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Tell me why: An ecological momentary assessment study of "unknown" substance use motive endorsement and the predictive utility of affect

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ABSTRACT

Background: Theoretical models of substance use motives emphasize the role of affect when making decisions about use and propose that there are moments during which decisions about use are made outside of conscious awareness or without clarity about why. However, to our knowledge, no previous research has examined the frequency and phenomenology of this motivational state. This study sought to fill this gap by introducing an "I don't know" option to a substance use motive questionnaire ("unknown" motive).

Methods: Fifty young adults (age=18–24) with substance use disorder (32 % alcohol use disorder, 34 % cannabis use disorder, 34 % both) completed 14 days of EMA consisting of five random momentary assessments which inquired about affect and substance use in the past 30 min. If participants reported use, motives for that use episode were assessed with a checklist (observations=293).

Results: "Unknown" motive endorsement occurred in ~40 % of use moments. Negative affect displayed a positive quadratic relationship, such that lower- and higher-than-average negative affect were associated with a greater probability of endorsement compared to mean ($ps \leq .002$). Positive affect displayed a negative quadratic relationship, such that person-mean positive affect was associated with a greater probability of endorsement ($ps \leq .001$).

Conclusions: This was the first study to investigate the occurrence of "unknown" motive endorsement and its predictors. This endorsement appears to be common and may have non-linear associations in opposite directions with positive and negative affect, highlighting the unique role of affect in substance use.

1. Introduction

Young adults aged 18–25 have the highest percentage (~27 %) of individuals meeting DSM-5 criteria for a substance use disorder (SUD; American Psychiatric Association, 2022) of any age group, with alcohol use disorder (AUD; 16.4 %) and cannabis use disorder (CUD; 16.6 %) being the most common (Center for Behavioral Health Statistics and Quality., 2024). As such, gaining a clearer understanding of modifiable characteristics and contexts in which young people with SUDs are using and experiencing consequences is critical. One such factor with clinical implications is substance use motives. Motives are thought to be the most proximal mechanisms to and reflect the functional significance of substance use (Adams et al., 2012; Cooper et al., 2015; Studer et al., 2016). While there are several models (e.g., Cox and Klinger, 1988; Koob and Le Moal, 2001; McCarthy et al., 2010), the current consensus is that motives vary along two dimensions: valence (positive or negative) and context (internal or external; 4). Crossing these dimensions yields five motives (Simons et al., 1998) each with differing functions and goals: coping (internal-negative), enhancement and expansion (internal--positive), social (external-positive), and conformity (external-negative).

Substantial evidence supports these trait-level motives and the motivational model broadly (Cooper et al., 2015; Simons et al., 1998). The model also proposes five tenets (Cooper et al., 2015): 1) People use to alter affective states, 2) People have beliefs and expectations about use that mold their motivational profiles, 3) People choose (inside and outside of conscious awareness) whether and how much to use to attain their affective goals, 4) Use motivated by different needs or serving different functions are characterized by unique contextual factors, and 5) Motives are the "final common pathway" through which distal factors impact people's decisions. These premises are ultimately linked by one's

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awareness of context as they make use decisions, but factors that impact these decisions may occur outside of conscious awareness (e.g., McCarthy et al., 2010). It is plausible that individuals may not be completely aware of their motives for use before every use event (Premise-3) even though they are able to articulate their motivation for use at the trait-level. These premises also provide a justification for measurement of substance use motives at the event-level, since contextual factors are foundational to motivational model (Premise-4) and motives have been shown to vary within-person (Votaw and Witkiewitz, 2021). For example, an individual experiencing heightened anxiety might know that they drink to cope with their negative affect broadly (i.e., at the trait-level), but what is driving their decision may be unclear in the moment given their level of distress. In other words, this decision to use may be happening automatically outside of their own conscious awareness. This motivation may, instead, only become clear after experiencing the emotional effects of use. The variability and role of awareness in the motivational model pose an important set of unanswered questions: 1) how often do people not know what is motivating their substance use (referred to as "unknown" motives hereafter) and 2) what are its associated contextual factors?

