

Overview

Substance Use Disorders and Addiction

Basic Concepts

- **Use/Consumption**: How much, how often, variability in quantity and frequency
- **Substance-related problems**: Acute and chronic consequences of substance use
- **Substance use disorders**: Syndromal constellation of certain symptoms
- **Addiction**: A construct related to compulsive use but varying perspectives on exactly what its “core” or “essence” is

Drug Classes

- Alcohol (ethanol)
- Cannabinoids (e.g., marijuana)
- Hallucinogens
- Inhalants
- Nicotine
- Opioids (natural and synthetic substances)
- Sedative hypnotics
- Stimulants

Use/Consumption

- Specific Substance
- Use/abstention
- Intensity of use
 - Frequency of use
 - Quantity/dose
- Pattern variability
- Route of administration

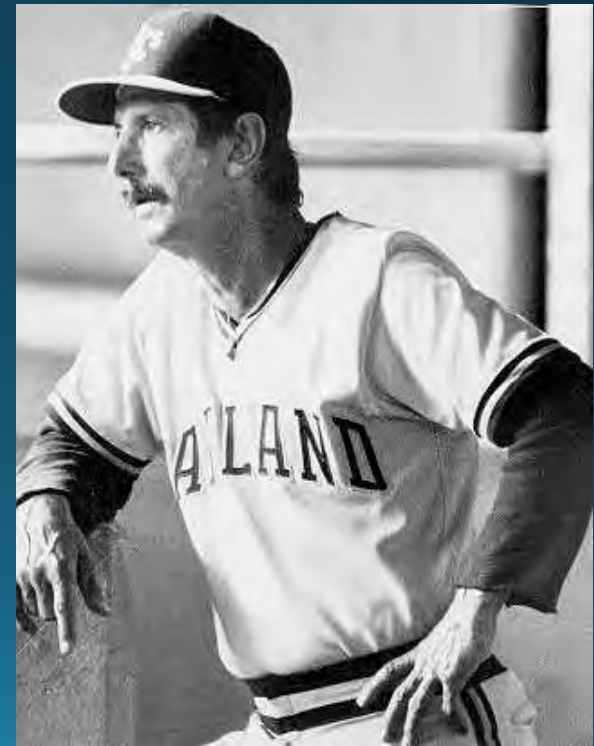
The Importance of Consequences of Use

- Is it the substance use that's the problem or its consequences?
- Types of consequences
 - Psychological
 - Social
 - Medical
 - Legal
- Acute vs. chronic

Consequences/Schmonsequences

- How do you decide a consequence is really a consequence?
 - Someone decides to blow off studying and gets high the night before an exam?
 - Someone uses a substance strategically in order to provide an excuse for failure?
 - Someone gets into fights when drinking?

It's not that Billy [Martin] drinks a lot, it's just that he fights a lot when he drinks a little. ~ Dick Young



Consequences/Schmonsequences

- How do you count them?
- ICD-10 vs. DSM-IV Dependence and DSM-5 SUD
 - Neglect of interests; increased time to obtain, use or recover
- Same consequence can lead to multiple criterion
- In NESARC, correlation between reduced social activities and role impairment is very high (.85)

Consequences/Schmonsequences

- Cultural, developmental, and contextual dependence
 - Driving while intoxicated
 - Failure to fulfill major role obligation
- Multiple determination
 - Often substance use is only one piece of the problem and can be difficult to determine if alcohol plays a causal or exacerbating role
 - “fantastic and uninviting behavior with alcohol,
 - and sometimes without” (Cleckley)

The Diagnosis of Substance Use Disorders (SUDs)

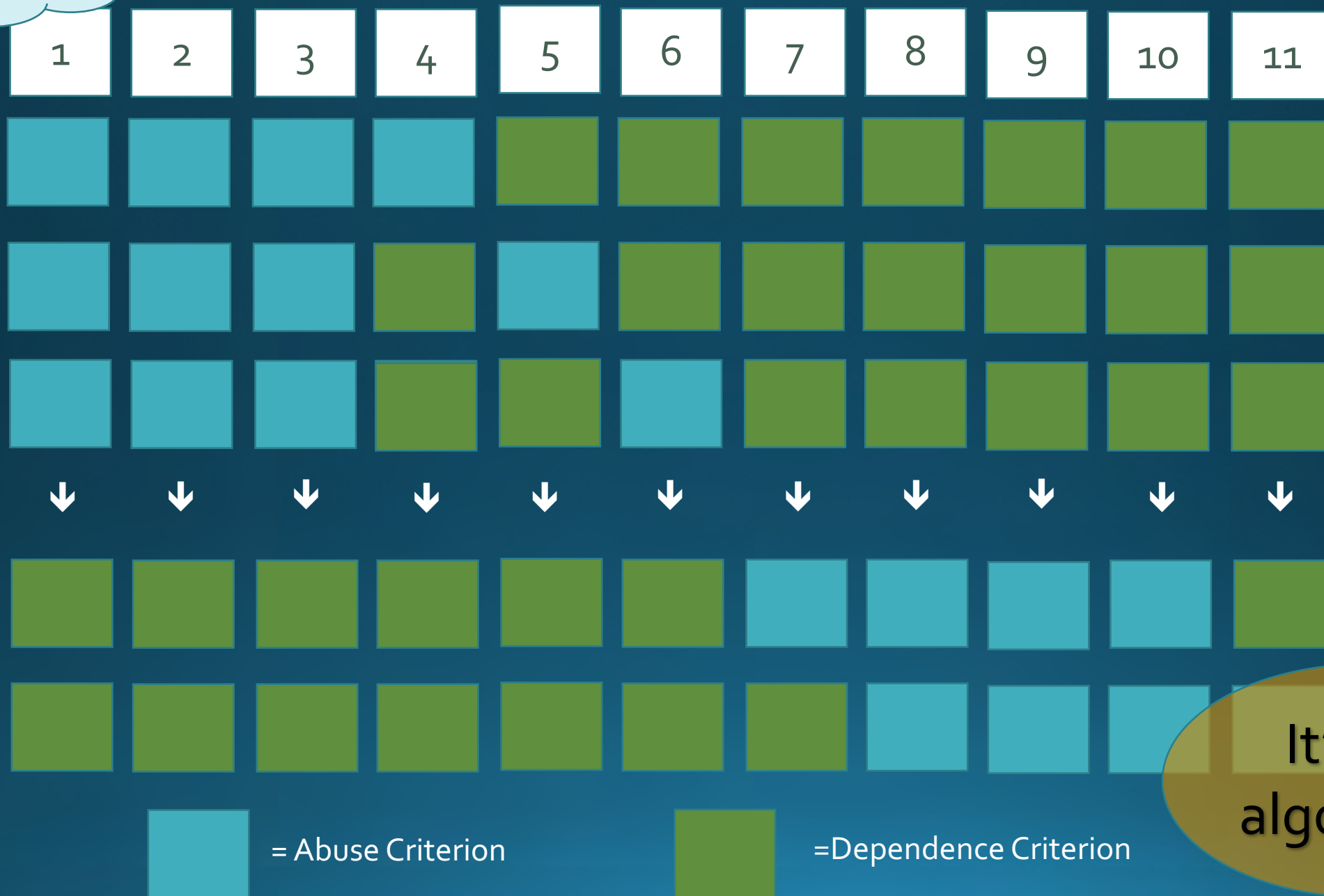
- Brief history of the concept of Substance Use Disorders
- The “modern era” (from vague to highly operationalized criteria)
 - DSM-I and DSM-II
 - Feighner Criteria and the RDC
 - DSM-III, III-R, and IV and ICD-10
 - The abuse/dependence distinction in DSM
 - Dependence and harmful use in ICD
 - DSM-5

What about the abuse/dependence distinction in DSM-III, III-R and IV?

- Evidence “for” the validity of the distinction
 - Dependence is more stable than abuse
 - Dependence is associated with more comorbidity than abuse, but..Does this have anything at all to do with the specific criteria for abuse versus dependence or is it an artifact of the algorithm?
 - One of four abuse criteria (in the absence of dependence)
 - Three of seven dependence criteria
 - It “takes more symptoms to be dependent”

What if....?

Criterion



It's the algorithm!

What about the abuse/dependence distinction in DSM-III, III-R and IV?

- Evidence “against” the validity of the distinction
 - Some “abuse” symptoms more severe than “dependence symptoms”
 - Numerous factor analytic studies indicate that the criteria set is largely unidimensional

SUD Criterion		DSM-IV	DSM-5
Use in hazardous situations	A B U S E	✓	✓
Failure to fulfill major role responsibilities		✓	✓
Social or interpersonal problems		✓	✓
~~Legal Difficulties~~		✓	
Tolerance	D E P E N D E N C E	✓	✓
Withdrawal		✓	✓
Impaired Control		✓	✓
Attempts or desire to “cut down”		✓	✓
Time spent (obtaining, using, recovering)		✓	✓
Important activities given up		✓	✓
Use despite physical or psychological problems		✓	✓
<i>Craving</i>			✓

