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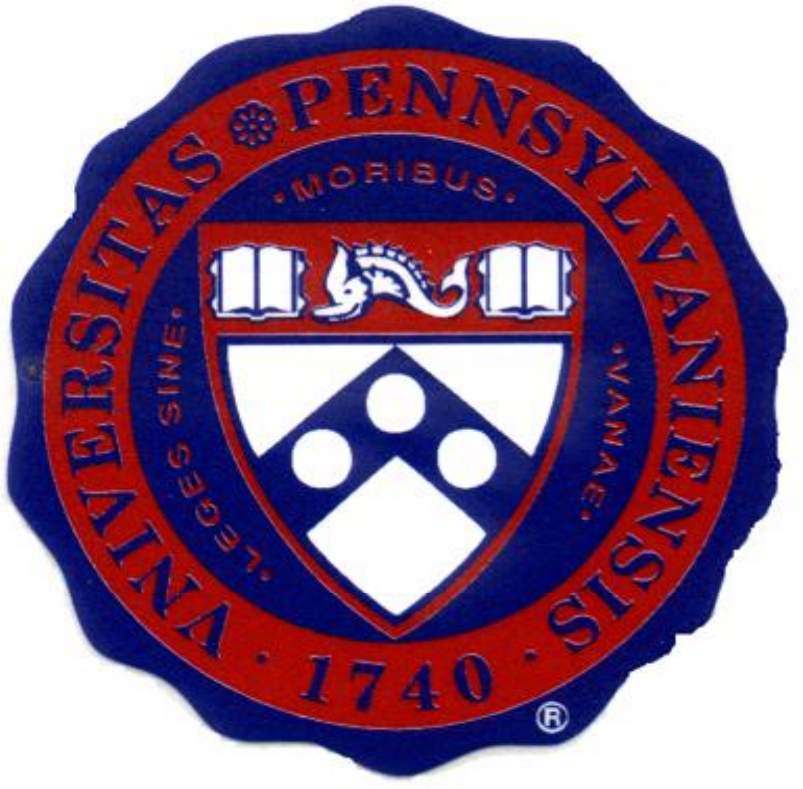
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# MEASURING IMPULSIVE BEHAVIOR IN INNER-CITY SUBSTANCE ABUSERS USING TRANSLATIONAL PROCEDURES BASED ON PRECLINICAL RESEARCH



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## Introduction

- Impulsive behavior can result in patients with mental and neurological disorders engaging in self-destructive behavior, including relapse of drug abuse or suicide.
- Impulsive behavior is an important symptom which is part of the diagnosis of disorders such as drug addiction, attention deficit hyperactivity disorder and personality disorders.
- Most methods used today measure the personality trait of impulsiveness and are not sensitive to short-term changes in impulsivity, e.g. those produced by illness-onset, emotional states and stress, or by successful treatments.
- Psychometrically validated procedures are necessary to provide tools for physicians and researchers to monitor the risk for impulsive behavior, focus and evaluate interventions, leading to improved outcomes for patients, savings in time, personnel and resources for treatment centers, and develop new treatments. This poster describes a pilot study, field testing a new objective interactive test battery which can measure the way in which impulsivity affects decision making and behavior at the time of testing (i.e. state impulsivity).
- Since impulsivity is multi-factorial, each subtest is designed to measure specific aspects of impulsive behavior.

## Translational Methods

- All the objective tests described in this poster were developed from procedures first used in preclinical studies using rats as subjects.
- Translational methods provide a link between basic biology and clinical application.
  - Measure overt behavior, rather than verbal reports
  - Each task focused on one psychological concept
  - Simple task design with clear outcome from each action
  - Complexity and difficulty developed by building up simple components
  - No verbal test material
- Implications for test design

## Methods

### Subjects

- 31 subjects (19 M, 12 F)
- Various diagnoses
- Average IQ 86.9

### Test Battery

- Visual Analogue Scales
- Barrett Impulsivity Scale
- Swedish University Scales of Personality
- Discrete Trial N-back
- Uncertain Visual Discrimination
- Variable Consecutive Number
- Delay of Reward

**Diagnoses**

- Yes/no schizophrenia diagnosis (independent of other diagnoses, n=11/18)
- Yes/no depression diagnosis (independent of other diagnoses, n=22/9)
- Yes/no suicide history (independent of primary diagnosis, n=20/11)
- Yes/no Substance Abuse (n=22/8)

## Test Materials - Scales

- Visual Analog Scales**
  - Today I feel irritable
  - Today I feel in control of my life
  - Today I feel impulsive
  - Today I feel depressed
  - Today my thoughts are going fast
  - Today I feel "sped up" inside
  - Today I feel argumentative
  - I currently feel high on drugs
  - I am feeling withdrawal
  - I am craving drugs
- Barrett Impulsiveness Scale**
  - Attentional Impulsiveness
  - Motor Impulsiveness
  - Non-Planning Impulsiveness
- Swedish University Scales of Personality**
  - Somatic Trait Anxiety (STA)
  - Psychic Trait Anxiety (PTA)
  - Stress Susceptibility (SS)
  - Lack of Assertiveness (LA)
  - Impulsiveness (I)
  - Adventure Seeking (AS)
  - Detachment (D)
  - Social Desirability (SD)
  - Embitterment (E)
  - Trait Irritability (TI)
  - Mistrust (M)
  - Verbal Trait Aggression (VTA)
  - Physical Trait Aggression (PTA)

