that many students have opportunities for significant PA increases. Yet, there are also a number of stressors that can occur as students advance in college, including demanding upper

level courses, increasing fiscal responsibilities, limited job prospects and so forth that may thwart PA growth. Arnett (2015) described the unsettled nature of emerging adulthood and the uneasiness that comes with that; such uncertainty may contribute to decreases in PA across this developmental period.

Regardless of the reasons for individual variability in the direction of PA changes, the fact that PA can change during this period is informative and the divergent directions may have direct implications for other areas of functioning. For instance, it is possible that increases in PA signify improvements in well-being (e.g., Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Seale, Berges, Ottenbacher, & Ostir, 2010). Alternatively, significant PA decreases could foreshadow poor mental health outcomes (e.g., Ruthig, Trisko, & Chipperfield, 2014). Importantly, no known literature has described fine-grained patterns of PA stability during emerging adulthood by distinguishing those who maintain high levels of PA across time from those who exhibit stable low or moderate levels of PA. So, even if a large portion of young adults maintain stability in their PA levels (Vaidya et al., 2002), questions remain regarding not only the nature of that stability but also how those with different patterns of PA stability compare to individuals who exhibit significant PA changes in terms of adjustment. Such information is important for establishing an in-depth understanding of PA continuity during this developmental period. The present study focused on individual-level, rather than mean-level, change and stability. In discussing the study of personality change, Roberts, Caspi, and Moffitt (2001) note that rank-order stability and mean-level change can misrepresent trait development and that examining these processes at the individual level provides a more "complete, complex, and nuanced picture" (p. 681). Presumably, the PA patterns that would be observed in the current study are the following: stable high PA, stable low PA, stable moderate PA, significant increases

in PA, and significant decreases in PA. However, given that the first goal of this project was to describe PA stability/instability patterns during this time period, specific predictions about the patterns that would be observed are not provided. Once the patterns of PA stability/instability were identified, those profiles were compared on several indices of adjustment that are particularly relevant to the developmental period of emerging adulthood: internalizing symptoms, substance use problems, and executive functioning abilities. Then, a theory-driven model was tested to determine whether initial levels of PA relate to later internalizing and substance use problems via executive functioning.

Li**nks Between PA and Indices of Adjustment**

Current views on the role of PA in psychosocial functioning may be over-simplified due to the focus on "high" and "low" PA without regard for the ways in which unique patterns of PA stability may influence outcomes in emerging adulthood. The present study examined intra-individual continuity in PA to determine whether nuanced patterns of stability can be detected (e.g., stable high, moderate, and low PA) and to delineate how specific patterns of PA stability/instability may influence adjustment. Findings from the current study have the potential to inform theoretical models on the role of PA development in psychosocial functioning and to aid in the refinement of intervention strategies for promoting adjustment during a developmental transition period that can include instability in a variety of domains (Arnett, 2015).

A commonly replicated finding in the extant literature is that low PA confers risk for depressive symptoms (e.g., Harding, Hudson, & Mezulis, 2014; Joiner, 1996). A major tenet of the tripartite model of anxiety and depression (Clark & Watson, 1991) is the unique relation between deficits in PA and greater depressive symptomatology. Yet, research has also documented inverse relations between PA and anxiety (Clements & Bailey, 2010; Kashdan,

2007; Khazanov & Ruscio, 2016). The present study sought to identify how unique patterns of PA continuity/discontinuity relate to internalizing symptoms during emerging adulthood.

In general, research on the role of PA in externalizing problems has been mixed (for a review, see Davis & Suveg, 2014). In terms of substance use problems specifically, both high and low levels of PA have been implicated in such problems (for a review, see Cheetham, Allen, Yücel, & Lubman, 2010). On the one hand, low PA may spur individuals to engage in substance use in an effort to counteract their low positive mood (Cheetham et al., 2010). Empirical work has supported this notion, indicating that positive mood is inversely related to substance use (e.g., Simons, Wills, & Neal, 2014; Wills, DuHamel, & Vaccaro, 1995). On the other hand, high levels of PA may be tied to risk behaviors (Cheetham et al., 2010). In line with this idea, positive urgency, which represents "the tendency to act rashly or maladaptively in response to positive mood states" (p. 107, Cyders et al., 2007), has been found to be associated with problematic use of a variety of substances (e.g., alcohol, cannabis, and other illegal drugs; Cyders et al., 2010; Stautz & Cooper, 2014; Zapolski, Cyders, & Smith, 2009). Determining how PA stability/instability patterns are implicated in substance use problems will provide a more comprehensive understanding of the role of PA in substance use during emerging adulthood (Davis et al., in preparation).

According to the broaden-and-build model of positive emotions, such emotions "share the feature of broadening an individual's momentary thought–action repertoire, but they also appear to share the feature of building the individual's personal resources, ranging from physical resources to intellectual resources to social resources" (p. 8, Fredrickson, 1998). This means that positive emotions serve to broaden the scope one's cognitions and attention (Fredrickson, 1998). Similarly, the flexibility hypothesis (Isen, 2008) postulates that PA contributes to flexible

thinking and decision-making, thereby preparing people to "respond effectively to complex or changing circumstances" (p. 550). A number of empirical studies have garnered support for links between PA and cognitive flexibility (e.g., Baumann & Kuhl, 2005; Yang & Yang, 2014). In a sample of undergraduates, Yang and Yang (2014) found that induced PA promoted task switching abilities, which rely on executive processes. Emerging adulthood is a key time for the development of executive functioning, a set of cognitive skills that contribute to goal-directed behaviors, because maturation of brain regions implicated in these abilities continues into adolescence and adulthood (Blakemore & Choudhury, 2006). Therefore, it is important to better understand factors that may explain individual differences in executive functioning and how such individual differences impact functioning in other domains.

A Theory-Driven Model of the Role of PA in Adjustment

The present study also examined executive functioning as a possible mechanism implicated in the associations between PA and indices of psychosocial functioning using developmental models informed by the broaden-and-build perspective (Fredrickson, 1998). Specifically, I longitudinally examined relations between initial levels of self-reported PA and later internalizing and substance use problems, as mediated by executive functioning abilities. Despite empirical support for the broaden-and-build model of positive emotions (e.g., Burns et al., 2008; Catalino & Fredrickson, 2011; Fredrickson & Joiner, 2002), no known research has tested this theory during emerging adulthood for both internalizing and substance use problems in the same investigation. Given that problems in these domains are prevalent during this period (Caldeira, Arria, O'Grady, Vincent, & Wish, 2008; Hunt & Eisenberg, 2010), it is important to identify potential pathways by which such problems develop. For substance use problems in particular, this model could be helpful for parsing apart the complex relations between PA and

substance use documented in the extant literature (Cheetham et al., 2010). As is the case with research on the links between PA and cognitive flexibility, research involving a broaden-and-build framework usually relies on state measures of PA, such as mood inductions or self-reports of emotions during a brief period (e.g., Burns et al., 2008; Catalino & Fredrickson, 2011; Fredrickson & Branigan, 2005; Fredrickson & Joiner, 2002; Fredrickson, Tugade, Waugh, & Larkin, 2003). Using a temperament measure of PA in the present study yields information on how ongoing affective tendencies relate to cognitive flexibility and, in turn, psychosocial functioning. Thus, examining temperamental PA in this context could serve to broaden the theoretical framework upon which the present models are based. For comparison purposes, particularly since research in this area focuses on PA as a mood state, the present mediation analyses were also run using a state measure of PA; no major differences in findings were expected across PA measures.

