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Acceptance Versus Distraction As Coping Strategies for Acute Pain and Pain-induced Alcohol Urge and Approach Inclinations

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Abstract

Excessive alcohol use is a leading cause of preventable death and disproportionately affects people with pain. Experimental research has identified pain as a determinant of alcohol use proxies that has its influence via negative affect (i.e. mediation effect). Although experimental research has shown that acceptance coping reduces pain-related negative affect, such effects have not been examined within the context of the pain and alcohol relationship. The purpose of this study was to test acceptance coping (vs. distraction) as a moderator of the previously established mediation model. Based on a randomized 2x2 between-subjects repeated-measures experimental design, pain-free hazardous drinkers ($N = 135$) were randomly assigned to receive acceptance or distraction coping training. They were asked to use the strategy while receiving a painful or non-painful acute stimulus. It was hypothesized that the effects of pain condition on negative affect would be weaker among those who received acceptance training, which would, in turn, result in lower ratings on alcohol use proxy measures vs. those receiving distraction. The indirect effects of coping condition were non-significant and there were no pain condition X coping condition effects on negative affect. Given this, the moderator was removed, and a simple mediation model was tested. Results showed significant indirect effects for alcohol urge through negative affect. Pain condition predicted increases in negative affect, but negative affect did not effect alcohol use proxies. Results suggest that there are no differences between acceptance and distraction coping in ameliorating the effects of acute pain on negative affect and alcohol use proxies. The previous mediation model was partially replicated. Findings provide information that may accelerate the design of interventions to curtail drinking for pain-coping by better understanding the utility of acceptance training and the pain and alcohol relation.

Keywords: physical pain, alcohol, experimental, acceptance training

Acceptance Versus Distraction as Coping Strategies for Acute Pain and Pain-Induced

Alcohol Urge and Approach Inclinations

by

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Table of Contents

Acceptance Versus Distraction as Coping Strategies for Acute Pain and Pain-Induced

Alcohol Urge and Approach Inclinations

Excessive alcohol use is a significant problem (Centers for Disease Control and

Prevention, 2013) that disproportionately affects people with pain conditions. Individuals with

persistent pain (i.e., a moderate or higher level of pain reported at each available interview over

24 months) showed 2.2 times greater odds of reporting heavy alcohol use than their pain-free

counterparts (Larson et al., 2007). Similarly, individuals with chronic pain (self-reported) were

more likely to meet diagnostic criteria for alcohol use disorder (AUD) than those who did not

endorse chronic pain (Von Korff et al., 2005). Such disparate rates raise concerns and must be

addressed because co-occurring pain and AUD (vs. AUD alone) impedes treatment for both

AUD and pain. AUD treatment outcomes for these individuals are characterized by fewer days in

AUD treatment, a lower likelihood of abstinence, and higher craving levels (Caldeiro et al.,

2008; Witkiewitz et al., 2015). Pharmacological pain treatments typically involve medications

for which alcohol use is contraindicated, and if used together can have harmful health

consequences (National Institute on Alcohol Abuse and Alcoholism, 2013). Furthermore, given

the propensity for misuse, pharmacological pain management options may be limited for persons

with a substance use history (Center for Substance Abuse Treatment, 2012).

Definition of Pain

Pain is a complex and subjective physical and emotional experience. The International

Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional

experience associated with, or resembling that associated with, actual or potential tissue damage"

(Raja et al., 2020). Pain is typically characterized as chronic (lasting longer than 3 months) or

acute (lasting up to 3 months).

Theoretical and Empirical Evidence that Pain is a Determinant of Alcohol Use

The negative reinforcement models of alcohol use and recent conceptualizations of pain and alcohol use posit that when persons experience pain, they are motivated to drink alcohol to alleviate the pain and pain-related negative affect (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Ferguson et al., 2020; Khantzian, 1985; Zale, Maisto, & Ditre, 2015). Consistent with theory, a comprehensive meta-analysis showed that acute alcohol use has analgesic effects (Thompson, Oram, Correll, Tsermentseli, & Stubbs, 2017), and indeed, individuals have reported using alcohol to self-medicate pain (Riley & King, 2009). Pain and alcohol use associations have been observed in cross-sectional and prospective studies (Jakubczyk, Brower, et al., 2016; Jakubczyk, Ilgen, et al., 2016; Sherrell, Trost, & Marmorstein, 2018), and more recently been expanded upon in experimental research.

Studying pain in the laboratory. Experimental pain studies can be conducted using models that simulate clinical pain in a laboratory (Arendt-Nielsen, 2007). A clinically significant level of pain has been defined as a pain intensity rating of greater than four out of 10 (Carr et al., 2013; Wang, Ho, et al., 2016). Experimental pain paradigms have been applied with both clinical populations and healthy persons (e.g., Ditre & Brandon, 2008; Göbel et al., 1994). A major benefit of examining pain phenomena among healthy persons is the lack of confounding factors associated with pain conditions (e.g., pain-related disability). Various pain paradigms have been used (e.g., evoked thermal pain and the cold pressor test; Olesen, Andresen, Staahl, & Drewes, 2012). However, most models evoke pain that is short-lasting (i.e., several seconds to five minutes) and often aim to reach one's pain tolerance. Evidence suggests that a moderate, or suprathreshold, level of pain provides a closer approximation of clinical pain compared to other levels of pain (e.g., threshold or tolerance) as measured by the association between pain ratings

and clinical pain response (Valencia, Fillingim, & George, 2011). As such, Moskal and colleagues (2018) recently developed a longer-lasting pain paradigm that produces moderate levels of pain in an attempt to better simulate clinical pain. This pain model involves the administration of a combination of capsaicin (8%) and an individualized level of moderate heat pain (pain intensity of 8/10) to cause a painful burning sensation that can last 15 minutes and is intended to approximate key features of clinical pain.

Experimental evidence of causal effects of pain on proxies of alcohol use. Applying this novel pain model, Moskal et al. (2018) conducted an experimental study to examine the causal effects of pain on proxies of alcohol use. Consistent with previous non-experimental research, the results of their study provided causal evidence that acute experimentally induced pain represents a potent determinant of urge and intention to use alcohol for healthy undergraduate student drinkers. Pain-induced negative affect mediated the relation between experimental pain condition and alcohol urge and intention to drink. Results suggest that, in agreement with theory (Baker et al., 2004; Khantzian, 1985; Zale et al., 2015), pain increases negative affect, which in turn increases alcohol urge and intention to drink. Thus, alcohol consumption among individuals experiencing pain may represent an attempt to alleviate physical and emotional aversive states associated with physical pain. Similar results were found in another study that examined alcohol demand after randomizing participants to receive delayed onset muscle soreness or a sham condition (Stennett et al., 2021).

Psychologically Based Coping Strategies for Pain

Although experimental research has clarified the pain-alcohol relation, less is known about how to intervene to prevent alcohol consumption using psychologically based strategies. As previously noted, the experience of pain is partly a subjective emotional experience and is not

limited to actual tissue damage. In fact, research has suggested that how individuals cope with pain is a strong determinant of their pain experience and functioning (Kohl, Rief, & Glombiewski, 2012; Thong, Tan, Lee, & Jensen, 2016; Turner, Jensen, & Romano, 2000). Given the costs and risks associated with medical (e.g., surgery) and pharmacological pain interventions (Gaskin & Richard, 2012), research and clinical interventions have expanded pain interventions to include psychologically based pain-coping strategies. Evidence suggests pain acceptance training may be a promising theoretically based intervention for pain-related drinking (Ilgen et al., 2016).

Acceptance-Based Pain Coping Strategies

Definition of acceptance. Hayes and colleagues define acceptance as "taking a stance of non-judgmental awareness and actively embracing the experience of thoughts, feelings, and bodily sensations as they occur" (S.C. Hayes et al., 2004, p.7). They further describe acceptance as involving an active and aware embrace of internal experiences without unnecessary attempts to change their frequency or form (Hayes et al., 2006). In essence, a state of acceptance is the opposite of experiential avoidance (S. C. Hayes, 2004). Some common pain acceptance approaches include encouraging individuals to let go of a struggle with pain and to notice their thoughts and feelings without allowing those internal events to control their actions (McCracken, 1998). Of note, acceptance is closely linked to the concept of mindfulness, which has been variably defined throughout the literature (Baer, 2011). A complete discussion of the differentiation between acceptance and mindfulness is outside the scope of this paper, but often the construct of acceptance is subsumed within the conceptualization of mindfulness (Baer et al., 2006). This paper will focus on acceptance as previously defined.

Theorized mechanisms of acceptance for pain. Acceptance is primarily theorized to aid pain coping by increasing psychological flexibility (Wicksell, Olsson, & Hayes, 2011), defined as the ability to be fully present in the moment and persist or adapt behavior, dependent on what the situation affords, toward valued goals (Ruiz, 2010). That is, someone can disconnect one's actions or behaviors from their thoughts and emotions. They might have the thought "I can't stand this" without behaviorally disengaging, particularly from activities that align with one's values (Hayes & Duckworth, 2006). Therefore, increases in psychological flexibility may result in the ability to pursue adaptive behavior (not using alcohol to cope) even while in an aversive state (pain-related negative affect).

However, acceptance training may also enhance one's state-level of acceptance, thereby reducing pain and pain-related negative affect. Using acceptance and viewing pain as a non-judgmental observer may work to ease the experience of pain by reducing the *additional* pain, distress, and unpleasantness that result from negative pain-related cognition (e.g., ruminating, pain catastrophizing, and negative self-talk; Kerns et al., 2011). Indeed, the pain-fear avoidance model suggests that pain is exacerbated by a fearful appraisal of the pain and subsequent avoidance attempts (Asmundson, Norton, & Vlaeyen, 2004; Norton & Asmundson 2003; Vlaeyen & Linton, 2000). Similarly, the theory of ironic processes (Wegner, 1992, 1994) postulates that efforts to avoid or suppress specific thoughts have the paradoxical effect of increasing the presence of such thoughts. Related to pain, efforts to cognitively suppress pain are theorized to enhance the emotional and sensory pain experience (Cioffi & Holloway, 1993). Bearing in mind that pain avoidance increases pain intensity and negative affect (Hayes et al., 2006; Kohl, Rief, & Glombiewski, 2012) and that acceptance is the antithesis of avoidance,

acceptance-based approaches should therefore ameliorate the aversive experience of pain (pain intensity and pain-related negative affect).

Empirical evidence of acceptance for pain coping. Acceptance-based coping strategies have been examined empirically as methods for alleviating pain and pain-related negative affect, both in clinical and healthy populations and in experimental and non-experimental studies.

Experimental evidence. Acceptance strategies have been shown to reduce pain intensity and unpleasantness evoked by acute experimental pain manipulations (e.g., Braams, Blechert, Boden, & Gross, 2012; Haspert et al., 2020; Keogh et al., 2005; Masedo & Esteve, 2007). These effects have been shown even after only brief acceptance coping training. For instance, Haspert and colleagues (2020) compared brief written acceptance-based coping instructions to no-coping control instructions in their ability to moderate both subjective and physiological pain responses resulting from heat pain stimulation trials. Pain-free German adults were recruited for the study and reported their pain intensity and unpleasantness, and their heart rate and skin conductance were recorded. Across all outcomes except skin conductance, acceptance showed reduced pain responses.

Moreover, although findings are mixed, likely due to varying study methods (e.g., pain induction stimulus, pain measurements, and approach to acceptance manipulation; Kohl, Rief, & Glombiewski, 2012), studies suggest that acceptance may even outperform other common pain-coping strategies such as suppression (Jackson et al., 2012), distraction (e.g., with imagery; Gutiérrez, Luciano, Rodríguez, & Fink, 2004; Keogh et al., 2005) and cognitive restructuring (Kohl et al., 2013). In an experimental study of healthy Chinese university students, Jackson and colleagues (2012) compared the effectiveness of three interventions for managing pain evoked by a cold pressor test. Participants viewed a self-guided PowerPoint presentation (~20 minutes)

of either acceptance training, an equivalent distraction training, or pain education and were asked to use this information during a cold pressor test. Results of this study showed that acceptance training was more effective than cognitive distraction in coping with experimental pain, as evidenced by increased pain tolerance (Jackson et al., 2012).

Clinical evidence. The empirical evidence reviewed thus far has focused on coping strategies occurring outside of the context of formal treatment, but acceptance is often embedded in or even central to evidence-based pain treatment. For instance, acceptance is a central component of several pain treatment approaches, including acceptance and commitment therapy (ACT) and mindfulness-based stress reduction (MBSR). The American Psychological Association's Division 12 Task Force on Psychological Interventions currently lists ACT as a treatment with "strong research support" in treating chronic pain. A recent meta-analysis of acceptance- and mindfulness-based interventions for chronic pain concluded that such treatments performed as well as cognitive-behavioral therapy (CBT) approaches (Veehof, Trompetter, Bohlmeijer, & Schreurs, 2016).

Acceptance Coping for Pain-Related Alcohol Use

Given that acceptance-based pain-coping strategies have been found to make the experience of pain less aversive (e.g., reduce pain-related negative affect and pain intensity), they may therefore be candidates for reducing the effects of pain on alcohol use. Despite the apparent clinical utility of applying acceptance strategies for pain-related alcohol use, little is known about whether acceptance training influences pain's effect on alcohol use or related factors. The clinical research on co-occurring pain and substance use generally focuses on the recruitment of individuals who misuse opioids or who are seeking general substance use treatment, rather than recruiting based on alcohol consumption-related criteria. Additionally,

treatment studies have included acceptance-based interventions combined with other approaches (e.g., CBT), so the specific effect of acceptance on alcohol use and related outcomes is unknown.