## Data Analysis

- Variables included in analysis (49 in total)
  - KBIT IQ
  - Self-rated Impulsivity
  - Rating of Test Acceptability
  - 10 VAS Scales
  - 16 Personality Measures
  - 20 Measures from Objective Tests
- Statistical Analysis
  - Reliability (not shown in this poster)
  - Primary I – correlations
  - Primary II – effects of diagnosis
  - Secondary
    - associations with different impulsivity ratings
    - Relationships amongst objective tests

## Procedures

### Visual Analog Scales

Approx Duration 12 min

### N-Back working memory

Approx Duration 12 min

### Uncertain Visual Discrimination

Approx Duration 5 min

### Variable Consecutive Number

Approx Duration 8 min

## Delay of Reinforcement

Approx Duration 20 min

## Study Design

- Subjects continued with normal treatment and care during the study
- Subjects recommended for study by treating physician & pre-screened with K-BIT
- Following day familiarized with touch screen
- Complete VAS and personality tests on the computer
- Complete objective behavioral tests
  - self-paced, not a fixed time to complete
  - in some cases split over two days
  - "smoke" breaks allowed
- Follow up interview to ascertain life events and feedback on test experience
- Receipt given for payment, which could be collected when leaving unit

## Correlations

	IQ	VAS-I	BIS AI	BIS MI	BIS NPI	SSP STA	SSP M	SSP I	1BK % Cor	1BK CRT	UVD CRT	VCN MCL
VAS-I	-0.15											
BIS AI	-0.01	0.50										
BIS MI	0.10	0.28	0.59									
BIS NPI	-0.14	0.56	0.63	0.46								
SSP STA	0.17	0.44	0.82	0.53	0.58							
SSP Imp	0.10	0.39	0.68	0.81	0.54	0.66						
SSP Mis	-0.16	0.52	0.71	0.57	0.52	0.78	0.66					
1 Bk % Cor	0.29	0.14	0.01	-0.13	0.01	0.09	-0.05	0.09				
1 Bk CRT	-0.53	-0.03	0.01	-0.01	-0.27	-0.28	-0.19	-0.11	-0.47			
UVD CRT	-0.01	-0.20	-0.08	-0.04	0.02	-0.10	-0.06	-0.17	0.15	-0.02		
VCN MCL	-0.03	0.35	0.29	0.13	0.43	0.45	0.22	0.43	-0.07	-0.21	-0.24	
DOR 1vsL	0.12	-0.26	-0.02	0.00	-0.23	-0.08	-0.02	-0.22	-0.14	0.23	0.03	0.03

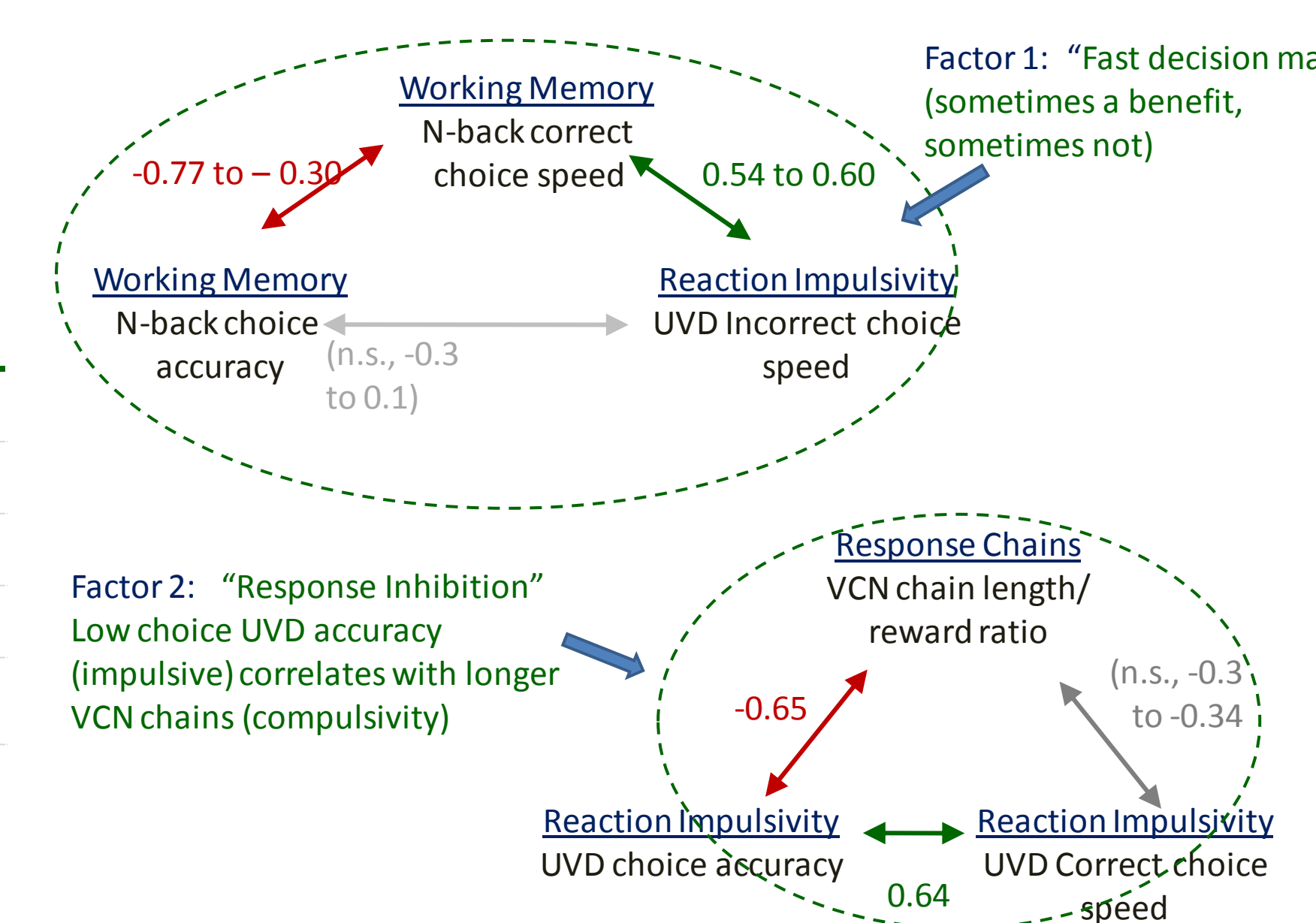
Selected measures amongst a total of 49. Statistical significance corrected for multiple comparisons (49\*48 in total). Red text shows p<0.05.

