Cognitive and neuropsychopharmacological processes in human drug craving
Franken, I.H.A.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Influence of individual differences in craving and obsessive cocaine thoughts on attentional processes in cocaine abuse patients

In the present pilot-study, the relation between craving, obsessive thoughts about cocaine, experienced control and attentional bias for cocaine related words is investigated. Sixteen cocaine abuse patients participated in a reaction time (RT) experiment which was employed to measure the ability of subjects to shift their attention away from cocaine related words. Post-experiment craving was found to be positively correlated with reaction times on drug related cues, in contrast to reaction time (RT) on neutral cues. Furthermore, obsessive thoughts about cocaine use and the experienced cocaine use control in the week before the experiment were correlated in a higher degree with RT's on drug cues than post-experiment craving. Attentional bias for drug cues was more present in patients with higher score on obsessive cocaine thoughts and higher craving scores. This study shows that individual differences on information processing within a cocaine abuse patient population are present.


Introduction
Attentional bias is believed to play an important role in the maintenance of psychiatric disorders. In the field of substance abuse, attentional bias may contribute to the maintenance of drug use and relapse. Although preoccupation with drug related stimuli is one of the key features of addiction, experimental studies on this topic are scarce. Several studies on abstinent alcoholics provide evidence for the presence of an attentional bias in abstinent alcoholics on alcohol related stimuli. In addition, the observation that substance abusers have difficulties in disengaging from addiction related stimuli is found for other addictive behaviors such as nicotine addiction, bulimia nervosa and cocaine addiction.

Experimental studies in smoking populations found that, in the presence of smoking cues, smokers have difficulties focusing their attention on alternative (neutral) cues. Initial difficulties in avoiding addiction related information, that is making attentional shifts away from this material, may promote relapse in abstinent smokers.

Prolonged RT's on attentional tasks in the presence of drug cues, and attentional bias on drug cues may reflect the presence of drug craving. However, in a recent study of Juliano & Brandon the authors found that RT's are affected by exposure to drug cues, yet RT variance could not be explained by craving alone.

In cognitive theory on emotional disorders, such as generalized anxiety, obsessive-compulsive disorders and depression, it is assumed that these disorders are associated with abnormalities in thought content. These patients experience problems by the frequency and meaning of disturbing thoughts.

The experimental paradigm of Stormark et al. and Posner, in which both long and short cue-target interval duration was used, was adapted for investigating the relation between frequency of obsessive cocaine thoughts, experienced cocaine use control and RT's on stimuli cued by cocaine-related and neutral words in a correlational design. Because the duration of cue presentation was found to be of influence on RT's to targets cued by alcohol words the influence of cue presentation time on reaction time was studied as additional research question.

Method
Subjects
Sixteen inpatients (3 female) of an addiction treatment department of a psychiatric hospit-
tal, who met the DSM-III-R criteria for cocaine dependence or cocaine abuse, participated voluntarily in the study. Written and oral information concerning the study was provided before the experiment, and consent was subsequently obtained. All subjects were screened by use of the Composite International Diagnostic Interview (CIDI) for DSM-III-R. None of the subjects met the criteria for schizophrenia, major depression or bipolar disorder. The mean age of the subjects was 26.4 years (s.d. 6.4 years). Mean days of cocaine abstinence was 184 days (s.d. 120 days), mean age of first cocaine use was 18.6 years (s.d. 2.3 years), and the mean years of regular (minimal 3 days a week) cocaine use was 5.7 years (s.d. 4.0 years). No subject received medication at time of the study.

**Measurement of cocaine craving**

Obsessive thoughts about cocaine and experienced control over cocaine use were measured by the Obsessive Compulsive Drug Use Scale (OCDUS-cocaine version). The OCDUS is constructed analogue to the Obsessive Compulsive Drinking Scale (OCDS). Similar to the OCDS, the OCDUS consists of two subscales: The obsessive subscale (OB), which measures the obsessive thoughts about cocaine, and the compulsive subscale (CP), which measures the compulsive drive to use cocaine and the experienced control over cocaine use. The sum of both scales results in a total score (TOT). All questions of the OCDUS refer to the last week. In a validation study of the original OCDS, the authors concluded that the OCDS is a reliable and valid self-rating instrument for the measurement of dimensions of alcohol dependence. All subjects were asked to fill out the OCDUS prior to the experiment. Immediately after the experiment, a visual analog craving scale (VAS craving) was administered in order to measure post-experiment craving.