Acceptance- and mindfulness-based treatment studies have shown favorable intervention effects on pain severity, alcohol use, and substance use (Garland et al., 2019; Ilgen et al., 2011; Ilgen et al., 2016; Ilgen et al., 2020; Vowles et al., 2020). In a randomized-controlled trial of adults with opioid-treated pain, an 8-week group intervention for mindfulness-based treatment was compared to a support group and showed reductions in pain and opioid misuse (Garland et al., 2019). Intervention effects from this trial also extended to ecological momentary assessments of craving, pain, and affect (Garland, Hanley, Kline, & Cooperman, 2019). In another treatment trial for pain and opioid use among individuals with hazardous opioid use, Vowels and colleagues (2020) examined effects of usual care plus an integrated group treatment, ACT for chronic pain combined with Mindfulness-Based Relapse Prevention (MBRP) for substance misuse, compared to a control group who received only treatment as usual. Similar to Garland and colleagues (2019), participants in the integrated treatment reported less opioid misuse, pain interference, and pain behavior (verbal and non-verbal behaviors indicating presence of pain). Additionally, a 12-week combined CBT and acceptance manualized intervention (Improving Pain During Addiction Treatment [ImPAT]) compared to an attention-matched supportive psychoeducational control condition was tested in 129 veterans with chronic pain who were receiving SUD treatment (Ilgen et al., 2016). Results showed that ImPAT reduced pain intensity and alcohol use frequency (Ilgen et al., 2016). Although limited, the current literature gives credence to the relevance of acceptance-based coping for reducing pain-related alcohol use.

Summary and Purpose of Study

Experimental research has established that pain is a determinant of proxies of alcohol use, however, less is known about how to intervene. Although acceptance-based approaches are being increasingly recognized as an effective treatment for pain, there remain unanswered questions about whether acceptance reduces the effects of pain on alcohol use and related factors. The purpose of the present study was therefore to extend previous experimental research of pain as a determinant of proxies of alcohol use (Moskal et al., 2018) by examining the influence of acceptance-based pain coping training. In the current study, undergraduate students identified as hazardous drinkers were randomly assigned to use either an acceptance or distraction coping strategy while undergoing either an experimental pain or no-pain (control) protocol.

Similar to other research (e.g., Gutiérrez et al., 2004), an active condition of distraction-pain coping was selected for comparison because research indicates that participants in a no-training control condition spontaneously cope using various strategies (Cioffi & Holloway, 1993). In this context, one of the most common methods used when individuals spontaneously cope is distraction (Barber & Cooper, 1972), and in general, distraction is effective at reducing pain induced experimentally or acute pain (Bascour-Sandoval et al., 2019). Thus, providing uniform distraction-coping instructions can limit potential confounding effects on the coping-training manipulation.

Study aim. This study essentially followed a 2 x 2 completely randomized factorial analysis of variance design, with random assignment to pain (pain or no pain) and coping method (acceptance or distraction) conditions as the independent variables and proxy measures of alcohol use as the dependent variables. Coping condition was examined as a moderator of the

previously established mediation model of pain predicting alcohol use proxies (Moskal et al., 2018).

It was hypothesized that within the context of the previously established mediation model (negative affect mediating the effects of pain condition on proxies of alcohol use), coping condition moderates the effects of pain condition on pain-related negative affect. Specifically, based on research showing that acceptance coping outperforms distraction coping at decreasing experimentally induced negative affect (Masuda et al., 2010; Broderick, 2005), it was hypothesized that the relationship between the experimental pain condition and negative affect is weaker among individuals in the acceptance coping condition (Figure 1, path a), thus weakening the effects of negative affect on alcohol use proxies.

Method

Design and Overview

Experimental design. The current research design is a randomized double-blind between-subjects 2x2 experimental design. Blinding was achieved by having two research assistants participate in each study session. One research assistant was responsible for collecting participant responses. The second research assistant was responsible for administering the experimental manipulations. Participation included two parts: (1) an online prescreening and (2) one in-person experimental session.

Participants. Based on *a priori* power analysis, a total of 132 participants were recruited from Syracuse University through SONA, a cloud-based participant pool management software that allows researchers to recruit participants, administer surveys, and provide participant compensation (Sona Systems, 2021). Class credit was awarded for participation. Inclusion criteria were as follows: age 18 or older; English speaking; undergraduate student

member of the Syracuse University Psychology Research Participation System (SONA participant pool); and hazardous drinker as defined by drinking patterns reported over the previous year, (AUDIT-C; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). Specifically, scores of 5 or higher for women and 7 or higher for men on the AUDIT-C were used to indicate hazardous drinking. These scores were identified as optimal cut-offs in previous studies with samples of students like those recruited in the present study (Campbell & Maisto, 2018; DeMartini & Carey, 2012). Students who were lighter drinkers were excluded from the study to create a more homogeneous sample and to reduce the potential for floor effects of the outcome variables that would be expected with less frequent alcohol use. Exclusion criteria included having any current physical pain or an acute/chronic pain condition, use of cannabis daily (due to the potential hyperalgesic effects associated with regular use; Clark et al., 1981), a chili pepper allergy (contraindicated with capsaicin used in the pain induction paradigm), or current (last week) use of pain medication, including, but not limited to nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, tricyclic antidepressants (amitriptyline), anti-epileptics (gabapentin), and opioids (Chou & Huffman, 2007; Falope & Appel, 2015). To enhance the generalizability of study findings and the ease of participant recruitment, students were not excluded based on their history of other drug use. However, to test for potential effects of drug use patterns on study variables, patterns of drug use were measured at baseline and examined as potential covariates.

Chemicals and Equipment

> **Capsaicin.** The capsaicin pain/heat model is designed to mimic the spontaneous burning pain, hyperalgesia, and allodynia associated with neuropathic and inflammatory clinical pain (Arendt-Nielsen & Andersen, 2005). Capsaicin is a vanilloid receptor agonist derived from

chili peppers. When applied in an epicutaneous solution, capsaicin stimulates transient receptor potential vanilloid (TRPV1) receptors on Aδ and C fiber nociceptors and causes a painful burning sensation like that experienced in clinical pain conditions, such as neuropathy (Lotsch et al., 2015; Frias & Merighi, 2016). Following previous research (Moskal et al., 2018), an 8% capsaicin solution was applied to the non-dominant volar forearm via a 1.5 cm x 1.5 cm gauze pad. This concentration of capsaicin in combination with an individualized level of moderate heat pain (pain intensity of 8/10) has been shown to be successful in producing clinical levels of pain (i.e., > 4/10 pain intensity; (Carr et al., 2013; Wang, Ho, et al., 2016) in previous research (Moskal et al., 2018).

Medoc Q-Sense CPM system. Heat was produced using a 30 x 30 mm Peltier-based computerized thermode connected to the Q-Sense Conditioned Pain Modulation (CPM) unit, an FDA-approved device manufactured by Medoc LTD (Ramat Yishai, Israel). The Medoc Q-Sense unit has software and hardware safeguards that prevent physical damage. Heat is produced using a heating foil and a Peltier element; the perception of heat pain in humans is thought to be mediated by activity in Aδ and C fibers (for reviews, see Reddy, Naidu, Rani, & Rao, 2012; Schepers & Ringkamp, 2009). Using Medoc software, the experimenter initiated a standardized pre-programmed protocol for both pain ratings and the pain induction protocol, causing the thermode temperature to fluctuate between 20°-50°C (heating at 2°C/sec and cooling at 1°C/sec). The computer-controlled thermode administration of the pain model enables a standardized administration across participants.

Experimental Conditions

Pain manipulation. A capsaicin-heat model, consisting of heat administered via the computerized CPM system (Q-Sense-CPM, Medoc Ltd, Ramat Yishai, Israel) and 8% capsaicin

solution was used to evoke individualized moderate pain. The capsaicin solution was applied topically to the inside of each participant's non-dominant volar forearm and covered with a small circular bandage. Then, a thermode was placed over the application area. In a similar sample, our research showed that this pain model successfully produced clinical pain levels (Moskal et al., 2018). In the no-pain control condition water was substituted for capsaicin and a non-painful level of heat (32°C) was administered.

Pain coping manipulation. Participants viewed a 15-minute PowerPoint presentation that provided training on an acceptance or a distraction coping strategy. Each presentation consisted of 27 content slides (see Appendix 1) that (1) introduce the pain coping concept and rationale, (2) provide guidance for applying the strategy, (3) instruct participants to participate in a brief (5 min) practice exercise, and (4) instruct participants to employ the strategy with their eyes closed throughout the pain manipulation. The slides were adapted from previous research examining the use of acceptance and distraction for coping with experimentally induced pain (Jackson et al., 2012). Adaptations included changing all references of the cold pressor test to the capsaicin-heat paradigm, updating formatting and imagery to a more current design, and including a practice exercise at the end of the presentation.

An experiential (practice) component was added to the presentation to increase the external validity of the coping strategy (i.e., rehearsal of the strategy is likely to occur in practice) and to increase the potency of the manipulation (Levin, Hildebrandt, Lillis, & Hayes, 2012). Similar experimental acceptance/distraction exercises typically last 30 seconds to 8 minutes (Branstetter-Rost et al., 2009; Gutiérrez et al., 2004; Kehoe, 2008; Kohl, Rief, & Glombiewski, 2012); a 5-minute duration was selected for this study to enhance the manipulation while limiting participant burden.

Acceptance training. The acceptance presentation was consistent with Acceptance and Commitment Therapy (Hayes et al., 2006) and followed earlier experimental studies that investigated brief acceptance-based pain-coping strategies (Branstetter-Rost, Cushing, & Douleh, 2009; Hayes et al., 1999; Jackson et al., 2012; Keogh et al., 2005). Specifically, participants in the acceptance condition were asked to be non-judgmental observers of their experience by noticing their thoughts and feelings without trying to change them. Participants were informed that awareness and acceptance can reduce the pain and aversive feelings that may result from worry or judgment of pain. Acceptance was described as an alternative to distraction and pain catastrophizing, which were briefly described.

Distraction training. Participants in the distraction condition were asked to distract themselves from thoughts and feelings by vividly imagining a pleasant experience, a distraction strategy commonly used in research and practice (e.g., McMullen et al., 2008; Moore et al., 2015). Participants were informed that distraction can be used to reduce pain and aversive feelings by leaving no attention to allocate to pain. Distraction was described as an alternative to acceptance and pain catastrophizing, which were briefly described.

Steps were taken to increase engagement with the material. First, participants were informed that a brief test would be administered after the presentation to ensure that they understood the instructions. Second, slideshows were audio narrated. The narration of all slides was performed by one person who was not involved in the study to reduce the likelihood of any demand effects. Lastly, the slideshows were set to advance to the next slide only once the audio narration for the present slide was complete. Thus, participants were prevented from fast-forwarding through the presentation, and slideshow duration was consistent across participants.

Procedures

Interested and eligible participants (based on pre-screening in SONA) were invited to attend a single-session laboratory study (Figure 2). All sessions occurred after 12 PM to reduce the potential for time-of-day effects. Pre-session instructions asked participants to refrain from non-prescription pain medications, alcohol, and illicit substances for 24 hours prior to the appointment. Compliance with pre-session instructions was verified by self-report. After completing informed consent procedures, permission was obtained to use a non-recording video monitoring system to ensure that the study ran smoothly. After obtaining permission, the monitoring device was turned on and positioned to face the participant in the experimental room. Research staff maintained the receiver which was periodically monitored for session compliance. At any point that participants were not compliant (e.g., not closing their eyes), researchers discreetly entered the experimental room and reminded participants of the instructions before leaving again. Care was taken to maintain the double-blind throughout the session, such that the blinded researcher did not view the receiver during the experimental manipulations.

Eligibility criteria were confirmed by self-report measures embedded in a Qualtrics survey. Then, baseline descriptive measures were collected using research assistant-administered questionnaires about alcohol and drug use, and research assistant-facilitated pain ratings via the Conditioned Pain Modulation (CPM) system (Q-Sense-CPM, Medoc Ltd, Ramat Yishai, Israel) (e.g., intensity, threshold, tolerance), and computer-administered questionnaires in Qualtrics (e.g., demographics, participant characteristics).

Subsequently, the unblinded researcher randomized participants to the acceptance or distraction pain-coping presentation and provided participants with instructions for navigating the presentation. Participants watched the presentation alone in the experimental room and when

complete summoned the research assistant using a doorbell. Participants then completed a Knowledge Check assessing their understanding of the pain-coping instructions. Participants were required to correctly answer all Knowledge Check questions ensuring their understanding of the instructions before advancing in the study protocol (Campbell-Sills et al., 2006; Jackson et al., 2012). If mastery of the material was not achieved, a summary of the instructions was provided followed by a second check for understanding and further clarification with the unblinded researcher, as needed (Jackson et al., 2012). All participants achieved 100% accuracy by the second Knowledge Check.

Next, participants were randomized to a pain induction condition (pain or no pain) as per the randomization scheme and completed baseline outcome measures (pre-pain manipulation) including state levels of pain intensity, negative affect using the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), alcohol urge (Monti, Rohsenow, & Hutchison, 2000), alcohol use questionnaire (AUQ; Bohn, 1995), and alcohol approach inclination using the Approach and Avoidance of Alcohol Questionnaire (AAAQ; McEvoy, Stritzke, French, Lang, & Ketterman, 2004).

Then, the capsaicin-heat pain manipulation setup and procedures began. The unblinded research assistant placed the solution and thermode on the participant's non-dominant volar forearm and instructed the participant to close their eyes and apply the assigned coping strategy once the research assistant left the room. They were instructed to keep their eyes closed until prompted with a sound from the computer. Beginning five minutes after the start of the pain manipulation (i.e. at peak pain, determined in pilot testing for another study; Moskal et al., 2018) a tone sounded on the computer and post-pain manipulation outcome measures were collected (state pain intensity, negative affect, alcohol urge, and alcohol approach inclination).

Pain induction procedures were terminated after completion of the outcome measures (~10 minutes for most participants), the thermode and solution were removed, and participants washed their forearm. Participants then completed the final set of questionnaires which assessed their level of success applying the pain-coping strategy, hypotheses of the study, and effort exerted during the study. Finally, participants were debriefed, and participation was complete.

Measures

Screening. The AUDIT-C (Bush et al., 1998) is a three-item measure that was used to determine if participants met criteria for hazardous alcohol use. It includes three items on a 5-point scale (0-4) that assess past-year drinking frequency, typical quantity, and frequency of heavy drinking, respectively. In this sample, the AUDIT-C demonstrated poor internal consistency (alpha = 0.53). Closer inspection of the scale shows that the frequency of alcohol consumption item (AUDIT Question 1) was not significantly correlated with the item assessing number of drinks per typical drinking day (AUDIT Question 2; $\rho = .081$, $p = .349$). A three-item medical questionnaire inquired about the presence or absence of current physical pain, known allergies to chili peppers, and current use of prescribed pain medications (including, but not limited to NSAIDs, muscle relaxants, tricyclic antidepressants [amitriptyline], anti-epileptics [gabapentin], and opioids). A one-item self-report question asked participants whether they could speak and read English well. Average frequency of cannabis use was measured using the frequency item from the daily sessions, frequency, age of onset, and quantity of cannabis use inventory (DFAQ-CU; Cuttler, & Spradlin, 2017), which has 13 response options and ranges from "I do not use cannabis" to "more than once daily."