DSM-5 Scorecard



Legal Problems Dropped



Abuse/Dependence Distinction Dropped



Craving Criterion Added



2/11 Algorithm



Retention of “Hazardous Use” Criterion



Lack of a Conceptual Core



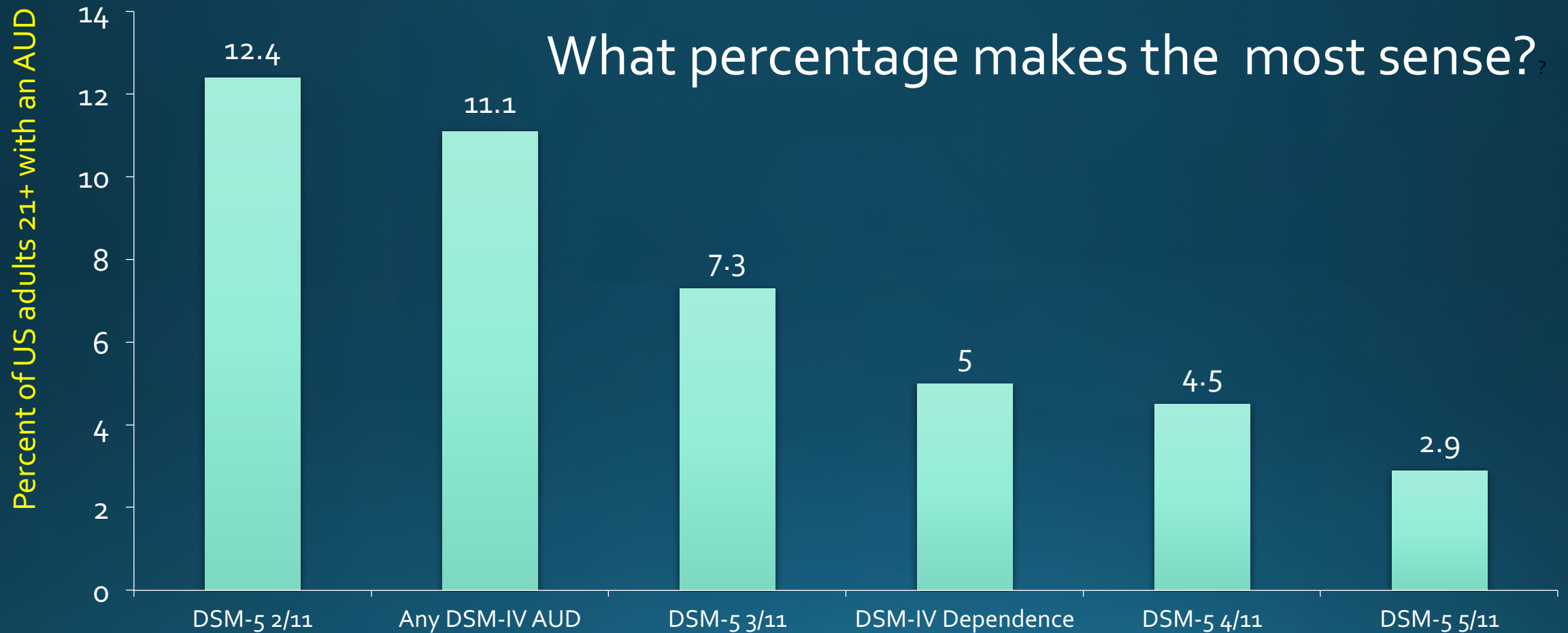
Severity Grading



The Diagnosis of Substance Use Disorders (SUDs): Some Remaining Issues

- HUGE variability in how a given criterion is operationalized
 - E.g., “craving”, withdrawal
 - Can we grade criteria??
- DSM-5 (and predecessors give very high prevalences)
 - Can we “tweak” current approaches?
 - Refining criteria sets and decision rules
- Integrating diagnosis and science: The RDoC movement and addiction
 - Can we develop diagnostic criteria that are science-based

Prevalence of Different AUD Definitions (Past Year)



Martin, Steinley, Verges and Sher (2011). The proposed DSM-5 2/11 symptom algorithm for SUDs is too lenient. *Psychological Medicine*, 41, 2008-2010.

Heterogeneity:

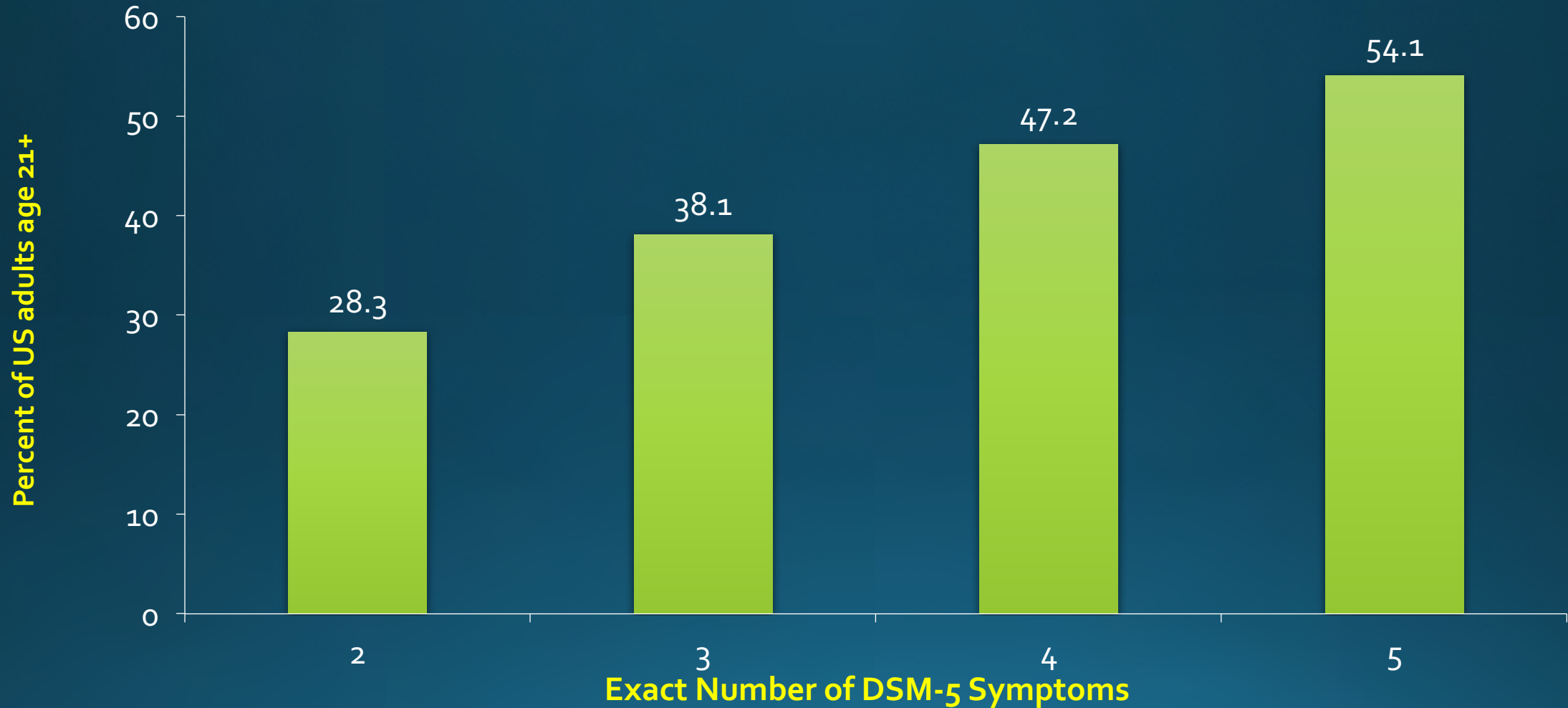
Symptom Configurations Among Those with Exactly 2 Symptoms (n = 1,486)

Larger/Longer and Hazardous Use	18%
Larger/Longer and Quit/Cut Down	14%
Larger/Longer and Withdrawal	10%
Tolerance and Quit/Cut Down	10%
Larger/Longer and Tolerance	6%

Martin, Steinley, Verges and Sher (2011). The proposed DSM-5 2/11 symptom algorithm for SUDs is too lenient. *Psychological Medicine*, 41, 2008-2010.

Severity:

5+ Drinks at Least Weekly for Different AUD Thresholds



Martin, Steinley, Verges and Sher (2011). The proposed DSM-5 2/11 symptom algorithm for SUDs is too lenient. *Psychological Medicine*, 41, 2008-2010.

But many ways to diagnose with an SUD

- Polythetic approach to diagnosis means
 - Not all individuals who diagnose share overlapping symptoms
 - Many different combinations possible (2036!!)
 - Do these make a difference?

	SUD Severity									
	Mild		Mod.		Severe					
	2	3	4	5	6	7	8	9	10	11
# Criteria Met	2	3	4	5	6	7	8	9	10	11
# of Possible Configurations	55	165	330	462	462	330	165	55	11	1

Comments about Severity in DSM-5

- Symptom configurations at varying DSM-5-defined severity levels (e.g., mild versus severe) are often more similar to each other on external indicators of severity than they are of individuals with the same DSM-5 severity levels
- Evidence that some configurations are subadditive or superadditive
- Raises questions as to the validity of severity grading for clinical decision making
 - More empirical work needed to validate the dimensional severity grading of DSM-5 AUD

Comorbidity

- SUDs are highly comorbid with each other and with other psychiatric disorders
- Multiple perspectives on this phenomenon
 - SUD → Other Disorder
 - Other disorder → SUD
 - Common third variable causation
 - Artefactual association (e.g., definitional overlap)
 - Chance association
- Hierarchical structures
 - Externalizing spectrum
 - The *p* factor (Caspi et al., 2014)

OR_{adj} 12-Month DSM-5 AUD & Psychiatric Disorders

Psychiatric Disorder	Mild AUD	Mod AUD	Severe AUD
Any DUD	3.0	5.3	11.8
Nicotine dep	2.2	3.5	6.0
Major Dep	1.3	1.8	2.9
Dysthymia	1.1	1.4	2.7
Bipolar I	1.9	3.3	4.9
Bipolar II	1.8	1.6	3.3
Panic	1.5	1.9	3.4

Adjusted for Sociodemographic Characteristics

[Grant et al. JAMA Psychiatry. 2015 Aug;72\(8\):757-66 supplement](#)

OR_{adj} 12-Month DSM-5 AUD & Psychiatric Disorders

Psychiatric Disorder	Mild AUD	Mod AUD	Severe AUD
Panic	1.5	1.9	3.4
Agoraphobia	1.7	1.7	3.0
Social phobia	1.0	1.7	2.3
GAD	1.6	1.4	3.1
PTSD	1.4	1.8	3.7
Antisocial PD	1.9	2.8	4.6
Borderline PD	2.1	2.9	5.9
Schizotypal PD	1.6	2.2	4.1