Dual process theory (Wiers et al., 2007) and empirical research (e.g., Ostafin and Palfai, 2006) propose that implicit information processing impacts explicit behavior outside of conscious awareness. When the learned emotional effects of use are coupled with internal and external contextual factors, implicit, "hot" processing might give rise to use directed at altering one's affect without concrete understanding or awareness of why (McCarthy et al., 2010; Simons et al., 2015; Wiers et al., 2007). Taken together with premises 3 and 4 (Cooper et al., 2015), this suggests the occurrence of "unknown" motives at the event-level. Yet, this phenomenon has not been explored. Lack of empirical investigation makes sense, given most of the previous literature and foundational motivational models are centered around trait-level motivations. Nonetheless, it is critical that research establish if and how often "unknown" motives are endorsed at the event-level and understand the factors that are associated with this endorsement, given its discussion in prominent motivational models.

For evolutionary purposes, the processing of affective information often takes precedence over non-affective information (McCarthy et al., 2010; Murphy et al., 1995; Wiers et al., 2007); consequently, mood repair is prioritized over other long-term goals (Tice et al., 2001). Given motives represent affectively laden mechanisms by which people assign an incentive value to a substance's ability to relieve or amplify affective states (Cooper et al., 2015), both positive (PA) and negative affect (NA) may be contexts that give rise to "unknown" motive endorsement.

Theory (McCarthy et al., 2010) proposes that individuals' decisions about use become different at various levels of NA. When deciding whether to use, individuals experiencing low NA will use habitually, with little awareness about their reason for use, while individuals experiencing high NA will likely use because of the learned reliability of use to relieve NA. NA has been shown to attenuate top–down information processing and decision-making processes, resulting in impulsive actions where behavior is not based on careful consideration of the situational demands (i.e., negative urgency; Cyders and Smith, 2008). This suggests that individuals might be more likely to use at high levels of NA with little consideration for why. Meanwhile, individuals exert the most cognitive control resources at moderate levels of NA making this the level of NA where people are most likely to have a clear understanding of their motives for use. This provides support to suggest that moments characterized by low or high NA are predictive of "unknown" motive endorsement.

Positive reinforcement and positive affective functioning broadly are particularly relevant constructs for young people (Emery et al., 2023; Emery and Simons, 2020). Previous work has observed an inverse association between PA and use at the event-level (Emery et al., 2021, 2023) suggesting people are more likely to use when PA is low, though results from day-level (Dora et al., 2023; Testa et al., 2019; Van Doren et al., 2024) and concurrent use moment (Buckner et al., 2015) analyses have provided a series of mixed findings. Also, individuals may not have a clear understanding of what their internal emotional experience is, as evidenced by a lower ability to label positive emotion states when PA is low (Emery et al., 2022), which may make assigning a motive for use challenging, and individuals may act without conscious thought (Shishido et al., 2013). Additionally, acting impulsively when PA is high (i.e., positive urgency) is associated with greater substance use (Cyders et al., 2009; Cyders and Smith, 2008). Given the nature of "hot" processing, people experiencing high PA may use substances without awareness about why. Phenomenologically, enhancement motives may not be an all-encompassing motive across all levels of PA (Emery et al., 2024), but may mirror the cognitive control and awareness states posed by negative reinforcement and dual processing theories.

In both cases, the greatest probability of "unknown" motive endorsement may occur at **both** high and low NA or PA. That is, these associations may not be linear, but quadratic– such that the lowest probability of endorsing an "unknown" motive occurs at mean levels of NA and PA. To our knowledge, no previous work has examined non-linear affective associations with substance use motives.

This study sought to characterize the frequency of "unknown" motive endorsement in clinical sample of young adult with AUD and/or CUD using ecological momentary assessment (EMA) and test if momentary NA and PA exhibit quadratic relationships with "unknown" motive endorsement, such that experiencing lower- or higher-than-average NA and experiencing lower- or higher-than-average PA are associated with a greater probability of "unknown" motive endorsement.

2. Method

2.1. Participants

Participants for this study were part of a parent EMA study (Colorado EMA Project for SUDs). Inclusion criteria for the parent study include college students aged 18–25 who met criteria for current AUD, CUD or both and have a smart phone. Participants were recruited from the university research participation pool, receiving partial course credit per survey completed.