Descriptive measures and potential covariates. A demographic questionnaire was included to collect information on gender, age, race, ethnicity, sexual orientation, income, class

status, and current employment status. These demographic data were used to describe the sample and to identify possible covariates. Consistent with experimental studies examining pain (Lee, Watson, & Frey Law, 2010; Parkerson & Asmundson, 2016), a common, valid measure of pain anxiety, anxiety triggered by the anticipation of pain (Pain Anxiety Symptoms Scale – 20 [PASS-20]; McCracken & Dhingra, 2002), pain catastrophizing, an exaggerated negative stance toward actual or anticipated pain (Pain Catastrophizing Scale [PCS]; Sullivan et al., 1995), and anxiety sensitivity, fear of experiencing sensations or behaviors associated with anxiety (Anxiety Sensitivity Index [ASI]; Deacon, Abramowitz, Woods, Tolin & 2003) were collected. Given that psychological flexibility is a mediator of acceptance-based interventions (Lin et al., 2018) baseline levels of psychological flexibility may influence how well the acceptance manipulation works and thus was measured using the Brief Experiential Avoidance Questionnaire (BEAQ; Gámez, Chmielewski, Kotov, Ruggero, & Watson, 2011). Finally, the baseline assessment measured other factors known to correlate with the dependent variables of alcohol use proxies: patterns of alcohol use (National Institute on Alcohol Abuse and Alcoholism's [NIAAA, 2003] recommended set of three alcohol consumption questions; the full AUDIT [Saunders et al., 1993]), drinking motives, or reasons for consuming alcohol (Drinking Motives Questionnaire-Revised [DMQ-R]; Cooper, 1994), cannabis use frequency (Cuttler & Spradlin, 2017), and pain-related alcohol expectancies (e.g., expectancies for alcohol analgesia; Ditre, 2006; Moskal et al., 2018).

Manipulation checks. Participants reported current pain intensity using an 11-point numeric rating scale (Farrar, Young, LaMoreaux, Werth, & Poole, 2001). To check understanding of the acceptance and distraction presentation instructions, a 4-item, true/false Knowledge Check of the instruction content was administered (Campbell-Sills et al., 2006).

Response options included yes, no, and unsure. If participants marked unsure or the incorrect

answer for any item, the presentation was reviewed until 100% accuracy was achieved. To

control for participants' expectancies about the usefulness of the coping strategy, immediately

following the presentation of the instructions, participants responded to a multiple-choice

question indicating how useful they expect the strategy to be. Response options were on a five-

point scale: 0 = not at all useful, 1 = a little bit useful, 2 = somewhat useful, 3 = very useful, and

5 = extremely useful (Litvin, Kovacs, Hayes, & Brandon, 2012). At the conclusion of the

experiment, participants reported on how well they followed the coping instructions (Success

Check), from 0 (not at all) to 8 (completely able) (Campbell-Sills et al., 2006).

Finally, following previous research that tested the effects of pain-coping manipulations

(Jackson et al., 2012), participants reported on the extent to which they used the following

cognitive coping strategies using an adapted version of the Coping Strategies Questionnaire

(Rosenstiel & Keefe, 1983): Acceptance (6 items), Ignoring Pain Sensations (6 items), Diverting

Attention (6 items), Reinterpreting Pain Sensations (6 items), Coping Self-Statements (5 items),

and Catastrophizing (5 items). Participants responded to each item indicating to what extent they

used each strategy (1 = never did that to 6 = very often did that). The CSQ was developed as a

measure of coping strategies that individuals typically use for chronic pain. As such, adjustments

were made to make the questions relevant to acute experimental pain. For instance, the stems of

questions used past tense language (e.g., "I told myself . . ." instead of "I tell myself. . .") and

some items less relevant to the nature of the experimental paradigm were not measured (e.g., "I

just go on as if nothing happened."). The CSQ includes subscales measuring Ignoring Pain

Sensations (i.e. denying that pain hurts or affects one in any way), Diverting Attention (i.e.

thinking about thinks that serve to distract one away from the pain), Reinterpreting Pain

Sensations (i.e. imagining something, which if real, would be inconsistent with the experience of pain; "I just think of it as some other sensation, such as numbness"), Coping Self-statements (i.e. telling oneself that one can cope with the pain, no matter how bad it gets), and Catastrophizing (i.e. negative self-statements, catastrophizing thoughts and ideation). Chronbach's alpha showed that each scale performed in the good range in terms of internal consistency in this sample (alphas = .83-.88). The CSQ is one of the most comprehensive measures of pain-coping strategies (Jensen & Karoly, 1991), but it does not include an acceptance coping category. Therefore, in addition to the relevant cognitive coping strategies of the CSQ (diverting attention, reinterpreting pain sensations, ignoring pain sensations, coping self-statements, and catastrophizing), an additional category of acceptance was included. The acceptance category comprised six acceptance items derived from Jackson 2012, including: 'During the thermal sensory testing, I tried to become more aware of sensations, thoughts, and feelings I experienced', '. . . tried to notice sensations without becoming too absorbed in them', '. . . tried to watch my experience as an observer would', '. . . paid attention to how my thoughts and sensations changed during the task', '. . . watched my own reactions while trying not to judge them' and '. . . tried to notice how sensations and thoughts would rise and fall away in my mind'. The internal consistency of the acceptance items was good (alpha = 0.89).

Outcome measures.

Negative affect. The state-version of the PANAS (Watson et al., 1988) negative affect scale (e.g., distressed, upset, irritable) was used to measure self-reported negative emotional response in the present moment. The scale consists of 10 items rated on a 5-point scale from very slightly or not at all (1) to extremely (5). A total score is summed from all items on the scale. The

internal consistency of the PANAS, measured at both pre- (α = .71) and post-manipulation (α = .81) was acceptable to good in this sample.

   ***Proxies of alcohol use*.** Three state-based self-report measures of current alcohol urge and approach inclinations, known to be related to and predictive of alcohol use, were used as proxies (Field & Jones, 2017; Flannery, Poole, Gallop, & Volpicelli, 2003; Klein et al., 2007; O'Malley et al., 2002; MacKillop, 2006). Given that these measures are merely proxies of alcohol use and that they are thought to capture slightly different components of alcohol use (e.g., urge to use vs intention to use), multiple measures were administered to capture the intended outcome more fully. Further, to enhance the likelihood of detecting an effect on outcomes, the briefest alcohol proxy measure (single-item urge) was administered first, at 5 minutes after the pain induction began, when pain was estimated to peak based on pilot testing. Participants indicated their alcohol urge from 0 (absolutely no urge) to 10 (very strong urge) on an 11-point Likert scale. Single-item measures such as this have been found to be both reliable and valid in assessing an individual's urge to drink (Rohsenow et al., 1992). Second, the internally consistent, reliable, and well-validated Alcohol Urge Questionnaire (AUQ; Bohn, Krahn, & Staehler, 1995) is an 8-item measure of current urge to drink alcohol (AUQ pre: α = .83, AUQ post = .79). The items are rated on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree). Finally, the Approach and Avoidance of Alcohol Questionnaire, (AAAQ; McEvoy et al., 2004), a 20-item scale that separately assesses inclinations to drink and to not drink alcohol was administered. It consists of three scales: Resolved-Regulated, Inclined-Indulgent (e.g., "I would like to have a drink or two"), Obsessed-Compelled (e.g., "My desire to drink seems overwhelming"). Participants report how strongly they agree with each item on a 9-point Likert scale, from 0 (not at all) to 8 (very strongly). Given that the current study aims to

examine proxies of alcohol use (rather than restraint from alcohol use), the Resolved subscale

was excluded. All scales demonstrated acceptable to good internal consistency, both pre- and

post- manipulation (Inclined pre/post α = .83/.83; Obsessed α = .76/.78)

Hypothesis and Data Quality Questionnaires. To test for potential experimenter

demand effects, open text box response formats were used to assess the participants' opinions on

the purpose and hypotheses of the study. Careless responding, effort, and attention can also

impact the usefulness of the data (Curran & Kotrba, 2012; Huang et al., 2015; Maniaci & Rogge,

2014; Meade & Craig, 2012; Woods, 2006), and it is recommended that inappropriate responses

be removed during data cleaning (e.g., Tabachnick & Fidell, 2007). Three attention check

instructed response items were included at various mid- and endpoints throughout the Qualtrics

questionnaires to identify careless responders (Meade & Craig, 2012). In addition to embedded

items, single-item indicators of effort put forth and attention given toward participation were

assessed (Meade & Craig, 2012). Response options for both items included: almost no (1), very

little (2), some (3), quite a bit (4), a lot of (5). Following the format used in previous research

(Meade & Craig, 2012), each item was preceded by a blurb to encourage honesty and remind

participants they receive credit no matter how they respond. Finally, one yes/no item assessed

whether participants thought that the researchers should use their data in our analyses in the

study (Meade & Craig, 2012).

Data Analysis Plan

All analyses were conducted using Statistical Package for Social Sciences (SPSS,

Version 27, 2020, IBM, NY). The criterion for statistical significance was set at an alpha level of

.05.

Preliminary data analysis. Descriptive statistics and bivariate correlations among

primary study variables were conducted. Tabachnick and Fidell's (2007) data screening and cleaning procedures were followed prior to analyses. Any respondents who failed an attention check item, noted their data should not be used, or scored 2 (very little) or lower on effort or attention items were removed from primary analyses due to concerns about the validity of their data (Meade & Craig, 2012). However, for comparison, primary analyses were also conducted with all eligible participants regardless of performance on the quality assurance items. Participants were also excluded from the primary analysis if they correctly predicted the study hypotheses.

Univariate outliers were identified by calculating a standardized residual and examining stem-and-leaf plots, scatterplots, and boxplots. Values in excess of 3.29 standard deviations ($p <$ .001, two-tailed test; Tabachnick & Fidell, 2001) were considered outliers and each outlying score was replaced with the next highest score within 3.29 standard deviation of the mean for each respective variable. Skewness and kurtosis and histograms were examined for non-normality in the distributions; transformations were conducted as necessary. Analysis of Variance (ANOVA) and Kruskal-Wallis ANOVA tests were used to examine baseline differences in continuous and categorical variables, respectively, between the four groups (pain/acceptance, pain/distraction, no pain/acceptance, no pain/distraction).

Additional group differences were examined as checks for the pain and coping manipulations. Pain intensity reported by the pain and no-pain conditions were compared using linear regression analysis controlling for the baseline levels of pain intensity. Acceptance and distraction coping training groups were compared on their self-reported success in applying the strategy, expected usefulness of the strategy (Kohl et al, 2013), and the extent to which they used a variety of coping strategies as measured by the adapted CSQ. Independent sample *t*-tests were

applied for parametric data and Mann-Whitney tests for non-parametric data). Participants who were unsuccessful in following the instructions (defined as reporting "not at all able" to follow directions on the difficulty check) were excluded from analyses.

Statistical power. A priori power analyses ($\alpha = .05$; power of .80) were estimated by referencing published guidelines (Preacher, Rucker, & Hayes, 2007) to determine the sample size required to power the moderated mediation analyses. Based on similar research, the regression coefficients for the conditional indirect effect of pain on negative affect and Alcohol Use Proxy at levels of acceptance are estimated to be 0.28 - 0.58 (Moskal et al., 2018; Riva, Wirth, & Williams, 2011). Published estimates (Preacher et al., 2007) suggest 100 participants will be powered (at .993) to detect the expected effect sizes for the bias-corrected bootstrap test of the conditional indirect effects. Thus, the sample size design of $N = 135$ was a conservative estimate of the sample required to detect the hypothesized primary aims.

Primary Analyses. The primary study hypothesis (see Figure 1) was tested using IBM SPSS Statistics Version 27 PROCESS moderated-mediation (model 7) with bootstrapping (A. F. Hayes, 2013; Preacher, Rucker, & Hayes, 2007). Bootstrapping draws repeated samples with replacement and obtains indirect effects and confidence intervals from each resampled data set. This statistical approach has advantages over other approaches (e.g., Sobel test), because it allows for robust standard errors, does not impose the assumption of normality, and reduces the inflation of Type 1 error (Preacher, Rucker, & Hayes, 2007). A heteroscedasticity consistent standard error and covariance matrix estimator, HC4 (Hayes & Cai, 2007) was used to adjust for the possibility of unequal variance in the data.

Baseline levels of negative affect and respective alcohol use proxy were entered as covariates in the models. Pain condition constituted the independent variable (coded 0 = no-pain

control condition; 1= pain condition) and alcohol use proxy was the outcome. Negative affect

was tested as a mediator and acceptance training condition (0=acceptance; 1=distraction) was

tested as a moderator of the path between pain condition and negative affect (Figure 1). This path

was chosen because of the hypothesized theoretical differences between the experiences of

negative affect by those in the acceptance condition and those in the distraction condition.

Continuous variables that define products were mean-centered prior to analyses. The statistical

significance of the indirect effects was assessed using 10,000 resamples and bias-corrected

confidence intervals (CIs; A.F. Hayes, 2013, Hayes, 2015).

<center>**Results**</center>

Participants

Of the 162 participants who completed screening in the laboratory, 13 (8.0%) participants

were excluded for not meeting study criteria, due to an AUDIT-C score of less than 5 and 7 for

women and men respectively ($n = 11$, 6.8%), daily use of cannabis ($n = 1$, 0.6%), or current use

of pain medication ($n = 1$, 0.6%). The remaining 149 participants were invited to complete the

full laboratory study. However, 2 participants discontinued due to time constraints, equipment

failure prevented data collection from 1 participant, and an additional 1 withdrew from

participating. Of the remaining 145 participants who completed the entire laboratory session, 10

were removed because participants failed at least one embedded attention check item ($n = 6$),

indicated their data should not be used ($n = 4$), reported exerting low effort during the study ($n = 1$),

1), reported allocating little attention to the study ($n = 1$) and/or stated they were unsuccessful in

following the coping instructions ($n = 1$; note that 3 people met criteria for exclusion based on

two of these categories). The majority of study participants were able to identify that the study

was examining some form of pain response among drinkers, with some correctly identifying a

focus on pain coping. However, no participants accurately surmised that the study was comparing two coping methods according to pain-related emotional response and alcohol use proxies. A total of 135 participants were eligible, completed the full study, were assumed to provide valid and reliable data (according to attention checks, self-reported effort and attention, and indication that their data should be used), and therefore, were included in the primary analyses.

