Ambivalence Model of Craving: A Latent Profile Analysis of Cue-Elicited Alcohol Craving in an Inpatient Clinical Sample

ROBERT C. SCHLAUCH, PH.D.,^{a,*} SAMARA L. RICE, PH.D.,^b GERARD J. CONNORS, PH.D.,^b & ALAN R. LANG, PH.D.^c

^aDepartment of Psychology, University of South Florida, Tampa, Florida

^bResearch Institute on Addictions, University at Buffalo, Buffalo, New York

^cDepartment of Psychology, Florida State University, Tallahassee, Florida

ABSTRACT. Objective: Craving has been defined as intense desires or urges to consume alcohol and is considered predictive of future drinking and relapse. Despite this assumption, research on the craving–drinking relationship has been mixed, calling into question how researchers define and measure craving. The primary aim of the current study was to examine a promising, but understudied, model of craving (Ambivalence Model of Craving [AMC]) that calls for the concurrent assessment of both approach (desires to use) and avoidance (desires to not use) inclinations. **Method:** Participants ($N = 175$) were recruited from an acute detoxification facility. Alcohol craving was evaluated with a cue-reactivity paradigm in which participants viewed substance cue slides and separately rated their desire to consume and not consume the substance after each image. Latent profile analysis examined distinct mo-

tivational profiles for alcohol predicted by the AMC: ambivalence (high approach, high avoidance), indifference (low approach, low avoidance), approach (high approach, low avoidance), and avoidance (low approach, high avoidance). **Results:** Latent classes corresponded to the AMC, but a fifth class differentiated moderate versus high ambivalence. Classes were associated with auxiliary variables in predicted directions; high ambivalence and approach classes were associated with greater drinking and negative consequences, whereas voluntary admittance to treatment was more likely with ambivalence and avoidance classes. **Conclusions:** The AMC provides a promising framework for evaluating cue-elicited craving and alcohol use in clinical samples and may be a useful model of craving for clinicians during treatment. (*J. Stud. Alcohol Drugs*, 76, 764–772, 2015)

DESPITE THE EMERGENCE of well-validated treatments for alcohol use disorders, only 30%–40% of people who enter treatment experience positive outcomes (i.e., abstinence or moderate drinking without problems) (Miller et al., 2001), and approximately 60% relapse to alcohol use within the first 3 months following treatment (Miller, 1996). Among the most studied variables hypothesized to play an important role in treatment outcomes is craving. Traditionally, craving has been defined as intense desires or urges to consume alcohol and is considered predictive of future drinking and relapse. However, research regarding the nature of the craving–drinking relationship has been less than convincing, and the experience of craving is not always predictive of relapse, calling into question the ways in which researchers define and measure craving (Drummond et al., 2000; Tiffany et al., 2000).

A potential explanation for the lack of consistent findings across studies regarding the causal relationship between craving and subsequent relapse might be the result of inad-

equately theories and measures for assessing craving experiences (Drummond et al., 2000). Most theories and measures of craving consider only the approach dimension—defined as intense desires for alcohol—while ignoring the desire to simultaneously reject or reduce use of the problematic substance, which also may influence behavior. For individuals seeking or receiving treatment for alcohol use disorders, craving often occurs in the context of not only desiring a substance, but also desiring to not use it. Avoidance inclinations may be an important consideration for explaining why, among individuals endorsing a strong desire for alcohol, some relapse whereas others do not. Conceptualizing craving as a potential approach–avoidance conflict provides the opportunity to better assess individual differences in the craving experience and thus may account for unexplained variance in the craving–drinking relationship.

With growing recognition of the importance of competing desires (Anton, 1999; Kavanagh et al., 2013; Tiffany, 1990), an understudied but promising area of research is the Ambivalence Model of Craving (AMC; Breiner et al., 1999; Stritzke et al., 2007). The AMC views craving as a complex experience requiring consideration of both the desire to use (approach) and desire to not use (avoidance) (Breiner et al., 1999; McEvoy et al., 2004; Stritzke et al., 2007). Approach and avoidance inclinations are presumed to develop as a function of the positive and negative consequences of use (Breiner et al., 1999), and consistent with

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*Correspondence may be sent to Robert C. Schlauch at the Department of Psychology, University of South Florida, 4202 East Fowler Ave., PCD4118G, Tampa, FL 33620, or via email at: rschlauch@usf.edu.