## Comparisons for high and low impulsivity responders for SSP subscales

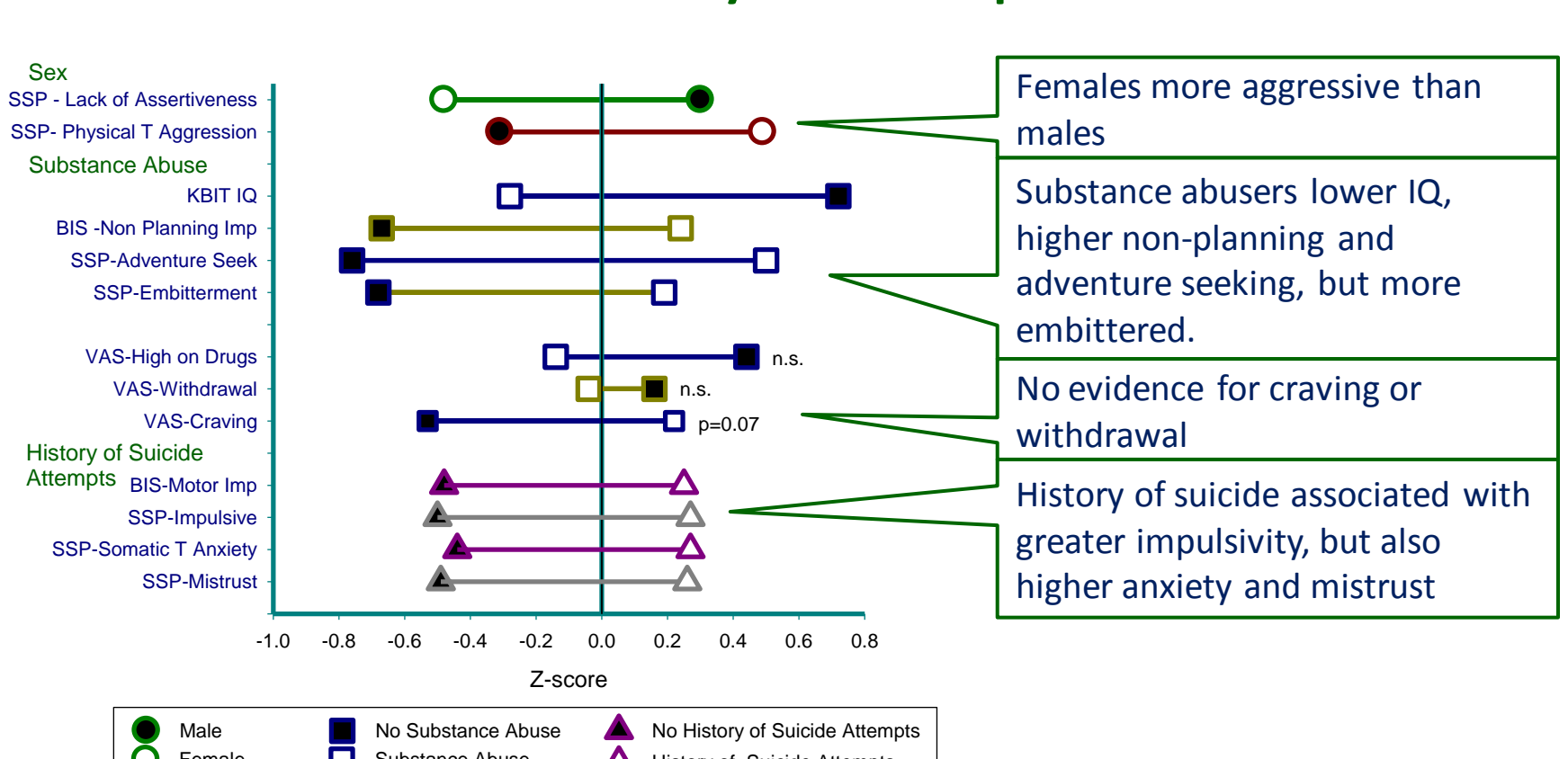
	Somatic Trait Anxiety	Psychic Trait Anxiety	Stress Susceptibility	Lack of Assertiveness	Impulsiveness	Adventure Seeking	Detachment	Social Desirability	Embitterment	Trait Irritability	Mistrust	Verbal Trait Aggression	Physical Trait Aggression
VAS 3 (Today I feel impulsive)	2.4 n.s.	2.5 n.s.	2.9 n.s.	0.7 n.s.	1.9 n.s.	0.8 n.s.	2.2 n.s.	-2.4 n.s.	2.2 n.s.	2.4 n.s.	2.3 n.s.	3.1 n.s.	3.1 n.s.
Self-Rated Impulsivity	2.8 n.s.	2.9 n.s.	2.9 n.s.	0.9 n.s.	3.1 n.s.	2.8 n.s.	2.6 n.s.	-1.0 n.s.	4.7 p<0.01	3.2 p<0.01	5.3 p<0.01	2.6 n.s.	2.1 n.s.
BIS-11 Cognitive Impulsiveness	8.2 p<0.01	5.1 p<0.01	5.9 p<0.01	1.8 n.s.	5.3 p<0.01	1.7 n.s.	3.5 p<0.05	-2.9 n.s.	4.6 p<0.01	4.1 p<0.01	6.1 p<0.01	4.3 p<0.01	5.3 p<0.01
BIS-11 Motor Impulsiveness	2.5 n.s.	3.0 n.s.	2.1 n.s.	-0.2 n.s.	3.5 n.s.	2.5 n.s.	3.0 n.s.	-1.3 n.s.	4.0 p<0.05	4.5 p<0.01	2.3 n.s.	2.5 n.s.	2.5 n.s.
BIS-11 Non-Planning Impulsiveness	3.6 p<0.05	4.6 p<0.05	4.5 p<0.01	1.7 n.s.	3.7 p<0.05	0.8 n.s.	3.1 n.s.	-2.9 n.s.	5.4 p<0.01	4.3 p<0.05	2.6 n.s.	2.1 n.s.	3.1 n.s.
SSP Impulsiveness	5.1 p<0.01	4.3 p<0.01	3.8 p<0.05	0.2 n.s.	X	2.4 n.s.	5.6 p<0.01	-1.2 n.s.	5.2 p<0.01	5.0 p<0.05	4.2 p<0.05	4.1 p<0.05	3.6 p<0.05