Some general comments on SUDs and Co-occurring Psychopathology

- SUDs are frequently comorbid with many other psychiatric disorders
 - Other SUDs
 - Conduct disorder and adult antisocial behavior
 - Other personality disorders (esp. Borderline PD)
 - Mood disorders (esp. Bipolar disorder)
 - Anxiety Disorders

Some general comments on SUDs and Co-occurring Psychopathology

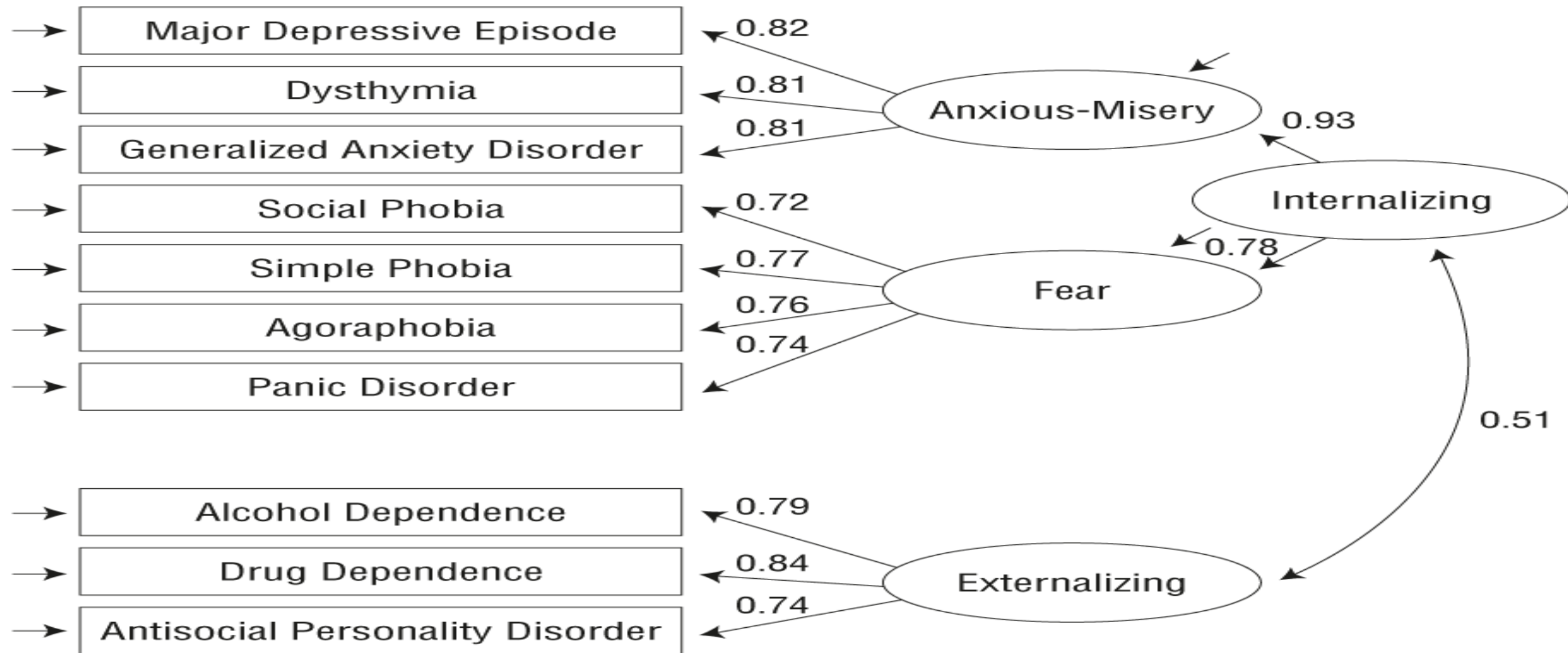
- Co-occurrences can be due to a number of reasons
 - SUD → Comorbid condition
 - Comorbid condition → SUD (“secondary” SUD)
 - SUD → Comorbid condition → SUD → Comorbid condition (reciprocal causation)
 - Common (“third variable”) causation
 - Artefact (e.g., definitional overlap)
 - Mere chance (independent conditions)
- Regardless of the reason, complicates assessment and treatment

General comments on SUDs and Co-occurring Psychopathology

- Is traditional psychiatric nosology the best way to conceptualize comorbidity?
- Latent Variable Perspective on Comorbidity
 - Internalizing and Externalizing Spectra

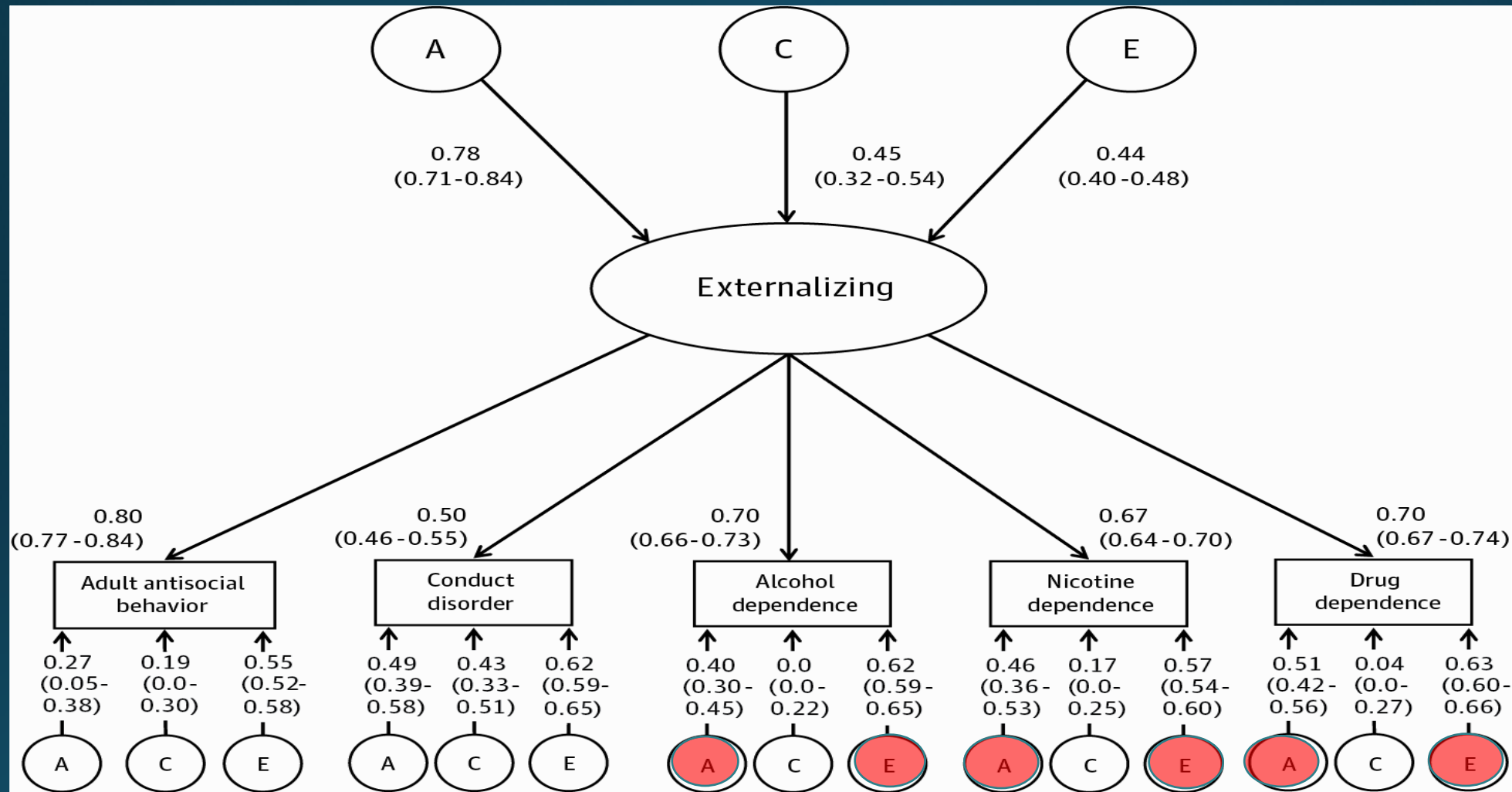
Internalizing and Externalizing

Factor Structure of Mental Disorders (Krueger, 1999)



Best-fitting model for the entire National Comorbidity Survey, a 3-factor variant of the 2-factor internalizing/externalizing model. All parameter estimates are standardized and significant at $P < .05$