Table 1 displays a summary of descriptive statistics for the final sample, including alphas for relevant measures. The average age of participants was 19.1, and 66 (48.9%) were men. Participants identified as 79.7% White, 4.5% Black, 12.0% Asian, and American Indian/Alaskan Native 1.5%, and 1.5% biracial; 12.6% identified as Hispanic/Latinx. The average AUDIT score was 13.52, and participants reported consuming on average 2.57 drinking days per week and 6.57 standard drinks per drinking day. They reported binge drinking (5+/4+ for males/females within a two-hour period) 1.67 days per week. The final sample included the following allocation to experimental conditions: 33 No Pain, Acceptance; 33 No Pain, Distraction; 35 Pain, Acceptance; 34 Pain, Distraction. As displayed in Table 1, there were no significant differences between groups on any baseline characteristics.

Descriptive statistics regarding primary variables of interest at pre- and post-experimental manipulation are summarized in Table 2. Bivariate correlation coefficients for key study variables are shown in Table 3. Pain tolerance and individualized level of pain (P80) were significantly correlated with gender such that men reported greater levels of both. Expectation for usefulness of the coping strategy was significantly positively correlated with the self-reported success of applying the strategy. One's self-reported success in applying the strategy was negatively correlated with negative affect post-manipulation. That is, those who reported more

success in applying the coping strategy reported less negative affect post-manipulation. Pain

alcohol expectancies was significantly positively correlated with three of the four alcohol-related

outcome variables (AUQ and the Inclined and Obsessed scales of the AAAQ). Pain

catastrophizing was significantly positively correlated with reported anxiety sensitivity,

experiential avoidance/psychological flexibility, negative affect (post-manipulation), and three of

the four alcohol use proxies (1-item urge, AUQ, and AAAQ Obsessed subscale). Additionally,

each of the four alcohol proxy measures was significantly positively correlated with one another

(rs = .573 to .685). Although there were no group differences across demographic variables,

models were tested with and without variables associated with primary outcomes entered as

covariates (i.e., success of applying strategy, pain alcohol expectancies, and pain catastrophizing)

to account for potential confounds. Interpretation of results did not differ with covariates

included, therefore, with the exception of success and expected usefulness which are

theoretically thought to have an impact on coping manipulation, covariates were excluded from

final models. ,.

Manipulation Checks

  Pain Intensity. Examination of the pain intensity ratings showed that the experimental

pain manipulation led to the intended effect. Individuals in the pain condition reported

significantly more pain ($M = 5.09$, $SD = 2.49$) than those in the no-pain condition ($M = 0.24$, SD

$= 0.58$) after controlling for baseline levels of pain intensity ($F(2,132)=118.08$, $p< .001$).

  Coping Strategy. Table 4 displays differences between coping conditions in terms of

expected usefulness, post-training success, and self-reported coping strategies used during the

pain manipulation.

  Expected Usefulness. No participants in any condition reported that the strategy would

be "not at all useful." The majority of participants reported it would be "somewhat" (Acceptance: 30.9%; Distraction: 32.8%) or "very" useful (Acceptance: 44.1%; Distraction: 40.3%). The results of the Mann-Whitney U test showed that there were no significant differences between coping conditions in the perceived usefulness of the assigned coping strategy (U = 2378.00, p = .641).

Success Applying Assigned Coping Strategy. All participants reported some level of success in applying the coping strategies. In the acceptance group, on average participants reported being between "somewhat able" and "mostly able" to apply the strategy (M = 5.72, SD = 1.97; on a scale of 0=not at all able to 8=completely able). In the distraction group participants reported on average being "mostly able" to apply the strategy (M = 6.60, SD = 1.61). There was a significant difference between coping conditions in self-reported success of applying the strategy, with participants in the distraction condition reporting greater success [t (133) = -2.83, p = .005].

Coping Strategies Questionnaire. As shown in Table 4, scores on the CSQ confirmed that the coping manipulation was successful. Participants in the Acceptance group applied acceptance-based strategies more frequently than those in the Distraction condition (M = 24.84, SD = 7.84 vs. M = 16.82, SD = 9.34). Likewise, participants assigned to the Distraction strategy reported using distraction coping strategies (i.e., Ignoring and Diverting subscales) more frequently than the Acceptance conditions (Ignoring: M = 22.90, SD = 6.38 vs. M = 15.46, SD = 6.75; Diverting: M = 24.96, SD = 5.10 vs. M = 10.12, SD = 5.38). There were no significant differences between the Acceptance and Distraction conditions in terms of how frequently participants applied catastrophizing and self-statement coping strategies (i.e., strategies that were not trained in the coping manipulation). Although the reinterpreting subscale of the CSQ was not

explicitly manipulated, it is not surprising that the Acceptance group reported using this strategy more frequently ($M = 15.71$, $SD = 8.71$) than the Distraction condition ($M = 11.73$, $SD = 5.65$), because some of the items overlap slightly with the instruction to be an "observer" of your pain in the acceptance manipulation (e.g., "I imagined the pain is outside of my body).

Primary Study Results: Testing the Proposed Model

Conditional Process Analysis. The analyses of the SPSS PROCESS macro testing the moderated mediation models are shown in Table 5 and Table 6 (Figure 3 depicts results for AUQ). Table 5 includes four sets of two models, one set for each alcohol proxy outcome variable model (1-item alcohol urge, AUQ, AAAQ Inclined, and AAAQ Obsessed). Model 1 represents the effects of pain condition, coping condition, and pain condition x coping condition on negative affect. Model 2 represents the effects of pain condition and negative affect on each respective alcohol proxy outcome. Table 6 shows the direct effects and shows the conditional indirect effect analyses of the effects of pain condition on negative affect at each coping condition. Model 1 and Model 2 analyses controlled for self-reported success in applying the coping strategy, expected usefulness of the strategy, and baseline levels of reported negative affect and the respective alcohol proxy.

As evidenced by a non-significant Pain Condition x Coping Condition interaction term, across all four sets of models, the effect of pain condition on negative affect did not depend on coping condition. That is, participants in the Acceptance and Distraction Coping conditions responded similarly in terms of their negative affect when randomized to the Pain and No Pain conditions, respectively. Given that the interaction term was not significant, main effects were examined. Pain condition was a significant predictor of negative affect across all models, indicating that those in the Pain condition experienced significantly more negative affect than

those in the No Pain condition. Coping condition did not significantly predict negative affect in any model, indicating no difference between Acceptance and Distraction conditions in reported negative affect. Model 2 results indicate that, contrary to hypotheses, neither pain condition nor negative affect significantly predicted any alcohol proxy outcome ($ps > .05$).

Non-significant conditional indirect effects show that, contrary to hypotheses, there was no evidence of moderated-mediation through negative affect for any alcohol use proxy[1]. That is, the conditional indirect effects were similar between groups, across alcohol use proxy outcomes (index of moderated mediation, Acceptance vs. Distraction for 1-item Urge: estimate = -0.163, SE = .178, 95%, CI: −0.625 to 0.025; for AUQ: effect = -0.681, SE= .672, 95%, CI: -2.385 to 0.102; for Inclined: estimate = -0.244, SE = .518, 95%, CI: −1.503 to 0.668; for Obsessed: estimate = -0.206, SE = .210, 95%, CI: −0.734 to 0.045). Results indicated a nonsignificant indirect effect of pain condition on alcohol use proxies through negative affective responses, for both the Acceptance condition and the Distraction condition (*CI*s included zero).

Mediation Analyses. Given the lack of conditional indirect effects, coping condition was dropped as a moderator, and the model was re-run as a mediation model to examine the indirect effects. Mediation was conducted using PROCESS Model 4 and with all of the same parameters of the moderated-mediation models. The mediation model analyses are shown in Table 7 and Table 8 (Figure 4 depicts results for AUQ). Table 7 consists of four sets of two models, one set for each alcohol proxy outcome variable model (1-item alcohol urge, AUQ, AAAQ Inclined, and AAAQ Obsessed). Model 1 represents the effects of pain condition on negative affect. Model 2 represents the effects of pain condition and negative affect on each respective alcohol proxy

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[1] Given that theories on acceptance suggest acceptance may work more directly on behavior than on affect, post-hoc analyses were conducted, substituting a single item from the AAAQ that assesses behavioral intentions to use alcohol for alcohol use proxies in the moderated mediation model. Results of this analysis had similar conclusions.

outcome. Table 8 represents the direct and indirect effects of the mediation analyses. Results

showed that pain condition significantly predicted negative affect across all mediation models,

such that those in the Pain condition reported greater negative affect than those in the No Pain

condition (ps <.05). Negative affect did not significantly predict any alcohol use proxy (ps >.05).

Tests of indirect effects of pain condition on alcohol use proxies via negative affect were

significant using 10,000 bootstrap resamples for the model predicting AUQ (effect = 0.991, 95%,

CI: 0.006 to 2.277). The indirect effect for the 1-item Urge outcome was not significant in the

primary analyses (effect = 0.223, 95%, CI: -0.003 to 0.528), but became significant in post-hoc

analyses that included all eligible participants (e.g., regardless of their reported effort). The

indirect effects for both scales of the AAAQ (Inclined and Obsessed) were not significant (CIs

included zero). Results indicate that the simple mediation hypothesis is partially supported. Of

note, primary analyses were re-run with all eligible participants (n = 149). With one exception

(i.e., 1-item alcohol urge mediation analysis mentioned earlier), the interpretation of results did

not differ from the analyses presented.

Discussion

This experimental study examined the effects of brief pain coping training in acceptance

and distraction regarding their ability to reduce acute pain-related negative affect and resulting

proxies of alcohol use. Previous lines of research have identified negative affect as a mediator of

the pain-alcohol urge relationship (Moskal et al., 2018) and has highlighted acceptance coping as

an effective strategy for reducing pain-related negative affect (e.g., Haspert et al., 2020; Keogh et

al., 2005; Masedo & Esteve, 2007). This study extends the literature on acceptance by examining

the effects of acceptance pain coping within the context of a larger theoretical model of pain and

alcohol use. This avenue of research has the potential for accelerating the design of interventions

to reduce alcohol use for pain-coping by better understanding the pain and alcohol relation and the utility of acceptance training.

Coping Strategy as a Moderator of the Indirect Effects

Contrary to hypotheses, there was not a significant conditional indirect effect of coping condition and pain on alcohol use proxies via negative affect. That is, there were no differences between acceptance coping and distraction coping in terms of ameliorating the effects of Pain condition on negative affect, and the previously established mediation model was not significant for either the Acceptance coping or Distraction coping condition. These null findings may be explained by several factors.

First, distraction has been identified as an effective coping strategy for acute pain (Jameson, Trevena, & Swain, 2011; Kohl, Rief, & Glombiewski, 2012) and is a default coping strategy for many people (Barber & Cooper, 1972). In contrast, acceptance coping strategies may be a novel concept and require additional practice to obtain the same level of pain-alleviating effects (Baer et al., 2012; Desbordes et al., 2015). One study showed that brief acceptance pain coping training was successful in increasing pain tolerance, but only for those who were already familiar with the strategy (Blacker et al., 2012). Taken together, it is possible that the coping training for acceptance was not potent enough to overcome the effects of distraction, a practiced strategy for many people.

Second, the coping training for distraction may have been more enhanced than expected due to increased positive affect. Although not measured in this study, positive affect may have been induced for participants in the distraction condition, because they were instructed to imagine "a vivid or pleasant memory of warmth/heat." In contrast, it is unlikely the acceptance coping training would have had a similar impact on positive affect with instructions to imagine a

conveyor belt or clouds in the sky. Much of the experimental pain coping literature examining distraction manipulations use pleasant imagery. However, future research could further evaluate the impact of the coping manipulation content by creating a more neutral distraction coping training (e.g., distraction by counting or imagining details of a neutral setting or object). Alternatively, research might also consider using an acceptance coping manipulation that uses a similarly pleasant imagery component.

Third, the differences in findings between this study and previously published research showing acceptance is superior to distraction for pain coping may be related to differences in the specific dimensions of pain studied and the nature of the pain paradigm. The present study measured pain intensity and pain-related negative affect resulting from a capsaicin-heat paradigm. In contrast, Gutiérrez et al. (2004), Keogh et al. (2005), and Jackson et al. (2012) who found acceptance superior to distraction examined pain tolerance with either electric shocks or the cold-pressor test. Additionally, a meta-analysis performed by Kohl and colleagues (2012) concluded that acceptance strategies performed better than distraction for increasing pain tolerance, but showed no differences in reported pain intensity or negative affect. It is possible that mechanisms of acceptance and distraction coping differentially influence certain pain outcomes. For instance, distraction is theorized to divert one's attention away from the pain (Johnson, 2005), whereas acceptance is theorized to influence psychological flexibility, or the ability to change or persist toward one's goals (Wicksell, Olsson, & Hayes, 2011). Tolerance maps most closely onto the concept of persisting, so perhaps it is not surprising that acceptance outperforms other coping methods on this dimension of pain. Future research may benefit from further exploring the pain and alcohol relation by comparing various pain outcomes and pain stimuli (e.g., electric shocks, cold pressor test).

Negative Affect as a Mediator of Pain and Alcohol Proxies

As evidenced by significant indirect effects, negative affect mediated the effects of experimental pain on two measures of alcohol urge[2]. These results are partially consistent with negative reinforcement models of alcohol use and previous experimental research that support pain as a determinant of alcohol use, via increases in negative affect (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Ferguson et al., 2020; Khantzian, 1985; Moskal et al., 2018; Zale, Maisto, & Ditre, 2015). Although significant a paths, b paths, and direct effects are not requirements of mediation (Hayes, 2018; Rucker, Preacher, Tormala, & Petty, 2011), it should be noted that the direct effects from pain condition to alcohol urge were not significant. Additionally, caution should be used in interpreting the significant indirect effects as it may be an artifact of a large effect in the a-path compensating for the non-significant b-path.