Two sample t-test with Bonferroni correction for multiple comparisons within each sub-test for high and low responders independent of diagnosis (approximately top 3<sup>rd</sup> vs bottom 3<sup>rd</sup> including tied scores).

## Relationships amongst objective tests

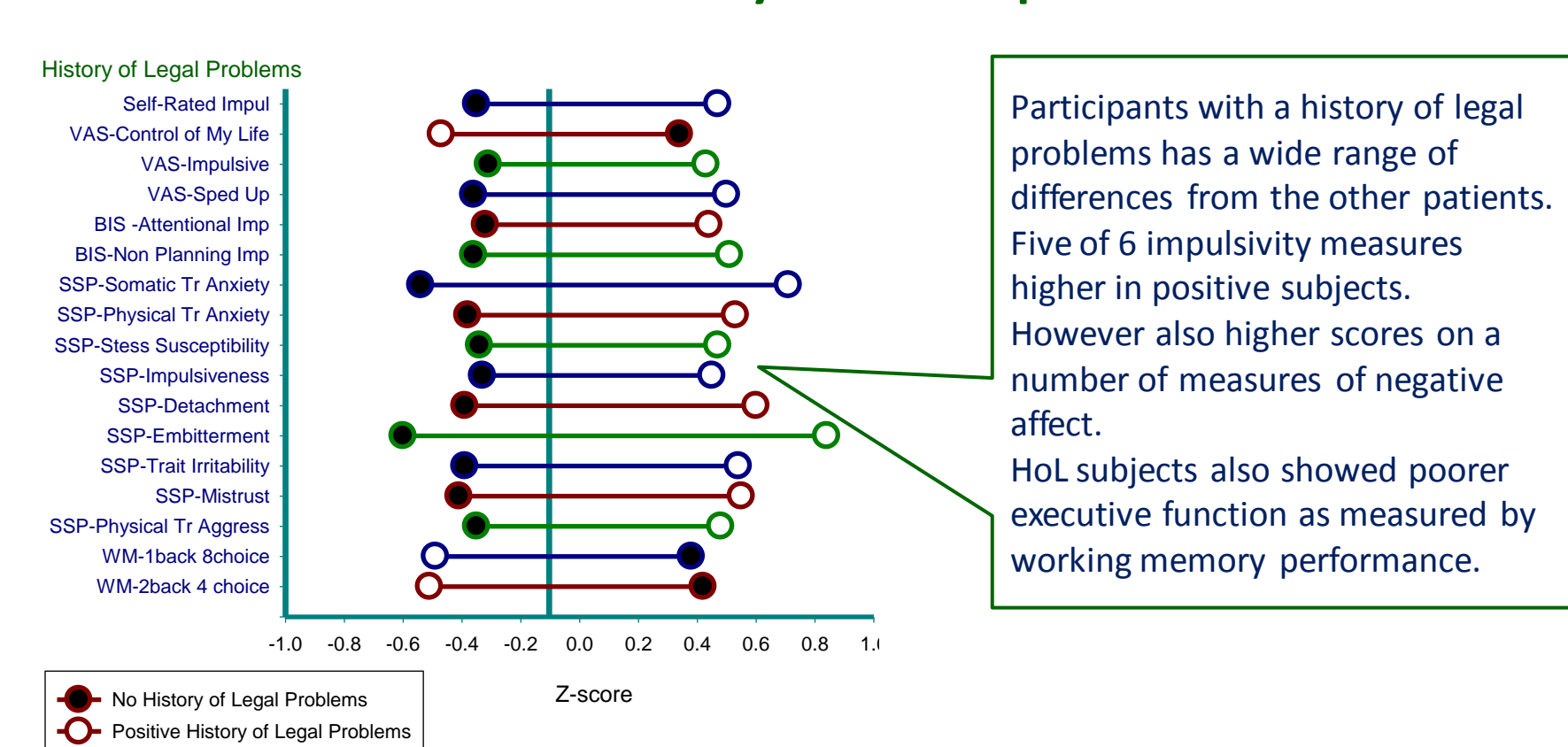