Sixty-eight undergraduate college students (M_{age}=19.1, SD_{age}=1.41) were recruited. Fifteen participants did not report any use moments during the sampling period and were removed, leading to a descriptive sample of 53 individuals. This sample was predominantly assigned female at birth (87 %) and identified as cisgender women (87 %). The sample was 87 % White, 2 % Asian, 2 % Black, 6 % Native American, 2 % Another, 2 % Multiracial and 77 % Non-Hispanic/Latine. Three participants were removed from the sample due to lack of item pairs necessary for the analysis. Overall, 50 participants were included in the analytic sample.

2.2. Procedure

Participants completed an online screener to determine eligibility criteria for participation. Participants that met the eligibility criteria were invited to attend an in-person enrollment session where they completed informed consent and were trained to use the EMA application (mEMA; Tuomenoksa, 2013) on their personal phone.

Participants completed five momentary assessments at random times within 3-hour blocks from 9am-midnight (random assessments; e.g., 9:00am-12:00 pm) and a morning assessment between 9:00 am and noon for 14 days.[3] Random assessments presented brief (~2 min)

[3] A small subsample of participants received begin and end use reports to test feasibility of these assessments. Data from these assessments were not included in the current analyses.

surveys asking for participants to report on their emotions and behavior during a specified period (e.g., past 30 min, since last survey). All EMA items were forced response. Data were drawn from the random assessments. The study was approved by the Institutional Review Board (2888).

2.3. Measures

2.3.1. Baseline measures

Current SUD was assessed with the Alcohol Symptom Checklist (Hallgren et al., 2022) and an adapted version for CUD. These checklists are 11-item self-report measures that inquire whether participants have experienced each of the 11 DSM-5 SUD criteria within the past year, a timeframe consistent with diagnostic standards. Summed scores reflect criteria counts and severity as defined in DSM-5 (mild=2–3; moderate=4–5; severe=6–11). Psychometric analyses support the reliability and validity (Hallgren et al., 2022) of the ASC across times and populations.

2.3.2. EMA measures

Affect in the previous 30 min was assessed by items from the PANAS-X (Clark and Watson, 1994) and the affect circumplex model (Larsen and Diener, 1992) on an 11-point scale (0 =*Not at all*–10 =*Extremely*). Five items assessed PA: happy, excited, calm, relaxed, and grateful. Five items assessed NA: sad, anxious, angry, lonely, and stressed. Previous research supports the internal consistency and criterion validity of these affective items assessed using EMA (Emery and Simons, 2020). PA and NA items were averaged into moment- and person-mean composite scores for their respective valence.

We calculated reliability of the PA and NA scales for this sample at L1 and L2 using McDonald's Omega (ω; Geldhof et al., 2014; McDonald, 2013), which is the ratio of the common variance to the total variance (common and unique; Dunn et al., 2014) and guidelines follow those for Cronbach's alpha. PA exhibited acceptable reliability at L1 (ω=0.79) and excellent reliability at L2 (ω=0.93). NA demonstrated acceptable reliability at L1 (ω=0.79) and excellent reliability at L2 (ω=0.88).

Substance use was assessed by number of drinks consumed over the last 30 min on an 11-point scale (*0–10 or more drinks*) and use of any THC-containing cannabis products within the last 30 min (*yes*= 1 or *no*= 0). Alcohol and cannabis use moments were collapsed into a single indicator since the motives question did not ask participants to specify what they were using and to maximize the number of observations.

Motives were assessed with a checklist representing the five substance use motives and an added "I don't know" option ("unknown" motive). Participants were only asked about their motives if they endorsed using substances in the past 30 min. Participants could select multiple motives. Checklists to examine motives are common (Votaw and Witkiewitz, 2021) and allow for exploration of co-occurring motivations. Participants were also given a "response not listed" option, ensuring that "unknown" motive endorsement was not representative of a general disagreement with the other listed motives. "Unknown" motive endorsement was a dichotomous indicator (endorsed=1 or not endorsed=0) and was the outcome variable.

