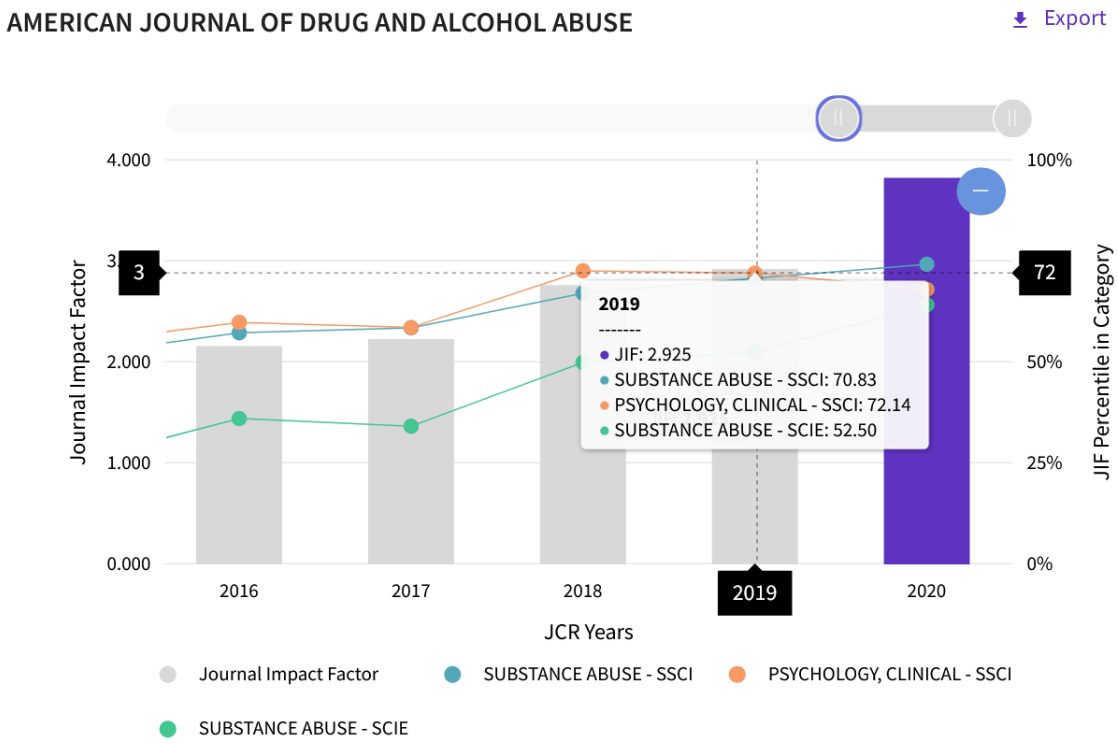
4) Gómez-Bujedo, J., Domínguez-Salas, S., Pérez-Moreno, P. J., Moraleda-Barreno, E., & Lozano, O. M. (2019). Reliability and validity evidence of a new interpretation bias task in patients diagnosed with drug use disorder: A preliminary study of the Word Association Task for Drug Use Disorder (WAT-DUD). *The American Journal of Drug and Alcohol Abuse*, *45*(4), 365-376. https://doi.org/10.1080/00952990.2018.1559848 **(Posición: 37/131; Q2).**



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2019	37/131	Q2	72.14
2018	36/130	Q2	72.69
2017	53/127	Q2	58.66
2016	49/121	Q2	59.92

EDITION
Social Sciences Citation Index (SSCI)

CATEGORY
SUBSTANCE ABUSE
10/37

JCR YEAR	JIF RANK	JIF QUARTILE	JIF PERCENTILE
2020	10/37	Q2	74.32
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2018	12/35	Q2	67.14
2017	15/35	Q2	58.57
2016	15/34	Q2	57.35

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METHODS IN ADDICTION RESEARCH

Reliability and validity evidence of a new interpretation bias task in patients diagnosed with drug use disorder: a preliminary study of the Word Association Task for Drug Use Disorder (WAT-DUD)

Jesús Gómez-Bujedo[a], Sara Domínguez-Salas[a], Pedro Juan Pérez-Moreno[a,b], Enrique Moraleda-Barreno[a,b], and Oscar M. Lozano[ab]

[a]Department of Clinical and Experimental Psychology, University of Huelva, Huelva, Spain; [b]Research Center for Natural Resources, Health and the Environment, University of Huelva, Huelva, Spain

ABSTRACT

Background: Interpretation bias tasks such as word association tests have shown a moderate relation with substance use, but most studies have been conducted in nonclinical samples and these tasks are difficult to rate. *Objectives*: To provide: (1) reliability evidence of the Word Association Task for Drug Use Disorder (WAT-DUD), a novel and easy-to-rate instrument for measuring interpretation bias and (2) validity evidence based on the relationship between the WAT-DUD and variables associated with patterns of drug use and treatment outcomes. *Methods*: 186 patients (67 outpatients and 119 inpatients, 90% males) participated in the study. The task consisted of a simultaneous conditional discrimination where an image (either explicit or ambiguous) was the sample and two words (drug-related or not) served as comparison stimuli. The Substance Dependence Severity Scale, the Cocaine Craving Questionnaire-Now, and the Multidimensional Craving Scale were also used. *Results*: The ambiguous images items showed adequate reliability in terms of internal consistency (α = .80) and test–retest reliability (79.7% on average). The interpretation of images as drug-related was positively correlated with craving for cocaine (r = .20; p = .029), alcohol (r = .30; p = . 01), and alcohol withdrawal (r = .31; p = .01) along with severity of alcohol dependence (r = .23; p = .04). No relationship was found with the severity of cocaine dependence, or its symptoms of abstinence. *Conclusion*: WAT-DUD shows psychometric properties that support its use in research contexts, although more research is needed for its use in the clinical setting.