Research has documented links between executive functioning deficits broadly, and cognitive flexibility impairments specifically, and both internalizing and substance use problems (Dickson, Ciesla, & Zelic, 2017; Holler, Kavanaugh, & Cook, 2014; Peeters et al., 2015; Stephan et al., 2017). Such work has typically examined executive functioning among those who already meet criteria for an internalizing or substance use disorder (e.g., Holler et al., 2014; Stephan et al., 2017). Nonetheless, problems with executive functioning have been found to predict later internalizing problems (Kertz, Belden, Tillman, & Luby, 2016) and even the initiation of substance use (Peeters et al., 2015). Problems with cognitive flexibility have also been found to be related to higher levels of rumination (Dickson et al., 2017), a predictor of internalizing symptoms and substance use issues (Nolen-Hoeksema & Harrell, 2002) that reflects the tendency to focus on one's distress and the possible causes and consequences of this distress (Nolen-

Hoeksema, 1991). Alternatively, those with higher levels of PA may be prone to greater cognitive flexibility and, therefore, less susceptible to developing internalizing and substance use problems. To be sure, research has shown that greater cognitive flexibility may serve to reduce the likelihood of maladjustment (e.g., Morris, Evans, Rao, & Garber, 2015). In a sample of young adults, Morris and colleagues detected an interaction between secondary control coping (e.g., acceptance) and cognitive flexibility such that those who were low on both factors exhibited increases in depressive symptoms. However, individuals who were low on secondary control coping but high on cognitive flexibility did not experience significant increases in depressive symptoms. Additionally, the National Institutes of Health recently released its Research Domain Criteria Initiative (RDoC), which emphasizes "positive valence systems" and "cognitive systems" as two of five domains of study that can further the field's understanding of mental health disorders. Thus, developing an in-depth understanding of the ways that PA and executive functioning relate to indices of maladjustment is consistent with the RDoC initiative and has the potential to provide key transdiagnostic information to move the field of developmental psychopathology forward.

The Present Study

The aims of the present study were threefold: 1) to describe temperamental PA stability/instability during emerging adulthood; 2) to longitudinally examine how developmental patterns of PA are implicated in key areas of psychosocial functioning during emerging adulthood and 3) to test a theory-driven model of how PA during this period relates to later internalizing and substance use problems through executive functioning abilities. College students' PA was assessed at baseline and 18-24 months later to provide an opportunity to observe the degree of stability of this construct.

It was expected that there would be individual variability in PA stability/instability. Most likely, participants would exhibit PA patterns consistent with stable high PA, stable low PA, stable moderate PA, significant increases in PA, or significant decreases in PA. However, it was unclear which exact groups of PA patterns would be found in the present study. Therefore, no hypotheses were made in regard to the first study aim. In addition, whether it would be possible to compare groups against each other in terms of psychosocial outcomes was dependent on how participants were distributed across the groups. For instance, any groups with too few participants would not be included in this set of analyses. The specific profiles that would emerge were unknown and thus, we did not make specific hypotheses for each group. Generally; however, I anticipated that a stable low PA group would experience the poorest outcomes (i.e., highest levels of internalizing and substance use problems and lowest levels of cognitive flexibility). In contrast, I expected that adjustment would be optimal (i.e., greater cognitive flexibility and lower internalizing and substance use problems) for those with stable high levels of PA. Given that group comparisons depended on the patterns observed in the present sample and the number of participants exhibiting each pattern, no specific hypotheses about the remaining potential groups were offered. With regard to the last aim, it was expected that cognitive flexibility would mediate the relations between PA and internalizing and substance use problems. Specifically, given that PA is generally considered adaptive (e.g., Fredrickson, 2002), it was hypothesized that greater PA at time one would be associated with greater cognitive flexibility at time two and, in turn, lower levels of internalizing and substance use problems at time two.

CHAPTER 2

Method

Participants

At time one, the sample included 494 undergraduate students who indicated they were medically healthy (N = 378) or had a medical condition (N = 116). In total, 306 participants agreed to be contacted about future studies, provided a phone number and/or email address, and were eligible to participate in the follow-up assessment within the allotted timeframe for the Clinical and Translational Research Unit (CTRU) Seed Grant. Of those participants who were eligible for the follow-up study, 256 were in the medically healthy group and 50 were in the medical condition group at time one. A total of 135 participants (N = 106 medically healthy individuals and N = 29 individuals with a medical condition) completed the time two assessment. Independent-samples t-tests indicated that there were no significant differences on the main study variables between those who participated in both assessments versus those who participated only at time one. However, in terms of demographic characteristics, those who participated only at time one were older than participants who completed both assessments $t(296.27) = 3.08$, $p < .01$. Additionally, chi-square tests involving a dichotomous code for whether or not participants completed both assessments (0 = participated only at time one and 1 = participated at both time points) indicated associations between this variable and participant sex (0 = male, 1 = female), $\chi^2(1) = 7.04$, $p < .01$, and race (0 = all races other than Caucasian, 1 = Caucasian), $\chi^2(1) = 4.82$, $p < .05$.

The present study will focus on the 102 participants who identified as being medically healthy at *both* time points. At time two, 4 participants identified as being medically healthy despite indicating they had a medical condition at time one. Additionally, eight participants who endorsed being medically healthy at time one reported having a medical condition at time two. Differences in relations between PA and some of the outcomes included in the present study based on medical status were observed at time one (Davis et al., in preparation), suggesting that the two groups should be examined separately. Demographic information for participants in the medically healthy group who participated at both time points are presented here. At time one, 81% of participants in the medically healthy group were females and 19% were males. Participants were between the ages of 18-23 years (M = 18.95 years; SD = 1.14) at time one and between 19-25 years at time two (M = 20.48 years; SD = 1.20). At time one, 61% of participants indicated they were first year students, 20% were second year students, 13% were in their third year, and 7% were in their fourth year or beyond. At time two, 44% of students identified as second years, 32% indicated they were in their third year, and 24% reported they were fourth year students or beyond or had graduated. Participants predominately identified as White/Caucasian (60%), followed by Asian (19%), Black/African American (10%), Hispanic (5%), and multiracial/other (7%).