2.4. Planned analysis

All analyses were conducted in Stata (StataCorp, 2025). Descriptive statistics were used to characterize the distribution of participants' SUD symptoms, frequency of use moments, frequency of "unknown" motive endorsement, and associative relationships between variables of interest.

Data were analyzed with multilevel models (MLMs), where moments (level 1 [L1]) were nested within-persons (level 2 [L2]). MLMs account for the non-independence of observations from nesting of time-varying observations via momentary random assessments within-persons (L1). Since the aims of this study were focused at L1, each model included random intercepts and fixed slopes to account for within-person variability, while constraining the effect between-persons (L2). All models included sex (L2), day of the week and day in the study (L1) as covariates. Previous work has demonstrated sex differences in subjective experiences of substance use (see McHugh et al., 2018). Day of the week was included to control for any daily variation in use patterns and affect while reducing potential serial auto-correlation across days (Mohr et al., 2001). Day in the study was included to account for any change over time not accounted for by the predictors of interest.

Initial intercept-only models (without any predictors) estimated intraclass correlations (ICC) to determine the proportion of variability in the focal variables that can be attributed to between- vs. within-person influences. Unknown motive endorsement at the next moment was regressed on continuous NA and PA at the previous moment using a multilevel logistic regression (i.e., lagged effects). At L1, NA and PA were person-mean centered, where deviations from the mean represent changes from an individual's own typical level of affect. At L2, each participant's mean NA and PA was grand-mean centered. Due to the item pairs required for this analysis (i.e., previous moment affect, next moment "unknown" motive endorsement), and the momentary pairings are within-day, some observations were not included.

Marginal effects at representative values were used to probe the hypothesized quadratic relationships (Williams, 2012). This approach is akin to simple slopes (Aiken et al., 1991), however, instead of comparing the slope values to zero, tests of second differences allow for investigation of how the slopes at values of interest ($\pm$1 *SD,* mean) differ from one another (Mize, 2019). Since we hypothesized a quadratic effect, we compared the slopes at $\pm$1 *SD* to the slope value at the mean of NA and PA.

2.5. Minimum detectable effect sizes

Following the approach of Lane and Hennes (Lane and Hennes, 2018, 2019), we assessed minimum detectable effect sizes from number of observations using the Monte Carlo simulation feature of Mplus 8.5 with repeated sampling (Muthén & Muthén, 2017). Consistent with previous research, 50 % of the variance in affect was specified at L1 (e.g., Dvorak et al., 2014; Emery and Simons, 2020). Since the aims of this study were at L1, power simulations focused on effect sizes at L1. Results from 10,000 simulations indicated that a sample of 50 individuals with 250 observations was $\geq$ 80 % powered to detect effects of β= 0.20 or higher. Accordingly, the models were adequately powered to detect any clinically meaningful effects.

2.6. Preregistration

Analysis plan and hypotheses were preregistered on Open Science Framework (OSF).[4] Preregistration can be found at https://osf.io/zmknw.

3. Results

3.1. Descriptive statistics

At baseline, 32 % of participants endorsed 2 or more symptoms of

[4] Preregistration included an additional aim and analysis not presented here for space purposes. The omitted analysis was the momentary prospective association between "unknown" motive endorsement and negative consequences at the next moment. In brief, we did not find a significant prospective association between "unknown" motive endorsement and negative consequences at L1; however, there was a significant bivariate correlation which we retain in our descriptive statistics. Detailed results from these analyses can be found in the supplemental materials on the OSF page as well as submitted supplemental materials.

Table 1
Correlation matrix and descriptive statistics.

Variable	*M*	(*SD*)	2	3	4	5	6
1. Sex			.22***	–.24***	.07***	–.10***	–.02
2. Age	19.1	1.4		–.22***	–.16***	.07***	.004
3. Negative Affect	2.4	1.3			–.25***	.10***	.34***
4. Positive Affect	5.4	1.3		–.50***		–.16***	–.20***
5. Unknown Motive Endorsement	2.3	3.5		.11*	–.09		.21***
6. Negative Consequences	5.9	7.6		.12***	–.10***	–.04	

Note. *Means* and *SDs* are either person-level aggregates over the sampling period or baseline measures. To the left of the diagonal are the within-person level correlations and to the right are the between-person level correlations. *Within-person note.* Observations 4980 person-moments. Negative Consequences = number of negative consequences since last survey (see supplemental methods). Positive and negative affect = mean in past 30 mins. *Between-person note.* $N = 68$. Sex (female = 0, male = 1). Negative Consequences = total number of negative consequences over the sampling period (see supplemental methods). Positive and negative affect = person-average aggregates over the sampling period. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2
Multilevel logistic regression model of affect and "unknown" motive endorsement.