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In recent years, several studies have been published that use behavioral tasks to study the psychological processes related to drug addiction and treatment outcomes (1,2). Among these tasks are indirect or implicit measures, which are characterized by the following features: (a) participants are unaware of what is being evaluated; (b) participants do not have conscious access to the cognitive processes evaluated; or (c) participants have no control over the evaluation (3). Some authors point out the advantages of these tasks over self-report measures because they are potentially less affected by social desirability bias and the possibility of falsification (4,5). Rooke, Hine & Thorteinsson (6) in a meta-analysis point out that implicit measures have a moderate relationship (r = 0.31 on average) with variables related to substance use. However, it is observed that the magnitude of the relationship between implicit association measures and substance use vary depending on several methodological factors. Specifically, semantic association tasks and word association tasks show larger effect sizes, reaching average values of .38 and .40, respectively. As the literature suggests, implicit processes assessed jointly with explicit measures or self-report measures can lead to a better prediction of drug use (7).

One of the paradigms used in these types of implicit measures is the word association task (8,9). Tasks of this sort are based on the presentation of stimuli not explicitly related to the drug (ambiguous stimuli). For this reason, some authors have pointed out that these tasks (including word association tasks, images, and ambiguous scenarios) evaluate interpretation bias (10). This set of tasks is based on the notion that repeated exposure to the drug and its consequences, jointly with contextual cues, makes it more likely that consumers will give a drug-related response to the presentation of

CONTACT Oscar M. Lozano oscar.lozano@dpsi.uhu.es Department of Clinical and Experimental Psychology, Facultad de Ciencias de la Educación, University of Huelva, Huelva 21071, Spain

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these stimuli (11–13). This theoretical approach has received empirical support from several studies that have revealed the relationship between performance on these tasks and self-reported use of various drugs, particularly alcohol and marijuana (8,14–21). For example, Stacy (8) presented 5 ambiguous words that could potentially be related to alcohol and marijuana (such as "shot" or "joint"), along with 33 control words (not related to drugs) to 567 university students. The instructions included the phrase: "Write next to each word the first word it makes you think of" (p. 185). The words written by the participants were then classified by independent observers according to whether they were related to drugs or not. The results indicated that drug-related responses to ambiguous stimuli were associated with the self-reported use of alcohol (r = 0.37) and marijuana (r = 0.61), showing moderate to large effect sizes. Similar results have been generated with variants of this task in other investigations (13,14), including the presentation of ambiguous images (14). Similarly, these associations have been described in studies carried out using ambiguous scenarios tasks. For instance, Woud et al. (22) found that patients diagnosed with alcohol dependence complete the ambiguous scenarios with more references to alcohol than control participants, and that interpretation bias was associated with high scores on the AUDIT scale, finding a high effect size (r^2 = 0.61). Similar results have been found in patients with borderline intellectual functioning, where those who had problematic alcohol use showed more interpretation bias than moderate drinkers (23).

In spite of the results obtained using these tasks with ambiguous stimuli, their use is relatively lower compared with other implicit tasks. In the study mentioned by Rooke, Hine, & Thorteinsson (6), it was shown that the use of these tasks constituted only 20% of the studies included in their meta-analysis. Nonetheless, the effect size observed in these tests showed higher values (r = .38) than those observed in other aspects of implicit cognition considered in this work, such as the tests of implicit attitudes (r = .27) or attentional bias (r = .26) (6). One of the factors that can influence their scarce use is the relative complexity and subjectivity involved in obtaining the measure (10,24), since this is usually obtained following classification of the responses of at least two observers (8,25). Similarly, some authors question the implicit character of word association tasks and suggest that they may be influenced by the demand characteristics of the task, such as social desirability bias (10). In addition to these factors, these tasks have been relatively unexplored psychometrically (26,27), which undoubtedly limits their administration.

It should also be noted that most studies with these tasks have been conducted in nonclinical samples. The most commonly studied samples are those of students, recreational consumers, or populations at risk of drug abuse (but not clinical), and hence the substances most frequently studied have been alcohol and marijuana (e.g. 8,14,15,17,21,28). In these studies, it has been usual to relate the execution of these tasks with the frequency of self-reported use of the substance. Within the clinical population, one of the few studies published is that of Woud et al. (22). However, to date there have been no studies that link performance on word association tests or interpretation bias tasks with variables related to treatment outcomes, such as indicators of adherence to treatment, relapse, or other variables related to the health status and quality of life of patients.

In summary, the specialized literature reveals that interpretation bias tasks (word association or ambiguous scenarios) present adequate relationships with drug use measures. However, these measures are hindered by the fact that their measurement is complex, and the psychometric evidence is inconsistent. In addition, a review of the literature indicates that few studies have been conducted in clinical samples.