The differing findings related to the indirect effects of the four alcohol proxy measures have several potential explanations. First, the ordering of outcomes may have affected the results. Peak alcohol urge was hypothesized to occur after 5 minutes of pain induction and at that time, the 1-item alcohol urge was measured, followed by the AUQ and the AAAQ, the latter of which showed non-significant mediation effects. It is possible that any pain-related urge may have diminished to the point of non-significance by the time the AAAQ was completed. It is also possible that the AAAQ Inclined and Obsessed subscales may be measuring a slightly different facet of alcohol urge that is less impacted by pain and pain-related negative affect. Further, there was less variability in the AAAQ Obsessed subscale which may have contributed to non-significant results.

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[2] In analyses with the refined sample of 135 participants who passed all data validation checks, the significance of the 1-item alcohol urge outcome was reduced to non-significant.

The non-significant relationships in the mediation model are not entirely surprising given that all participants were given *some form* of a coping strategy. By providing coping strategy training and giving explicit instruction to use the strategy, it is possible that the strength of the relations (e.g., between pain condition and alcohol use proxies, and between negative affect and alcohol use proxies) was weakened to the point of null results. That is, participants likely experienced less negative affect, and as a result, reported lower ratings on the alcohol use proxies than they would have without being given a coping strategy. Indeed, participants in the original experimental study (Moskal et al., 2018) reported a 12.5% increase in negative affect post-pain induction and only a 6.7% increase (Pain, Acceptance condition) in the current study. Of note, these data are derived from two different experimental contexts, therefore, this comparison is made with caution.

Strengths

This study had several strengths of note. First, it has a high level of internal validity. Participants were randomized to condition, double-blinding was employed, and the manipulations (pain and coping training) were highly standardized and confirmed by manipulation checks. Participants were also visually monitored using a non-recording video device during the laboratory session, which increases confidence that instructions were being followed (e.g., eyes closed during the coping training practice segment). Additionally, participants were apparently healthy, pain-free individuals, which limits potential confounding factors associated with chronic pain. The hypotheses of this study also have a strong theoretical basis.

Limitations and Directions for Future Research

The overarching public health concern that this research was designed to inform was chronic pain and hazardous alcohol consumption. Although acute experimental pain research has implications for chronic pain (Arendt-Nielsen, 2007; Kim, Park, Kim, Kang, Chang & Jin, 2014), they are not the same construct. Similarly, although alcohol use proxies have implications for alcohol use behaviors (e.g., Field & Jones, 2017; Flannery, Poole, Gallop, & Volpicelli, 2003), it is important to note that proxies of alcohol use are different from actual alcohol use. Within the context of acute experimental pain, participants are aware that the pain will eventually end, and they are given the option to stop the pain stimulus at any time. Additionally, chronic pain is associated with several problems beyond the physical and emotional effects associated with acute pain. Individuals with chronic pain often suffer from reduced quality of life, co-occurring mental health problems (e.g., depressive symptoms), additional health problems (e.g., obesity), and pain-related disability (Dueñas et al., 2016; Mills, Nicolson, & Smith, 2019). Research shows a high correlation between alcohol use proxies and alcohol consumption, but the ecological validity from measures of these proxy constructs is an empirical question.

Given the factors associated with chronic pain, it is also unknown to what degree the current study findings, with a sample of pain-free college students, extend to clinical pain samples or actual alcohol use. For instance, it is possible that the coping training used in the current study would not have been as successfully applied among individuals with chronic pain due to their already taxed cognitive functioning (Eccleston & Crombez, 1999). Future research could benefit from replicating this study in a clinical pain sample and by examining the effects of these coping strategies on naturally occurring chronic pain and alcohol use.

The current study's experimental pain manipulation induced an individualized level of pain to limit potential confounds of factors affecting pain sensitivity. However, it is possible that some participants may have differentially responded to the individualized pain manipulation. Future research may consider accounting for factors known to influence pain sensitivity (e.g., psychological factors such as depressive symptoms and other substance use such as nicotine dependence; Baiamonte et al., 2014, Hansen, Horjales-Araujo, & Dahl, 2015).

Distraction was selected as an active control condition, similar to other research (e.g., Gutiérrez et al., 2004), to reduce variability in strategies applied by participants, and to test acceptance against a known effective strategy for reducing negative affect. Although this study design has its strengths, the lack of a pure no-coping instruction control condition limits the interpretation of current findings. It is possible that neither acceptance nor distraction coping training was effective in reducing negative affect and the resulting alcohol use proxies any more than not being given any coping training. Future research could include a third no-coping instruction condition to clarify these findings.

An additional limitation of the current study is that it relies purely on self-report data. It is possible that participants could have ignored pre-session instruction and attended the session with alcohol/drugs in their system. Biological verification of alcohol and drug use would increase the certainty that the instructions were indeed followed. Of note, however, no participants appeared visibly intoxicated, and all were able to correctly answer consent verification questions about the details of the study and accurately responded to the coping training knowledge check. Self-report of negative affect requires some degree of insight into one's feelings. Future research could supplement self-report data with physiological measures of negative affect (e.g., heart-rate variability).

The coping training in the present study required participants to use imagery. Future research and clinical work may further enhance the effects of these interventions by accompanying instruction with external stimuli, such as guided audio clips or virtual reality software. These external stimuli may better hold one's attention and also reduce the cognitive resources needed to apply the strategy (e.g., Dahlquist & Nagel, 2009).

This study used the PANAS to measure the level of pain-related negative affect. Some research suggests that affect is not unidimensional (e.g., intensity of positive or negative affect), but rather may be multi-dimensional and be characterized by one's level of arousal as well as its level of pleasantness. Future research may benefit from examining affect as a multidimensional construct, for instance, with the circumplex model of affect (Russell, 1980).

Study Implications

Despite this study's limitations, its results have implications for furthering the current knowledge base on and clinical care of co-occurring pain and alcohol use. First, the content and duration of the coping conditions used in this study suggest that minimal training is required to decrease pain-related negative affectivity and alcohol urge. If so, then self-directed pain coping training material (e.g., web-based training; smartphone apps) may be a low-cost helpful resource for individuals experiencing pain and co-occurring hazardous alcohol use. Additionally, expected usefulness of the coping strategy was positively related to self-reported success in applying the strategy. Self-reported success was significantly negatively correlated with negative affect following the pain manipulation. These findings suggest that higher levels of expected usefulness may increase one's investment in applying the given strategy, which increases their coping success, resulting in decreased negative affect. Such conclusions are consistent with the Health

Belief Model and supported by empirical research (Carpenter 2010; Rosenstock, Stecher, &

Becker, 1988) that highlights how perceived benefits of an outcome predict behavior.

Conclusions

The present study partially replicated previous research noting the important role that

negative affect plays in the relation between physical pain and alcohol use. Findings also note

that acceptance and distraction coping perform equally well within the context of acute

experimental pain, in terms of their ability to reduce negative affect and the resulting increased

alcohol use proxies. Future work is needed to better understand how these findings translate to

chronic pain and alcohol consumption.

Table 1

Characteristics of Participants in the Experimental Study, by Condition (N = 135)

Characteristic	Overall N = 135 n (%)/ M (SD)	No Pain, Acceptance n = 33 n (%)/ M (SD)	No Pain, Distraction n = 33 n (%)/ M (SD)	Pain, Acceptance n = 35 n (%)/ M (SD)	Pain, Distraction n = 34 n (%)/ M (SD)	ANOVA/ Fisher Exact p-value
Gender (male)	66 (48.9%)	16 (48.5%)	16 (48.5%)	17 (48.6%)	17 (50.0%)	0.08, $p = .999$
Age (years)	19.7 (1.15)	19.1 (1.1)	19.0 (1.3)	19.1 (1.2)	19.1 (1.1)	$F (3, 131) = 0.03$, p=.992
Race (White)[a]	106 (79.7%)	28 (87.5%)	22 (66.7%)	27 (77.1%)	29 (87.9%)	4.22, $p = .238$
Black	6 (4.5%)	1 (3.1%)	3 (9.1%)	1 (2.9%)	1 (3.0%)	-
Asian	16 (12.0%)	3 (87.5%)	7 (21.2%)	4 (11.4%)	2 (6.1%)	-
American Indian/Alaska Native	2 (1.5%)	0 (0.0%)	0 (0.0%)	2 (5.7%)	0 (0.0%)	-
Native Hawaiian/ Other Pacific Islander	1 (0.8%)	0 (0.0%)	1 (3.0%)	0 (0.0%)	0 (0.0%)	-
Biracial	2 (1.5%)	0 (0.0%)	0 (0.0%)	1 (2.9%)	1 (3.0%)	-
Hispanic	17 (12.6%)	4 (12.1%)	6 (18.2%)	3 (8.6%)	4 (11.8%)	1.47, $p = .706$
Class standing						1.02, $p = .990$
Freshman	77 (57.0%)	19 (57.9%)	20 (60.6%)	19 (54.3%)	19 (55.9%)	-
Sophomore	33 (24.4%)	7 (21.2%)	7 (21.2%)	10 (28.6%)	9 (26.5%)	-
Junior	10 (7.4%)	3 (9.1%)	2 (6.1%)	2 (5.7%)	3 (8.8%)	-
Senior	15 (11.1%)	4 (12.1%)	4 (12.1%)	4 (11.4%)	3 (8.8%)	-
Household Income						3.36, $p = .779$
$10,000 – 25,000	2 (1.5 %)	1 (3.0%)	0 (0.0%)	0 (0.0%)	1 (2.9%)	-
$25,000 – 50,000	5 (3.7%)	0 (0.0%)	1 (3.0%)	2 (5.7%)	2 (5.9%)	-
$50,000 – 75,000	16 (11.9%)	2 (6.1%)	6 (18.2%)	3 (8.6%)	5 (14.7%)	-
$75,000 – 100,000	28 (20.7%)	8 (24.2%)	6 (18.2%)	7 (20.0%)	7 (20.6%)	-
> $100,000	84 (62.2%)	22 (66.7%)	20 (60.6%)	23 (65.7%)	19 (55.9%)	-

Characteristic	Overall $N = 135$ n (%)/ M (SD)	No Pain, Acceptance $n = 33$ n (%)/ M (SD)	No Pain, Distraction $n = 33$ n (%)/ M (SD)	Pain, Acceptance $n = 35$ n (%)/ M (SD)	Pain, Distraction $n = 34$ n (%)/ M (SD)	ANOVA/ Fisher Exact p-value
Average cannabis use frequency						10.82, $p = .092$
No cannabis use	30 (22.2%)	4 (12.1%)	10 (30.3%)	9 (25.7%)	7 (20.6%)	-
Less than once a year	7 (5.2%)	5 (15.2%)	1 (3.0%)	1 (2.9%)	0 (0.0%)	-
Once/year	5 (3.7%)	1 (3.0%)	1 (3.0%)	2 (5.7%)	1 (2.9%)	-
Once/3-6 months	20 (14.8%)	5 (15.2%)	6 (18.2%)	5 (14.3%)	4 (11.8%)	-
Once/2 months	18 (13.3)	2 (6.1%)	7 (21.2%)	7 (20.0%)	2 (5.9%)	-
Once/month	14 (10.4%)	2 (6.1%)	4 (12.1%)	2 (5.7%)	6 (17.6%)	-
2-3 times/month	20 (14.8%)	6 (18.2%)	2 (6.1%)	7 (20.0%)	5 (14.7%)	-
Once/week	5 (3.7%)	0 (0.0%)	1 (3.0%)	0 (0.0%)	4 (11.8%)	-
Twice/week	9 (6.7%)	4 (12.1%)	1 (3.0%)	2 (5.7%)	2 (5.9%)	-
3+ times/week	7 (5.2%)	4 (12.1%)	0 (0.0%)	0 (0.0%)	3 (8.8%)	-
Drinking days/week	2.57 (1.10)	2.8 (1.0)	2.3 (1.0)	2.6 (1.3)	2.6 (1.1)	$F(3,131) = 1.20, p = .311$
Drinks/drinking day	6.57 (2.86)	7.1 (3.4)	6.4 (2.9)	6.4 (2.8)	6.4 (2.4)	$F(3,131) = 0.56, p = .644$
Binge drinking days/week	1.67 (1.16)	2.0 (1.2)	1.4 (1.0)	1.5 (1.2)	1.7 (1.2)	$F(3,131) = 1.69, p = .172$
AUDIT-C total (α =.53)[b]	7.60 (1.46)	8.0 (1.6)	7.5 (1.3)	7.4 (1.6)	7.6 (1.3)	$F(3,130) = 2.41, p = .335$
AUDIT total (α = .55)[b]	13.52 (4.28)	14.7 (4.5)	13.2 (4.4)	12.8 (4.0)	13.5 (4.3)	$F(3,131) = 1.21, p = .308$
DMQ-R						
Enhancement (α = .78)	16.73 (3.86)	17.5 (4.6)	16.1 (3.5)	16.4 (3.8)	16.9 (3.5)	$F(3,131) = 0.81, p = .489$
Coping (α = .827)	11.61 (4.55)	12.2 (4.8)	11.2 (4.6)	10.5 (4.4)	12.5 (4.4)	$F(3,131) = 1.38, p = .251$
Conformity (α = .79)	8.68 (3.69)	9.1 (4.2)	8.9 (3.2)	8.3 (3.0)	8.7 (4.3)	$F(3,131) = 0.29, p = .835$
Social (α = .86)	19.87 (3.50)	19.4 (5.0)	20.4 (2.4)	19.4 (2.9)	20.2 (3.3)	$F(3,131) = 0.73, p = .537$