Procedures

All participants were initially recruited from a psychology undergraduate research pool at the University of Georgia. To be included in the study, it was required that participants be at least 18 years of age. Students signed up for the study through an online research pool portal, which contained a brief summary of the study's goals. Individuals who signed up for a study assessment online then came to the researchers' laboratory where they provided written consent

prior to participation. Participants also had the option to give written permission to be contacted about future study opportunities. Those who indicated they wished to be informed about such opportunities provided email and/or telephone contact information. Participants completed a series of questionnaires online, which took about 1 hour. All measures were administered using a laboratory computer and were securely hosted on the university's online survey system (Qualtrics®). For participating in the study, individuals received one hour of research credit.

The time two assessment took place 18-24 months (M = 18.35 months, SD = .59) after the participant's initial assessment. For the time two assessment, participants from time one who indicated on the future studies form that they would be willing to be contacted about future research opportunities were contacted by research assistants by phone and/or email. The 306 participants who agreed to be contacted about future studies, provided contact information, and were eligible within the time two study window were contacted a total of four times each. Email and phone contacts were alternated whenever possible (e.g., two phone calls and two emails per participant). Of those who were contacted but did not participate in the time two assessment, some indicated a lack of interest in the study, others noted they had moved away and would be unable to complete the study in person, some provided contact information that did not work (e.g., disconnected phone number, invalid email address), and lastly some simply did not respond.

Those willing to participate in the time two assessment came to the CTRU at the University of Georgia, where they completed consent and future studies forms, computerized measures via Qualtrics®, executive functioning tasks on an iPad, and a brief structured interview. Participation took about 1-1.5 hours for the time two assessment and participants were initially compensated $50 for their time. Because of difficulties recruiting for the time two

assessment, compensation was raised to $75 after about 1.5 months of recruitment then to $100 about 3.5 months after that. We allowed more time before raising from $75 to $100 since only seven participants became eligible within the first two months of the $75 incentive. So, to allow more time to monitor the impact of the incentive change, in addition to accounting for the holiday breaks that coincided with this time period, we waited a bit longer to increase to $100. All study procedures were approved by the university's Institutional Review Board.

Measures

Demographics. Participants provided background information (e.g., age, sex) via a demographics questionnaire at both time points. This information was used to report on study characteristics and to determine potential covariates to be included in the primary analyses.

PA.

Adult Temperament Questionnaire-Short Form (ATQ-SF; Evans & Rothbart, 2007). The 77-item ATQ-SF was administered to assess temperament at both time points. The Positive Affect scale (e.g., "It doesn't take much to evoke a happy response in me;" 5 items) was used in the present study. Response options ranged from "1" ("extremely untrue of you") to 7 ("extremely true of you"); participants could answer "not applicable" as needed. Higher scores were reflective of greater PA. Scale scores represent the mean of the available items for that scale. In the manuscript on the development of the ATQ, Evans and Rothbart (2007) reported a Cronbach's alpha of .71 for the Positive Affect scale on the short form of the measure. Of note, Cronbach's alpha values for the Positive Affect scale in the present study were originally .62 and .59 for time one and time two, respectively. However, after item analysis, item 3 (i.e., "Sometimes minor events cause me to feel intense happiness") was eliminated, and alpha improved to .69 and .66 for time one and time two, respectively.

Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). To compare the role of state PA in adjustment to that of temperamental (i.e., trait) PA, given that much of the literature on the broaden-and-build model has focused on state measures of PA (e.g., Fredrickson & Branigan, 2005), the 20-item version of the PANAS was used for the present mediation analyses. On the PANAS, participants marked the extent to which they experienced 20 different emotions at that moment; response options ranged from "1" ("very slightly or not at all") to 5 ("extremely"). Thus, the PANAS served as a measure of current affective states. The Positive Affect scale (10 items) from time one was used in the present study. This scale assessed emotions such as "interested" and "excited," with higher scores corresponding to greater PA. Cronbach's alpha for the Positive Affect scale at time one was .91.

Executive functioning. The NIH Toolbox (Weintraub et al., 2013; Weintraub et al., 2014; Zelazo et al., 2014) version of the Dimensional Change Card Sort Test, which was originally created by Zelazo and colleagues (e.g., Frye, Zelazo, & Palfai, 1995; Zelazo, 2006), was used as an index of cognitive flexibility at time two. This 30-item measure was administered on an iPad and required participants to match bivalent test pictures to a target picture based on a specified dimension (i.e., shape or color). After a predetermined number of trials, the dimension that the participant needed to use to sort pictures switched. Participants completed a set of practice trials for sorting along the color and shape dimensions, separately, before beginning the actual assessment. All instructions were read aloud to the participant by a trained research assistant. Total scores account for accuracy and speed, with higher scores indicating greater cognitive flexibility. The present study relied on age-corrected standard scores, which have a normative mean of 100 and a standard deviation of 15.

Depressive symptoms. The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) was used to assess depressive symptoms at each time point; the current study focused on time two symptoms. Participants rated the severity of their depressive symptoms during the past two weeks using a 4-point likert scale. All items were summed to yield a total score, with higher total scores indicating greater depression severity. This self-report measure typically consists of 21 items, but the current study utilized 20 items from this form. Due to the difficulties in following up with participants regarding suicidal ideation in the context of a large, anonymous survey study, the suicidality item was not administered in the present study. Cronbach's alpha was .90 for the BDI-II total score at time two.

Anxiety symptoms. Participants completed the Beck Anxiety Inventory (BAI; Beck & Steer, 1990) as an index of anxiety symptoms at both time points and time two symptoms were used as a dependent variable in the present analyses. This measure is comprised of 21 items and participants responded to each item using a 4-point scale from "Not at all" to "Severely" to indicate how severe each symptom had been during the past week. All items were summed to create a total score, with higher scores reflecting greater severity. Cronbach's alpha was .92 at time two.

Alcohol use-related problems. The 10-item Alcohol Use Disorders Identification Test, Second Edition (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) was administered to assess alcohol use-related problems at both assessments and this study focused on AUDIT scores at time two. For the first eight items, participants responded on a 5-point scale regarding how frequently problematic drinking occurred for them. On the last two items, participants responded 0 ("No"), 2 ("Yes, but not in the last year"), or 4 ("Yes, during the last year"). All

items were summed to yield a total score, with higher scores corresponding to greater levels of alcohol use-related risk. Cronbach's alpha in the present study was .81 at time two.

Drug use-related problems. To assess problematic drug use, not including alcohol, the Drug Use Disorders Identification Test (DUDIT; Berman, Bergman, Palmistierna, & Schlyter, 2003) was administered at both time points. This 11-item questionnaire mainly relies on a 5-point scale to indicate the frequency of problematic drug use. Similar to the AUDIT, the last two items were scored 0 ("No"), 2 ("Yes, but not over the past year"), or 4 ("Yes, over the past year"). The total score from time two was used as an outcome variable in the present analyses; this score was calculated by summing all items. Higher total scores reflected greater drug use problems. Cronbach's alpha in the present study was .84 at time two.

