Heavy cannabis use and attentional avoidance of anxiety-related stimuli

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ABSTRACT

Objectives: Cannabis is now the most widely used illicit substance in the world. Previous research demonstrates that cannabis use is associated with dysfunctional affect regulation and anxiety. Anxiety is characterised by attentional biases in the presence of emotional information. This novel study therefore examined the attentional bias of cannabis users when presented with anxiety-related stimuli. The aim was to establish whether cannabis users respond to anxiety-related stimuli differently to control participants.
Methods: A dot-probe paradigm was utilised using undergraduate students. Trials contained anxiety-related stimuli and neutral control stimuli. Eye-tracking was used to measure attention for the stimuli.
Results: Results indicated that cannabis users demonstrated attentional-avoidance behaviour when presented with anxiety-related stimuli.
Conclusions: The findings suggest a difference in processing of emotional information in relation to neutral information between groups. It would appear that cannabis users avoid anxiety provoking stimuli. Such behaviour could potentially have motivational properties that could lead to exacerbating anxiety disorder-type behaviour.

1. Heavy cannabis use and attentional avoidance of anxiety-related stimuli

When in threatening situations, individuals with anxiety disorders differ from others in terms of how they think (Butler & Matthews, 1983), remember (Amir, Foa, & Coles, 1998), and attend (MacLeod & Mathews, 1988). Research now suggests that these findings may be associated with biases in attentional processing (see Mogg & Bradley, 1998). Of tasks designed to measure attentional bias (AB), the most commonly used measure is a modified version of the Stroop task (Stroop, 1935). During this task a delay in reaction time (RT) for the emotional words would be expected, as long as the word meaning is relevant to participants. This interference has been suggested to be representative of an AB. This is because the delay is thought to be the result of the meaning of the word capturing the attention of the participant, thus reducing cognitive resources for the concurrent task (that of naming the colour). Anxiety-related AB is generally assumed to be the result of a negative appraisal of threat-related stimuli, as threat stimuli could potentially have inherent motivational properties (see Mogg & Bradley, 1998). Such findings have been replicated and extended by use of other tasks, such as the dot probe (see Cisler & Koster, 2010) and eye-tracking techniques (see Armstrong & Olatunji, 2012).

The AB associated with threat-related stimuli has been well documented (e.g. Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007). Those who are prone to anxiety problems have been found to have an increased AB for stimuli related to threat compared to those who are typically not anxious (e.g. Mogg & Bradley, 1998). For example, those with specific phobias have demonstrated an AB for stimuli related to their phobia (e.g. an AB for spiders). By contrast, those who have generalised anxiety disorders demonstrate an AB for stimuli that are generally threat-related (see Bar-Haim et al., 2007). Such AB has been found to be a robust phenomenon within populations high in anxiety (e.g. Cisler, Bacon, & Williams, 2009). Whether these ABs are *toward* the stimulus or *away* from the stimulus is an important issue.

Cisler and Koster (2010), through meta-analysis, made the suggestion that there are three forms of AB: facilitated attention, delayed disengagement, and attentional avoidance (attentional avoidance cannot occur concurrently with the other forms of AB). For threat stimuli, facilitated attention has been observed where attention has been found to be drawn to threat stimuli. This is a process of rapid orienting of attention. Further, threat stimuli are also associated with a delayed disengagement of attention. This is when attention has been captured by threat stimuli, which impairs the switching of attention. Attentional avoidance has been suggested to be the complete contrast of traditional notions of AB, as it is thought that threat stimuli, in some cases, actually cause attention to be diverted away from a threat cue (e.g. Koster, Crombez, Verschuere, & De Houwer, 2006). This entire process, though

noting that each component can exist without the presence of the other two, has been thought to be the result of a hypersensitive system for coping under threat. We are rapidly able to locate threat and have trouble removing our attention from it. But, following threat, we remove our attention from the threatening stimulus, perhaps to alleviate anxiety (Cisler & Koster, 2010).

Although there is a lot of research which suggests the role of attention in the alleviation of anxiety (e.g. Eysenck, Derakshan, Santos, & Calvo, 2007), there are other, less covert, methods anxiety sufferers have utilised. One such method that anxiety sufferers have found to cope with their anxiety is substance abuse (see Nunes & Blanco, 2009). Indeed, data from the National Comorbidity Study (Kessler, Chiu, Demler, & Walters, 2005) indicates that individuals with anxiety disorders are 2–3 times more likely to have a substance use disorder at some time in their lives than the general population. These results suggest that there may be a comorbidity between substance use and anxiety disorders. However, the cause and effect would appear unclear. Substance use can be used as a maladaptive form of emotion regulation, as it can manage negative affect and enhance positive affect (Tschann et al., 1994). Theories supporting the negative reinforcement and self-medication theory claim that emotional processes with their related disturbances are the primary contributing factor of substance use, abuse, and dependence (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; Duncan, 1975; Khantzian & Treece, 1985). It is postulated that individuals engage in substance use behaviour to cope with stress and the preceding reason for initiation is emotional distress (Tschann et al., 1994).