Characteristic	Overall $N = 135$ n (%)/ M (SD)	No Pain, Acceptance $n = 33$ n (%)/ M (SD)	No Pain, Distraction $n = 33$ n (%)/ M (SD)	Pain, Acceptance $n = 35$ n (%)/ M (SD)	Pain, Distraction $n = 34$ n (%)/ M (SD)	ANOVA/ Fisher Exact p-value
Pain Alcohol Expectancies (α = .92)	18.83 (10.03)	19.2 (10.6)	16.9 (9.8)	19.7 (10.1)	19.4 (9.8)	$F(3,131) = 0.53, p = .665$
PASS-20 (α = .93)	33.82 (17.17)	35.4 (17.2)	31.8 (16.2)	33.2 (17.7)	34.9 (18.0)	$F(3,131) = 0.31, p = .817$
PCS (α = .93)	16.76 (9.46)	16.9 (8.3)	15.9 (9.7)	16.0 (9.1)	18.2 (10.7)	$F(3,131) = 0.41, p = .744$
ASI Total (α = .87)	22.7 (13.9)	24.1 (13.7)	23.1 (15.5)	19.3 (12.1)	24.6 (14.1)	$F(3,131) = 1.04, p = .379$
BEAQ (α = .83)	43.27 (10.97)	42.9 (9.6)	42.3 (11.5)	41.8 (10.1)	46.1 (12.5)	$F(3,131) = 1.08, p = .359$
QST Ratings						
Threshold (°C)	43.58 (2.86)	43.0 (2.7)	43.9 (3.0)	43.8 (2.5)	43.6 (3.3)	$F(3,131) = 0.67, p = .571$
Tolerance (°C)	47.24 (1.39)	47.0 (1.3)	47.3 (1.4)	47.4 (1.2)	47.2 (1.7)	$F(3,131) = 0.45, p = .721$
P-80 (°C)	45.46 (1.60)	45.5 (1.4)	45.4 (1.7)	45.6 (1.4)	45.4 (1.9)	$F(3,131) = 0.24, p = .870$

Note. ASI = Anxiety Sensitivity Index. AUDIT-C = Alcohol Use Disorder Identification Test- Consumption; BEAQ = Brief Experiential Avoidance Questionnaire; DMQ-R = Drinking Motives Questionnaire-Revised; P-80 = individualized pain rating in which participant reported 80/100 pain intensity; PASS-20 = Pain Anxiety Symptoms Scale-20; PCS = Pain Catastrophizing Scale; QST = quantitative sensory ratings. Binge drinking was defined as 5 or more (males) or 4 or more (females) drinks containing alcohol within a 2-hour period; before conducting Fischer Exact Tests, the following categories were combined into a single category because the number of cells having a count less than 5 exceeded the minimum expected count: Class Status 'junior' and 'senior' and Household Income $10,000 to $75,000, and Cannabis Use Frequency was re-coded into three categories (no use to once/year; once/3-6 months to once/month; 2-3 times/month or more). All non-normal data were transformed prior to analyses, however, there were no differences in interpretation of findings between original and transformed data, therefore, original data are presented.

[a]$n = 133$ and [b]$n = 134$ due to missing data

α calculated based on total sample (N=135)

Table 2

Pre- and Post-Manipulation Levels of Dependent Variables, by Condition (N = 135)

Variable	No Pain, Acceptance n = 33 n (%)/ M (SD)	No Pain, Distraction n = 33 n (%)/ M (SD)	Pain, Acceptance n = 35 n (%)/ M (SD)	Pain, Distraction n = 34 n (%)/ M (SD)
Pain intensity				
Pre	0.24 (0.50)	0.33 (0.74)	0.15 (0.56)	0.15 (0.56)
Post	0.18 (0.47)	0.30 (0.68)	5.31 (2.56)	4.85 (2.44)
Negative affect				
Pre	12.18 (2.86)	12.12 (2.60)	11.23 (1.82)	11.56 (1.86)
Post	12.30 (2.90)	11.45 (0.44)	13.89 (4.80)	12.44 (3.82)
1-item urge				
Pre	1.27 (2.00)	1.00 (2.11)	0.43 (1.00)	0.68 (1.53)
Post	0.73 (1.06)	0.58 (1.52)	1.00 (1.59)	0.56 (1.81)
Alcohol Urge Questionnaire				
Pre	15.15 (7.86)	14.00 (7.59)	14.43 (6.67)	13.32 (7.87)
Post	16.27 (7.54)	15.55 (8.56)	16.94 (8.25)	13.62 (5.91)
AAAQ Inclined				
Pre	17.61 (9.47)	15.73 (9.14)	15.37 (8.68)	13.76 (9.30)
Post	16.52 (10.00)	14.91 (9.57)	15.91 (9.27)	13.47 (9.88)
AAAQ Obsessed				
Pre	2.64 (4.21)	2.67 (3.89)	1.23 (1.97)	1.65 (2.73)
Post	2.15 (3.68)	1.88 (3.80)	1.57 (2.56)	1.44 (2.86)

Note. AAAQ = Alcohol and Avoidance of Alcohol Questionnaire; PANAS = Positive and Negative Affect Schedule; Pre = baseline levels before pain induction and coping training; Post = after pain induction and coping training. Untransformed data shown.

Table 3

Bivariate Correlations among Select Study Variables (N = 135)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Gender	−																	
2. AUDIT†	-.144	−																
3. Expectation	.043	.042	−															
4. Success	.012	-.170*	.245**	−														
5. PAE	-.046	.208*	-.021	-.008	−													
6. PASS-20††	.299***	.127	.002	-.099	.014	−												
7. PCS††	.224**	.168	.052	-.048	.094	.794***	−											
8. ASI†	.138	.188*	.073	.046	.188*	.566***	.589***	−										
9. BEAQ	.258**	.106	.072	.101	.111	.477***	.521***	.562***	−									
10. Threshold‡‡	-.009	-.094	-.166	-.145	-.025	.133	.079	.107	.070	−								
11. Tolerance‡‡	.300***	-.178*	-.137	-.115	-.042	.156	.066	.096	.044	.694***	−							
12. P-80‡	.307***	-.148	-.115	.183	.005	.172*	.128	.139	.141	.565***	.759***	−						
13. Pain	.044	-.096	.130	-.119	.067	.143	.089	.062	.110	.109	.061	.172*	−					
14. NA	.104	.150	.037	-.329***	-.088	.319***	.256**	.185*	.162	.028	.122	.131	.393***	−				
15. Urge	.031	.146	-.088	-.117	.115	.146	.231**	.140	.054	-.112	-.079	-.003	.142	.234**	−			
16. AUQ	-.058	.213*	-.037	-.129	.181*	.093	.147*	.180*	.022	-.183*	-.029	-.079	.037	.166	.680***	−		
17. Inclined	-.133	.290***	.166	-.064	.221**	.084	.143	.077	-.033	-.188*	-.160	-.134	-.017	.052	.573***	.609***	−	
18. Obsessed	-.071	.281***	-.040	-.104	.228**	.132	.252**	.216*	.074	-.201*	-.190*	-.130	-.005	.129	.685***	.721***	.648***	−

Note. AUDIT = Alcohol Use Disorder Identification Test; PAE = Pain Alcohol Expectancies; PASS-20 = Pain Anxiety Symptoms Scale-20; PCS = Pain Catastrophizing Scale; ASI = Anxiety Sensitivity Index; BEAQ = Brief Experiential Avoidance Questionnaire; P-80 = individualized pain rating in which participant reported 80/100 pain intensity; NA = Negative affect; AUQ = Alcohol Urge Questionnaire. *r* = Pearson product-moment (continuous variables), Spearman's rho (categorical/ordinal variables). Post-manipulation values of variables #13-18 shown. Several variables were transformed prior to analyses: †log transformation; ††squareroot transformation; ‡reflect and log transformation; ‡‡reflect and square-root transformation.
*p < .05. **p < .01. ***p < .001.

Table 4

Group Differences in Coping Strategy-Related Variables (N = 135)

	No Pain, Acceptance *n* = 33 *n* (%)/ *M* (SD)	No Pain, Distraction *n* = 33 *n* (%)/ *M* (SD)	Pain, Acceptance *n* = 35 *n* (%)/ *M* (SD)	Pain, Distraction *n* = 34 *n* (%)/ *M* (SD)	*t*-test/Mann-Whitney test of Coping Groups
Expected usefulness	2.5 (0.9)	2.5 (0.9)	2.5 (0.9)	2.7 (0.9)	U = 2378.00, p = .641
Success	5.4 (2.2)	6.7 (1.8)	6.0 (1.7)	6.5 (1.4)	t (133) = -2.83, p = .005
CSQ strategies					
Acceptance (α = .89)	23.6 (7.7)	15.2 (9.2)	26.1 (7.9)	18.4 (9.3)	t (133) = 5.41, $p < .001$
Ignoring (α = .88)	13.8 (6.6)	22.6 (5.5)	17.1 (6.5)	23.2 (7.2)	t (133) = -6.58, $p < .001$
Diverting (α = .83)	9.6 (4.7)	23.7 (5.9)	10.6 (6.0)	26.2 (3.8)	t (133) = -16.42, $p < .001$
Reinterpreting (α = .85)	13.6 (8.6)	10.3 (4.3)	17.7 (8.5)	13.1 (6.5)	t (133) = 3.14, p = .002
Self-statements (α = .87)	13.3 (6.7)	15.7 (8.4)	19.4 (6.1)	20.4 (6.9)	t (133) = -1.26, p = .209
Catastrophizing (α = .87)	5.2 (0.4)	5.3 (0.9)	7.2 (3.7)	6.6 (2.9)	t (133) = 0.60, p = .548

Note. Success = self-reported success in applying assigned coping strategy. All adapted Coping Strategy Questionnaire (CSQ)

subscales have 6 items, with the exception of self-statements and catastrophizing which have 5 items. Acceptance was coded as 0;

distraction was coded as 1. Success scale coded 0 (not at all able) to 8 (completely able).

Table 5

Model Coefficients for the Conditional Process Models (N = 135)

Predictor Variable	Dependent Variable					
	Model 1			Model 2		
	B	SE (HC4)	p	B	SE (HC4)	p
	Negative Affect (M)			1-item Alcohol Urge (Y)		
Pain Condition (X)	**2.723**	**0.727**	**<.001**	0.272	0.233	.245
Negative Affect (M)	-	-	-	0.111	0.081	.173
Coping Condition (W)	-0.044	0.466	.925	-	-	-
Pain x Coping Condition (MxW)	-1.462	0.964	.132	-	-	-
Constant	2.930	1.540	.059	-0.643	0.725	.377
	$R^2 = .501$			$R^2 = .379$		
	$F(7, 127) = 13.748, p < .001$			$F(6, 128) = 6.319, p < .001$		
	Negative Affect (M)			Alcohol Urge Questionnaire (Y)		
Pain Condition (X)	**2.754**	**0.734**	**<.001**	-0.733	1.001	.465
Negative Affect (M)	-	-	-	0.457	0.279	.104
Coping Condition (W)	-0.060	0.469	.898	-	-	-
Pain x Coping Condition (MxW)	-1.491	0.965	.125	-	-	-
Constant	**3.274**	**1.589**	**.041**	3.580	4.126	.387
	$R^2 = .502$			$R^2 = .504$		
	$F(7, 127) = 13.745, p < .001$			$F(6, 128) = 15.400, p < .001$		

	Model 1			Model 2		
	B	*SE* (HC4)	*p*	B	*SE* (HC4)	*p*
	Negative Affect (M)			Inclined (Y)		
Pain Condition (X)	**2.691**	**0.728**	**<.001**	0.811	0.873	.354
Negative Affect (M)	-	-	-	0.164	0.342	.632
Coping Condition (W)	-0.099	0.474	.835		-	-
Pain x Coping Condition (MxW)	-1.487	0.963	.125	-	-	-
Constant	**3.385**	**1.624**	**.039**	-4.166	2.313	.074
	$R^2 = .507$			$R^2 = .772$		
	$F (7, 127) = 13.881, p <.001$			$F (6, 127) = 72.250, p <.001$		
	Negative Affect (M)			Obsessed (Y)		
Pain Condition (X)	**2.709**	**0.737**	**<.001**	0.250	.291	.392
Negative Affect (M)	-	-	-	0.139	.097	.155
Coping Condition (W)	-0.014	0.469	.976	-	-	-
Pain x Coping Condition (MxW)	-1.483	.970	.129	-	-	-
Constant	3.008	1.647	.070	-1.504	0.898	.097
	$R^2 = .502$			$R^2 = .867$		
	$F (7, 127) = 13.519, p <.001$			$F (6, 127) = 64.706, p <.001$		

Note. X = independent variable; M = mediator; W = moderator; Y = dependent variable; B = unstandardized beta coefficient; *SE* = standard error. Analyses controlled for reported success of applying the strategy, expected usefulness, baseline levels of negative affect, and baseline levels of the respective alcohol use proxy. Acceptance Condition was coded as 0; Distraction Condition was coded as 1. Pain was Condition coded as 1; No Pain Condition coded as 0. Heteroscedasticity-consistent inference HC4 (Cribari-Neto) standard error estimators are displayed to adjust for the possibility of unequal variance in the data. Boldface text indicates significant effect.

Table 6

Direct and Conditional Indirect Effects (N=135)

Dependent Variable	Effect	*SE* (HC4)/ *SE* (Boot)	*t*	*p*	Boot LLCI	Boot ULCI
1- Item Urge						
Direct Effect	0.272	0.233	1.169	.245	-.189	.733
Conditional Indirect						
Acceptance	0.303	0.216	-	-	-.012	.804
Distraction	0.140	0.096	-	-	-.018	.347
AUQ						
Direct Effect	-0.733	1.001	-0.733	.465	-2.713	1.246
Conditional Indirect						
Acceptance	1.257	0.800	-	-	-0.033	3.028
Distraction	0.577	0.370	-	-	-0.062	1.359
Inclined						
Direct Effect	0.811	0.873	0.929	.354	-0.916	2.538
Conditional Indirect						
Acceptance	0.441	0.746	-	-	-1.017	1.966
Distraction	0.197	0.339	-	-	-0.468	0.895
Obsessed						
Direct Effect	0.250	0.291	0.860	.392	-0.326	0.826
Conditional Indirect						
Acceptance	0.376	0.243	-	-	-0.023	0.907
Distraction	0.170	0.113	-	-	-0.029	0.413

Note. SE = standard error; LLCI = lower level confidence interval; ULCI = upper level confidence interval; AUQ = Alcohol Urge

Questionnaire. Acceptance Condition was coded as 0; Distraction Condition was coded as 1. Pain was Condition coded as 1; No Pain

Condition coded as 0. Heteroscedasticity-consistent inference HC4 (Cribari-Neto) standard error estimators are displayed for the direct

effects to adjust for the possibility of unequal variance in the data. Bootstrap standard errors are depicted for the indirect effects.