**Measurement of attentional bias**

The RT-experiment was programmed in EXPE language and was run on an IBM-PC and a IBM color monitor. Cues, drug or neutral words (1:1), were presented on the monitor in a rectangle in the left or right hemifield (1:1). Following presentation of 100 or 500 ms (1:1) duration, the word disappeared and immediately a target stimuli (an asterisk) was presented in either the left or right hemifield rectangle. The target stimuli appeared in the same hemifield as the cue (valid trial), or in the opposite hemifield (invalid trial; 2:1). Subjects responded by means of a response box connected with the computer, and were instructed to press the right or left button (dependent on the target location) of this response box when the target appeared on the screen. For details and schematic outline of this task is referred to Stormark et al. Two types of cues were used: neutral words and cocaine related words. The cocaine words included: Cocaine, coke, base, high, flash, blow, pipe and dope. Neutral words were matched for the number of letters (in Dutch language) and included: South, east, west, north, table, curtain, meter and stick. Each of the 16 cues were presented six times in random order, resulting in a 94-trial task. The experimental task duration was approximately 15 minutes. RT's were recorded in milliseconds from stimulus onset until a manual response was given on one of the two response buttons. Responses after three seconds from stimulus onset were excluded from statistical analysis.

Before the experiment, instructions were presented on the computer screen. After these instructions, eight practice trials were presented, in which the subjects received feedback by computer screen when the response was not adequate (too slow or fast). Following the computer task, subjects were asked to complete the VAS craving scale and to recall as many presented words as possible. RT's on the invalidly cued target stimuli trials (asterisk appeared in the opposite hemifield as the cues) were used as measure for attentional bias, that is, problems with disengaging from the presented cue.
Table 1. Mean RT’s to neutral and drug cues and correlation between RT and OCDUS/Post-experiment craving score (n=16).

<table>
<thead>
<tr>
<th></th>
<th>Mean (s.d.)</th>
<th>Pearson’s r (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RT</td>
<td>OCDUS OB</td>
</tr>
<tr>
<td>RT long (500 ms) drug cues</td>
<td>372.8 (113.0)</td>
<td>0.45 (0.08)</td>
</tr>
<tr>
<td>RT long (500 ms) neutral cues</td>
<td>378.4 (92.8)</td>
<td>0.29 (0.26)</td>
</tr>
<tr>
<td>RT short (100 ms) drug cues</td>
<td>442.0 (106.5)</td>
<td>0.60 (0.02)</td>
</tr>
<tr>
<td>RT short (100 ms) neutral cues</td>
<td>444.1 (141.7)</td>
<td>0.22 (0.45)</td>
</tr>
</tbody>
</table>

Results
The relation between OCDUS-score, post-experiment VAS craving-score and RT’s on neutral versus drug cues is summarized in table 1. No significant overall differences in RT’s between the neutral versus drug cues could be found. The mean number of remembered cocaine (x=3.4, s.d.=1.7) cues was significantly higher than the remembered neutral (x=1.6, s.d.=1.3) cues (2-tailed paired t-test; t(16)=5.3, p<.001).

Discussion
In general, longer RT’s reflect difficulties to disengage from the cue. In the present study, RT’s on cocaine versus neutral cues were not found to be different. However, the present study shows that individual differences play a role in craving-RT paradigms. We found that post-experiment craving, obsessive thoughts on craving and experienced control on cocaine use are related to difficulties in making attentional shifts away from cocaine cues. Persons with more obsessive thoughts and high craving on cocaine demonstrate longer RT’s on cocaine related cues in contrast to neutral cues, where this relation was not observed. The relation between craving, experienced control and RT’s was only significant in the short cue-target interval (100 ms). In the long cue-target interval (500 ms) this relation did not reach the 0.05 level of significance. Differences in long and short cue presentation time may reflect extended influence of conscious avoiding strategies of the subject. In the long cue-target interval the subject has more time to employ this conscious strategy.12

In addition to attentional bias, in abstinent cocaine abuse patients a memory bias for cocaine related cues compared to neutral cues was found. This may reflect that more attention was drawn on the cocaine cues compared to neutral cues during the attentional task.

For the first time, this study shows a relation between obsessive thoughts about cocaine, experienced control, craving and attentional bias operationalized as the ability to disengage from cocaine related cues. This implicates that individual differences on information processing in a cocaine abuse patient population may be present. Furthermore, the finding that the correlation between RT and cognitive correlates of craving was only significant in the short cue-target interval provides an indication that this attentional bias is an automatic process. Because studies on information processing in substance abuse patients are scarce, more research is needed in this area.

References

Chapter 5
Chapter 5