Thus, the objectives of the present work are, using a sample of patients in treatment, to provide: (1) reliability evidence of the Word Association Task for Drug Use Disorder (WAT-DUD), a novel and easy-to-rate instrument for measuring interpretation bias; and (2) validity evidence based on the relationships between the WAT-DUD and variables associated with patterns of drug use and treatment outcomes. For this last objective, four scores will be explored: choice of words related to the drug in ambiguous and explicit images, and response time for the word choice when presented with ambiguous and explicit images. According to previous studies that have analyzed the relationship between drug-related responses to ambiguous stimuli, craving and substance use (29), we expect to find the following results: (i) Patients with greater cravings will choose a higher number of drug-related words among the set of ambiguous images.

Similarly, given the relationship found between withdrawal symptoms and the severity of dependence with other implicit tasks performance (2) we expect to find: (ii) patients with more withdrawal symptoms will select more drug-related words when presented with ambiguous images; and, (iii) patients with a higher degree of severity of dependence will select more drug-related words when presented with ambiguous images. On the basis of previous work carried out on attentional bias and other implicit measures that allow

analyzing reaction times (30), it is hypothesized that: (iv) higher levels of craving, withdrawal symptoms, and severity of dependence will be related to faster reaction times when choosing ambiguous and explicit images. Given that some authors have shown a pattern of avoidance of explicit drug stimuli in patients who have relapsed (28,29), in the current task this pattern of avoidance should be characterized by choosing words not related to the drug, with faster response times. Therefore, we expect to find: (v) a lower percentage of drug-related words in those patients who relapse compared to those who do not; and, (vi) the patients who relapse will show a response bias toward explicit drug images, showing shorter RTs than non-relapse patients.

Method

Participants

The sample consisted of 186 substance use disorder patients in treatment (67 outpatients and 119 inpatients) attending public centers for the care of people with addiction problems in the province of Huelva (Spain). To participate in the study, participants had to meet the following inclusion criteria: (i) be a consumer of alcohol and cocaine; (ii) have a SUD associated with at least one of these two substances, diagnosed according to the diagnostic criteria of the DSM IV; and (iii) sign the informed consent form. Patients excluded where those: (i) having vision problems that impeded the execution of the tasks; (ii) having other mental disorders that affect the execution of the task (e.g., mental retardation or severe mental disorders); (iii) receiving medication that could interfere with their cognitive abilities. The participants were recruited between May 2016 and June 2017.

Instruments

Word Association Task for Drug Use Disorder (WAT-DUD)

This task has been developed under the paradigm of simultaneous conditional discrimination tasks (31). In these, an image (neutral, ambiguous, or explicitly related to drugs) is presented next to two words (one related to the drug and the other not). The images were extracted from the Internet by filtering them for non-commercial use. For this search, words such as 'drug', 'heroin', 'cocaine', 'cannabis', 'drug treatment', 'drug use', 'addiction', 'rush', 'drug consequences', 'drug effects' were used, along with 'drug sale', 'drug traffic', 'drug fun' and combinations of these keywords. Images of various substances were used because polydrug use is the most commonly reported situation among people with substance use problems (32). We also included neutral images corresponding to frequently used words ('house', 'pencil', 'sky', etc.). Three members of the research team independently searched for the images, generating a bank of 330 images. Subsequently, two members of the research team classified all images according to the degree of relationship with drugs, with three categories: neutral (images without any relation to drugs, e.g., a book), ambiguous (images that can evoke drugs, but which are not explicit, e.g., smoking paper), and explicit images (images with a content in which drugs or related contexts are visualized, e.g., marijuana leaves). Each researcher categorized the images independently. The degree of agreement between the two researchers for the 330 images was not quantified. However, from this corpus of images we selected 35 neutral images, 35 explicit images, and 70 ambiguous images in which there was 100% agreement between the 2 researchers. The remaining images were excluded.

In order to select the words accompanying each of the images, this corpus of 140 images was presented to a sample of 10 drug users and 10 nondrug users. Each of these participants was shown the selected images and, for each of them, they had to indicate five words evoked by the image. Then, for each image, both the drug-related and unrelated word that was most often mentioned by the participants was selected. Once the images and associated words had been established, the task was programmed and a pilot study was conducted.

The task was programmed in Unity 3D. This consisted of the central presentation of the image, accompanied by two words that appeared below the image (related and unrelated to drugs), and the participants had to indicate which of the two words evoked the image (see Figure 1). The images were accompanied by the two selected words, counterbalanced in their presentation (left and right) and randomized for presentation. No time limit was set for the subjects to respond. Prior to the start of the task, the subjects received the instructions ("Next, a series of images will appear on the screen, one at a time. Each of these images will appear with two words. You must choose as quickly as possible one of the two words. To do this, click on the chosen word") and two test trials were carried out. In addition, if necessary, the evaluator explained again the task. Once the participant understood the instructions properly, the task began.

Figure 1. Examples of the three types of images used in the task. A: Neutral; B: Ambiguous; C: Explicit. When faced with the image (sample) the participant had to choose one of the two words (comparisons). The words considered correct (a) or related to drugs (b and c) are highlighted in bold. The images were extracted from the Internet by filtering them for noncommercial use.