Table 7

Model Coefficients for the Mediation Models (N = 135)

Predictor Variable	Dependent Variable					
	Model 1			Model 2		
	B	*SE* (HC4)	*p*	*B*	*SE* (HC4)	*p*
	Negative Affect (M)			1-item Alcohol Urge (Y)		
Pain Condition (X)	**2.003**	**0.534**	**<.001**	0.273	0.233	.244
Negative Affect (M)	-	-	-	0.11	0.078	.155
Constant	**0.257**	**0.381**	**<.001**	-0.626	0.535	.244
	$R^2 = .381$			$R^2 = .379$		
	$F (3, 131) = 18.702, p <.001$			$F (4, 130) = 5.906, p <.001$		
	Negative Affect (M)			Alcohol Urge Questionnaire (Y)		
Pain Condition (X)	**2.009**	**0.536**	**<.001**	-0.859	0.938	.361
Negative Affect (M)	-	-	-	0.493	0.296	.098
Constant	0.536	1.429	.708	1.431	3.324	.668
	$R^2 = .382$			$R^2 = .500$		
	$F (3, 131) = 19.549, p <.001$			$F (4, 130) = 20.056, p <.001$		
	Negative Affect (M)			Inclined (Y)		
Pain Condition (X)	**1.973**	**0.535**	**<.001**	0.714	0.840	.397
Negative Affect (M)	-	-	-	0.248	0.345	.473
Constant	0.647	1.624	.691	-4.374	2.227	.052
	$R^2 = .384$			$R^2 = .767$		
	$F (3, 131) = 19.498, p <.001$			$F (4, 130) = 88.100, p <.001$		

	Model 1			Model 2		
	B	*SE* (HC4)	*p*	*B*	*SE* (HC4)	*p*
	Negative Affect (M)			Obsessed (Y)		
Pain Condition (X)	**1.985**	**0.540**	**<.001**	0.250	0.291	.392
Negative Affect (M)	-	-	-	0.139	0.097	.155
Constant	0.277	1.521	.856	-1.504	0.898	.097
	$R^2 = .382$			$R^2 = .750$		
	$F (3, 131) = 19.334, p <.001$			$F (4, 130) = 51.330, p <.001$		

Note. X = independent variable; M = mediator; W = moderator; Y = dependent variable; *B* = unstandardized beta coefficient; *SE* = standard error. Analyses controlled for baseline levels of negative affect and baseline levels of the respective alcohol use proxy. Pain was Condition coded as 1; No Pain Condition coded as 0. Heteroscedasticity-consistent inference HC4 (Cribari-Neto) standard error estimators are displayed to adjust for the possibility of unequal variance in the data. Boldface text indicates significant effect.

Table 8

Direct and Indirect Effects for Mediation Model of Pain Condition's Effect on Alcohol Use Proxies via Negative Affect (N=135)

Dependent Variable	Effect	SE (HC4)/ SE (Boot)	t	p	Boot LLCI	Boot ULCI
1- Item Urge						
Direct Effect	0.273	0.233	1.169	.244	-0.189	0.734
Indirect Effect	0.223	0.139	-	-	-0.003	0.528
AUQ						
Direct Effect	-0.859	0.938	-0.916	.361	-2.714	0.996
Indirect Effect	**0.991**	**.596**	**-**	**-**	**0.006**	**2.277**
Inclined						
Direct Effect	0.714	0.840	.850	.397	-0.947	2.375
Indirect Effect	0.490	0.525	-	-	-0.546	1.561
Obsessed						
Direct Effect	0.283	0.283	1.001	.319	-0.276	0.842
Indirect Effect	0.256	0.167	-	-	-0.033	0.612

Note. SE = standard error; LLCI = lower level confidence interval; ULCI = upper level confidence interval. Acceptance Condition was coded as 0; Distraction Condition was coded as 1. Pain was Condition coded as 1; No Pain Condition coded as 0. Heteroscedasticity-consistent inference HC4 (Cribari-Neto) standard error estimators are displayed for the direct effects to adjust for the possibility of unequal variance in the data. Bootstrap standard errors are depicted for the indirect effects. Boldface text indicates significant effect.

Figure 1

Moderated-mediation conceptual model for proposed primary aim.
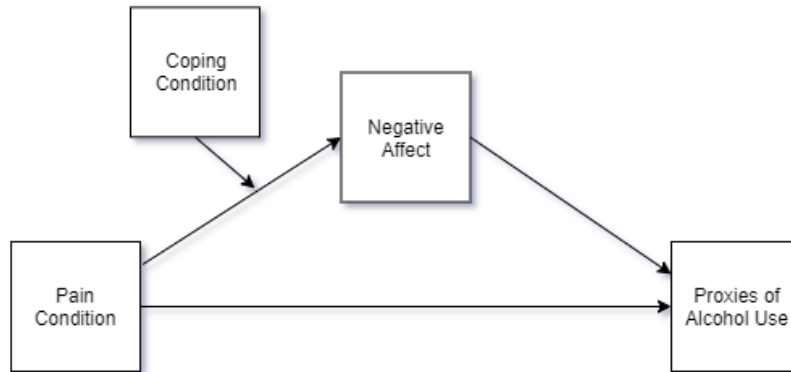
Figure 2

Sequence of events in the experiment with approximate duration

```
┌─────────────────────────┐
│     Baseline measures   │
│         (45 min)        │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│      Pain ratings       │
│         (10 min)        │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│     Randomization to    │
│   pain-coping condition │
│         (20 min)        │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│       Pain-coping       │
│   manipulation check    │
│         (2 min)         │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│     Randomization to    │
│   pain condition; start │
│     pain manipulation   │
│         (15 min)        │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│    Pain manipulation    │
│          check          │
│         (2 min)         │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│     Outcome measures    │
│         (10 min)        │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│        End pain         │
│      manipulation;      │
│        debriefing       │
│         (10 min)        │
└─────────────────────────┘
```
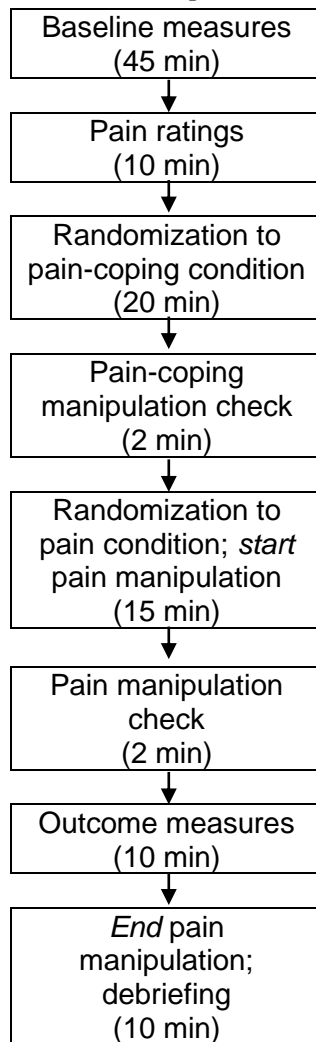
Figure 3

Conditional mediation model for pain condition and coping condition predicting Alcohol Urge

Questionnaire via negative affect (N = 135).
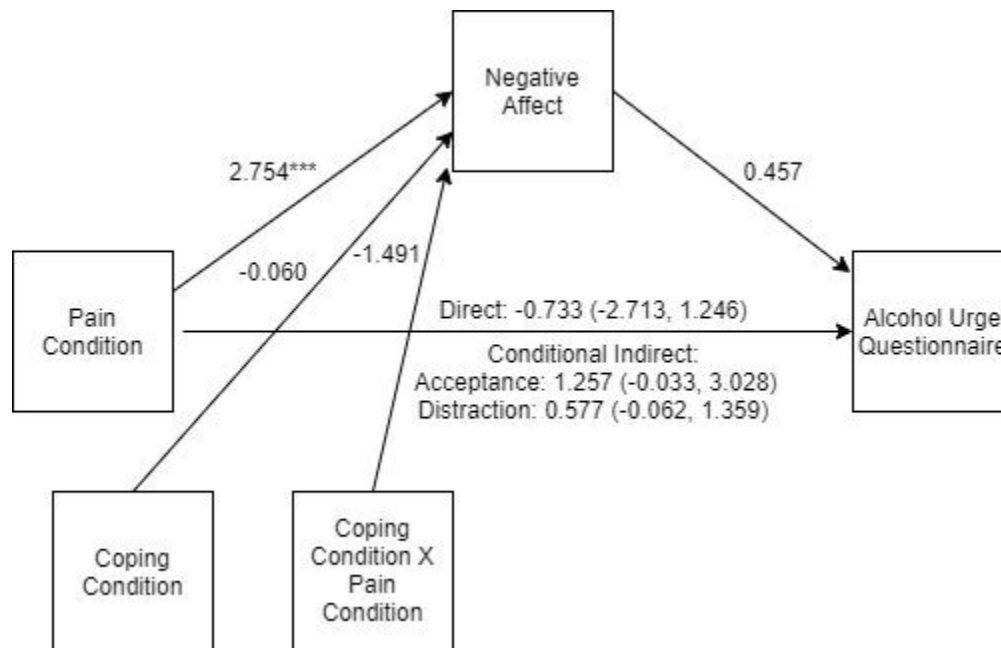
Figure 4

Simple mediation model for pain condition predicting Alcohol Urge Questionnaire via negative affect (N = 135).
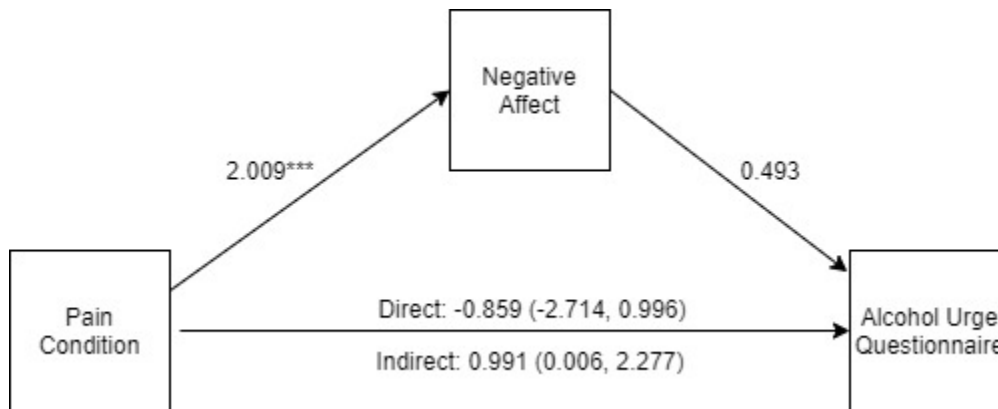
Appendix 1.

Pain-Coping Presentations (Acceptance = Presentation A; Distraction = Presentation D).

*Note: some items on the handout may appear to overlap or to be incomplete. However, this is due to use of PowerPoint animation and they do not appear this way in presentation mode.

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Presentation A

ACCEPTANCE of pain

AIM: This presentation describes three strategies used to cope with pain.

However, the main focus is on **ACCEPTANCE coping** which we'd like you to use in the sensory testing exercise.

Please attend carefully to this information. You'll be given a brief test after the presentation to make sure you understand the main ideas.

People typically cope with pain in three main ways:

1 Distraction
2 Catastrophizing
3 Acceptance

1. Distraction

This is when you reduce pain by thinking about or doing other things.

Examples – turning your head away when getting a shot or focusing on conversation with friends when you have a headache.

Distraction works best when pain is less intense. However, when pain is intense or severe, it can be much harder to distract from.

There is a common expression:

"Don't think of pink elephants"

The main idea... you try NOT TO THINK of "pink... ...ORE YOU THINK about them.

Sometimes trying NOT TO THINK about pain can make you THINK MORE about the pain.

1 Distraction
2 Catastrophizing
3 Acceptance

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2. Catastrophizing

This is coping by focusing on pain and becoming overwhelmed by it. People who catastrophize view pain as terrible and feel they can't stand it.

Catastrophizing can motivate help-seeking in emergencies. However, it is less helpful when pain is not signaling physical damage and can actually increase pain intensity.

Pain is like a baby tiger

Imagine at home tonight there is a baby tiger in your kitchen. He is cute but snarls at you like he wants something. You look in the refrigerator and find meat for him.

He is satisfied for a short time but then comes back again, and again, wanting more each time. Soon you have nothing more to give him. He has become HUGE, and there is only you left to eat.

If you think pain is "awful" and "overwhelming," this may cause more pain and catastrophic thoughts like "I can't cope," or "I can't stand it," or "this is terrible."

Catastrophizing about pain can be a vicious cycle, like feeding a baby tiger.

Such catastrophizing thoughts are NOT helpful when pain is ongoing or not signaling damage.

Vicious cycle of Catastrophizing

pain

The pain is awful.

The pain is overwhelming.

This is terrible.

pain

I can't cope. I can't stand it.
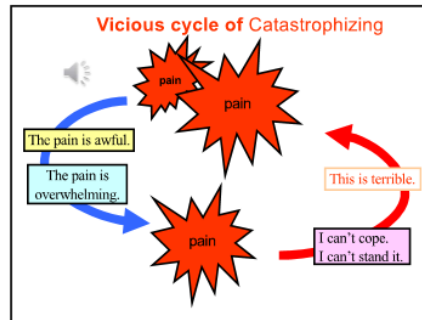
- Distraction and catastrophizing both have disadvantages when pain is intense and/or ongoing.

- During the past 10 years, a growing body of research has found a third coping approach, **acceptance**, that is beneficial to many.

- The rest of this presentation will provide information and brief training in acceptance coping for pain.

---

1 Distraction

2 Catastrophizing

3 **Acceptance**

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3. Acceptance

Acceptance coping is based on Buddhist philosophy. One of the main ideas is that as we become more aware, we realize there is no permanent reality, all experience is transient, and nothing lasts forever.

One theme is to observe the ongoing stream of internal and external events you experience as they arise.