	OR	*SE*	*z*	*p*-value	*95 % CI*
Within-Person (L1; Time-Varying)					
Monday	1.26	1.08	0.64	.521	0.40, 6.05
Tuesday	1.72	1.23	0.76	.445	0.42, 6.99
Wednesday	1.03	0.74	0.04	.971	0.25, 4.19
Thursday	1.49	0.97	0.60	.548	0.41, 5.45
Friday	0.86	0.55	−0.23	.816	0.25, 3.01
Saturday	1.46	0.91	0.62	.536	0.44, 4.89
Day in the Study	**1.26**	**0.06**	**4.87**	**< .001**	1.14, 1.38
Lagged Negative Affect (NA)	0.73	0.16	0.28	.783	0.78, 1.40
Quadratic Lagged NA	**1.20**	**0.07**	**3.13**	**.002**	**1.07, 1.35**
Lagged Positive Affect (PA)	1.37	0.22	1.95	0.05	0.94, 1.05
Quadratic Lagged PA	**0.72**	**0.06**	**−3.62**	**< .001**	**0.61, 0.86**
Between-Person (L2; Time-Invariant)					
Sex	0.57	0.53	−0.61	.544	0.09, 3.48

Note: $N = 50$. Level 1 observations = 293 person use-moments. *OR* = Odds ratio. Level 1 variables were person-mean centered and Level 2 variables were grand-mean centered. Sex (female = 0, male = 1). Sunday was the reference group for day-of-the-week indicators.

AUD, 34 % endorsed 2 or more symptoms of CUD, and 34 % endorsed 2 or more symptoms of both. Participants completed 3163 random surveys of the possible 4200, indicating a 75.3 % completion rate, which is standard for this population (Jones et al., 2019).

There were 373 use moments across the sampling period; of these, an "unknown" motive was endorsed 149 times (39.95 %) and was the **only** endorsed motive 115 times (30.83 % of all use moments, 77.18 % of "unknown" motive endorsements). On average, individuals reported 7.69 use moments (Median=5, Range=1–25, *SD*=6.39) and endorsed "unknown" motives 2.9 times across the sampling period (Median=2, Range=0–18, *SD*=3.67). See Table 1 for bivariate correlations.

The ICC for "unknown" motive endorsement was 0.21, denoting that 79 % of this endorsement propensity varied at the within-person level. ICCs were 0.44 and 0.41 for PA and NA, respectively, denoting that about 60 % of the variability in affective experiences were due to within-person factors. Overall, ICCs for focal variables supported L1 analyses.

3.2. Multilevel models

At L1, both PA (*OR*=0.73, $p < .001$, 95 %CI [0.61, 0.86]) and NA (*OR*=1.20, $p = .002$, 95 %CI [1.07, 1.35]) exhibited a significant prospective quadratic effect on odds of endorsing an "unknown" motive at the next moment as hypothesized (Table 2). NA demonstrated a positive quadratic association (Fig. 1). Contrary to our hypotheses, PA demonstrated a negative quadratic association (Fig. 2).

Tests of second differences demonstrated that slope values at lower-than-average (difference=-0.07, $p = .002$) and higher-than-average NA (difference=-0.08, $p = .001$) were significantly different from the slope at the mean, demonstrating a significant positive quadratic relationship. See Table 3a for marginal effect values and Table 3b for linear comparisons. Slopes at lower-than-average (difference=0.10, $p = .001$) and higher-than-average PA (difference=0.14, $p < .001$) were significantly different from the slope at the mean, demonstrating a significant negative quadratic relationship. See Table 4a for marginal effects values and Table 4b for linear comparisons.