The data were collected using a Compaq Deskpro S710 computer with a frequency of 72 Hz on a 17-inch monitor. Once the task had been designed, a pilot study was carried out with the 140 images in a sample of 10 patients diagnosed by SUD and 25 nondrug users. For each image, the percentages of the associated words chosen (neutral and drug-related) were calculated in both groups. The time taken to administer the task was also measured, and the participants were asked about the degree of fatigue experienced from carrying out the task. Given that the participants considered the execution time to be long, the authors decided to reduce the number of images shown. To do this, the authors selected the 25 neutral and 25 explicit images in which there was the most agreement between both groups. For the selection of the ambiguous images, the 50 images that showed a greater percentage difference between both groups were selected. For these 50 images, the differences were confirmed to be statistically significant ($p < .05$).

This last group of images constituted the initial task presented in this study, consisting of the presentation of 100 images (plus 2 practice trials) in 2 blocks of 50 images each. There was an inter-block interval of 1 min. These 100 images were distributed as follows: 16 images related to alcohol, 13 images related to cannabis, 11 images related to cocaine, 10 images related to heroin, and 25 images related to nonspecific drug use and polydrug contexts for any drug (e.g., party images or rehabilitation centers).

The dependent variables considered were the proportion of times that the participants indicated the words related to the drugs (in ambiguous and explicit images), and the average response latency between the presentation of the image and the choice of the words in ambiguous and explicit images with respect to neutral images.

Measures of drug use patterns to test the association with WAT-DUD scores

Substance Dependence Severity Scale – SDSS- (33). The Spanish version of this scale was used to evaluate the drug use pattern and severity of alcohol and cocaine dependence. This scale evaluates the severity of dependence, taking as reference the month prior to the interview, following the diagnostic criteria of the DSM-5, and provides scores in a range between 0 and 68 (a higher score indicates a greater severity of dependence). Similarly, this instrument includes a checklist with symptoms of abstinence from the different drugs evaluated. On the alcohol scale, internal consistency, as estimated by Cronbach's alpha coefficient, yielded a value of α = .82, and for the cocaine scale, a value of α = .73 was obtained.

Cocaine Craving Questionnaire-Now – CCQ-N-10. This instrument consists of 10 items that assess the craving of cocaine at the time of administration. The Spanish version of this instrument was used (34). The internal consistency of this instrument, estimated through Cronbach's alpha coefficient, was α = .91

Multidimensional Craving Scale – EMCA- (35). The Spanish version of this instrument was used to evaluate alcohol craving. This scale is composed of 12 items and in the sample of this study an internal consistency of α = .90 was obtained.

Variables related to the therapeutic process

Dropout/Retention. Treatment dropout was operationalized as a dichotomous variable (dropout/retention): when patients failed to attend for 2 consecutive days without justification, they were registered as dropout.

Relapse. Among patients in treatment, cocaine and alcohol use was recorded as a dichotomous variable.

The detection of cocaine use was carried out through urinalysis using the immunoenzymoanalysis technique. Alcohol use was detected through blood samples, measuring carbohydrate-deficient transferrin (CDT). A value was considered positive when CDT was >1.7%.

Procedure

The tests were administered by a psychologist with experience in patient evaluation, who was trained specifically for the administration of these tests. The interviews were conducted in individual sessions, in a room in the center where patients received treatment.

Initially, the therapists from the healthcare centers informed the patients that a study was being carried out by researchers from the University of Huelva. They also indicated that the study was independent of the therapeutic process they followed and informed them of the voluntary nature of their participation. If the patients agreed to participate, they were transferred to a room in the same center in which the psychologist was located. Before the start of the test, the patient was given an informed consent form and, after signing the form, the administration of the tests was initiated. Once the study ended, the participants were thanked for their collaboration.

The outpatients were monitored for three months to compare variables related to treatment outcomes. Of the 67 initial outpatients, there were 18 patients who were excluded from the analyzes for giving erratic response patterns (see the following section), so in total there were 49 outpatients that were followed-up for 3 months. During this period, it was noted whether the patients were still in treatment (n = 27) or if they had stopped attending the scheduled appointments (n = 22).

This study was approved by the ethics committee of the University of Huelva (PSI2016-79368-R).

Analysis

A preliminary analysis of the data was conducted for those participants who presented an erratic pattern in the execution of the tasks. The authors considered an erratic pattern to be one in which the participants, when faced with neutral images that showed, for example, a forest, chose the word "fish" instead of "trees" (see Figure 1). When this pattern was observed repeatedly, this was taken to indicate that the participant was not attending to the semantic relationships between the stimuli of the task. According to the probability of the binomial distribution, it was estimated that the probability of presenting four or more errors is lower than 0.01. Following this criterion, 22 participants (7 outpatients and 15 inpatients) were eliminated from the study. No participant was eliminated on the basis of their responses to the remaining stimuli, since for ambiguous and explicit images there were no correct or erroneous answers, only drug-related or drug-unrelated responses. Subsequently, those that showed univariate anomalous values in the averages of the reaction times were eliminated through a boxplot graph using *Tukey fences*: Q1 − 1.5*(Q3 − Q1); Q3 + Q1 * Q3 − Q1). On the test, 14 participants (7 outpatients and 7 inpatients) were eliminated for this reason, while 9 others (4 outpatients and 5 inpatients) were eliminated on the retest. Thus, the sample as a whole consisted of 141 patients (49 outpatients and 92 inpatients). The subsample used to calculate the test–retest coefficient was composed of 61 patients, who returned to complete the task 10–-15 days after the first evaluation.