## Personality Descriptors



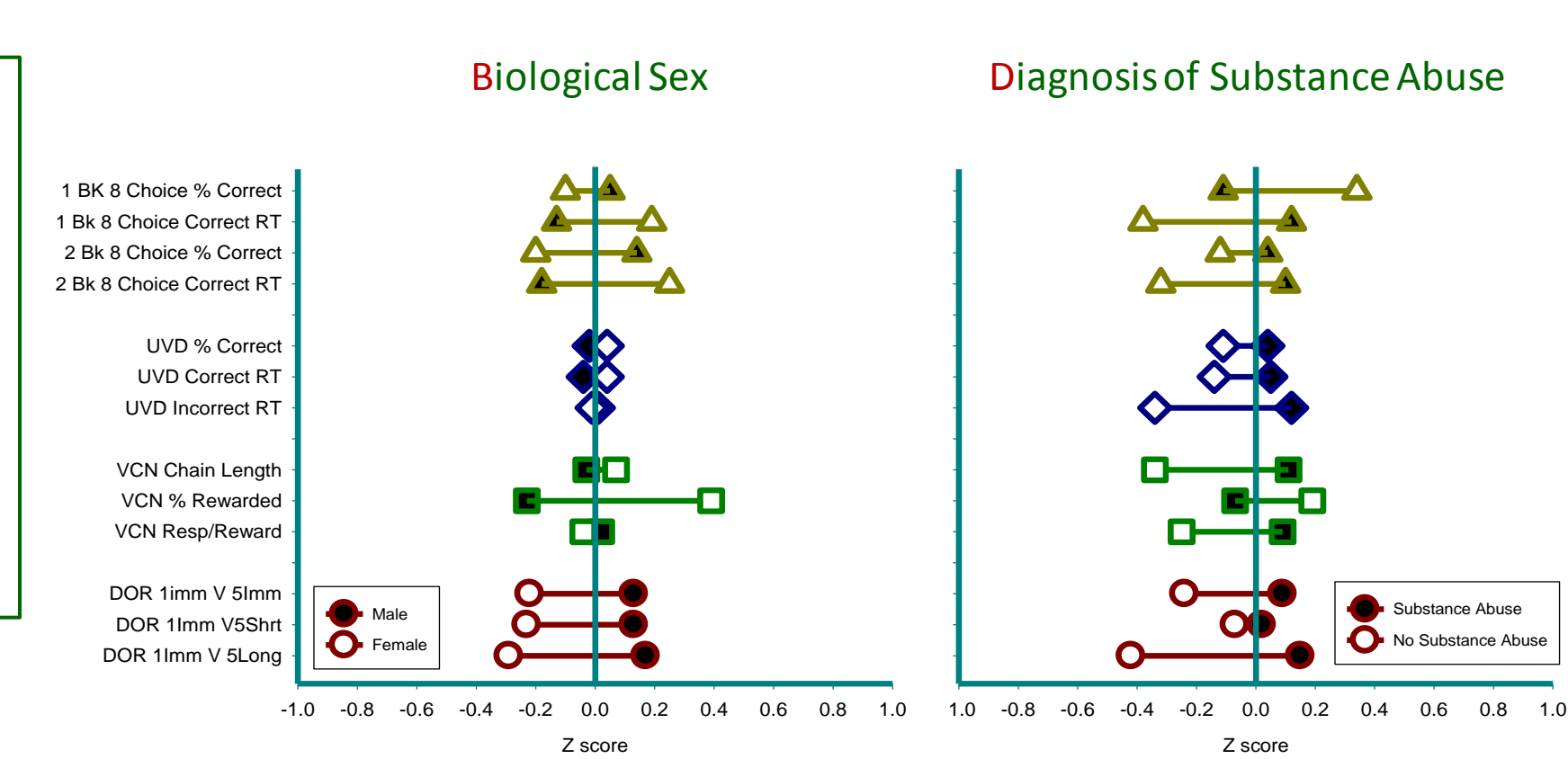
Points to the right of the vertical illustrate a greater level of the personality descriptor than the group as a whole. All differences listed here were statistically significant unless otherwise indicated.