Analytic Plan

Study aim 1: Identifying PA stability/instability patterns. All analyses were conducted using IBM SPSS Statistics, Version 24. Distinct PA stability groups were determined empirically before comparing these groups on the outcome variables of interest. Two approaches for partitioning PA groups were employed and the strategy that maximized the overall number of participants included in the analyses while also maximizing the number of participants in each specific group was used for comparing groups on the outcome variables. In the first iteration of determining PA stability groups, the Stable High group was comprised of individuals who were at least one standard deviation above the mean on the ATQ-SF Positive Affect Scale at both time points. Similarly, the Stable Low group included participants who fell at least one standard deviation below the mean in terms of their PA scores at both time points. The Stable Moderate group included individuals who were within one standard deviation of the mean of PA scores at time one and time two. Significant increases and decreases in PA were

based on reliable change index (RCI) scores (Jacobson & Truax, 1991), whereby the difference between time two and time one scores was compared to the standard error of change scores, with RCI values greater than the absolute value of 1.96 reflecting significant change. Those who exhibited significant increases in PA across time were grouped separately from those who demonstrated significant PA declines from time one to time two.

The second method for determining PA groups was adapted from an approach outlined in Belsky, Fish, and Isabella (1991). Specifically, the high, moderate and low groups at each time represented the top, middle, and bottom third of the sample, respectively, in terms of PA scores at that particular time point. The stable groups were indicative of participants that stayed in the same third of PA scores at both time points. For instance, those in the Stable High group were participants who were in the top third of PA scores at both time one and time two. The Stable Moderate group consisted of participants who scored in the middle third for PA at both time points. Lastly, the Stable Low group included those who scored in the bottom third of the sample for PA at both time points. In my proposal, I stated that Increasers would be those participants who shifted from the low PA group at time one to the high PA group at time two. Similarly, I proposed that participants classified as Decreasers would be those who were in the high PA group at time one but the low group at time two. In the present study, in addition to using the aforementioned criteria for determining Increasers and Decreasers, I examined the number of participants who shifted PA groups at all. In this way, Increasers were those who shifted up at least one PA category (e.g., from the bottom third to the middle third) and Decreasers were individuals who moved down at least one PA category from time one to time two (e.g., from the top third to the middle third). In all methods for dividing participants into PA groups, each PA group was assigned a distinct numerical code to allow for comparisons between

groups on the main outcome variables of interest. Any PA groups with small sample sizes, defined as fewer than 5 participants per group (Larson, 2008), would be removed from analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) models.

Study aim 2: Comparing PA stability/instability patterns on indices of psychosocial functioning. To determine whether there were any differences between the PA stability/instability groups in terms of the means for substance use problems, internalizing problems, and cognitive flexibility, a one-way MANOVA and two separate one-way ANOVAs were run, respectively. In the MANOVA the between-groups factor was the PA stability categorical variable (coded according to which PA pattern each participant followed) and the dependent variables were drug and alcohol use problems. Drug and alcohol use problems were entered as separate dependent variables in the MANOVA. Such problems are often examined independently in relation to positive emotions in the extant literature (e.g., Simons et al., 2014; Zapolski et al., 2009). Significant MANOVA results were to be followed up with univariate tests. For the ANOVAS, the between-groups factor was the PA stability group variable. In one ANOVA, an internalizing problems composite was entered as the dependent variable and in the other ANOVA, cognitive flexibility was entered as the dependent variable. Given the high degree of conceptual and statistical overlap between anxiety and depression, and consistent with the extant literature (e.g., Davis, Suveg, Whitehead, Jones, & Shaffer, 2016; Davis et al., under review), a composite of internalizing problems was created by averaging standardized *z* scores for the BAI and BDI-II total scores at time two. Of note, anxious and depressive symptoms were moderately correlated in the present study, $r = .44$, $p < .001$. Post-hoc comparisons were examined using Tukey's Honestly Significant Difference (HSD) test. Additionally, if only two

PA patterns had sufficient participants to conduct comparisons, I planned to conduct an independent samples t-test for each dependent variable.

Study aim 3: Testing a theory-driven model of links between PA and adjustment. The publicly available PROCESS SPSS macro (http://afhayes.com/introduction-to-mediation-moderation-and-conditional-process-analysis.html; Hayes, 2013) was used to conduct mediation analyses. Separate models for internalizing, drug use, and alcohol use problems were run. In all models, PA at time one was the independent variable, cognitive flexibility at time two served as the mediator, and time two adjustment problems (internalizing, drug use, or alcohol use problems) was the dependent variable. The PROCESS macro provides an estimate of the magnitude of the indirect effect, in addition to demonstrating whether or not the indirect effect is statistically significant. Bootstrap resamples of 5,000 at 95% bias-corrected confidence intervals were used. Bootstrapping can be helpful for accounting for possible violations of normal distribution assumptions (Hayes, 2013). Significant mediation results are evident when the 95% confidence interval for the indirect effect does not include zero. Despite strong theoretical justification for testing a mediation model, I recognize the inherent statistical issue of testing a mediator and an outcome variable at the same time point. This is noted as a study limitation.

Data cleaning and preparation. Prior to conducting the primary analyses, descriptive statistics and correlations between all study variables were run. Independent samples t-tests were conducted to determine whether there were any differences on the main study variables by sex and/or race and, therefore, whether these variables should be entered as covariates. Because the vast majority of the sample identified as Caucasian, race was dichotomized (coded as all races other than Caucasian = 0 and Caucasian = 1) for these analyses. Correlations between age and the main study variables were also tested.

Assumptions for ANOVA, MANOVA, and regression were checked prior to running analyses. Specifically, the homogeneity of variance assumption was tested using Levene's test. In the case of a significant Levene's test, Welch's *F* was used instead of the traditional *F* test for significance when reporting ANOVA results. Box's test was examined to determine whether homogeneity of covariance matrices could be assumed. The Durbin-Watson test was employed to assess independence of error terms. Correlations between time one PA and time two cognitive flexibility, as well as tolerance values, were examined to determine whether multicollinearity was an issue and, therefore, whether it would be inappropriate to run the mediation models. Correlation values greater than .8 between these variables and tolerance below .1 was considered problematic. Plots of standardized residuals against standardized predictor variables were employed to check for linearity and homoscedasticity of residuals. Outliers were detected using boxplots; values that were greater than three standard deviations from the sample mean for a given variable were excluded from further analyses (e.g., Blair & Raver, 2014). Normality of the data was checked with the Kolmogorov-Smirnov test and Q-Q plots. Little's test (Little, 1988) was utilized to assess missing data patterns. Rates of missing data at time one for the full healthy sample were quite low; all participants had sufficient data for the BAI score to be calculated, only two participants were missing BDI-II and AUDIT scores, one participant had a missing DUDIT score, and three were missing scores on the ATQ-SF Positive Affect scale. Thus, while multiple imputation procedures were considered, they were unlikely to be necessary given the anticipated rates of missing data.