Shared Etiology Among Externalizing Conditions



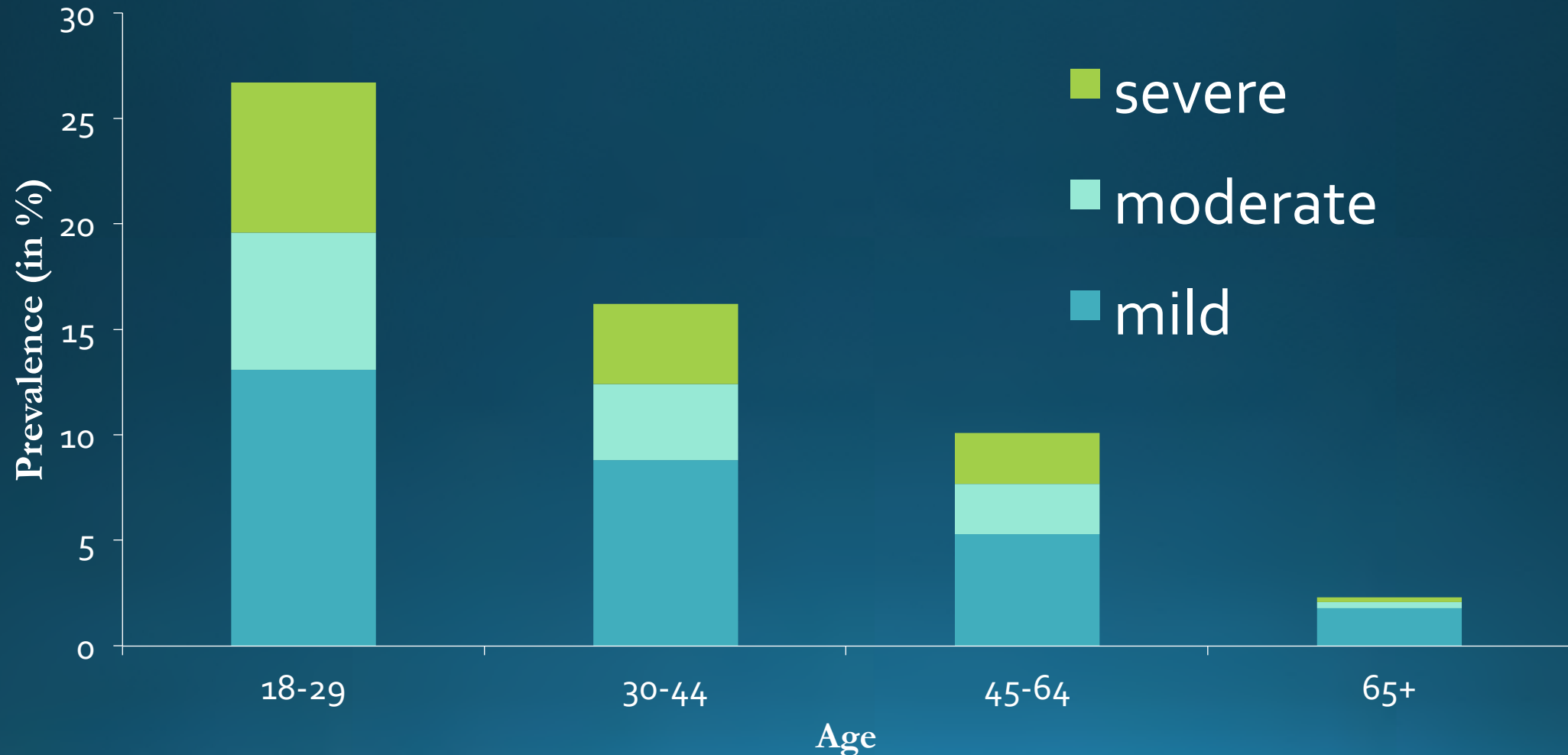
Hicks BM, Foster KT, Iacono WG, McGue M. (2013) Genetic and Environmental Influences on the Familial Transmission of Externalizing Disorders in Adoptive and Twin Offspring. *JAMA Psychiatry*. 2013;70(10):1076-1083.

A developmental perspective:

Epidemiology of SUDs

12-mo DSM-5 Alcohol Use Disorder

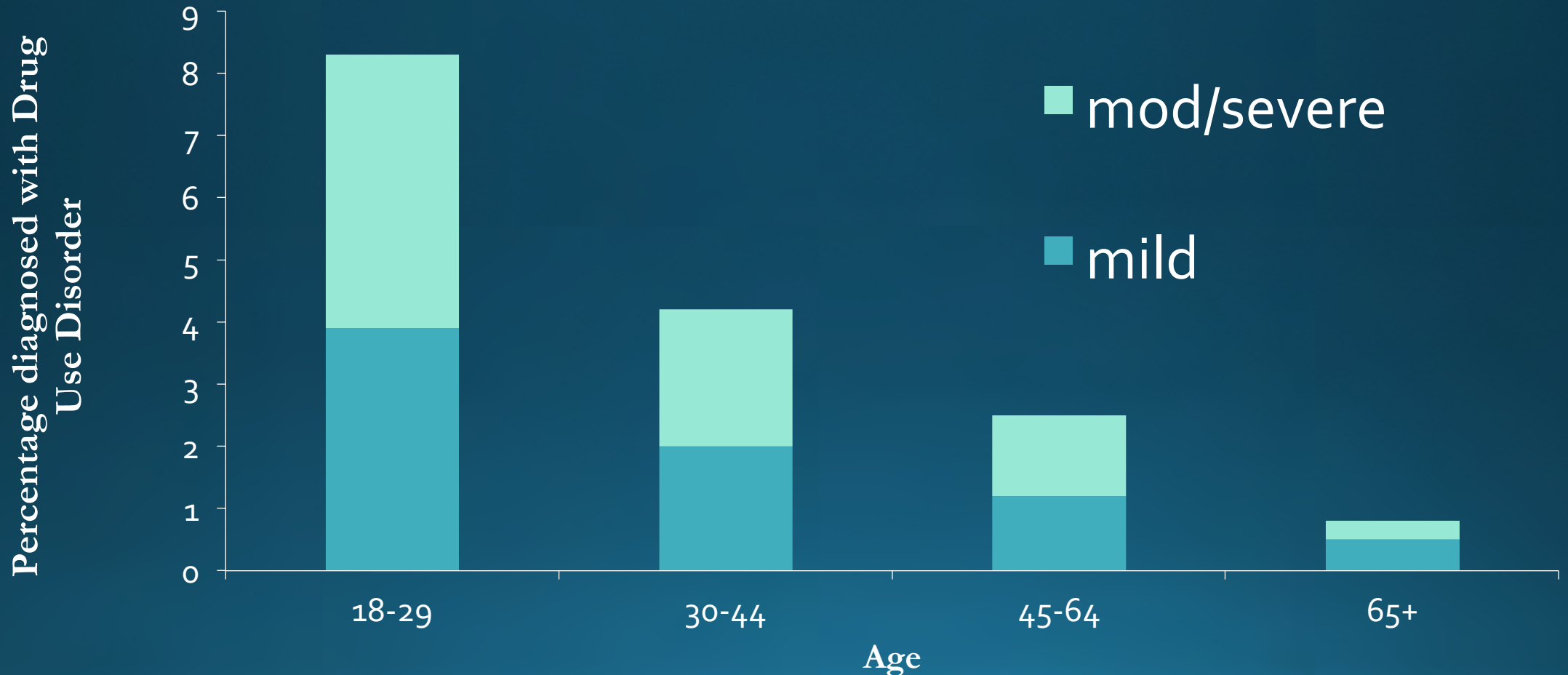
(from NESARC-III)



[Grant et al. JAMA Psychiatry. 2015 Aug;72\(8\):757-66](#)

12-mo DSM-5 Drug Use Disorder

(from NESARC III)

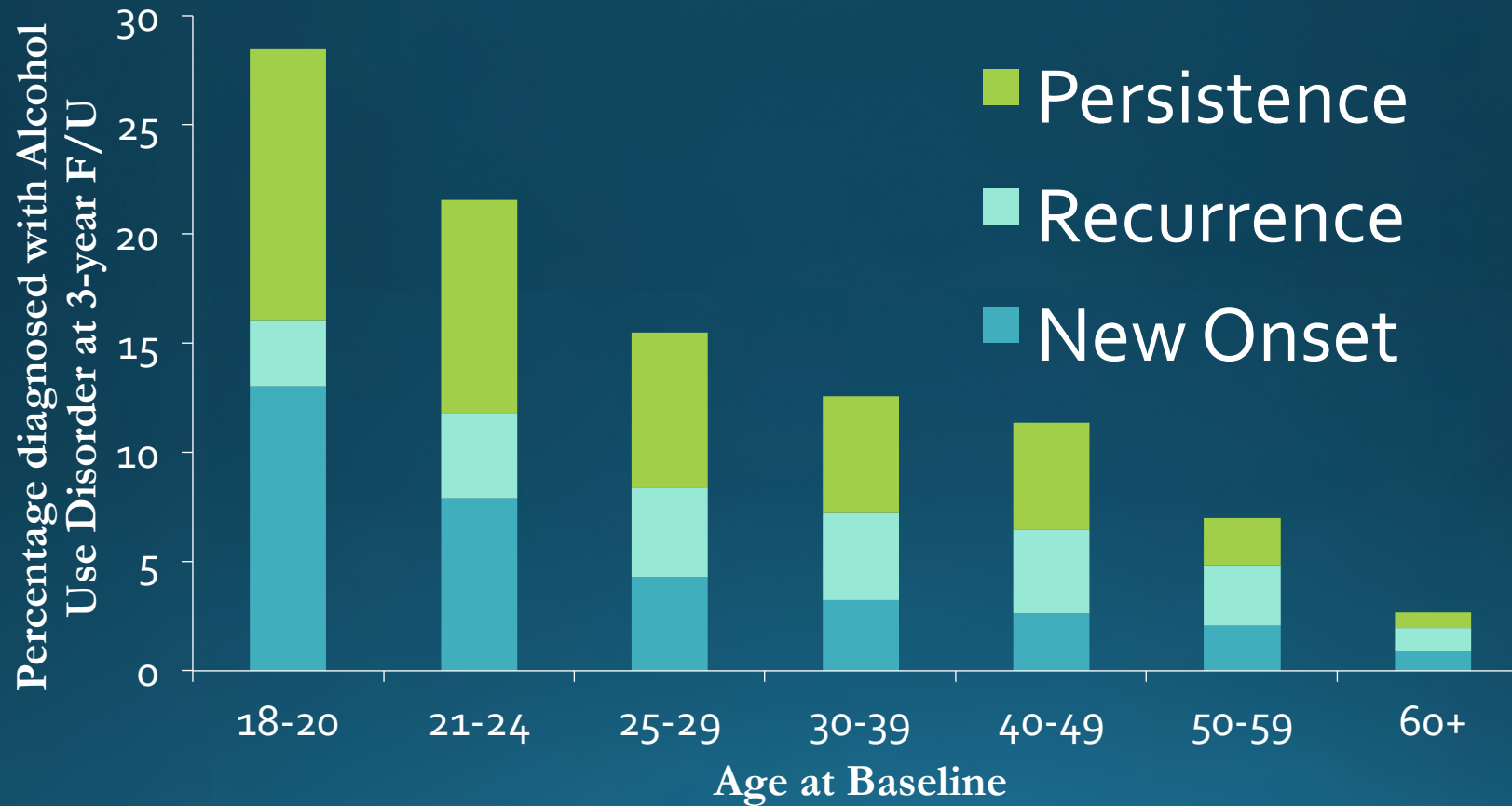


Grant, et al. JAMA Psychiatry. 2016;73(1):39-47

Why the strong age-gradient in the age-prevalence curve?