As best you can, notice experiences without judging them. Watch these fade and new sensations, thoughts, and feelings arise in awareness.

Watch how sensations, thoughts, and feelings change, much like you might watch clouds slowly pass in the sky.

Two Goals of Acceptance Training

1 Increase Awareness

2 Become a Non-Judgmental Observer

---

1. Increasing Awareness

Become more aware of your experience.

This can seem frightening during a sensory testing exercise so let us explain.

During the exercise, many people have a variety of sensations such as "stinging," "tingling," "pain," "stabbing," "swelling," "throbbing," even "warmth," and "burning."

At some point, some people conclude such sensations are "painful," "too painful," or even "unbearable."
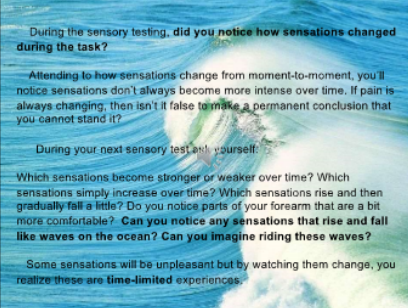
Increasing Awareness of Sensations *Actually Helps* You to Bear Them

People often eat food without actually tasting it or noticing subtle combinations of saltiness, sweetness, spiciness, sourness or even bitterness in flavor. In the same way, people might conclude they can't stand pain without actually noticing varied sensations they have.

During your previous sensory testing, **did you notice some sensations are actually not quite as painful as others?**

Often people notice more intense sensations and are less aware of sensations that are less intense or are not painful.

For example, some people notice "stabbing" but less intense sensations such as "warming" or "numbing" are also present. Noticing VARIED sensations you experience and "tuning in" or "turning up the volume" on sensations that are less painful is a benefit of increased awareness.

During the sensory testing, **did you notice how sensations changed during the task?**

Attending to how sensations change from moment-to-moment, you'll notice sensations don't always become more intense over time. If pain is always changing, then isn't it false to make a permanent conclusion that you cannot stand it?
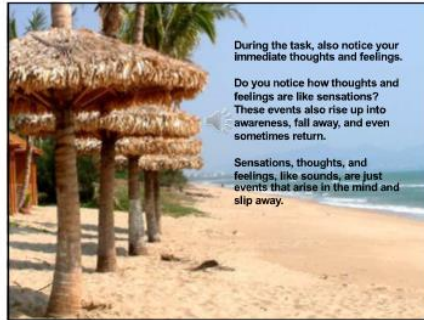
During your next sensory test ask yourself:

Which sensations become stronger or weaker over time? Which sensations simply increase over time? Which sensations rise and then gradually fall a little? Do you notice parts of your forearm that are a bit more comfortable? **Can you notice any sensations that rise and fall like waves on the ocean? Can you imagine riding these waves?**

Some sensations will be unpleasant but by watching them change, you realize these are **time-limited** experiences.

3

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During the task, also notice your immediate thoughts and feelings.

Do you notice how thoughts and feelings are like sensations? These events also rise up into awareness, fall away, and even sometimes return.

Sensations, thoughts, and feelings, like sounds, are just events that arise in the mind and slip away.

Two Goals of Acceptance Training

1 Increase Awareness

2 Become a Non-Judgmental Observer

Balance

There is a balance inside. On one side is worry, on the other is acceptance. Worry undermines acceptance.

How do people create worry?

Often worry comes from judging experiences as "good" or "bad." If we decide an experience is "negative" or "bad," we may worry and this causes more bad feelings.

When we experience life events non-judgmentally, we worry less about them.

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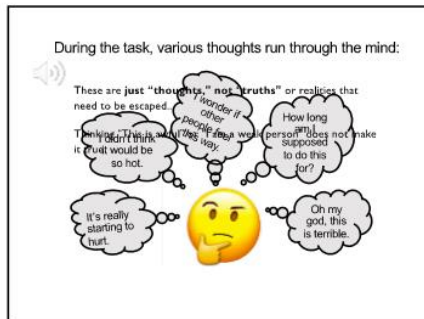
2. Non-Judgmental Observation

-In acceptance coping, we ask that you notice internal and external events, but notice such experiences without judgment.

-As best you can, NOTICE BUT STEP BACK FROM thoughts, emotions, and sensations. Watch them as an OBJECTIVE OBSERVER might.

-Even if you notice sensations, **you are not your sensations**, thoughts, or emotions.

During the task, various thoughts run through the mind:

These are **just "thoughts," not "truths"** or realities that need to be escaped.

I wonder if other people feel this way.

How long am I supposed to do this for?

I didn't think it would be so hot.
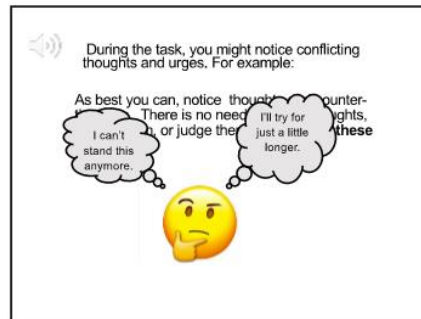
It's really starting to hurt.

Oh my god, this is terrible.

During the task, you might notice conflicting thoughts and urges. For example:

As best you can, notice thoughts counter-thoughts. There is no need or judge them. **these**

I can't stand this anymore.

I'll try for just a little longer.

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As best you can, during the task, watch thoughts and feelings come into awareness as if you are watching from above or outside the self.

Even judgmental thoughts like "acceptance coping is foolish" can be noticed without becoming absorbed in them.

- As emotions rise into awareness, can you also watch them without passing judgment?

- Feeling tense or afraid doesn't always mean one is in danger.

- Similar to observing sensations, can you notice how thoughts and feelings rise up into awareness, how they change or repeat, how some of them also fade away?

Possible Strategies for Developing a Non-Judgmental Stance

These metaphors may help to take the perspective of a non-judgmental observer.

Imagine your mind is a **conveyor belt.** Observe your thoughts, feelings, and sensations as they come down the belt. Observe, label, and categorize them. Watch them pass.

Imagine your mind is the **sky** -- thoughts, feelings, and sensations **are clouds** you watch passing by.

Practice

• You just learned about 3 types of coping: distraction, catastrophizing, and **acceptance**.

• This **acceptance strategy** is the strategy that you will use during the next thermal sensory test.

• For the next 5 minutes, practice using these **acceptance** strategies.

• Close your eyes and imagine the thermode causing you pain.
• Notice your thoughts and feelings as a non-judgmental observer.
• Identify your thoughts and feelings and notice them passing you by on a conveyor belt or imagine them as clouds you watch passing by.

Practice

5:00

• Close your eyes and imagine the thermode causing you pain.
• Notice your thoughts and feelings as a non-judgmental observer.
• Identify your thoughts and feelings and notice them passing you by on a conveyor belt or imagine them as clouds you watch passing by.

The End

Thanks for viewing this presentation. You might find some information useful for the next thermal sensory task.

Please let the experimenter know if you have any questions about this presentation.

Your next sensory test will commence shortly. Remember, it is important that you try your best to use the **acceptance** strategies during the sensory testing.

Ring the doorbell to let the experimenter know you have finished the presentation.

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Presentation D

DISTRACTION from pain

AIM: This presentation describes strategies used to cope with pain.

However, the main focus is on effective ways of using **DISTRACTION coping,** which we'd like you to use in the next sensory testing exercise

Please attend carefully to this information. You'll be given a brief test after the presentation to make sure you understand the main ideas.

People typically cope with pain in two main ways:

1 Focusing on Pain

2 Distraction

Focusing or Catastrophizing

Focusing involves drawing your attention towards pain. Although this strategy can be useful, it sometimes leads to catastrophizing or becoming overwhelmed by pain. People who catastrophize about pain view it as awful or terrible and feel that they cannot stand it.

Catastrophizing can be helpful when it motivates the person to seek help in an emergency and can reduce the risk of physical damage. However, catastrophizing is less helpful when pain is not signaling further physical damage and can contribute to increases in pain and distress and a failure to notice decreases or changes in pain intensity.

Pain is like a baby tiger

Imagine at home tonight there is a baby tiger in your kitchen. He is cute but snarls at you like he wants something. You look in the refrigerator and find meat for him.

He is satisfied for a short time but then comes back again, and again, wanting more each time. Soon you have nothing more to give him. He has become HUGE, and there is only you left to eat.

Catastrophizing about pain can be a vicious cycle. Like feeding a baby tiger, if you think pain is "awful" and "overwhelming", this may cause pain to intensify and further catastrophic thoughts like "I can't cope" or "I can't stand it" or "this is terrible."

Such thoughts can be helpful in emergencies but are often unhelpful when pain is not signaling damage or for people who have ongoing pain.

1

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Vicious cycle of Catastrophizing

pain

The pain is awful.

The pain is overwhelming.

This is terrible.

I can't cope. I can't stand it.

1 Focusing on Pain
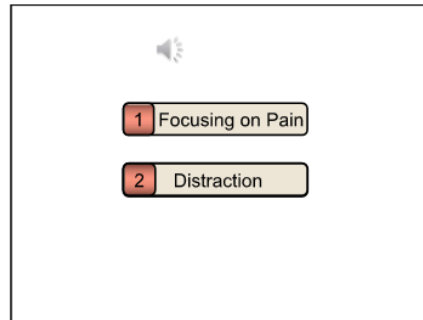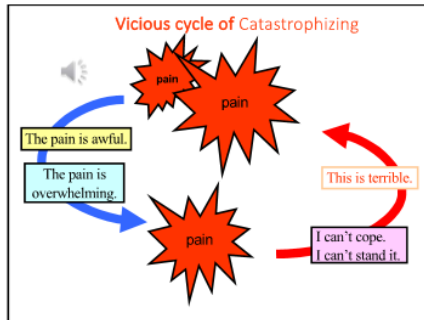
2 Distraction

Distraction

Focusing on pain and catastrophizing about it can be adaptive in certain situations but the approach has disadvantages when pain is intense, "benign" and/or ongoing.

Distraction is a strategy to reduce pain by thinking about and/or doing other things.

- Distraction **is likely** the most common strategy people use to cope or help others cope with pain.

- Why and how does distraction work?

- What are examples of distraction in everyday life?

- Are some ways of distracting attention more effective than others?

Distraction

1 How does distraction work?

2 Examples of distraction in everyday life

3 Ineffective Distraction

4 Effective distraction

How does distraction work?

The rationale of distraction:

— paying attention to or focusing on pain may increase pain because all of one's attention is focused on the hurt. There is **little else to notice except how much** it hurts.

The basic idea behind distraction is that by focusing at least some attention on thoughts or activities unrelated to the headache, it will be noticed less. Distraction provides a **competing focus of attention.**

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Ineffective distraction: Example 1

- Counting numbers (1, 2, 3, 4,……) to distract from the pain.

1
2
3
4
:

- This can help to bear pain for a short time…
"… just 10 more seconds"… But may help less if pain continues

Ineffective distraction: Example 2

- You are instructed to listen to and repeat aloud letters presented to you through headphones at a rate of three letters every 2 seconds.

CDR TTG JIG KOP …

- When pain is more intense, this form of distraction is unlikely to work for most people.

- You may try these ways to divert your attention from the feeling of your forearm during the sensory test but such methods are often not effective in coping with pain. Why?

It doesn't work!

These methods have a repetitive and monotonous quality that is less than ideal for capturing attention.

Distraction

1 How does distraction work?

2 Examples of distraction in everyday life

3 Ineffective Distraction

4 **Effective distraction**

What's the key of **effective** distraction?

Absorbing or vivid images, memories, thoughts and actions

- **Absorbing or vivid images, memories, thoughts, and actions** are better at CAPTURING and HOLDING your ATTENTION. In theory, when more of your mind is captured by other things, less of your mind is on pain… and pain is less noticeable.

- You can distract yourself from the pain by concentrating on the details of an imagined scene.

- You can use the following suggestions:

Effective distraction: Example 1
—— Vivid images

Personal, pleasant scenes

- "I am sitting on a beach in Hawaii. The sky is a pure blue, and the sea is dark blue. The beach is white; soft sand is slipping away smoothly through my fingers. As I lie back, the warm breeze blows gently on my face. I inhale the fresh, salty air…"

- **What are the vivid images you can call up from YOUR life?**

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Effective distraction: Example 2
Absorbing memories or fantasies
• I remember…

"…sitting besides a warm fire, chatting with my best friend about something funny that happened this week…"

• Are there absorbing memories you can call up from your own life?

• The images can be visual but using other senses can help too – for example, playing a song in your head

Effective distraction: Example 3
When you "can't beat 'em, join 'em"

• To cope with the heat, imagine *personal* or pleasant heat scenes or memories:

• Walking down a hot or sunny street with friends, listening to the birds chirping …
• Kids playing in the sun…
• Sunbathing or walking across a sunny beach

• What vivid or pleasant memories of warmth/heat have you had in YOUR life?

• These are simply examples of imagery you can use to distract yourself. Although you can build one of these scenes in your mind, the most important point is to imagine real *personal* experiences that are *vivid* and help to capture some of your attention.

• **The goal of distraction is not to eliminate pain completely, just to reduce it with vivid, personally meaningful, competing information.**

• Remember just to concentrate on the details of your imagined scene or scenes.

Practice
• You just learned about 2 types of coping: focusing on pain and **distraction**.

• This **distraction strategy** is the strategy that you will use during the next thermal sensory test.

• For the next 5 minutes, practice using these **distraction** strategies.

• Close your eyes and imagine the thermode causing you pain.
• Think about a vivid or pleasant memory of warmth/heat you have had in your life.
• Try to imagine every detail of this scene and distract yourself from the pain and any pain-related feelings, such as anxiety.

Practice

⏱ **5:00**

• Close your eyes and imagine the thermode causing you pain.
• Think about a vivid or pleasant memory of warmth/heat you have had in your life.
• Try to imagine every detail of this scene and distract yourself from the pain and thoughts.

The End

Thanks for viewing this presentation. You might find some information useful for the next thermal sensory task.

Please let the experimenter know if you have questions about this presentation.

Your next sensory test will commence shortly. Remember, it is important that you try your best to use these **distraction** strategies during the sensory testing.

Ring the doorbell to let the experimenter know you have finished the presentation.

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