Power analyses were conducted using G*Power to determine the number of participants necessary for the group comparisons as well as for the mediation model. Assuming five PA groups would be detected (i.e., Stable High, Stable Low, Stable Moderate, Increasers, and

Decreasers), for a power level of 80% (p = .05) and a moderate effect size (f = .25), 200 participants would be needed for the ANOVA analyses. For the MANOVA, a total sample size of 125 would be necessary to detect a moderate effect (f^2 (V) = .0625) at a power level of 80% (p = .05). For mediation, to find a moderate effect (f^2 = .15) at a power level of 80% (p = .05), 68 participants were needed. Therefore, the present study was adequately powered for the mediation model but the ANOVA and MANOVA results should be interpreted with caution given the current sample size (N = 102).

CHAPTER 3

Results

Preliminary Analyses

Before conducting the primary analyses, assumptions of ANOVA, MANOVA, and regression were examined. The Kolmogorov-Smirnov results, in addition to visual inspection of Q-Q plots, yielded evidence of non-normality for all of the main study variables except cognitive flexibility, the PANAS PA scores at time one, and the ATQ-SF PA scores at time two. Given that we would not expect the main study variables to be normally distributed and that the statistics chosen are robust to violations of normality (Glass, Peckham, & Sanders, 1972; Hayes, 2013; Olson, 1976), the raw data were not transformed. Boxplots indicated the possibility of outliers for a number of the outcome measures and statistical criterion (i.e., greater than three standard deviations from the mean) was used to trim outliers. For the time two outcomes, the outliers excluded were as follows: one score on the AUDIT, three scores on the DUDIT, and one score on the BAI. Levene's test was not significant for the ANOVA models with internalizing problems, $F(4, 96) = 2.46$, $p = .051$, or cognitive flexibility, $F(4, 97) = .55$, $p = .70$, as the dependent variables, suggesting homogeneity of variance could be assumed. Box's test value of 41.77 was significant ($p < .001$) for the MANOVA, indicating homogeneity of covariance matrices could not be assumed. Pillai's trace, which can withstand violations of this assumption, was therefore used to report MANOVA results (Olson, 1976). The assumption of independent error terms was supported based on Durbin-Watson test values near 2 (Durbin & Watson, 1951). Plots of standardized residuals against standardized predictor variables indicated linearity and

homoscedasticity of residuals could be assumed across variables, though the shape of the plot for drug use problems was less clear. This plot appeared to have a slight funnel shape, but no curve, suggesting potential heteroscedasticity of residuals but not non-linearity. Thus, to be conservative and to decrease the likelihood of biased standard error estimates, the heteroscedasticity-consistent standard error estimator was used in PROCESS when running mediation models with drug use problems as the outcome variable (Hayes, 2013). PA scores at time one based on both the ATQ-SF and PANAS were not significantly associated with cognitive flexibility, and these correlations were small in magnitude, thereby indicating multicollinearity was not of concern for the mediation analyses. Tolerance values exactly or nearly equal to 1 across models also supported this conclusion.

Little's MCAR test (Little, 1988; $\chi^2(7) = 3.53$, $p = .83$) confirmed the data meets the assumption for missing completely at random (MCAR). Missing data were very minimal for medically healthy participants who came in for assessments at both time points; only one participant was missing a score for the PANAS PA scale at time one. Therefore, multiple imputation was unnecessary and this participant was simply not included in the relevant mediation analyses.

Descriptive statistics and intercorrelations for the main study variables are presented in Table 1. PA scores from the ATQ-SF were positively correlated across time ($r = .50$, $p < .001$). PA at time one was negatively correlated with depressive symptoms ($r = -.39$, $p < .01$) at time two. PA at time two was also negatively associated with depressive symptoms ($r = -.55$, $p < .001$) at time two. Of note, the only significant correlation involving PA from the PANAS was a positive correlation between PANAS PA scores at time one and ATQ-SF PA scores at the same time ($r = .36$, $p < .001$). Drug use problems at time two were positively correlated with alcohol

use problems (r = .40, p < .001) and depressive symptoms (r = .23, p < .05) at time two. Independent-samples t-tests demonstrated that depressive symptoms at time two varied by race, $t(100) = 2.99$, $p < .01$, such that Caucasian participants endorsed lower levels of depressive symptoms than participants who identified as another race. PA scores from the ATQ-SF at time two differed by sex, $t(100) = -2.18$, $p < .05$, such that females endorsed higher levels of PA than males. Age at time one was positively correlated with depressive symptoms at time two (r = .22, p < .05). No significant correlations between age at time two and any of the primary study variables were detected. Given that there were so few relations between demographic characteristics and the main study variables, these demographic variables were not included as covariates in subsequent analyses. Furthermore, due to the small overall sample size, time one symptoms were not able to be included as covariates as originally planned.

Primary Results

Study aim 1: Identifying PA stability/instability patterns. Table 2 shows the number of participants included in each PA stability/instability group based on all grouping methods. In the first method for partitioning PA stability/instability groups, the groups were defined as follows: Stable Low meant that participants scored at least one standard deviation below the mean on the ATQ-SF PA scale at both time points, Stable High indicated that participants scored at least one standard deviation above the mean on the ATQ-SF PA scale at both time points, Stable Moderate reflected individuals who scored less than one standard deviation away from the mean on PA at both time points, Increasers were those who exhibited RCI scores above 1.96, and Decreasers were those had RCI scores less than -1.96. A total of 80 participants fell into one of these groups, with the majority (n = 57) being in the Stable Moderate category. Given that this

approach did not maximize the number of participants in each cell, the groups derived from this method were not used in later group comparisons.

In the second method for determining PA groups, the sample was divided into the top, middle, and bottom third of ATQ-SF PA scores at each time point using the cut point function in SPSS. This function was meant to divide the sample into three equal groups. Given that a number of participants had the same PA score at a given time point, the groups were not able to be divided into exactly equal groups. The Stable Low group included those who scored in the bottom third of PA scores at both time points, the Stable Moderate group was comprised of participants who scored in the middle third at both time points, and the Stable High group scored in the top third on the PA scale at both time points. Increasers were initially defined as those who moved from the low group at time one to the high group at time two and Decreasers represented the opposite shift (i.e., from the high group at time one to the low group at time two). This method yielded an overall sample size of 55, including groups with small sample sizes (e.g., $n = 3$ for the Increasers).

