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Empirical research

Neurological evidence of acceptance and commitment therapy effectiveness in college-age gamblers☆

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ABSTRACT

The present study examined the potential neurological impact of Acceptance and Commitment Therapy (ACT) delivered to college-aged disordered gamblers. A randomized control design employed 18 participants to complete two functional magnetic resonance imaging scans during which time gamblers completed a slot machine activity. Following the initial scan, ten subjects were exposed to 8 h of ACT delivered 1:1 by a therapist, and the other eight remained untreated. Using a mixed 2 (group: ACT, Control) × 2 (condition: wins, losses) × 2 (time: pre, lost) design, the self-report and behavioral aspects of the slot machine activity, in addition to the brain activation data were compared across time. Results indicated that post-treatment, disordered gamblers reported higher rates of psychological flexibility and mindfulness than control gamblers. Similarly, brain activation patterns differed significantly between groups for winning outcomes when compared to losing outcomes following treatment. These data suggest that psychological reconditioning of behavioral and neurological responses to various addictive stimuli are possible using ACT. Implications for the future of contextual control, human language, and understanding addiction are suggested.

Gambling disorder is estimated to affect 0.5–7.7% of the global population (Williams, Volberg, & Stevens, 2012), and 3–8% of adolescents and young adults (Petry, 2005; Shaffer & Hall, 2001). Gambling across the lifespan occur on a continuum, ranging from never gambled to experimenting or recreational, to frequent, excessive, or disordered (Stinchfield, Hanson, & Olson, 2006). According to the Diagnostic Statistical Manual-5, gambling disorder is indicated when 4 or more symptoms are endorsed, including loss of a significant relationship, gambling during times of distress, hiding the extent of the gambling problem, and a preoccupation with gambling related thoughts (American Psychological Association, 2013). Gambling prevalence rates continue to be higher in adolescents and young adults, including college students, as compared with adults (e.g., Derevensky & Gupta, 2000; Shaffer, 2000; Shaffer & Hall, 2001). College students, as young as 18 years of age, represent a high-risk gambling population, as 42% will engage in some form of gambling during the college years (LaBrie, Shaffer, LaPlante, & Wechsler, 2003). Although many college students do in fact gamble, only a small percentage will develop a gambling addiction (Winters, Bengston, Door, & Stinchfield, 1998).

College students may be more at risk for developing disordered gambling due to a range of socio-cultural factors. For instance, college students may have fewer financial and social resources during the collegial transition years, and may result to gambling for financial means (Arnett, 2000). Similarly, demographic variables such as gender and familial history of gambling (Oei and Raylu, 2004) and addictive behaviors more generally (Slutske et al., 2001), may also increase college students' propensities to gamble (see also King, Abrams, & Wilkinson, 2010).

Gambling may also persist as a result of stimulus control and various functions of verbal behavior (Dymond & Roche, 2010). Skinner's (1959) early work on stimulus control emphasized the rule that "*stimuli present at the moment of reinforcement produce a maximal probability that the response will be repeated*" (p 143); therefore any change in the "stimulating situation reduces the probability" of future occurrences of behavior (p. 143–144). Analyses of behavior have advanced towards conditional discriminations as the unit of analysis for functional descriptions of stimulus classes: while relating pairs of stimuli formed stimulus classes so that each stimulus could serve a common function (e.g., stimulus equivalence; Sidman, 1969, 1994). Stimulus equivalence, as a conceptualization and experimental approach, has become a useful way to understand how verbal humans learn to relate various stimuli together simply by inference (or derivation) from a

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reinforcement history among other stimulus pairings (see also Dymond & Rehfeldt, 2000). Additional complexity in the analysis of derived responses is introduced by examining how a function of one stimulus can impact the functions of another stimulus without any direct training.

The concept of transformation of stimulus functions (Dougher & Markham, 1994, 1996) suggests that a training history on one member of a stimulus class (Stimulus X) will not only spread to other members of that specific class (Stimuli Y and Z), but also to another separate stimulus class (Stimuli E, F and G) if one member (not even the initially trained Stimulus X) is made equivalent to a member of the separate class (Stimulus Z is trained to be equal to Stimulus G). This transformation effect has been shown with eliciting functions (Dougher, Hamilton, Fink, & Harrington, 2007), as well as a variety of operant functions (e.g., Catania, Horne, & Lowe, 1989; Dougher, Perkins, Greenway, Koons, & Chiasson, 2002; Rehfeldt & Hayes, 1998) including applied problems such as pathological gambling (Dixon, Wilson, & Whiting, 2012; Hoon, Dymond, Jackson, & Dixon, 2008; Zlomke & Dixon, 2006).

Relational Frame Theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001) expands the general notion of stimulus equivalence by its inclusion of relations between stimuli other than equal. Types of relations may include opposite, comparison, temporal, and hierarchical. Within a gambling context many such relations exist where one casino may be "better than" another, a game may pay "more than" another and the player wants to be the "opposite of" a loser when going home that evening. Over the past decade a number of studies on gambling have demonstrated that when the contingencies remain the same on various gambling options, certain learning histories may transfer or transform the participant's responding into novel situations and impact wagering, persistence or both (e.g., Dixon, Bihler, & Nastally, 2011; Dixon, Nastally, Jackson, & Habib, 2009; Dixon, Wilson, & Whiting, 2012; Hoon, Dymond, Jackson, & Dixon, 2008; Zlomke & Dixon, 2006). Relational responding and self-generated rule-following (Wilson & Dixon, 2015; Wilson & Grant, 2015) have been shown to impact response allocation across games of chance with equal pay out rates.