Further, discrimination indexes were calculated for ambiguous and explicit images, discarding those with discrimination indexes (point-biserial correlation) lower than .20. Thus, the final set of images consisted of 25 neutral images, 30 ambiguous images, and 10 explicit images (Table 1).

To estimate the reliability of the images, negative and positive specific agreement was used due to the symmetry problems described by Feinstein & Cicchetti (36) for the kappa coefficient. The relationships between continuous variables were calculated by applying Pearson's correlation analysis. The Mann–Whitney U test was applied for the comparison between groups of patients who were followed up at 3 months. The calculated effect size was r, according to the recommendation for nonparametric tests given by Fritz, Morris, & Richler (37).

Results

Characterization of the sample

The sample consisted of 128 men and 13 women, with an average age of 38.09 years (SD = 9.30). For the majority of the participants, the highest level of education was having completed primary studies (46.1%), with 20.6% completing complementary secondary education, and 22% completing high school. The remaining percentage of the sample had not completed primary studies. With regard to the employment situation, the majority of the participants were unemployed (62.1%), and 26.4% were working at the time of the interview. With respect to marital status, 61.4% of the participants were single, 11.4% were married, 25.7%

Table 1. Discrimination indices for initial items in the WAT-DUD task.

Ambiguous						Explicit			
Items	Disc. indexes	Items	Disc. indexes	Items	Disc. indexes	Items	Disc. indexes	Items	Disc. indexes
S11	−0.01	S14	0.18	S51	0.31	S65	−0.07	S18	0.28
S63	0.02	S23	0.19	S38	0.31	S47	−0.04	S68	0.28
S72	0.04	S40	0.19	S67	0.31	S62	−0.04	S41	0.31
S73	0.1	S48	0.21	S60	0.32	S03	−0.04	S53	0.40
S45	0.10	S37	0.21	S32	0.34	S59	−0.04	S74	0.40
S28	0.11	S31	0.23	S39	0.37	S09	−0.04	S36	0.41
S07	0.12	S20	0.23	S16	0.38	S56	0.0		
S66	0.12	S55	0.25	S43	0.38	S50	0.0		
S08	0.13	S04	0.26	S17	0.42	S06	0.0		
S52	0.13	S13	0.26	S25	0.43	S44	0.0		
S54	0.15	S01	0.27	S42	0.45	S12	0.08		
S05	0.16	S34	0.27	S64	0.45	S75	0.12		
S26	0.16	S46	0.28	S22	0.46	S30	0.13		
S57	0.17	S10	0.28	S69	0.56	S27	0.16		
S02	0.17	S19	0.28			S21	0.18		
S35	0.17	S58	0.28			S15	0.18		
S49	0.18	S29	0.28			S24	0.22		
S61	0.18	S70	0.29			S71	0.26		

Ambiguous: Images that do not include stimuli explicitly related to the drug.
Explicit. Images that include stimuli related to the drug.

were separated or divorced, and 1.4% of the participants were widowed. None of the sociodemographic variables showed statistically significant relationships with the indicators of the task (proportion of drug words selected in the ambiguous images, proportion of drug words selected in explicit images, and reaction times for selecting both types of images), except for age which correlated negatively with the number of words related to drugs in the ambiguous images (r = -.217, p < .01).

Of the sample, 87.9% of the participants were in treatment due to problems derived from the use of cocaine and 50.4% due to alcohol problems, while 38.3% of the sample presented problems due to simultaneous use of both substances. In addition to these substances, 45.4% of patients had problems derived from cannabis use and 26.2% from heroin use. No statistically significant differences were found for any of these variables in the analyzed indicators, except among those who had simultaneous problems of cannabis and heroin use. These patients indicated more times the words related to drugs in the explicit images of drugs (M = 0.96, SD = 0.10, M = 0.98, SD = 0.03, t = 2.013, p = .033).

Item analysis and reliability estimation

Table 2 shows the discrimination indices and the values of the reliability coefficients estimated as internal consistency and as test–retest. As observed, all the items present discrimination values above .20, and are thus regarded as adequate values.

In terms of internal consistency, the ambiguous images yielded a Cronbach's alpha coefficient of .80 [.75–.84], while the explicit images yielded a coefficient of .63 [.53–.72]. In terms of reliability estimated as test–retest and with respect to correct answers, the ambiguous

Table 2. Discrimination indices and reliability coefficients of the selected ambiguous items in the WAT-DUD task.