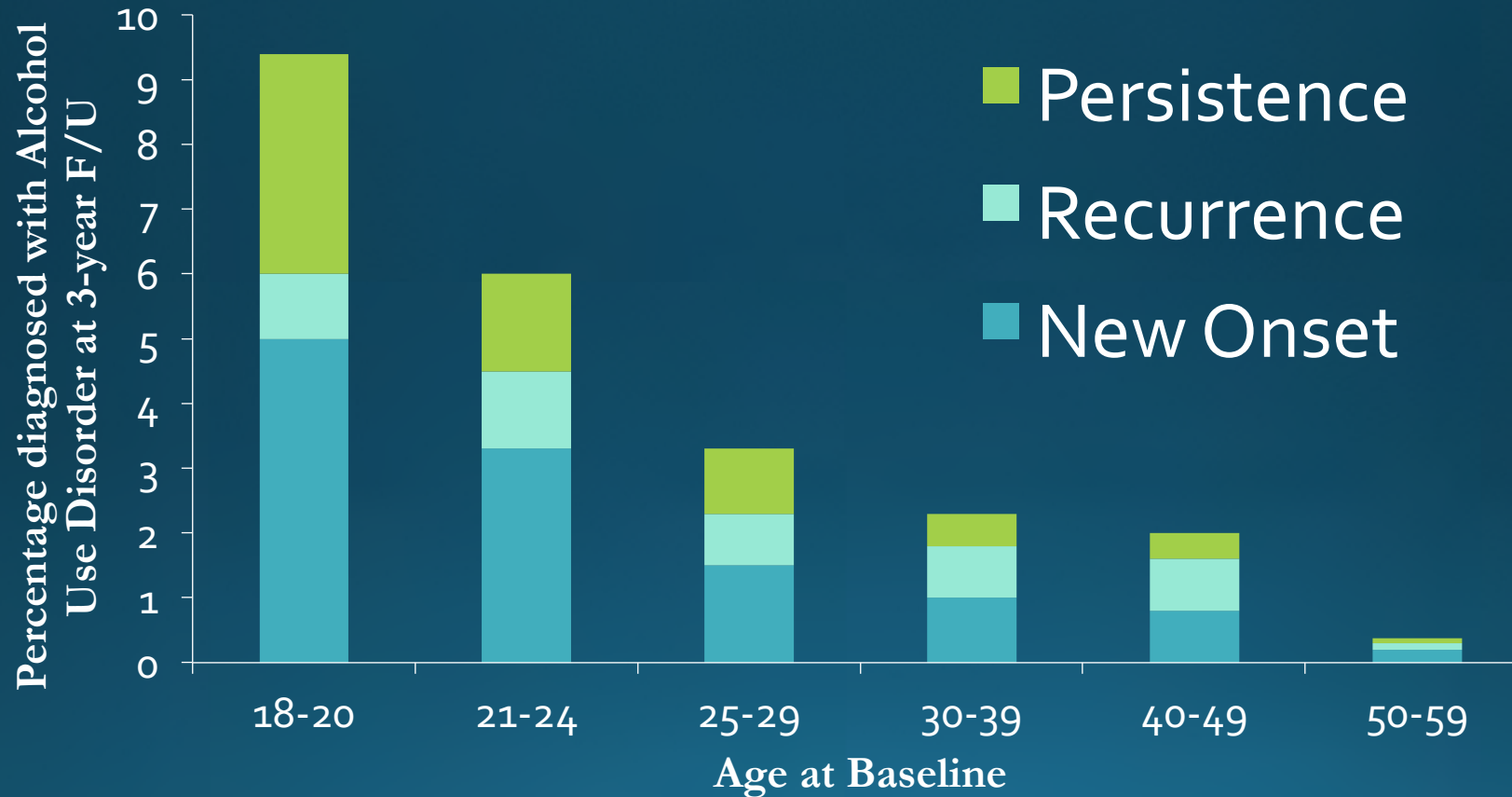
- Differential mortality?
- Cohort differences?
- Adolescent and young adult false positive diagnoses?
- “Maturing out”

Overall 12-mo AUD



Verges et al. (2012)

Overall 12-mo Drug Use Disorder



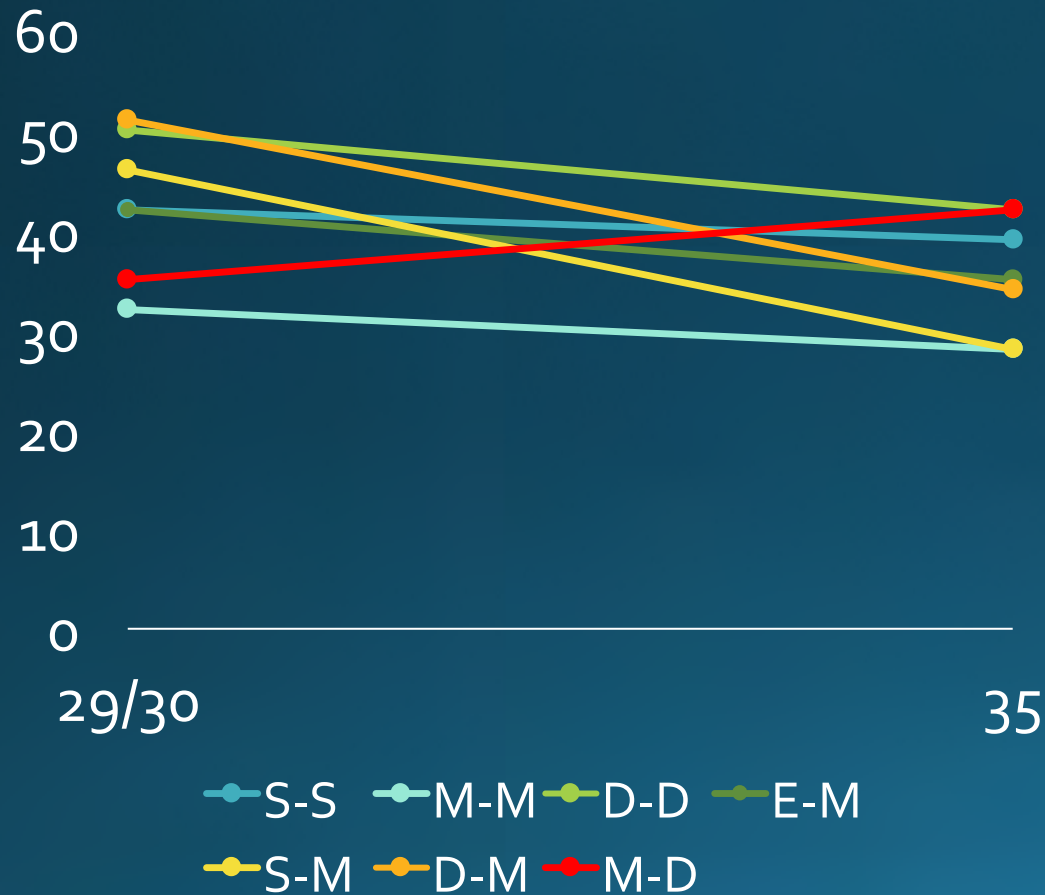
Verges et al. (2013) Am J Pub Health

Why the big decrease in prevalence?

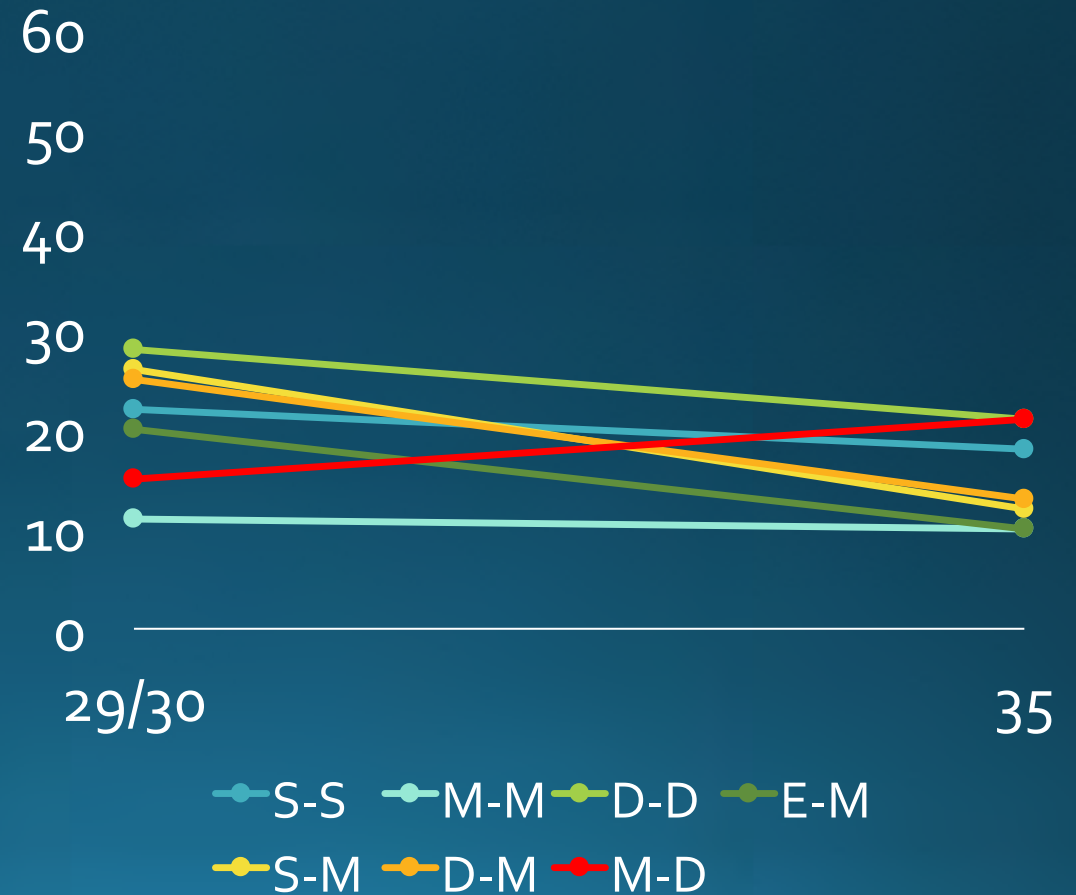
- “Maturing out”!
 - Assumption of Adult Roles
 - Spouse/Partner
 - Parent
 - Wage earner
 - Roles tend to be “incompatible” with a heavy substance involved lifestyle