## Personality Descriptors



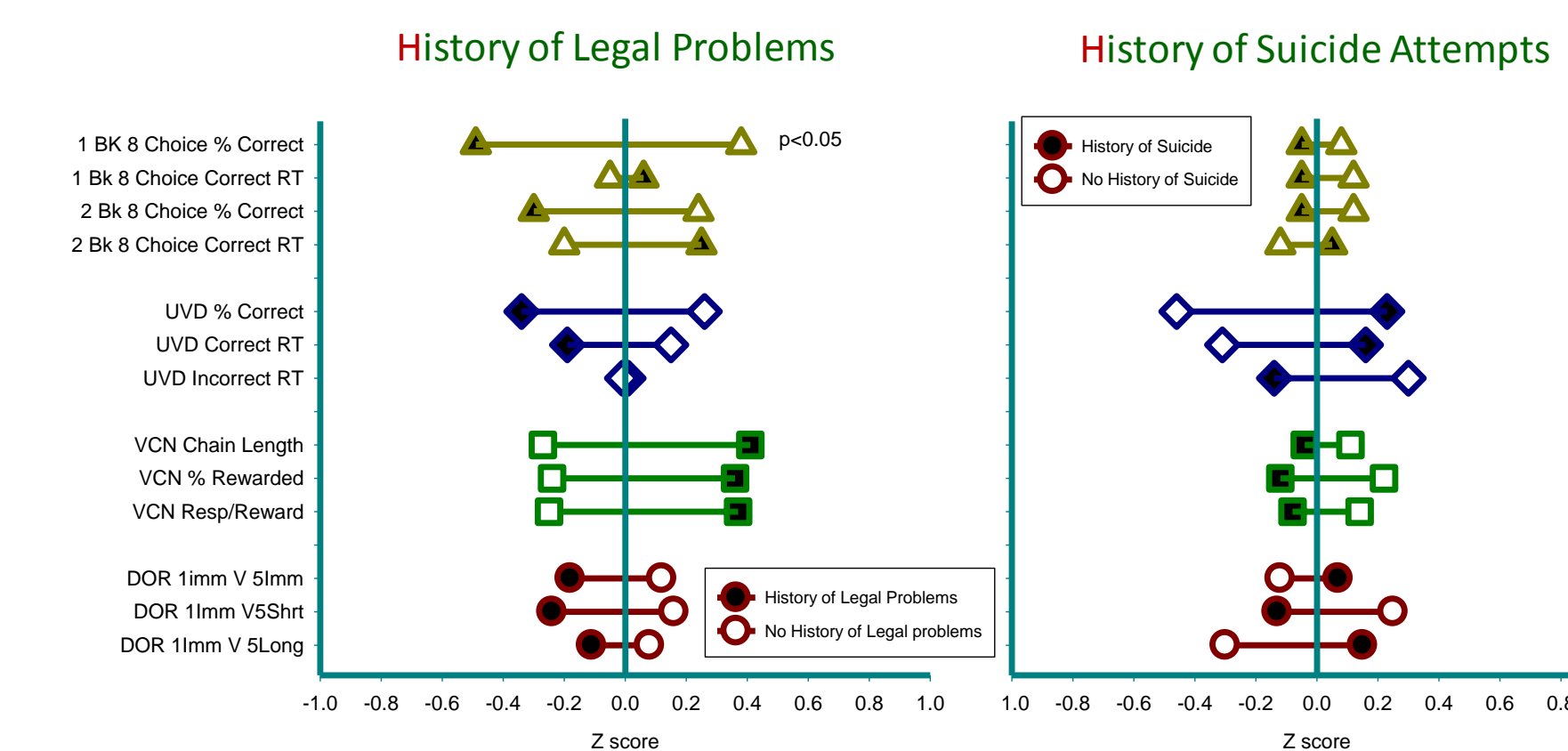
Points to the right of the vertical illustrate a greater level of the personality descriptor than the group as a whole. All differences listed here were statistically significant unless otherwise indicated.