FIGURE 1. Ambivalence Model of Craving. Figure 1a: Adapted from Breiner et al. (1999). Figure 1b: Adapted from Stritzke et al. (2007) with permission from Nova Science Publishers.

neurobiological theories (Barkby et al., 2012; Cacioppo et al., 1999), represent separate dimensions that may be reciprocally or simultaneously activated, resulting in four hypothetical quadrants (Figure 1a; indifference, approach, avoidance, ambivalence).

Measurement of both approach and avoidance inclinations as separate dimensions within the AMC framework has several clinical and methodological advantages (see Stritzke et al., 2007, for a review). For example, evaluation of both dimensions over time allows for the assessment of craving and competing desires as a function of both substance use patterns and recovery status of those seeking or receiving treatment (Figure 1b). Further, it has been argued that measuring “craving” exclusively in terms of approach without consideration of a separate, yet concurrent, avoidance inclination may misrepresent a motivational disposition that is a combination of both, thereby significantly diminishing the utility of the information obtained (Breiner et al., 1999).

Studies examining avoidance inclinations have provided support for its incremental validity in predicting substance-related variables in both nonclinical and clinical samples, and findings from cue-reactivity studies indicate that approach and avoidance can be independently measured as separate dimensions (Curtin et al., 2005; Schlauch et al., 2013a; Stritzke et al., 2004). Further, avoidance inclinations are positively related to taking steps to make a change,

demonstrating congruence between desire to not consume alcohol and self-reported behaviors to abstain from or reduce alcohol use (Klein et al., 2007; Schlauch et al., 2012, 2013a). They also distinguish between clinically significant subgroups of smokers trying to quit (high approach, high avoidance) and not quit (high approach, low avoidance), differentiating among those craving cigarettes smokers who are also ready to change and who may benefit from intervention (Stritzke et al., 2004).

Avoidance inclinations have also been shown to moderate the effect of approach inclinations on drinking. Craving, when measured solely as an approach inclination, would be expected to inexorably lead to subsequent drinking. However, participants high in avoidance drink less alcohol regardless of their degree of approach (Schlauch et al., 2013b). This is important because it suggests that once internal or external cues trigger urges to use, people can resist them (Tiffany, 1990). The AMC provides a framework for which alcohol/other drug use is not inevitable when approach is activated but rather is dependent on competing desires and presumably effortful control such that the stronger one's avoidance inclinations are, the less likely the decisional balance tips in favor of use. Therefore, avoidance inclinations may provide incremental validity over traditional craving assessments (i.e., approach inclinations only) in predicting alcohol and other drug use and aid in relapse prevention by

identifying those at highest risk (i.e., those high on approach and low on avoidance or those high on both).

Despite these promising findings, no studies have empirically tested the existence of the four hypothesized motivational quadrants among those diagnosed with substance use disorders. The primary aim of the current study was to provide further validity to the AMC via examination of the motivational profiles among those admitted to an inpatient substance use treatment program. Specifically, using latent profile analysis (i.e., mixture modeling), we sought to identify distinct latent classes based on alcohol approach and avoidance inclinations assessed with a cue-reactivity paradigm. Consistent with the AMC, we predicted that a four-class solution representing four motivational quadrants (i.e., indifference, avoidance, approach, and ambivalence) would best fit the data. Further, we hypothesized that these classes would be differentiated on measures of alcohol-related problems, drinking behaviors (occasions/week and drinks/occasion), and voluntary admission to the unit such that high approach classes would exhibit greater alcohol use and consequences and high avoidance classes would exhibit less alcohol use and fewer consequences and a greater probability of voluntary admittance.