4. Discussion

This study used EMA to fill an important gap in the substance use motives literature, relating to affect and awareness of use motivation. Models of addiction, including the affective-motivational model (Cooper et al., 2015), emphasize the importance of contextual factors for making moment-to-moment decisions about substance use. These models also state that decisions about use may happen within *and* outside of conscious awareness depending on contextual information (e.g., affect; Cooper et al., 2015; McCarthy et al., 2010; Wiers et al., 2007). Despite longstanding theoretical conceptualization and discussion of this construct, to our knowledge, this was the first empirical work to test this phenomenon.

Our results suggest that "unknown" motive endorsement is common (~40 %), indicating that individuals often use without clear or conscious knowledge about why, as proposed. Importantly, "unknown" motive endorsement was distinct from one's motive not being listed (a response option in the motives checklist), which was endorsed in 6 % of use moments. This provides confidence that "unknown" motive endorsement is representative of a lack of clarity about motives for use in any given moment rather than a general disagreement with the motives provided. Taken together, this is an important and novel contribution to the motives literature. The study also sought to investigate under what conditions individuals endorse "unknown" substance use motives. Given the centrality of affective functioning in both addiction (Cooper et al., 2015; Koob, 2015) and decision making (Lerner et al., 2015), we examined the prospective impact of how individuals felt before use on "unknown" motive endorsement. Here, we found that NA and PA exhibited quadratic associations with "unknown" motive endorsement.

As hypothesized, NA at the previous moment displayed a positive quadratic relationship with "unknown" motive endorsement at the next

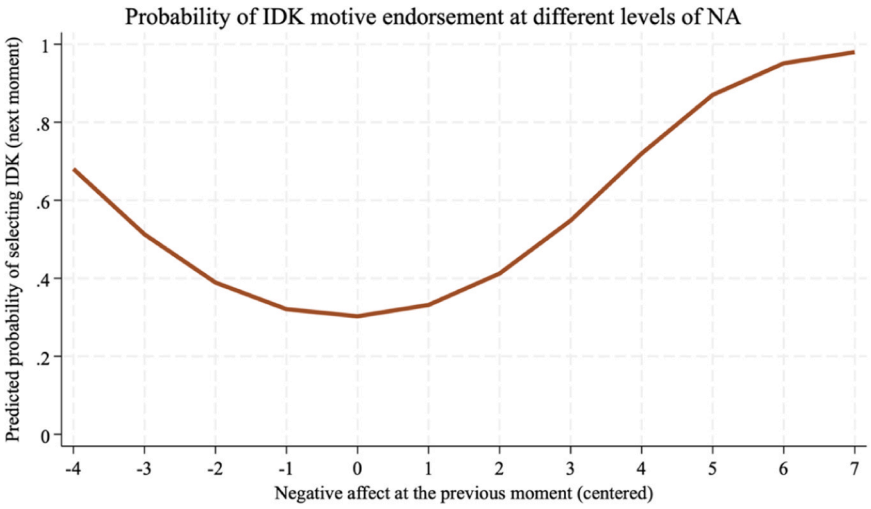

Fig. 1. Predicted probabilities of prospective "unknown" motive endorsement and negative affect.