Ambiguous					Ambiguous (Cont.)				
Items	Disc. indexes	Neg. agree	Positive agree	% test–retest agree	Items	Disc. indexes	Neg. agree	Positive agree	% test–retest agree
S01	.30	.98	.0	96.4	S60	.36	.99	.67	98.2
S04	.26	.67	.57	72.5	S69	.57	.95	.71	91.7
S10	.30	.97	.0	94.6	S17	.48	.84	.36	75.0
S13	.27	.94	.57	89.2	S20	.24	.81	.52	73.2
S16	.35	.93	.53	87.1	S29	.35	.94	.40	89.3
S19	.25	.84	.42	75.0	S32	.27	.89	.78	85.7
S22	.37	.89	.50	82.1	S38	.30	.62	.67	70.7
S25	.45	.83	.53	75.0	S43	.36	.60	.78	71.4
S31	.27	.94	.25	89.3	S46	.24	.66	.65	60.7
S34	.26	.86	.57	78.6	S55	.26	.66	.54	67.7
S37	.23	.95	.44	91.1	S58	.27	.60	.78	71.4
S39	.35	.81	.54	73.2	S64	.43	.79	.73	76.7
S42	.42	.81	.43	71.4	S67	.26	.86	.54	78.6
S48	.28	.88	.35	80.4	S70	.33	.76	.59	69.6
S51	.29	.81	.65	76.8					
Mean						**.31**	**.83**	**.54**	**77.1**

Disc. indexes: discrimination indexes; Neg. agree: negative agreement; Positive agree: positive agreement; % test–retest agree: percentage of test–retest agreement.

images presented a range of negative agreement between .62 and .98, with an average agreement of .83; in the case of positive agreement, values ranged between 0 and .78, with an average of .54.

For explicit images, the average positive agreement was .98, whilst negative agreement was 0. Finally, the test–retest reliability in the reaction time indicator showed values r = .75 [.69–.81] for the ambiguous images, and r = .65 [.56–.73] for the explicit images.

The difference in the choice of drug-related words between ambiguous and explicit images was statistically significant (ambiguous, M = 0.28, SD = 0.16, explicit, M = 0.97, SD = 0.08, F = 515.85, p < .001), as was the difference in reaction times (ambiguous, M = 1449.83 SD = 900.7, explicit, M = 1023.5, SD = 679.2, F = 29.39, p < .001).

Evidence of validity based on the relationship with other variables of addiction

The analysis of the scores showed that there were no statistically significant differences between those who had problems exclusively with alcohol, exclusively with cocaine, or with both substances. However, for the ambiguous images, there were statistically significant differences between those who consumed one substance or both. In particular, those who had problems with one substance (exclusively alcohol or cocaine) indicated on a smaller number of occasions words related to drugs (M = 0.26, SD = 0.16) than those who consumed both substances (M = 0.32, SD = 0.16), these differences being statistically significant (t = 2.14, p = .034; *Cohen's d* = 0.38).

Tables 3 and 4 show the correlation between drug use variables and task indicators for the different categories of images. As observed, the number of times that drug-related words were selected correlates positively and significantly with cocaine craving (r = .20; p = .029) and alcohol (r = .30; p = .010). In addition, the symptoms of alcohol withdrawal and the severity of dependence on this substance were also related to the number of times that drug-related words were chosen (r = .31; p < .010 and r = .23; p = .040, respectively). No statistically significant relationships were observed with the reaction times.

Table 3. Discrimination indices and reliability coefficients of the explicit selected items in the WAT-DUD task.

Items	Discrimination indexes	Negative Agreement	Positive agreement	Percentage of test–re-test agreement
S18	.21	.0	.95	91.1
S24	.22	.0	.98	96.4
S33	.43	.0	.94	89.3
S36	.49	.0	.99	98.2
S41	.34	.0	.99	100
S53	.47	.0	.99	98.2
S68	.34	.0	.99	98.2
S71	.23	.0	.99	94.6
S74	.47	.0	.97	100
Mean	.36	.0	.98	96.2

Evidence *of* validity based on the relationship with the therapeutic process

Initially, we tested whether there were statistically significant differences between the patients in treatment and those that had left treatment in terms of sociodemographic variables and drug use related variables. None of the sociodemographic variables showed statistically significant relationships with maintaining or abandoning treatment. Further, no relationship was observed with alcohol craving (Mann–Whitney U = 351.5, z = −0.443, p = .657), cocaine craving (Mann–Whitney U = 373.5, z = −0.026, p = .979), alcohol withdrawal symptoms (Mann–Whitney U = 327.0, z = −0.885; p = .376), cocaine withdrawal symptoms (Mann–Whitney U = 333.5, z = −0.719, p = .472), alcohol dependence (Mann–Whitney U = 373.0, z = −0.037, p = .970), or cocaine dependence (Mann–Whitney U = 341.5, z = −0.577, p = .564). Similarly, none of these variables showed a relationship with alcohol or cocaine relapse.

Table 5 shows the relationship between the indicators of the task and variables related to the therapeutic process of the patients. It is observed that those who had previously undergone treatment had a shorter reaction time for explicit images compared with those who had no previous treatment (*effect size* r = 0.34).

Although no statistically significant differences were detected in any of the indicators of the task between those who remained in treatment and those who had discontinued treatment, it is observed that among those who remain in treatment, patients who relapsed and consumed cocaine with 3 months after the initial evaluation indicated fewer words related to drugs in response to explicit images (*effect size* r = 0.38) and also had a shorter reaction time to these stimuli (*effect size* r = 0.58).