Method

Participants

Participants ($N = 175$) were recruited from an inpatient substance use disorder treatment program offering detoxification services for substance use problems. Admission criteria to this program include (a) a substance use disorder diagnosis, (b) being assessed as cooperative and nonviolent, (c) current alcohol or other substance use at a quantity and frequency sufficient to have developed tolerance and be at risk for withdrawal symptoms when substances are terminated, (d) requiring medical and nursing services to manage withdrawal symptoms, and (e) absence of signs and symptoms requiring acute inpatient hospitalization (e.g., schizophrenia, actively suicidal). The treatment facility accepts both voluntary and involuntary admissions. Of the 175 recruited participants, 172 provided cue-reactivity data for the current analyses and 144 provided complete data on both cue-reactivity and questionnaire data of interest. Participants were predominantly male (62.3%; 29.7% female, 8.0% missing information about sex) and White (53.9%; 27.7% African American, 3.9% multiracial, 3.9% American Indian/Native Alaskan, 5.1% other, 8.4% unknown), with a mean age of 41.6 years ($SD = 11.2$; 8.0%, or $n = 14$ missing data). Sixty-six percent reported that they were admitted voluntarily. At the time of participation, the average stay on the unit was 2.3 days ($SD = 1.3$; 10.3%, or $n = 18$ missing data). Forty-nine percent of participants reported using multiple illicit substances (i.e., excluding alcohol and cigarettes) within

TABLE 1. Alcohol and other drug use history

Variable	% of sample using			
	Never	Lifetime	Last 12 months	Last 30 days
Marijuana	14.0	86.0	50.9	36.0
Opiate (any)	44.7	55.3	36.9	26.1
Heroin	84.1	15.9	6.2	3.1
Pain medications	46.3	53.7	36.9	25.6
Benzodiazepines	50.0	50.0	34.0	27.2
Stimulant (any)	23.8	76.2	49.4	37.9
Cocaine	36.0	64.0	33.3	23.3
Crack cocaine	46.3	53.7	36.2	27.5
Amphetamine	59.0	41.0	11.5	9.6
	<i>M</i>	<i>SD</i>	<i>Mdn</i>	
Alcohol use				
No. of occasions/week	6.73	7.09	4.50	
Quantity/occasion	7.25	4.11	8.00	
Cigarette use				
No. of cigarettes/day	17.27	13.32	20.00	
Substance use problems				
SMAST	7.75	4.20	9.00	
DAST	12.64	8.34	14.00	

Notes: No. = number; SMAST = Short Michigan Alcoholism Screening Test; DAST = Drug Abuse Screening Test.

the past 12 months (38% within the past 30 days) and had significant alcohol and other drug use problems (see Table 1 for the history of substance use). There were no differences between those providing complete data and those who did not (i.e., completed cue-reactivity task but not all the questionnaires) on alcohol approach or avoidance inclinations.

Materials

Equipment. An HP Pavilion dv9000 laptop computer (Hewlett-Packard Company, Palo Alto, CA) and a projection unit were used to project the substance cues and instruction slides onto a white projection screen. Microsoft PowerPoint software (Microsoft, Redmond, WA) controlled the timing and presentation of the preparatory slides, substance cues, and rating periods.

Slides. Nine appetitive substance categories were represented: alcoholic beverages ($n = 15$; 6 beer, 6 distilled spirits, 3 wine), cigarettes ($n = 6$), marijuana ($n = 6$), stimulant drugs ($n = 12$; 6 crack cocaine, 6 cocaine), prescription medication ($n = 12$; 6 benzodiazepines, 6 opiates), heroin ($n = 6$), food ($n = 6$), and nonalcoholic beverages ($n = 6$). The alcoholic beverage slides were from the Normative Appetitive Picture System (Stritzke et al., 2004), which have been previously validated for measuring both approach and avoidance inclinations in three independent samples (Curtin et al., 2005; Schlauch et al., 2013a; Stritzke et al., 2004). Alcohol cues varied by setting (e.g., bar, restaurant, home, neutral background) and activity state (e.g., substance sitting untouched on table, held in hand, or actively consumed). Participants viewed three sets of 23 slides, which were counterbalanced among six possible presentation orders.

Substance cue-reactivity ratings. After the presentation of each slide, participants rated the degree to which they wanted to consume (approach) and did not want to consume (avoidance) each substance on a 9-point scale (0 = *not at all* to 8 = *very much*). Participants were instructed to report their “initial reactions” to the substance rather than a long-term goal to either use or abstain and that their approach and avoidance ratings were independent of each other. Internal consistency estimates within each substance category were excellent for both approach and avoidance ratings (α 's ranging from .91 to .97).