There could potentially be three theoretical mechanisms in place that explain the link between substance use and anxiety. Firstly, substance use disorders could potentially develop in an attempt to self-medicate anxiety symptoms. Secondly, anxiety symptoms could occur whilst experiencing substance use withdrawal symptoms. Finally, there could be an interaction between the above mechanisms. Here depressants, such as alcohol, opiates and cannabis, could be used in an attempt to decrease anxiety, but during withdrawal states, anxiety could be increased which would lead to an exacerbation of the anxiety disorder and making relapse to substance use more likely.

Of substances of abuse, cannabis has long been associated with anxiety. Agosti, Nunes, and Levin (2002) found that cannabis dependence doubled the likelihood of an anxiety disorder. There is also evidence to suggest potentially a causal relationship (see Patton et al., 2002). However, whether this is a cause or effect is beyond the scope of this paper. Nevertheless, it would appear that there is evidence which could suggest that cannabis users use cannabis in order to alleviate the symptoms of anxiety, as frequent cannabis use has been found to be associated with self-reported statements related to physical discomfort, unpleasant emotions, and conflict with others (Johnston & O'Malley, 1986; cf. McKay, Murphy, McGuire, Rivinus, & Maisto, 1992). Kaplan, Johnson, and Bailey (1986) indicated that a link exists between avoidance coping strategies and increased cannabis use. Cannabis users, with elevated social anxiety, report to use cannabis to avoid social scrutiny and as a negative affect management strategy (Buckner, Bonn-Miller, Zvolensky, & Schmidt, 2007). Consistent with the motivational models of substance use it is also claimed that individuals with an elevated social anxiety also use cannabis to reduce anxiety in social situations (Baker et al., 2004).

Therefore, due to the association between cannabis and anxiety, it is particularly important to provide evidence which may increase our understanding toward how this association manifests. Previously research has indicated altered affective response and emotional evaluation in cannabis users (see Gruber, Rogowska, & Yurgelun-Todd, 2009; Wesley, Lile, Hanlon, & Porrino, 2015). Cannabis would appear to decrease reactivity to negative affective stimuli whilst also acutely inducing anxiety (see Powell, Tait, & Lessiter, 2002; Salamone, 1994). This pattern of affective evaluation may be the result of deficits in implicit evaluation and attentional processes. Indeed, Metrik et al. (2015) observed that a

sub-group of cannabis users with cannabis dependence demonstrated a within-subjects difference regarding the processing of emotional-related words on an emotional-Stroop task when under the influence of cannabis. It was suggested that cannabis may increase in the cognitive resources required for the processing of negatively valenced stimuli. However, these previous findings predominantly measure biases in cognitive processing, rather than biases in the orientation of attention. Tasks like the emotional-Stroop would appear to measure the delayed disengagement of attention caused by the meaning of a stimulus causing an increase in cognitive processing. In order to measure the emotionally aversive nature of a stimulus a visual probe task would be necessary with gaze tracking capabilities.

Within this paper, we aim to observe whether cannabis users demonstrate an AB for anxiety-related stimuli. Note, we do not suggest that cannabis is the only substance of abuse that may lead to differences in AB. Previous research would suggest that there are a number of types of AB which could be demonstrated by our sample (see Cisler & Koster, 2010). Therefore, we utilise a dot-probe (see MacLeod, Mathews, & Tata, 1986), as this is more sensitive at measuring the different AB than the emotional-Stroop (as within the Stroop there are not multiple stimuli in different locations competing for attention). In the dot-probe task, a trial involves two stimuli, typically presented on the left and right part of the distal layout, such that one stimulus is neutral, whilst the other is anxiety-related. The stimuli disappear and a dot appears either at the location of the neutral or the anxiety-related stimulus. The task of the participant is to identify the location of the dot as quickly as possible. Depending on whether the dot replaces the neutral or the anxiety-related stimulus, and the relative speed of responding across trials, the experimenter can establish the presence of an AB. The speed of which one responds on the dot-probe indicates which picture was being looked at when the probe appeared. Therefore, if, for example, the anxiety-related stimulus was being attended to when the probe appeared, one would anticipate a decreased reaction time (RT) for responding to the probe due to already attending to that side of the screen. However, as well as RT, we can also look at accuracy, and, with the use of an eye-tracker, first fixation and dwell time. First fixation time is the time to orient attention toward each picture and dwell time is the amount of time looking at each picture-type; either anxiety-related or neutral control. Previous research has suggested that anxiety-related stimuli can either lead to facilitated attention, delayed attentional disengagement, or attentional avoidance (see Cisler & Koster, 2010). We aim to measure whether cannabis users differ from controls in the way they process anxiety-related stimuli.

2. Methods

2.1. Participants

A total of 40 participants were recruited for the study. However, of those participants initially recruited 23 participants were included in the final analyses. The cannabis user group were asked about their cannabis use and required to have not taken cannabis within the previous 24 h but they were required to otherwise be daily cannabis users. Control non-users were required to have never taken cannabis to be eligible to participate. These criteria remove recreational cannabis users and are consistent with previous studies (see Gruber et al., 2009; Wesley et al., 2015). Therefore, nine participants were found to be ineligible to participate through this pre-selection phase, due to not matching these user criteria. A further eight participants' results were unavailable due to calibration errors with the eye-tracker. Therefore, the final sample consisted of eight heavy cannabis users (mean age: 23.13; sd: 4.16; male = 6) and 15 control non-users (mean age: 24.13; sd: 3.94; male = 10). Participants were recruited from Swansea University and received course credit for their time.