Discussion

Research using interpretation bias tasks has shown that performance on such tasks present moderate relationships with different variables of substance use (6). However, until now there have been few studies developed with standardized tests in which the psychometric properties have been provided (26,27), and only one study has been found in patients diagnosed with substance-related disorders

Table 4. Correlations between task indicators and variables related to addiction.

		Proportion of ambiguous words	Proportion of explicit words	RT ambiguous	RT explicit
Craving	Cocaine	.20*	.06	.10	−.12
	Alcohol	.30**	−.02	.04	−.17
Symptoms of withdrawal	Cocaine	.07	.06	.12	−.01
	Alcohol	.31**	−.07	.16	−.04
Severity of dependence	Cocaine	.14	.17	.13	−.02
	Alcohol	.23*	−.06	.15	−.05

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

(22). Thus, in spite of the preliminary nature of our findings, we believe that the contribution of our work is twofold. First, we have provided a new instrument framed within the scope of the tasks of implicit association and interpretation bias together with their psychometric properties. Unlike existing word association tasks (8,9,11–23), the WAT-DUD does not require the subsequent coding of the participants' answers, and also allows for the measurement of reaction times. Second, the present work provides new evidence with regard to therapeutic outcome variables in addition to the relationships among drug use variables that have already been analyzed previously (15,16). It should be noted that, in an exploratory manner, four scores derived from this task have been analyzed: choice of words related to the drug in ambiguous and explicit images, and response time for the word choice when presented with ambiguous and explicit images. The distinction between ambiguous and explicit images is based on the fact that the processing of these signals plays different roles in the models of addiction (29). Further, the indicators (drug-related words and reaction times) have been selected for comparability with previous similar tasks (6). Given the preliminary nature of the present study, we decided to test the psychometric properties of each of these indicators.

In general, our results show a set of ambiguous images with an adequate internal consistency and test-retest reliability. For the set of explicit images, test–retest reliability shows high stability values, with modest internal consistency. In terms of validity evidence, the relationships found moderately support the hypotheses proposed. In particular, as expected, the proportion of drug-related words selected in response to ambiguous images is related to the drug use variables analyzed. No relationships were found with the RTs. According to outcome variables, RTs for explicit images were related to cocaine relapse and previous treatment. No other expected relationships were found according to the numbers of drug-related words selected in the ambiguous condition.

Reliability was estimated through two different approaches. Using Cronbach's alpha coefficient, the internal consistency of the responses to the presented images was analyzed. The result obtained is adequate for ambiguous images, although for the explicit images this value falls slightly below the recommended values (38). However, this latter observation could be due to the lack of variability in these types of images, since homogeneity negatively influences this coefficient (39). As we have seen, for the explicit images the percentage of participants that indicate the word related to the drug is close to 100%, as expected. The reliability of the answers of the participants, analyzed as the percentage agreement between test and retest, has shown results that can generally be considered satisfactory. Only one image showed stability below 65% (mixed drinks/refreshment), and another two below 70% (bottles/supermarket and alcohol/friends). Further, in the explicit images the average agreement exceeded 96%, as was also expected. With respect to the correlation coefficient between the test–retest for reaction times, the values have also shown to be adequate for ambiguous images, and are slightly below the psychometrically recommended values for explicit images. However, it should be noted that there are few studies that analyze the test–retest reliability in tests that measure reaction times, some of which are found in tests such as the Drug Stroop or visual probe test, with results that are similar to or even lower than those found in the present study (40,41).

In terms of evidence for the validity of the scores, relationships were studied with variables related to drug use and therapeutic outcomes. Craving, withdrawal symptoms, and the severity of dependence appeared to be related to the task scores when involving ambiguous images. In particular, the patients most affected by the substance and with the most intense cravings tended to identify more ambiguous images as being related to the drug, in line with the results reported by Woud regarding alcohol (22). This relationship with craving has been observed in other implicit tasks such as the attentional bias tests (30,42). For example, with the drug Stroop task Waters, Marhe, and Franken (43) found higher reaction times when the participants were in a situation of "temptation" to use the drug than in control measurements. The effect sizes calculated from their data

Table 5. Relationships with variables of the therapeutic process.

		Proportion of ambiguous words		Proportion of explicit words		RT ambiguous		RT explicit	
		Mean (SD)	U Mann–Whitney (effect size)	Mean (SD)	U Mann–Whitney (effect size)	Mean (SD)	U Mann–Whitney (effect size)	Mean (SD)	U Mann–Whitney (effect size)
Previous treatment	No (n = 19)	.27 (0.16)	274.5 (0.07)	.98 (0.04)	198.0 (0.21)	4029.7 (1188.7)	255.5 (0.18)	1345.5 (815.6)	176.0* (0.34)
	Yes (n = 30)	.25 (0.12)		.94 (0.13)		3628.9 (1022.5)		834.5 (549.9)	
Adherence to treatment	No (n = 22)	.23 (0.13)	213.0 (0.18)	.95 (0.05)	197.5 (0.00)	3713.9 (983.5)	253.0 (0.00)	1037.2 (706.4)	257.0 (0.04)
	Yes (n = 27)	.28 (0.14)		.96 (0.14)		3832.8 (1221.6)		984.9 (700.9)	
Relapse cocaine	No (n = 19)	.27 (0.14)	68.0 (0.06)	.99 (0.03)	50.5* (0.38)	3772.9 (1264.3)	45.0 (0.09)	1227.3 (700.5)	14.0** (0.58)
	Yes (n = 8)	.29 (0.16)		.86 (0.22)		3974.9 (1183.2)		409.4 (415.7)	
Relapse alcohol	No (n = 17)	.29 (0.14)	66.5 (0.10)	.97 (0.11)	77.0 (0.13)	3799.1 (1170.3)	77.5 (0.00)	995.8 (639.9)	69.0 (0.02)
	Yes (n = 10)	.26 (0.15)		.93 (0.18)		3890.0 (1367.6)		966.6 (830.9)	