Measures

Drinking History Questionnaire. The Drinking History Questionnaire is a 10-item instrument based on the work of Cahalan and colleagues (1969) that assesses the quantity and frequency of current and past alcohol consumption as well as subjective experiences and beliefs regarding the individual's own use of alcohol.

Drug Abuse Screening Test. The Drug Abuse Screening Test (Skinner, 1982) is a 28-item true/false self-report instrument designed to tap various consequences related to drug use disorders. Research has shown the Drug Abuse Screening Test to have strong reliability and validity as an index of substance use disorders (Skinner, 1982).

Short Michigan Alcohol Screening Test. The Short Michigan Alcohol Screening Test (SMAST; Selzer et al., 1975) is a 13-item true/false measure consisting of items related to alcohol use disorders and drinking-related problems. The SMAST has been deemed reliable and valid for measuring alcohol-related problems (Hays et al., 1995; Selzer et al., 1975), with scores of 2 indicating possible problematic use and 3 or higher indicating problematic use (Selzer et al., 1975).

Survey of Alcohol and Drug Use. The Survey of Alcohol and Drug Use (Johnston et al., 2010) is a self-report measure taken from the Monitoring the Future Survey that contains questions regarding the history and frequency of use across a broad range of drugs. Specifically, participants report on the number of occasions they used a variety of substances in their lifetime, during the past 12 months, and during the past 30 days.

Procedure

Participants were told that the purpose of the study was to examine people's responses to pictures associated with common habits and that the study would require them to complete two tasks over one 3-hour session: (a) an image rating task (~60 minutes) and (b) a self-report questionnaire task (~60–120 minutes). Each session could have up to 12 participants, although most sessions involved fewer than four participants because of low census, prior participation, or patient decisions not to participate.

Consenting participants were given a pencil and binder that included three sections for the cue-reactivity task, one for each set of 23 images. Instructions for rating the images on the two dimensions of approach and avoidance were provided followed by two practice trials. Each rating began with a 4-second preparatory slide, followed by presentation of a substance cue for 6 seconds and then a 30-second rating period. Based on findings from pilot studies of the present protocol and previous studies using similar procedures, it was expected that participants would generally finish their ratings within 15–20 seconds, leaving a rest period of about 10–15 seconds before the next preparatory slide signaled the conclusion of the current rating period. Participants were given a 5-minute break between each set of pictures. Following the cue-reactivity task, participants completed additional questionnaires.

Data analytic strategy

Before all analyses, variables were examined for outliers and normality and found to be within acceptable ranges. To examine our hypotheses, a latent profile analysis (i.e., mixture modeling) was conducted with mean approach and avoidance inclinations for alcohol cues only as indicators (Mplus 7.11; Muthén & Muthén, 2012). We focused on alcohol approach and avoidance inclinations because alcohol was the most frequently used substance for those admitted to the detoxification treatment program, with approximately 89.6% indicating multiple problems associated with alcohol use (i.e., SMAST ≥ 2). Latent profile analysis is a person-centered approach that seeks to identify homogeneous

TABLE 2. Summary of means, standard deviations, and correlations (number of observations)

Variable	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.
1. Voluntary (<i>n</i> = 147)	0.659	0.475	—	.123	.079	-.011	-.005	.187*
2. Frequency (<i>n</i> = 158)	6.728	7.086		—	.550**	.470**	.388**	-.039
3. Quantity (<i>n</i> = 153)	7.255	4.109			—	.599**	.375**	.006
4. SMAST (<i>n</i> = 170)	7.747	4.191				—	.439**	.026
5. Approach (<i>n</i> = 172)	3.130	2.508					—	-.353**
6. Avoidance (<i>n</i> = 172)	5.383	2.421						—

Notes: Voluntary = voluntary admittance (0 = no, 1 = yes); frequency = number of drinking occasions per week; quantity = number of drinks per occasion; SMAST = Short Michigan Alcoholism Screening Test; approach = approach inclinations; avoidance = avoidance inclinations.