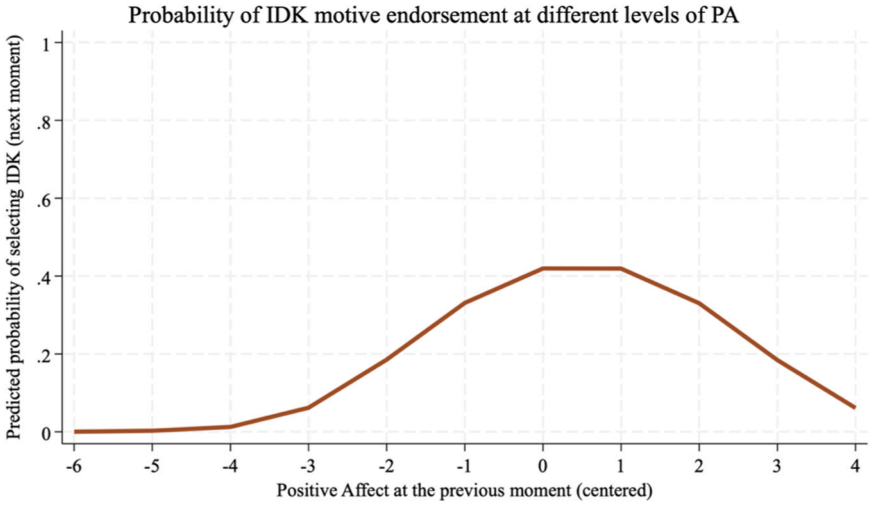

Fig. 2. Predicted probabilities of prospective "unknown" motive endorsement and positive affect.

Table 3a
Marginal effects – negative affect.

	dy/dx	*SE*	*p*-value	*95 % CI*
Negative Affect (Lagged)				
−1.496 (- 1 SD)	−.068	.034	.051	−.135,.000
0 (Mean)	.005	.019	.784	−0.32,.043
1.496 (+1 SD)	**.080**	**.029**	**.007**	**.022,.138**

Note: $N = 50$. Level 1 observations = 293 person use-moments. *Dy/dx* = slope or rate of change value for every 1 unit change in NA.

Table 3b
Linear comparisons – negative affect.

	lincom	*SE*	*p*-value
Negative Affect (Lagged)			
−1SD compared to Mean	**−.073**	**.024**	**.002**
+ 1 SD compared to Mean	**−.075**	**.023**	**.001**

Table 4a
Marginal effects – positive affect.

	dy/dx	*SE*	*p*-value	*95 % CI*
Positive Affect (Lagged)				
−1.517 (- 1 SD)	**.150**	**.031**	**< .001**	**0.09,.211**
0 (Mean)	.045	.023	.051	.000,.092
1.517 (+1 SD)	**−.091**	**.039**	**.019**	**−.168, −.015**

Note: $N = 50$. Level 1 observations = 293 person use-moments. *Dy/dx* = slope or rate of change value for every 1 unit change in PA.

Table 4b
Linear comparisons – positive affect.

	lincom	*SE*	*p*-value
Positive Affect (Lagged)			
−1SD compared to Mean	**.104**	**.031**	**.001**
+ 1 SD compared to Mean	**.137**	**.037**	**< .001**

moment. These results are consistent with predictions set forth by negative reinforcement theories of addiction (e.g., McCarthy et al., 2010) and negative urgency (Cyders and Smith, 2008). This hints at the role of interoceptive and subconscious awareness about early withdrawal symptoms (Wiers et al., 2007) or learned consequences of use (McCarthy et al., 2010) at low NA, while at high NA, reflexive use is likely aimed at alleviating NA without much deliberate thought (Cyders and Smith, 2008; McCarthy et al., 2010; Wiers et al., 2007).

Contrary to hypotheses, PA displayed a negative quadratic relationship with "unknown" motive endorsement where lower- and higher-than-average PA were prospectively associated with lower probabilities of "unknown" motive endorsement. This suggests that implicit processing might, instead, occur when individuals are experiencing typical PA, which might be characteristic of individuals with SUD. In these moments, there may be a lack of interoceptive cues that an affective shift is desired or required, which may be present at lower and higher than average levels of PA. Here, people are less likely to consciously know why they are engaging in use behaviors. While somewhat inconsistent with research on the association between positive urgency and substance use (e.g., Cyders and Smith, 2008), this pattern could emerge if PA arousal were taken into consideration. Our composite score of PA included three low (e.g., calm) and two high arousal PA (e.g., excited), while positive urgency may apply differently across the PA spectrum. Thus, future work might consider disaggregating positive affect by arousal using a battery with more affect adjectives across the arousal continuum.[5]

Taken together, the pattern of "unknown" motive endorsement observed here underscores the importance in understanding the affective circumstances that precede use (e.g., non-linear associations). Highlighting these conditions provides a framework for prevention and intervention efforts in substance use treatment (e.g., mindfulness-based treatments centered around affective up- and down-regulation). In tandem, motives may be modifiable (Crutzen et al., 2013), thus providing a direct target for treatment. Future work should continue to examine the moment-to-moment predictive relationship between affect and "unknown" motive endorsement and investigate the effects of other feeling states (e.g., craving). Future work should also examine L2 associations between affect and "unknown" motive endorsement.