Prevalence of Heavy Drinking in the last Two Weeks (Classes 1976-1989)

Men

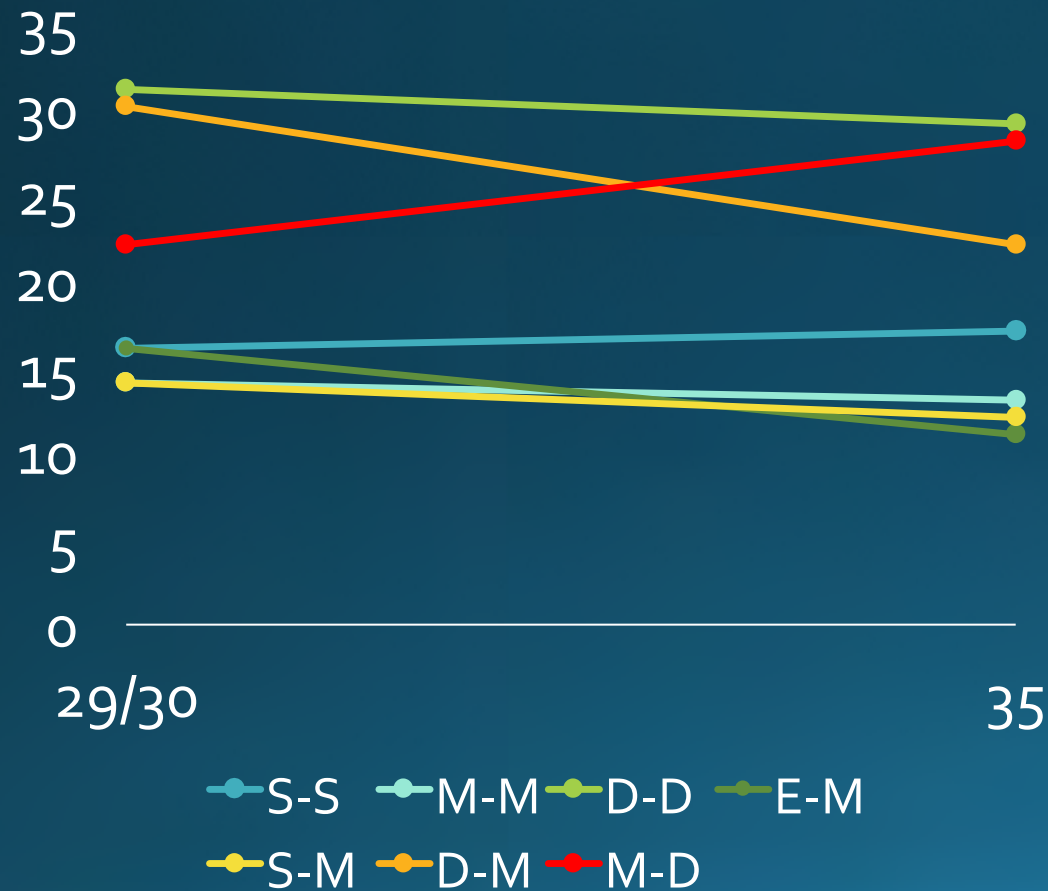


Women

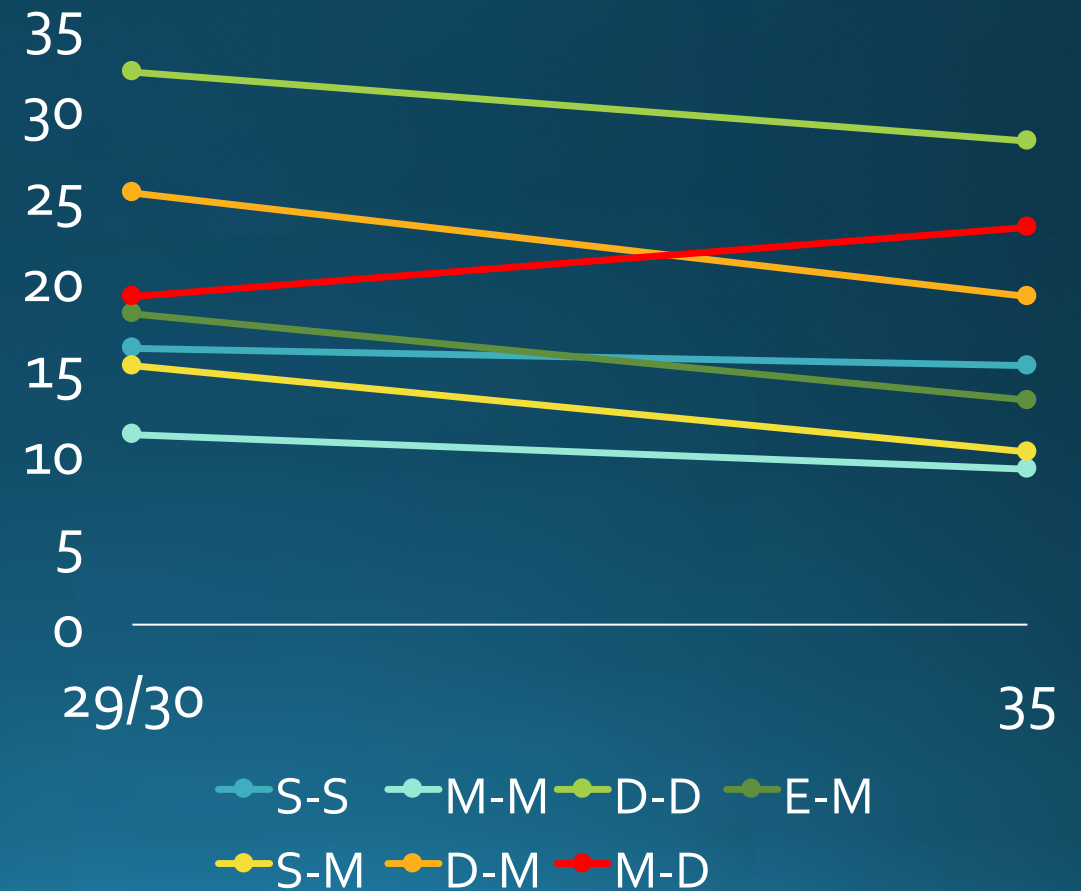


Half-Pack or More Daily Cigarette Smoking (Classes 1976-1989)