* $p < .05$; ** $p < .01$.

TABLE 3. Latent profile analysis: Summary of fit indices

Variable	AIC	BIC	aBIC	Entropy	LMR LRT
1 Class	1,602.77	1,615.36	1,602.70	—	—
2 Class	1,523.57	1,545.60	1,523.43	.88	<.001
3 Class	1,492.59	1,524.06	1,492.40	.89	.002
4 Class	1,484.14	1,525.05	1,483.89	.86	.082
5 Class	1,440.96	1,491.32	1,440.65	.91	.004
6 Class	1,434.23	1,494.03	1,433.87	.90	.197
7 Class	1,425.63	1,494.88	1,425.22	.90	.489

Notes: AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = sample size-adjusted Bayesian Information Criterion; LMR LRT = Lo-Mendell-Rubin Likelihood Ratio Test p value for (K-1) classes. A significant p value indicates that the K-1 class model should be rejected in favor of a model with at least K classes. **Bold** indicates best fitting model.

groups of individuals (i.e., latent classes) based on similar patterns of responding. Identification of the appropriate number of classes is driven by both theoretical and statistical considerations (i.e., fit indices). To minimize problems associated with local maxima, 1,000 random sets of starting values, 50 iterations, and 100 final stage optimizations were specified (Muthén & Muthén, 2012). Following the identification of the best-fitting model, to ensure that the final model did not reflect a local maximum, the analysis was replicated, increasing the number of random starts to 5,000, number of iterations to 100, and final stage optimizations to 500. Finally, a three-step approach was used to analyze auxiliary variables to minimize the potential for bias estimates due to class uncertainty (Asparouhov & Muthén, 2013). Means, standard deviations, and correlations among the variables of interest are presented in Table 2.

Results

Latent profile analysis: Model fit

Results from the latent profile analysis indicated that a five-class solution best fit the data (see Table 3 for summary of fit indices). Specifically, the lowest Bayesian Information Criterion was obtained for the five-class solution with minimal changes occurring for the Akaike Information Criterion and sample size-adjusted Bayesian Information Criterion beyond the five-class solution. Further, entropy was highest for the five-class solution, and the Lo-Mendell-Rubin Likelihood Ratio Test indicated that the five-class solution was

a better fit to the data when compared with the four-class solution ($p = .004$).

Inspection of the five-class solution revealed (see Table 4 and Figure 2 for summary of estimated means), as expected, an approach group (Class 1, $n = 18$), an indifferent group (Class 2, $n = 16$), and an avoidance group (Class 3, $n = 74$). In slight contrast to our prediction, two ambivalent groups were identified, the first of which represented moderate ambivalence (Class 4, $n = 39$) and another exhibiting high ambivalence (Class 5, $n = 25$). To further explore the fit of the five-class solution, conditional probabilities for each class were examined. The average conditional probability for the approach group was .960 (Class 4 second highest at .036), the indifferent group was .939 (Class 1 second highest at .033), the avoidance group was .964 (Class 5 second highest at .024), the moderate ambivalence group was .920 (Class 1 second highest at .041), and the high ambivalence group was .912 (Class 3 second highest at .057), suggesting that the five-class model provided an excellent fit to the data.

Latent profile analysis: Auxiliary variable analysis

To examine the specificity of the alcohol approach and avoidance classes, we conducted an auxiliary variable analysis examining class differences in approach and avoidance inclinations related to control cues. Consistent with theory, no significant differences—overall equality test of means, $\chi^2(4) = 3.74$, $p = .442$ —were noted on approach inclinations for control cues between the approach ($M = 4.79$, $SE = 0.47$), indifference ($M = 4.08$, $SE = 0.44$), avoidance ($M = 4.84$, $SE = 0.24$), moderate ambivalence ($M = 4.87$, $SE = 0.26$), and high ambivalence alcohol classes ($M = 5.32$, $SE = 0.34$). With regard to avoidance inclinations toward control cues, means were generally low across all five classes: approach ($M = 2.42$, $SE = 0.37$), indifference ($M = 2.79$, $SE = 0.49$), avoidance ($M = 2.27$, $SE = 0.21$), moderate ambivalence ($M = 3.25$, $SE = 0.28$), and high ambivalence ($M = 2.19$, $SE = 0.43$). The overall equality test of means was approaching significance, $\chi^2(4) = 9.28$, $p = .054$, and follow-up pairwise comparisons revealed differences between the avoidance and moderate ambivalence ($p = .006$), as well as the moderate ambivalence and high ambivalence classes ($p = .041$). However, such effects were in the opposite direction when compared with alcohol avoidance inclinations. Exploratory