Because just slightly more than half of the sample was included in the second method, I broadened the definitions for Increasers and Decreasers to include anyone that shifted PA categories from time one to time two. Therefore, Increasers were any participants who moved up at least one PA group between time points (e.g., from the low group to the moderate group). The Decreasers were then any participants who moved down at least one PA group from time one to time two (e.g., from the high group to the moderate group). With this broadened definition of PA Increasers and Decreasers, all participants were able to be included in a PA group and no individual group had too few participants to conduct comparisons on the outcome variables of interest. Specifically, 19 participants were in the Stable Low group, 8 fell into the

Stable Moderate category, 20 participants were in the Stable High Group, 32 were identified as Increasers, and 23 were Decreasers. Therefore, the latter approach to partitioning PA stability/instability groups was used for subsequent analyses.

Study aim 2: Comparing PA stability/instability patterns on indices of psychosocial functioning. In all ANOVA and MANOVA models, the PA categorical variable served as the between subjects factor. For the first ANOVA, the dependent variable was internalizing problems at time two. The overall *F* test indicated that significant group differences on internalizing problems were present, $F(4, 96) = 5.52$, $p < .001$, $\eta^2 = .19$. The Stable Low PA group had significantly higher levels of internalizing problems than those in the Stable Moderate group ($p < .05$, $d = 1.09$), the Stable High group ($p < .001$, $d = 1.32$), and the Increasers ($p < .01$, $d = .93$). The difference in internalizing problems between the Stable Low group and Decreasers was not significant ($p = .19$, $d = .59$).

In the second ANOVA model, cognitive flexibility served as the dependent variable. The overall *F* test indicated that cognitive flexibility did not significantly differ between the PA groups, $F(4, 97) = .18$, $p = 95$, $\eta^2 = .01$.

For the MANOVA, both drug and alcohol use problems were entered as dependent variables. The MANOVA was not significant, $V = .137$, $F(8, 188) = 1.73$, $p = .10$, $\eta_P^2 = .07$, suggesting that when examined together, alcohol and drug use problems did not significantly vary across PA groups. However, examination of univariate tests for the purposes of better understanding the results, particularly in light of the exploratory nature of these analyses, indicated that the nonsignificant MANOVA was likely driven by nonsignificant differences between PA groups on alcohol use problems specifically, $F(4, 96) = .89$, $p = .47$, $\eta^2 = .04$. Levene's test was not significant for the ANOVA involving alcohol use problems, $F(4, 96) =$

1.12, $p = .35$, meaning that homogeneity of variance could be assumed. Alternatively, Levene's test was significant for the ANOVA with drug use problems as the dependent variable, $F(4, 94) = 7.33$, $p < .001$. Welch's F was not significant, $F(4, 32.93) = 2.58$, $p = .055$, $\eta^2 = .10$, but Brown-Forsythe results indicated significant differences between PA groups on drug use problems, $F(4, 48.43) = 2.73$, $p < .05$, $\eta^2 = .10$. The Stable Low PA group endorsed higher levels of drug use problems than the Stable High group ($p < .05$, $d = .88$); all other group comparisons were nonsignificant. Means and standard deviations for internalizing problems, cognitive flexibility, alcohol use problems, and drug use problems per PA group are presented in Table 3.

Study aim 3: Testing a theory-driven model of links between PA and adjustment. For the final study aim, mediation models were run in PROCESS. PA from the ATQ-SF at time one served as the independent variable and cognitive flexibility at time two was the mediator. Internalizing, alcohol use, and drug use problems were entered as the dependent variables in separate models. The indirect effects of PA on internalizing, $b_{boot} = .0002$, $SE_{boot} = .01$, 95% CI [-.01, .02], alcohol use, $b_{boot} = -.002$, $SE_{boot} = .05$, 95% CI [-.12, .08], and drug use, $b_{boot} = .002$, $SE_{boot} = .03$, 95% CI [-.06, .07], problems through cognitive flexibility were all nonsignificant (see Table 4 for complete mediation results). Additional analyses examined the models separately for depressive and anxiety symptoms. The indirect effects were nonsignificant when anxious, $b_{boot} = .004$, $SE_{boot} = .11$, 95% CI [-.20, .26], and depressive, $b_{boot} = .004$, $SE_{boot} = .05$, 95% CI [-.09, .12], symptoms were treated as separate dependent variables.

While the present study was focused on trait PA, for comparison, I also examined state PA using the PA scale from the PANAS as an independent variable in the mediation models; cognitive flexibility remained the mediator (see Table 5). There were no significant indirect

effects when internalizing problems, b_{boot} = -.001, SE_{boot} = .002, 95% CI [-.01, .001], alcohol use problems, b_{boot} = .01, SE_{boot} = .01, 95% CI [-.01, .04], or drug use problems, b_{boot} = .01, SE_{boot} = .01, 95% CI [-.002, .04], were the dependent variables. Moreover, when the internalizing problems composite was split into raw BAI and BDI-II scores, the indirect effects remained nonignificant for both anxious, b_{boot} = -.02, SE_{boot} = .03, 95% CI [-.11, .01], and depressive, b_{boot} = .001, SE_{boot} = .02, 95% CI [-.03, .05], symptoms.

CHAPTER 4

Discussion

The present study provides key descriptions of nuanced temperamental PA stability/instability patterns during emerging adulthood. Results shed light on similarities and differences in adjustment across these distinct PA patterns, highlighting the psychosocial risk associated with continuously low levels of PA. The findings are in line with previous research that has demonstrated the vulnerability low PA poses for indices of maladjustment (Cheetham et al., 2010; Clements & Bailey, 2010; Harding, Hudson, & Mezulis, 2014; Joiner, 1996) and the present study expands upon such work by indicating how those exhibiting low PA over time compare to emerging adults who exhibit other patterns of PA stability/instability. The current study can inform theoretical models regarding temperament development during emerging adulthood and can aid in the identification of at-risk individuals who are likely to benefit from prevention and intervention efforts.

Study Aim 1: Identifying PA Stability/Instability Patterns

With regard to the first study aim, five patterns of PA stability/instability were detected in the present sample such that all participants could be grouped into one of the following categories: Stable Low PA, Stable Moderate PA, Stable High PA, Increasers, or Decreasers. Though no specific a priori hypotheses were offered for this study aim, the groups that were borne out of this data coincided with the patterns I speculated about initially. The results support the notion that temperament development continues into adulthood (e.g., Kandler et al., 2013). Interestingly, whereas prior research has suggested that a minority of individuals during

emerging adulthood exhibit significant PA change (Vaidya et al., 2002), the majority of the present sample (54%) fell into either the Increasers or Decreasers. This is likely due to the less restrictive criteria used in the current study to define PA change in order to maximize the participants included in the group comparisons. It will be important for future research to examine the current research questions with larger sample sizes to determine if the same PA patterns hold. Nonetheless, the present study is important for moving beyond research that has simply focused on whether or not PA remains stable by documenting specific patterns of both stability and change.