Men

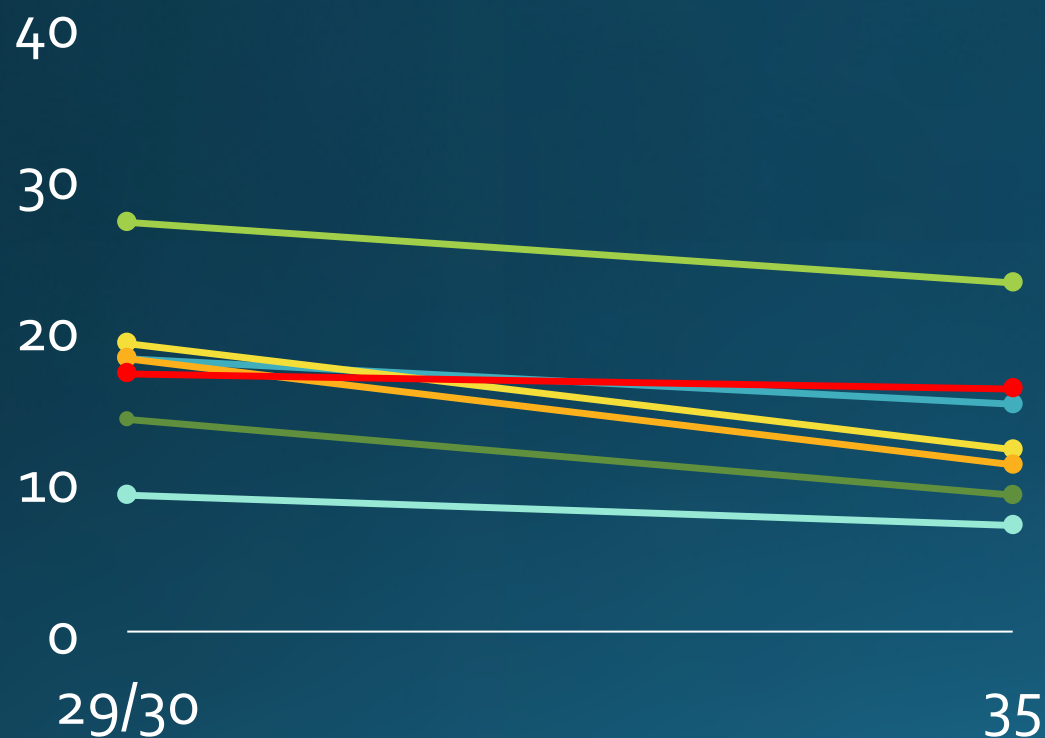


Women



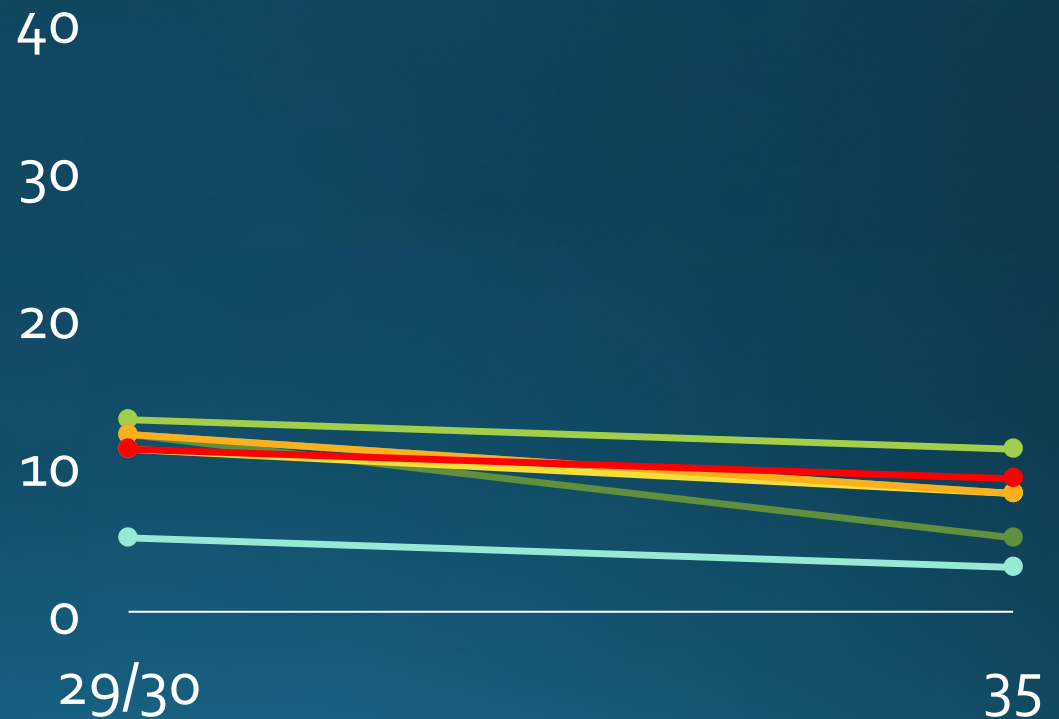
Prevalence of Marijuana Use in the Last 30 Days (Classes 1976-1989)

Men



S-S M-M D-D E-M
S-M D-M M-D

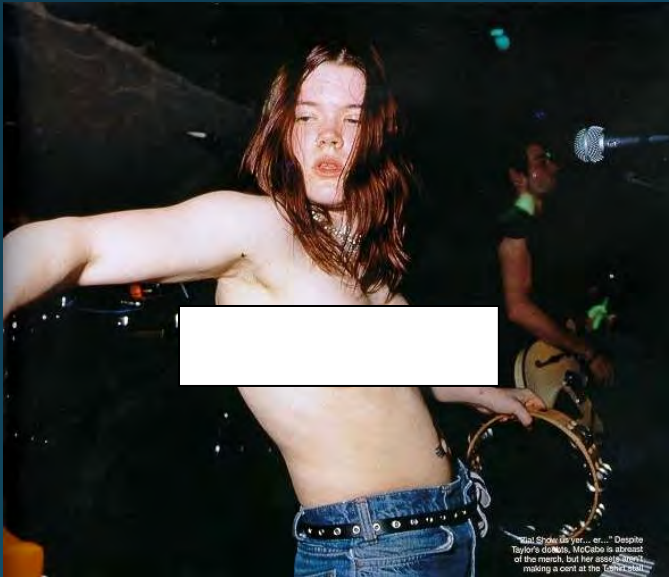
Women



S-S M-M D-D E-M
S-M D-M M-D

Zia McCabe of the *Dandy Warhols*

The Transformation of Zia



to



Zia Explains Maturing Out



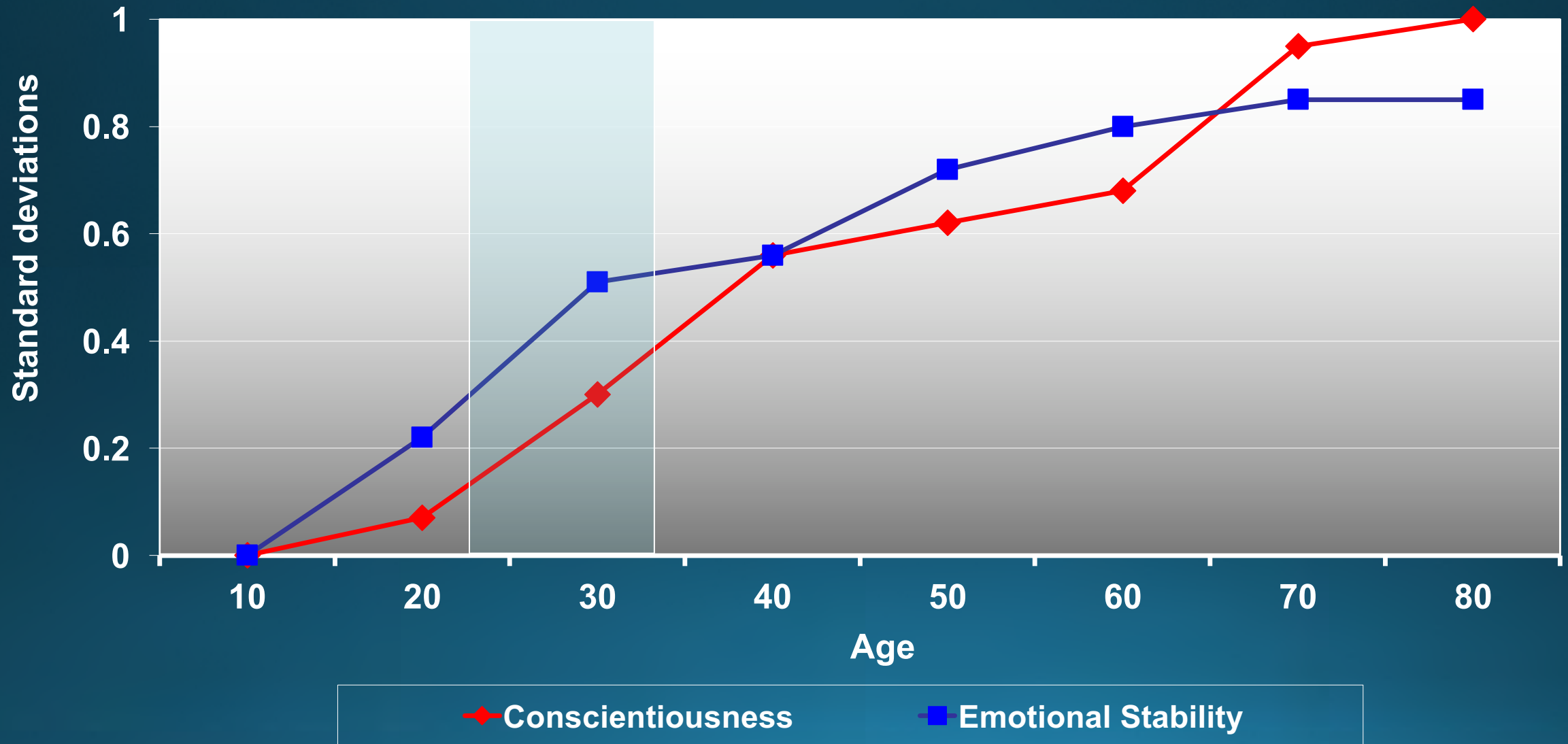
Screenshot of Zia McCabe video

Is there more to “maturing out” than
mere role incompatibility?

Patterns of Mean-Level Change in Personality Traits Across the Life Course: A Meta-Analysis of Longitudinal Studies