## Objective Test Performance



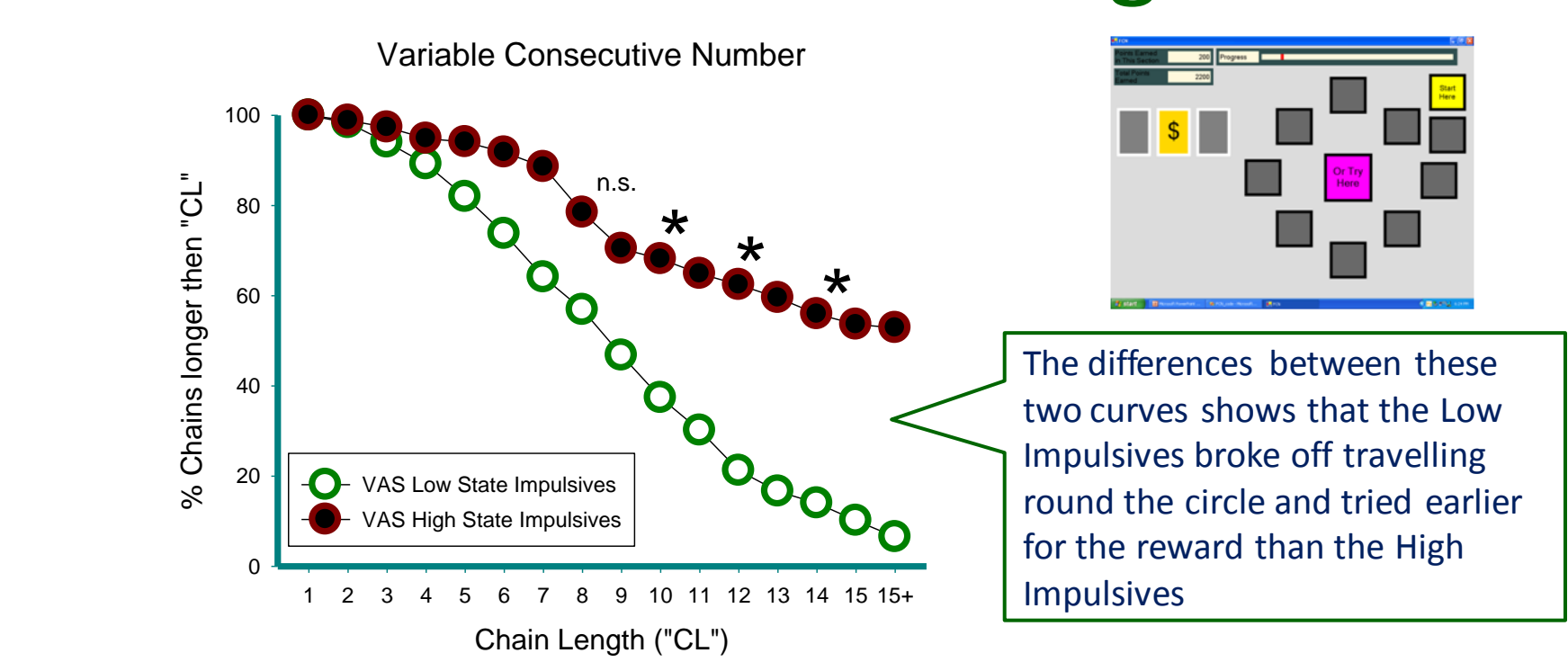
There were no significant differences between biological sexes or positive/negative diagnosis of substance abuse on any of the measures of performance in the objective tests

## Objective Test Performance



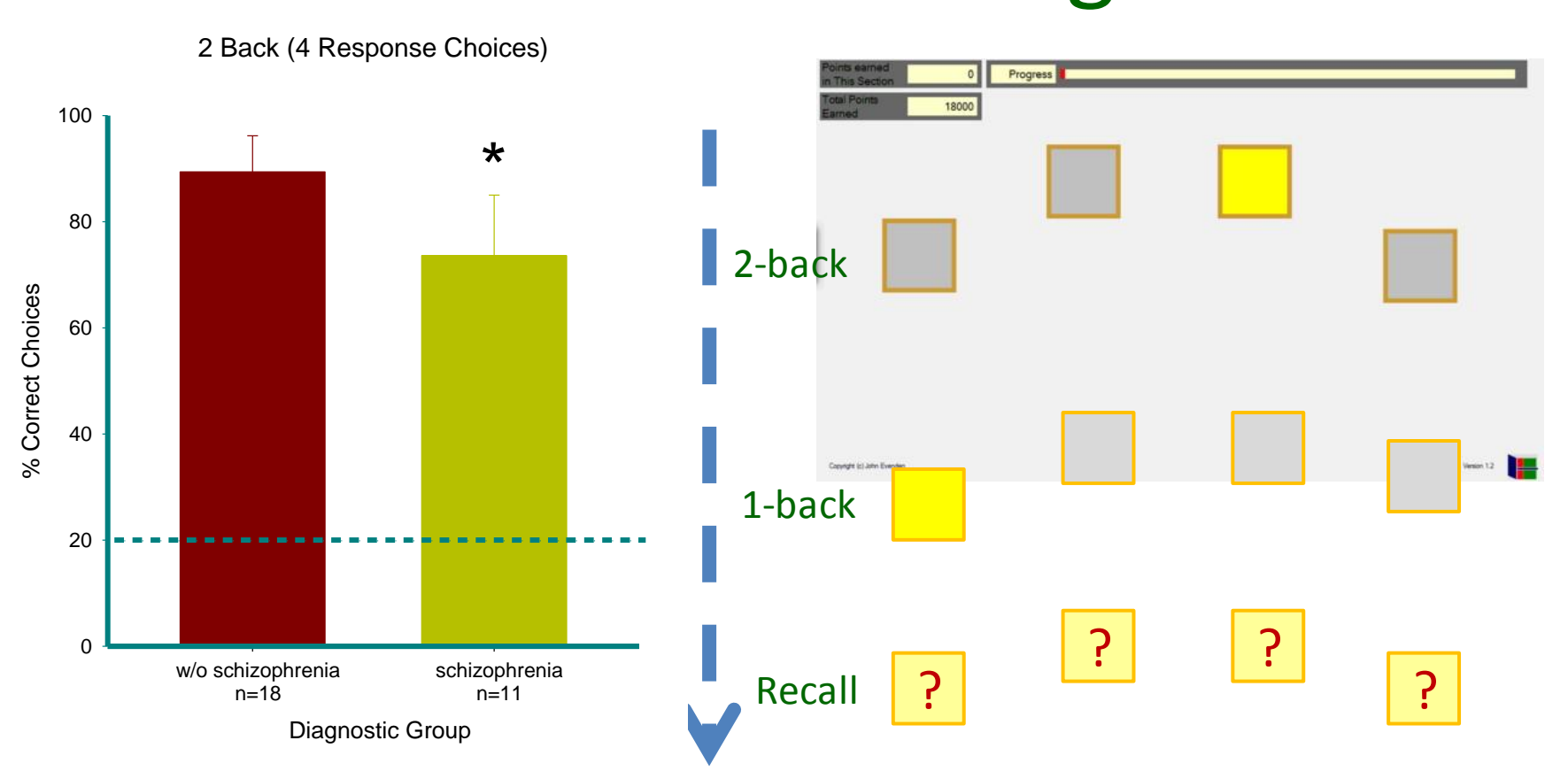
The only significant difference between the two groups was the reduced working memory performance in the participants with a history of legal problems (also shown in previous figure). None of the other differences reach statistical significance