TABLE 4. Latent profile analysis: Estimated approach and avoidance means

Variable	Approach			Avoidance		
	M	SE	[95% CI]	M	SE	[95% CI]
Class 1 ($n = 18$) Approach	6.40	0.33	[5.75, 7.06]	1.60	0.29	[1.01, 2.13]
Class 2 ($n = 16$) Indifference	1.39	0.39	[0.63, 2.15]	1.59	0.29	[1.02, 2.16]
Class 3 ($n = 74$) Avoidance	0.99	0.17	[0.66, 1.32]	7.16	0.09	[6.98, 7.33]
Class 4 ($n = 39$) Moderate ambivalence	4.67	0.25	[4.18, 5.16]	4.25	0.28	[3.71, 4.79]
Class 5 ($n = 25$) High ambivalence	5.55	0.43	[4.71, 6.40]	7.37	0.17	[7.04, 7.70]

Notes: Approach and avoidance are rated on a 9-point scale from 0 (*not at all*) to 8 (*very much*). CI = confidence interval.

FIGURE 2. Class alcohol approach and avoidance estimated mean ratings (0 = not at all to 8 = very much)

analyses revealed no significant associations between age, gender, or race and class membership.

Next, we examined the relationship between the five classes and voluntary admittance, average number of drinking occasions per week, average number of drinks per occasion, and problems associated with alcohol use. Using a three-step approach, class membership was regressed onto each of the four predictors. Therefore, results from these analyses are interpreted as a multinomial regression.

With regard to voluntary admittance, those who checked themselves in voluntarily were more likely to be in the avoidance group (estimate = 1.459, $p = .024$; OR = 4.302), moderate ambivalence group (estimate = 1.700, $p = .028$; OR = 5.474), or high ambivalence group (estimate = 2.090, $p = .010$; OR = 8.085) when compared with the approach group. No differences were found for voluntary admittance when classes were compared with the indifference group or between the moderate ambivalence and high ambivalence groups.

Next, we examined the relationship between frequency of drinking (average occasions per week) and class membership. Results indicated that fewer drinking occasions were associated with a greater probability of being in the avoidance group (estimate = -0.113, $p = .004$) and moderate ambivalence group (estimate = -0.083, $p = .033$) when compared with the approach group. In addition, greater drinking frequency was associated with being in the high ambivalence group when compared with the avoidance group (estimate = 0.120, $p = .003$) and moderate ambivalence group (estimate = 0.089, $p = .015$).

Regarding quantity of drinking, results indicated that fewer number of drinks consumed per occasion was associated with membership in the indifference group (estimate = -0.248, $p = .023$) and avoidance group (estimate = -0.192, $p = .029$) when compared with the approach group. Greater number of drinks per occasion was associated with membership in the high ambivalence group when compared with those in the indifference group (estimate = 0.312, $p = .001$), avoidance group (estimate = 0.255, $p = .001$), and moderate ambivalence group (estimate = 0.210, $p = .010$).

We also examined the relationship between problems associated with use (SMAST) and class membership. Results indicated that greater problems were associated with membership in the high ambivalence group when compared with the indifference group (estimate = 0.428, $p < .001$), avoidance group (estimate = 0.361, $p < .001$), and moderate ambivalence group (estimate = 0.234, $p = .023$). Greater problems were also associated with membership in the approach group when compared with the indifference group (estimate = 0.245, $p = .015$) and avoidance group (estimate = 0.178, $p = .033$). Finally, greater problems were associated with membership in the moderate ambivalence group when compared with the indifference group (estimate = 0.193, $p = .014$) and avoidance group (estimate = 0.127, $p = .021$).