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

show reduced values for both cocaine Stroop (d = 0.17) and heroin Stroop (d = 0.20), and have very wide confidence intervals and can thus be considered reliable. In this same study, there was no relationship between craving and another implicit measure. Using the Dot probe task, Garland, Froeliger, Passik & Howard (44) found a moderate correlation (r = .36) with craving in opioid-dependent patients, and a similar ratio (partial square eta = 0.26) was found with social alcohol drinkers (45). In comparison with these studies, and as already shown, the WAT-DUD has provided similar or larger effect sizes in this study compared with other established implicit measures. However, contrary to what was found in the literature (46), no relationship was found with the severity of cocaine dependence, or with the symptoms of abstinence from this substance. Future studies should confirm if this result is due to the characteristics of the sample.

With respect to reaction times, and in line with other implicit measures that evaluate reaction times (6), our hypothesis was that patients with higher cravings, withdrawal symptoms, and severity of dependence would have shorter reaction times. However, the results of this study have not provided evidence for these relationships. This could be because the hypotheses were proposed on the basis of previous evidence provided by tasks that measure different cognitive processes to those evaluated using this task. For example, relationships similar to those hypothesized have been found in attentional bias tasks (30,43) and in other measures of implicit attitudes (47).

Further, this is one of the first studies to analyze the relationship between interpretation bias tasks and therapeutic outcomes. Since the present data have only been obtained from a small sample of outpatients, the results should be treated with caution. Nonetheless, we consider that some of our findings are noteworthy. Although no relationships were detected when using the ambiguous images, for the explicit images there are statistically significant differences between cocaine users who relapse and those who adhere to treatment. In particular, it is observed that patients who relapse chose fewer words related to drugs. In addition, this choice is made more rapidly in this group than those who do not relapse. Both indicators could be taken to show that in this group of patients there is a pattern of avoidance of these stimuli. Previous studies have shown that patients who have experienced the negative effects of the drug show a greater attentional bias avoiding drug related images when compared with mere habitual users (48). Similarly, it has been found that the pattern of avoidance of stimuli related to the drug is more frequent in patients who relapse (49). The specific processes and conditions that lead to this result remain

unclear. Spruyt et al. (50) propose that patients who present avoidance have more difficulties in continuing with treatment because this behavior does not allow for the development of adequate management strategies for drug-related situations. Field and Wiers (51) advocate a more local explanation, suggesting that the cues related to the drug have aversive properties when presented in a therapeutic context. Other studies have proposed that the therapeutic process may lead to reevaluation of the hedonic value of stimuli related to the drug, although the results are still unclear (52).

Finally, while we consider that the present study provides a useful tool for research and clinical practice, it is necessary to bear in mind some limitations. First, it should be noted that the words used correspond to a great extent to the jargon used by this group of subjects. Therefore, the use of this task in non-Spanish contexts would require the necessary adaptation of these words, as has occurred with analogous tasks (10). Second, it is worth noting that 90% of the participants in the study were men. This asymmetric distribution of men and women has not allowed us to analyze the possible impact of gender on the results, which constitutes a limitation. This is particularly the case when looking at the follow-up results, since only three women remained in the study at 3 months. However, the percentage of men and women is similar to that observed in the demand for treatment for drug use in the general Spanish population (84% in Spain (53). Third, it should also be noted that the size of the sample is limited. However, for the statistical tests used, the sample sizes are adequate. In any case, future work is needed to extend the generality of these findings both in patients and in samples of consumers. Finally, it is necessary to keep in mind that the reliability indicators can be considered adequate for the administration of the scale in research contexts. However, for administration in the clinical setting, a more accurate instrument is needed, so its use in this context should be considered with caution.

In conclusion, we would like to point out that the present study is of a preliminary nature in terms of the psychometric results obtained. The development of the task has followed a careful process according to psychometric standards and has allowed us to obtain a first version with acceptable psychometric properties. However, it will be necessary to develop this task in more depth in a variety of ways. For instance, it would be of interest in future works to explore the possibility of using new scoring strategies for reaction times by analyzing, for example, whether reaction times on tasks for ambiguous images (choice of words related or unrelated to drugs) are related to drug use pattern variables or therapeutic outcome measures. Similarly, convergent evidence is needed with that provided by other tasks of semantic association. Moreover, we believe that future work should delve more deeply into providing new evidence regarding the clinical relevance of this task. In this regard, it could be useful to provide scales or alternative scoring procedures that make it easier to interpret the scores of this task in a clinical context. Finally, new studies are needed to provide evidence of validity of the task scores in women, since in this study it has not been possible to address whether the scores have a differential impact according to the gender of the participants.

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