Importantly, conceptualization of "unknown" motives makes most sense at the state level. In this way, "unknown" motive endorsement does not represent an independently occurring motive so much as it is descriptive of an underlying lack of awareness for any motive that is likely a time-limited state that is contextually bound. While individuals can articulate trait-level motivations for use, this study demonstrated that "unknown" motive endorsement occurs moment-to-moment. Theoretical models discuss this state such that articulation for a discrete motive is not possible or is inaccessible (e.g., occurs implicitly or habitually; Cooper et al., 2015; Wiers et al., 2007). Supported by dual process theory (Lieberman, 2007; Satpute and Lieberman, 2006), individuals endorsing "I don't know" may be experiencing tension in explicit and implicit processing. While their explicit motive for use is "unknown", an implicit process is taking place. Future work should investigate the within- and between-person boundary conditions of "unknown" motive endorsement, examine co-occurring motives, their contextual similarities and differences.

The novelty and contributions of this study should be balanced against its limitations. Though individuals could select multiple motives at L1, we did not include or control for endorsement of other motives in our models; however, "I don't know" was most often selected on its own. Future work should include other motives to better understand how much unique variance is accounted for by "unknown" motive endorsement. EMA allows for greater ecological validity by asking participants questions about their experiences in real-time, real-world contexts (Shiffman et al., 2008). Though the events are temporally ordered, due to the lack of direct manipulation, we cannot assume causality. Our momentary assessments ask about an individual's experience from the past 30 min and use moments outside of this time window are not captured. Future work could utilize event-contingent use assessments, which comes with other challenges, including lower completion rates (Shiffman et al., 2008). Additionally, the exact meaning of selecting "I don't know" by a participant during any given use moment remains unclear without an opportunity to provide qualitative responses. This endorsement could be encapsulating a variety of cognitive experiences or motivations for use that seem difficult to articulate moment-to-moment, particularly for individuals with SUD. For example, "I don't know" could translate to simple wanting or craving of a substance without a clear understanding about *why* (such that one's motive would simply be "I just wanted to"). This lack of qualitative understanding, while an inherent limitation of the current study, provides a critical and impactful next step in understanding "unknown" motive endorsement. Future work could utilize free response options (i.e., qualitative textboxes) during EMA and/or qualitative interviews to understand how participants are utilizing this response option and what they are thinking when selecting "I don't know." Further, concerns regarding participants selecting "I don't know" as potential reactivity to the protocol are belayed by the response option "Reason not listed" being presented simultaneously, which was only endorsed eight times total across all participants. Finally, our sample was predominantly comprised of white identifying female college students, which limits generalizability; however, all models presented controlled for sex.

Overall, this study leveraged EMA to provide seminal empirical support and a proof-of-concept for a theoretically predicted phenomenon. This motive endorsement was contextualized by specific levels of affect; particularly, affective valence *and* intensity demonstrated varying relationships with "unknown" motive endorsement. Theory regarding motivation for substance use has predicted the event-level occurrence of this phenomenon, yet to our knowledge no empirical work had explored it thus far. Understanding how awareness of one's actions is impacted by contextual factors has potential implications for prevention and intervention efforts, particularly mindfulness-based interventions, which emphasize awareness in decision-making.

Conflicts of Interest Statement

On behalf of all authors, the corresponding author states that there are no conflicts of interest.

CRediT authorship contribution statement

Angelica DeFalco: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Emery Noah:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

None.

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[5] A set of analyses were completed exploring these effects disaggregated by level of arousal for both PA and NA at the request of a reviewer. These were not preregistered. Results are included in the supplemental materials. In brief, we did not find any significant linear or non-linear associations ($ps > .124$) between low or high arousal PA or NA. See Supplemental Table 2 for the full model estimates.

Alcohol Abuse and Alcoholism (AA029033; PI: N. Emery).

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.drugalcdep.2025.112885.

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