Discussion

Using a latent profile analysis, results indicated five distinct motivational profiles within a clinical sample receiving inpatient substance use disorder treatment. Consistent with

the AMC, motivational profiles reflecting indifference, approach, avoidance, and ambivalence were identified. However, ambivalence was further split into two classes differentiated by craving intensity, one characterized by high scores on approach and avoidance and the other by moderate scores on both. The hypothetical classes were also associated with clinically relevant variables in predictable ways, providing additional support for the AMC. For example, those who voluntarily checked themselves into the inpatient detoxification facility were more likely to fall within one of three motivational profiles characterized by higher avoidance (i.e., high avoidance, moderate ambivalence, high ambivalence) when compared with the approach-only group. This suggests that avoidance inclinations may be a key component when seeking help for problematic use. Indeed, previous research supports such a notion such that avoidance inclinations are uniquely related to taking steps to make a change and treatment retention (Klein et al., 2007; Schlauch et al., 2012, 2013b).

In addition, theoretically important differences also emerged on variables related to drinking behaviors and problems associated with use. As expected, the indifference group was associated with fewer drinking behaviors and problems associated with use when compared with those high on approach or ambivalent. Further, significant differences were also noted between the high approach classes (e.g., high approach, high ambivalence) and lower approach classes (e.g., high avoidance, indifference), such that classes with greater approach inclinations were associated with greater drinking behaviors, particularly in comparison with those high on avoidance only. In addition, those with moderate ambivalence demonstrated lower levels of drinking when compared with those high in approach only, suggesting that avoidance may moderate the effect of approach on drinking behaviors (Schlauch et al., 2013b), particularly among those with moderate levels of approach.

Of particular interest, and in contrast to our initial prediction, was the division of ambivalence into two distinct classes. The high ambivalence class engaged in more drinking and reported greater problems associated with use when compared to those with moderate approach and avoidance inclinations, but both were differentiated from the approach group on the decision to seek treatment (i.e., voluntary admittance). Previous literature from participants attending longer-term outpatient treatment would predict that high ambivalence would be associated with lower drinking when compared with those high on approach only (Schlauch et al., 2013b). However, it is possible that those in the high ambivalence class were in the very early stages of change and only recently transitioned from approach to ambivalence; therefore, their drinking behaviors before admittance to the detox unit were similar to those high on approach only. Such findings are also theoretically consistent with individuals in the contemplation stage of change, who are often character-

ized as highly ambivalent (Connors et al., 2013; Engle & Arkowitz, 2006), as well as findings examining changes in approach and avoidance inclinations during longer treatment periods (Schlauch et al., 2012, 2013b). It will be important for future research to examine the ways in which those receiving treatment transition from one class to another during the course of recovery. Nevertheless, results continue to provide support for the AMC and suggest that distinct motivational profiles exist among those receiving treatment.

Findings from the current study have several methodological and clinical implications. Results support the notion that cue-elicited craving is more than just approach inclinations, and that for some, craving represents the co-activation of competing motivational systems. This is important, as the joint consideration of a separate co-occurring avoidance dimension in the study of craving may provide incremental predictive validity in the prediction of alcohol-related variables. Indeed, several studies have now demonstrated that after controlling for approach inclinations, avoidance inclinations predict unique variance in alcohol and cigarette use (e.g., Curtin et al., 2005; Schlauch et al., 2012, 2013b; Stritzke et al., 2004). In addition, results support craving as a process that can be mapped as an "evaluative point" within the two primary dimensions of approach and avoidance inclinations during the course of recovery from alcohol use disorders (Stritzke et al., 2007). Specifically, results demonstrated that craving profiles were a function of variations in drinking patterns and decisions to enter treatment. Greater understanding of the co-activation of avoidance inclinations during craving experiences may provide an explanation for why some people are able to successfully restrain drinking behaviors despite strong desires to use. Furthermore, fluctuations in avoidance inclinations may be more important in the prediction of drinking during treatment than changes in approach (e.g., Stritzke et al., 2007), thereby elucidating a potentially important mechanism in drinking change.