Study Aim 2: Comparing PA Stability/Instability Patterns on Indices of Psychosocial Functioning

While no explicit a priori hypotheses were made for the second study aim, I indicated that the Stable Low group was likely to exhibit the poorest outcomes (i.e., lowest cognitive flexibility and highest internalizing and substance use problems) and the Stable High group was likely to exhibit optimal outcomes (i.e., highest cognitive flexibility and lowest internalizing and substance use problems) based on the extant literature. The findings partially support these predictions in that the Stable Low group demonstrated significantly higher levels of internalizing problems than all other PA groups, with the exception of the Decreasers. Additionally, the Stable High group endorsed the lowest levels of internalizing problems, though this group only significantly differed from the Stable Low PA group. Overall, the findings for internalizing problems make sense based on the robust support in the extant literature for links between low PA and depressive symptoms specifically (e.g., Clark & Watson, 1991) and internalizing problems broadly (for a review, see Khazanov & Ruscio, 2016). Furthermore, the internalizing problems mean for the Stable High group points to the protective function of high PA (e.g., Silk,

Shaw, Forbes, Lane, & Kovacs, 2006). The lack of a statistically significant difference between the Stable Low group and the Decreasers suggests there may be something risky about declining PA levels during this developmental period. To be sure, research suggests declines in PA can have maladaptive consequences in terms of internalizing symptoms (e.g., Ruthig et al., 2014). However, given that the Decreasers did not significantly differ from any other PA group, it would be premature to over-interpret these findings.

Unexpectedly, there were no significant differences between the PA groups in terms of cognitive flexibility. The mean scores for the cognitive flexibility variable were above the normative average for all PA groups, likely reflecting the fact that this was a highly educated sample. Perhaps, intellectual abilities were buffering against the negative impact of problematic PA patterns on cognitive flexibility performance. From a statistical standpoint, the fact that the vast majority of the sample scored at or above the normative average may have led to a range restriction on the cognitive flexibility scores, precluding the detection of differences across PA groups. Additionally, research on the association between PA and cognitive flexibility often relies on mood inductions to produce PA (e.g., Baumann & Kuhl, 2005; Yang & Yang, 2014). It may be the case that mood manipulations just prior to a cognitive flexibility task lead to a more potent impact of PA on cognitive flexibility performance than does the natural experience of PA across time. Research also suggests that the role of PA in cognitive flexibility likely depends on approach-motivation intensity (Liu & Wang, 2014). High-approach-motivated PA reflects PA that occurs in the midst of goal pursuit and low-approach-motivated PA generally occurs when there is no goal or once a goal has been achieved (Liu & Wang, 2014). Specifically, Liu and Wang (2014) found that low-approach-motivated PA (induced via pictures of landscapes) promoted cognitive flexibility while also increasing distractibility for undergraduates on a set-

shifting task. Alternatively, high-approach-motivated PA (induced via pictures of desserts) led to decreased distractibility but increased perseveration on this task. Therefore, future research that parses apart low- and high-approach-motivated PA patterns across time may be particularly important for understanding the role of PA stability/instability in cognitive flexibility. Interestingly, inspection of means showed that the Increasers had the highest average cognitive flexibility scores, suggesting that increases in PA during emerging adulthood may be beneficial for executive functioning. However, this group did not significantly differ from the others, so firm conclusions about the benefits of temperamental PA increases for cognitive flexibility during this developmental period cannot be made at this time.

While the overall MANOVA for substance use problems was not significant, exploratory examination of univariate tests yielded possible differences on drug use problems, at least based on Brown-Forsythe *F* results. Specifically, the Stable Low group endorsed significantly higher levels of drug use problems than the Stable High Group. These findings are in line with research that supports low PA as a vulnerability for substance use (for a review, see Cheetham et al., 2010). In fact, continuously low PA appeared to be a specific vulnerability for drug use rather than for substance use more broadly in the present study. This points to the importance of examining alcohol and drug use problems separately given that PA may function differently depending on which outcome is being considered. The lack of significant differences for alcohol use problems may be best understood when considering the prevalence of problematic alcohol consumption during this developmental period. Binge drinking is common during the college years (e.g., Cranford, McCabe, & Boyd, 2006; Wechsler, Lee, Kuo, & Lee, 2000) and therefore may be less closely tied to problematic PA profiles than is the use of illicit drugs. While not significant, it is worth noting that the Decreasers endorsed the highest levels of alcohol use

problems. It may be the case that whereas the continuous experience of low PA poses particular risk for drug use problems, a decline in PA, perhaps resulting from a major life stressor, is of most concern in terms of alcohol use problems.

Study Aim 3: Testing a Theory-Driven Model of Links Between PA and Adjustment

Counter to my hypotheses, none of the indirect effects for the relations between PA and adjustment via cognitive flexibility were significant. This held true regardless of whether a state or trait PA measure was used as the independent variable and regardless of whether the internalizing problems composite or depression and anxiety raw scores were used as the dependent variables. Testing the mediation models using a measure of state PA confirms that the lack of findings was not simply due to the present study's focus on temperament. However, given that the PANAS was administered 18-24 months prior to the assessment of cognitive flexibility, substance use problems, and internalizing symptoms, the possibility remains that concurrent state PA, particularly as measured via susceptibility to a mood induction, could yield different results. Additionally, it may be the case that the pathway from temperamental PA to internalizing and substance use problems is more complex than could be captured using the present models. Considering links between cognitive flexibility deficits and rumination (Dickson et al., 2017), it may be the case that rumination is an intermediary variable between cognitive flexibility and adjustment that needs to be considered. Similarly, adaptive coping methods (e.g., broad-minded coping) would be worth examining either in parallel or serial mediation models with executive functioning indices of cognitive flexibility given support for such coping variables as mediators in the broaden-and-build literature (Fredrickson & Joiner, 2002; Reschly, Huebner, Appleton, Antaramian, 2008).

Limitations and Future Directions

A number of limitations ought to be considered when interpreting the present findings. First, the sample size was modest, thereby limiting statistical power, especially for group comparisons. Thus, ANOVA and MANOVA results should be treated as preliminary findings and further examination of the current study questions with larger sample sizes is needed. The present sample was comprised predominately of Caucasian females; replication is needed in more demographically diverse samples, including samples with nonstudents, to determine the generalizability of findings. In the mediation models, the mediator and dependent variables were measured at the same time point. Though the mediation models were nonsignificant, this issue of the timing of variables leaves open questions regarding the true order of effects. Conducting similar research with at least three time points will be important for fully understanding how the relations between variables play out over time. The inclusion of additional time points will also allow for the examination of complex statistical models such as multiple serial and parallel mediation, growth curve, and transactional models. The majority of measures included in the present study were based on self-report. Future research would benefit from the inclusion of multi-informant, multi-method approaches to assessing the variables of interest. Lastly, the ATQ-SF does not have established criteria for determining "low," "high," and "moderate" levels of PA, so my discussion of these terms is based on relative comparisons within the current sample. It will be beneficial for future research to develop normative cutoffs to allow for comparisons of PA stability/instability patterns across studies and to facilitate clinical assessment, and therefore prevention and intervention efforts, based on this criteria.