## Additional Findings



The group was ranked on their scores on the VAS scale "Today I feel impulsive". The top one third (VAS High State Impulsives) were compared to the bottom one third (VAS Low State Impulsives). The high impulsive subjects showed a much large proportion of long response chains on the VCN test than the low impulsives (i.e. they continued on round the circle for longer). Thus subjects rating themselves as feeling impulsive actually show compulsive responding in this test.

## Additional Findings



Subjects with a diagnosis of schizophrenia or related Axis I disorder performed significantly worse on the discrete trial spatial n-back procedure, under the 2-back conditions with 4 options. Rats chronically treated with the NMDA antagonist, MK-801, an animal model of schizophrenia also perform worse on this test.

## Personality and Performance

- There was little or no interaction between personality or global self ratings of impulsivity and performance of the objective tests
  - This is a fairly common finding
- Most obvious possible explanation is that personality questionnaires are summing up behavior and experiences over a long period ("a general pattern") and whereas the objective tests are measuring current behavior ("day-to-day changes")
  - Some supportive evidence that VAS-IMP did not strongly correlate with PQ but had the strongest relationship with the objective tests
- A second possibility is that responses to PQs combine influences from different aspects of impulsivity which are not shared amongst all patients. The objective tests may detect more selective influences, which are specific to individuals, and thus less consistent and statistically reliable
- Patients may not be fully aware of their traits, and may under or over-estimate them, or weight them differently depending on cultural expectations

## Impulsivity and Affect

- Personality scales are picking up an affective component which the objective tests are not
- Relationship is real
  - Impulsivity and negative affect potentially mediated by common biological factors such as low 5-HT or PFC dysfunction.
    - But there is plenty of preclinical evidence using analogous procedures that alterations in 5-HT and FCX function influence performance
  - Impulsive behavior has negative consequences for individuals which causes low mood
    - Low mood/dysphoria engenders impulses to "escape" from current situation with negative consequences
- Relationship is not real
  - Individuals make bad decisions which have negative consequences which they retrospectively label as impulsive and apply the label to their acts
    - Responses in PQs depend on participants own judgment of their actions
  - Individuals with emotional dysregulation are labeled as impulsive by people around them, and come to use this term as part of their self-image.

## Conclusions Relevant to Substance Abuse

- Substance abusers treated as inpatients did not report withdrawal or craving.
- Substance abusers generally had lower KBIT IQ, lower BIS planning and more adventure seeking.
- Substance abusing psychiatric patients did not differ from psychiatric patients were not diagnosed as substance abusers in the objective tests.
- Little evidence of trait or state impulsivity in this sample of substance abusers from a typical inner city inpatient ward.
- Variations in trait and state impulsivity were not related to specific psychiatric diagnoses
- Relationship established between state impulsivity, high reaction impulsivity and compulsive responding on VCN (difficulty to inhibit ongoing behavior pattern) similar to that hypothesized to underlie drug addiction

## General Conclusions

- Computerized administration of questionnaires and objective tests functioned very well with this population, despite their low average IQ and lack of familiarity with computers.
- As expected, the questionnaires did pick up differences amongst the patients, but these seemed to be more related to the participants general social situation (as exemplified by their history of legal problems) than with specific psychiatric diagnoses
- In this patient group trait impulsiveness appears to be one component of personality associated with a general pattern negative affect.
- Objective tests, which measure state impulsivity, and in which the affective component has been eliminated, do not correlate with trait impulsiveness.
- Our hypothesis is that performance of objective tests of impulsive behavior is related to aspects of cognition covered by term "executive function".