Although this study offered further validation for an ambivalence conceptualization of craving and provided some insights that may advance the field's understanding of craving experiences among those with severe substance use disorders, it was not without limitations. First, despite theory and clear hypothesis, latent profile analysis is a data-driven approach. Thus, sample size becomes an important consideration such that few participants in a class may indicate an overextraction of the latent classes. However, in addition to class size as one of many statistical considerations, decisions on class extraction are based on the research question, theoretical justification, and interpretability given the research context. Although most were detoxing from alcohol, alcohol use was not the primary reason for detoxification among a small minority of participants. The smaller number of participants in the indifference class (9.3% of the sample) can be interpreted in this context, such that approximately 11% ($n = 19$) indicated minimal problems with alcohol,

which is consistent with the final n for the indifferent group ($n = 16$). Further, some recommendations state that classes should not contain less than 1% of the total number of participants to be interpretable (Jung & Wickrama, 2008), and it may be expected that some classes may contain approximately 10% of participants. Nevertheless, it will be important for future research to replicate the five-class solution found in the current data in larger sample sizes. In addition, future prospective research is needed to examine the ways in which people change during the course of recovery, including transitioning from one class to another (e.g., latent transition analyses).

The use of an inpatient sample provided an opportunity for greater generalization to clinical substance use disorder populations; however, this particular inpatient sample had some features that might limit the generalizability to other substance-dependent samples. First, participants were recruited from an acute detoxification facility where stays were short, and many may not have been fully detoxified at the time of participation. The effects of their withdrawal status on responses to the research protocol are unknown and may differ from those in later stages of treatment or recovery. For example, acute withdrawal and the use of medications to control such withdrawal symptoms may affect general arousal ratings and subsequent craving responses. However, such concerns may be mitigated by several factors. There is literature suggesting that those in withdrawal and receiving detoxification medication (i.e., chlorthalidone) do not differ on cue-elicited approach craving compared with those not requiring detoxification (Monti et al., 1993). In fact, findings from Monti and colleagues suggest that the greatest reactivity to cues occurs early in treatment and that such effects are not moderated by withdrawal status. Thus, one could argue that early on in the detoxification process (i.e., 2.2 days on average), reactivity ratings would be enhanced rather than attenuated. Furthermore, exploratory analysis revealed that class membership was not related to the number of days in the unit at the time of participation.

Second, many patients in our sample were polysubstance users, and we were not in a position to evaluate all of their other dependencies or how they might interact with alcohol use disorders and subsequent craving responses. Further, it is likely that participants were representative of other substance-misusing populations with comorbid psychiatric disorders, including mood, anxiety, and personality disorders. Unfortunately, we were not in a position to collect information on clinical diagnoses, and thus the effect of comorbidity could not be evaluated. Future research would benefit from understanding the factors that may moderate profiles associated with approach and avoidance inclinations.

These limitations notwithstanding, results from the current study provided support for the Ambivalence Model of Craving, as distinct latent classes were found whose estimated means on approach and avoidance generally corre-

sponded to what is predicted by the AMC. Furthermore, the approach class was associated with heavier drinking, more negative consequences because of alcohol, and a higher likelihood of involuntary admittance to the detox unit, whereas the avoidance class was the opposite. Although craving is usually conceptualized as an approach dimension only, findings from the current study demonstrated the simultaneous presence of both approach and avoidance dimensions for some participants. The ambivalence classes may obscure the craving–drinking relationship when the avoidance dimension is not considered in the assessment of craving.

The joint consideration of both approach and avoidance inclinations may help us better understand the role of craving in treatment and its association with alcohol consumption, as well as explaining mixed findings in the literature regarding the craving–drinking relationship. Individual differences in avoidance inclinations may help explain why, among participants highly endorsing the approach dimension of craving, some participants relapse and others do not (Stritzke et al., 2007). The precise measurement of craving is important given the addition of craving to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (American Psychiatric Association, 2013), criteria for substance use disorders. Existence of the hypothesized motivational profiles suggests that the AMC may be useful in treatment planning, because it provides a framework for which clinicians can monitor craving experiences and how they might affect future lapses and relapses (Schlauch et al., 2013b). Future research applying the use of these motivational profiles and how individuals transition from one profile to another provides exciting avenues to pursue for those interested in craving and treatment outcomes.

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