As the body of experimental evidence continues to grow in support of an RFT explanation as to why someone would gamble, alter responses across games, and be resistant to quitting gambling, it naturally follows that the therapeutic application of RFT (e.g., Acceptance and Commitment Therapy, ACT; Hayes, Stroshal, & Wilson, 1999/2011) may hold promise in altering established relational networks to reduce the gambling behavior of a given person. The goal of ACT is to foster *psychological flexibility*, or to "train individuals to actively and openly contact their ongoing experiences in the present moment… without defense and as it serves their chosen values" (Sandoz, Wilson, & Dufrene, 2010, p 17). Psychological flexibility is targeted through the use of six interrelated components or processes termed: acceptance, present moment focus, defusion, self as context, committed action, and values. The ACT model is a set of therapeutic techniques designed to alter the way contextual verbal relations function, in the hopes of influencing experiential avoidance. The empirical evidence in support of ACT as an effective therapeutic technique continues to expand (see Ruiz, 2012 for a review), and has been evidence of an effective treatment option for substance use disorders (e.g., Twohig, Shoenberger, & Hayes, 2007).

A few brief experimental-based ACT approaches have been employed with problem gamblers and the results appear promising. In the first investigation on ACT in a gambling context, Nastally and Dixon (2012) documented a reduction in gamblers' irrational beliefs after exposure to a brief computerized delivery of ACT. Gamblers completed a slot machine activity before and after the intervention, wherein gamblers rated how close each slot machine outcome was to a win (1= not at all close, 10= very close to a win). The intervention included a PowerPoint slide-show across ACT component, each targeted at the near-miss effect (i.e., 1 or 2 identical slot machine symbols short of a win, on a single payout line). Following ACT, all three gamblers' subjective ratings of near-miss outcomes decreased. In a related study, Whiting and Dixon (2014) assessed the extent to which acceptance and defusion (through an imaginal desensitization task) would have on gambling. Thirty gamblers were randomly assigned to complete 30 imaginal desensitization trials (either imagining slot machine gambling 30 times plus dropping quarters in a laundry machine 3 times, or imagining dropping quarters in a laundry machine 30 times plus slot machine gambling 3 times). Next, gamblers were asked to play on a slot machine for as long as they wanted to. Results showed that participants who accepted gambling images/thoughts played less than participants who did not think about gambling images/thoughts. Taken together it appears that a full therapeutic trial for pathological gamblers could be valuable using the ACT model.

If implemented successfully an ACT-based treatment for disordered gamblers could potentially make gambling less appetitive by disrupting existing relational networks between stimuli, or by creating new competing relational frames that are in contrast to prior held frames. For example, if a client tends to see gambling as an activity which allows for acquiring additional money with no effort (if-than frame), and is seen as equivalent to working a job that yields money (coordination frame), that client may find little reason to quit gambling because it is just another way to make money. However, if that client is now exposed to a therapeutic intervention which alters such relations to include relational networks targeted at larger value systems (e.g., *If I gamble, then no bills get paid; and gambling is the same as missing family time*), then the client might reduce gambling because these relational frames contain more aversive stimulus functions than before (Barnes-Holmes, Barnes-Holmes, McHugh, & Hayes, 2004; see also Hayes et al., 2001 for similar argument).

To date, therapeutic interventions for gambling have relied heavily on self-reports of gambling (e.g., Hodgins, Currie, & el-Guebaly, 2001; Petry, Weinstock, Morasco, & Ledgerwood, 2009; see also Gooding & Tarrier, 2009 for a review), with limited outcome studies focusing on direct behavioral observation. Unlike other substance use disorders, direct measures useful in detecting substance use over time (such as urine or hair samples) are not possible for gambling. While subjective reporting and reliable psychometric assessments are commonly place for gambling research, additional direct observational methods across a range of behavioral phenomenon (including physiological changes) may serve as additional measures to assess the effectiveness of interventions.

Emerging neuroimaging studies on substance use disorders have found neurological similarities between disordered gambling and other substance use (e.g., Potenza, 2008; Shah, Potenza, & Eisen, 2004) including cocaine (Wareham & Potenza, 2010), methadone and alcohol (Goldstein & Volkow, 2002), and tobacco (De Ruiter et al., 2009). Neuroimaging studies have also found differences in brain activation and functioning patterns across gambling proclivity (Habib & Dixon, 2010) and gambling outcomes (Dixon, Wilson, & Habib, 2014). For instance, Habib and Dixon (2010) subjected disordered and non-disordered gamblers to a slot machine activity. Gamblers were instructed to rate each slot machine outcome (e.g., wins, losses, and near-misses or 2 of 3 matching symbols on the payout line) during the slot machine activity. Results showed increased dopaminergic activation for non-disordered gamblers during winning trials when compared to losing trials; with increased dopaminergic activation for disordered gamblers during near-miss trials when compared to losing trials.