Conclusions

The present study contributes to our understanding of temperament development, and its psychosocial implications, during emerging adulthood. In particular, the identification of distinct patterns of PA stability/instability provides a fine-grained description of PA development that is key for advancing temperament theory and for spurring additional empirical work during this pivotal developmental period. Building upon the substantive research base regarding the adverse outcomes associated with low levels of PA (e.g., Ameringer, Chou, Sussman, Unger, & Leventhal, 2015; Kendall et al., 2015), the present study yields important information about the maladjustment that emerging adults with continuously low levels of PA may face in comparison to their peers exhibiting other PA stability/instability patterns. The results suggest that ongoing monitoring of PA, such as through the administration of universal screeners on college campuses, may be helpful for identifying those most at-risk for maladjustment, at least in terms of internalizing and drug use problems. In fact such PA screeners may serve as key tools for facilitating transdiagnostic prevention efforts during the college years, especially for prevention programs targeting internalizing and drug use problems. Furthermore, given the adverse consequences associated with the continuous experience of low PA in the present study, the findings provide additional support for positive psychology interventions that aim to boost PA in order promote well-being and mitigate against adjustment problems. Importantly, such interventions have shown promise in addressing internalizing and substance use problems (e.g., Chaves Lopez-Gomez, Hervas, & Vazquez, 2017; Kahler et al., 2015) and thus may be particularly applicable for emerging adults exhibiting low levels of PA across time.

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Table 1

Intercorrelations and Descriptive Statistics for Main Study Variables

Variable	1	2	3	4	5	6	7	8	M (SD)	Range
1. ATQ-SF PA T1	__	.50**	.36**	-.004	-.15	-.39**	-.06	-.35**	4.75 (1.27)	1.50-7.00
2. ATQ-SF PA T2		__	.11	-.003	-.20	-.55**	-.19	-.17	4.85 (1.24)	1.25-7.00
3. PANAS PA T1			__	.15	.03	-.13	.08	-.06	27.28 (8.19)	10-47
4. Cognitive Flexibility T2				__	-.13	-.01	.09	.11	105. 38 (13.18)	72-131
5. Anxiety Symptoms T2					__	.44**	.06	.05	9.78 (8.98)	0-37
6. Depression Symptoms T2						__	.13	.23*	9.20 (7.57)	0-28
7. Alcohol Use Problems T2							__	.40**	5.22 (4.49)	0-16
8. Drug Use Problems T2								__	1.68 (2.94)	0-13

Note. T1 = time one. T2 = time two. ATQ-SF = Adult Temperament Questionnaire-Short Form. PA = Positive Affect. PANAS = Positive and Negative Affect Schedule.
** $p < .01$. * $p < .05$.

Table 2

Number of Participants for Each PA Grouping Method

Grouping Method	Total *N*	Stable Low	Stable Moderate	Stable High	Increasers	Decreasers
Method 1	80	6	57	4	7	6
Method 2	55	19	8	20	3	5
Method 2 With Broadened Change Definition	102	19	8	20	32	23

Table 3

Means and Standard Deviations for Outcome Variables Within Each PA Group

Outcome	Stable Low (N = 19)	Stable Moderate (N = 8)	Stable High (N = 20)	Increasers (N = 32)	Decreasers (N = 23)
Internalizing Problems[a,b,c]	.66 (.99)	-.28 (.72)	-.42 (.58)	-.16 (.74)	.12 (.81)
Cognitive Flexibility	105.42 (14.92)	105.38 (14.64)	103.30 (14.33)	106.47 (13.22)	105.64 (10.83)
Alcohol Use Problems	5.63 (4.03)	4.75 (4.53)	3.80 (3.74)	5.19 (4.72)	6.30 (5.12)
Drug Use Problems[b]	3.39 (4.46)	1.63 (2.26)	.50 (1.32)	1.81 (3.06)	1.18 (1.89)

Note. [a] significant difference ($p < .05$) between Stable Low and Stable Moderate groups; [b] significant difference ($p < .05$) between Stable Low and Stable High groups; [c] significant difference between Stable Low and Increasers ($p < .05$). Sample sizes per group vary slightly depending on the dependent variable being examined due to the removal of outliers.

Table 4

Mediation Analyses With ATQ-SF PA as the Independent Variable

	Path A (*b*, SE)	Path B (*b*, SE)	Path C (*b*, SE)	Path C' (*b*, SE)	Indirect Effect (AxB) (*b*, SE)	95% CI for Indirect Effect
PA—Cognitive Flexibility—Internalizing Problems	-.05 (1.04)	-.01 (.01)	-.21 (.06)**	-.21 (.06)**	.0002 (.01)	-.01, .02
PA—Cognitive Flexibility—Alcohol Use Problems	-.07 (1.04)	.03 (.03)	-.20 (.35)	-.20 (.35)	-.002 (.05)	-.12, .08
PA—Cognitive Flexibility—Drug Use Problems	.07 (1.09)	.02 (.02)	-.82 (.30)**	-.82 (.30)**	.002 (.03)	-.06, .07

Note. PA = positive affect. All path coefficients are unstandardized. Path A = effect of PA on cognitive flexibility. Path B = effect of cognitive flexibility on the dependent variable (i.e., internalizing, alcohol, or drug use problems). Path C = total effect. Path C' = direct effect of PA on the dependent variable.
** $p < .01$.

Table 5

Mediation Analyses With PANAS PA as the Independent Variable

	Path A (*b*, SE)	Path B (*b*, SE)	Path C (*b*, SE)	Path C' (*b*, SE)	Indirect Effect (AxB) (*b*, SE)	95% CI for Indirect Effect
PA—Cognitive Flexibility—Internalizing Problems	.25 (.16)	-.01 (.01)	-.01 (.01)	-.004 (.01)	-.001 (.002)	-.01, .001
PA—Cognitive Flexibility—Alcohol Use Problems	-.22 (.16)	.03 (.03)	.04 (.05)	.04 (.06)	.01 (.01)	-.01, .04
PA—Cognitive Flexibility—Drug Use Problems	.23 (.20)	.03 (.02)	-.02 (.04)	-.03 (.04)	.01 (.01)	-.002, .04

Note. PA= Positive Affect. All path coefficients are unstandardized. Path A = effect of PA on cognitive flexibility. Path B = effect of cognitive flexibility on the dependent variable (i.e., internalizing, alcohol, or drug use problems). Path C = total effect. Path C' = direct effect of PA on the dependent variable.