Brent W. Roberts and Kate E. Walton
University of Illinois at Urbana–Champaign

Wolfgang Viechtbauer
University of Maastricht

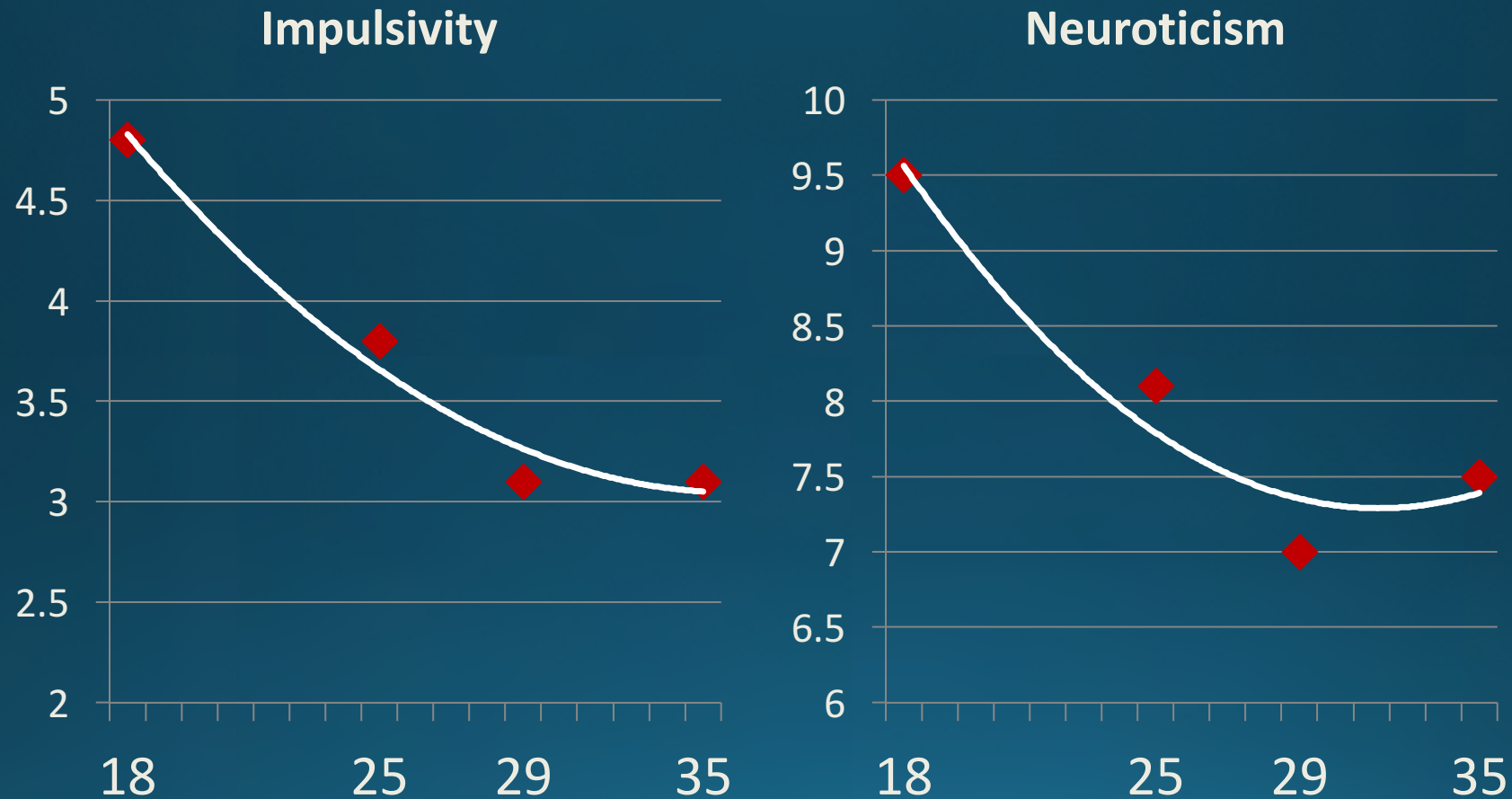


Personality Changes

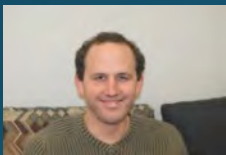
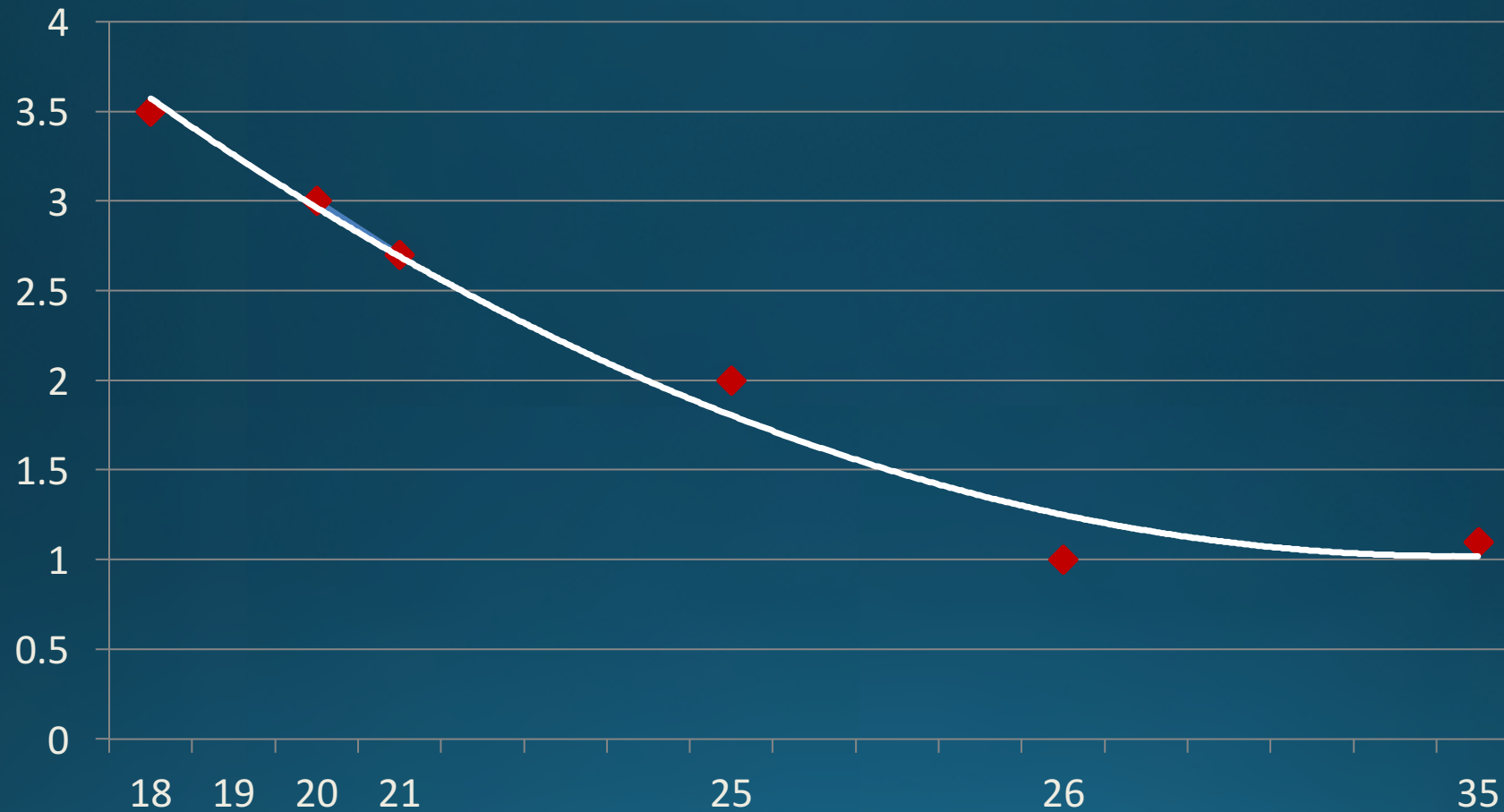
What are the implication for the course of substance-related problems?

- Personality traits show normative age- related changes over the course of development
- During this same period of time, considerable “maturing out” of alcohol problems is also occurring
 - Assumption of adult roles appears to explain some of this effect
 - Can personality change also contribute?

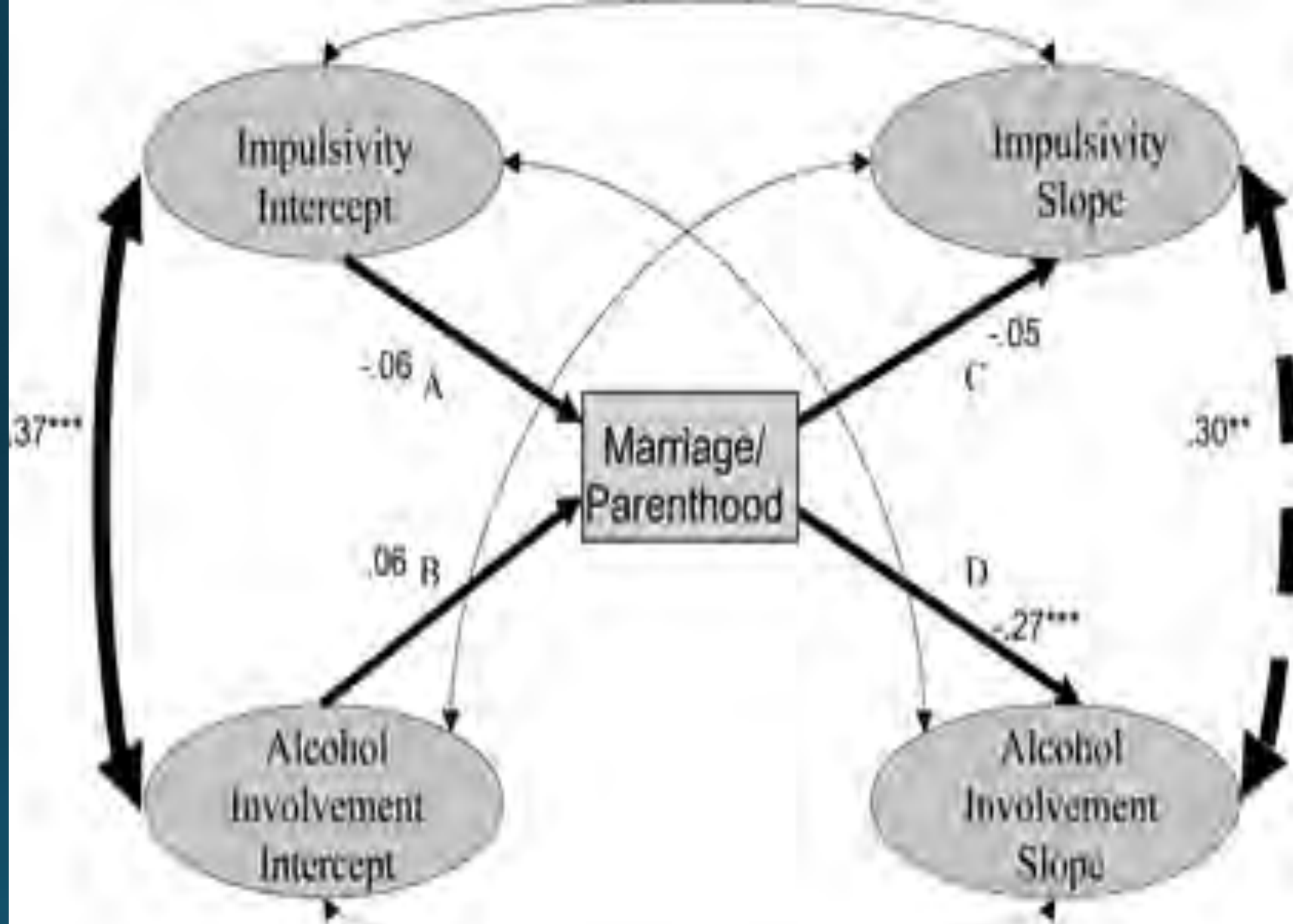
Personality Change

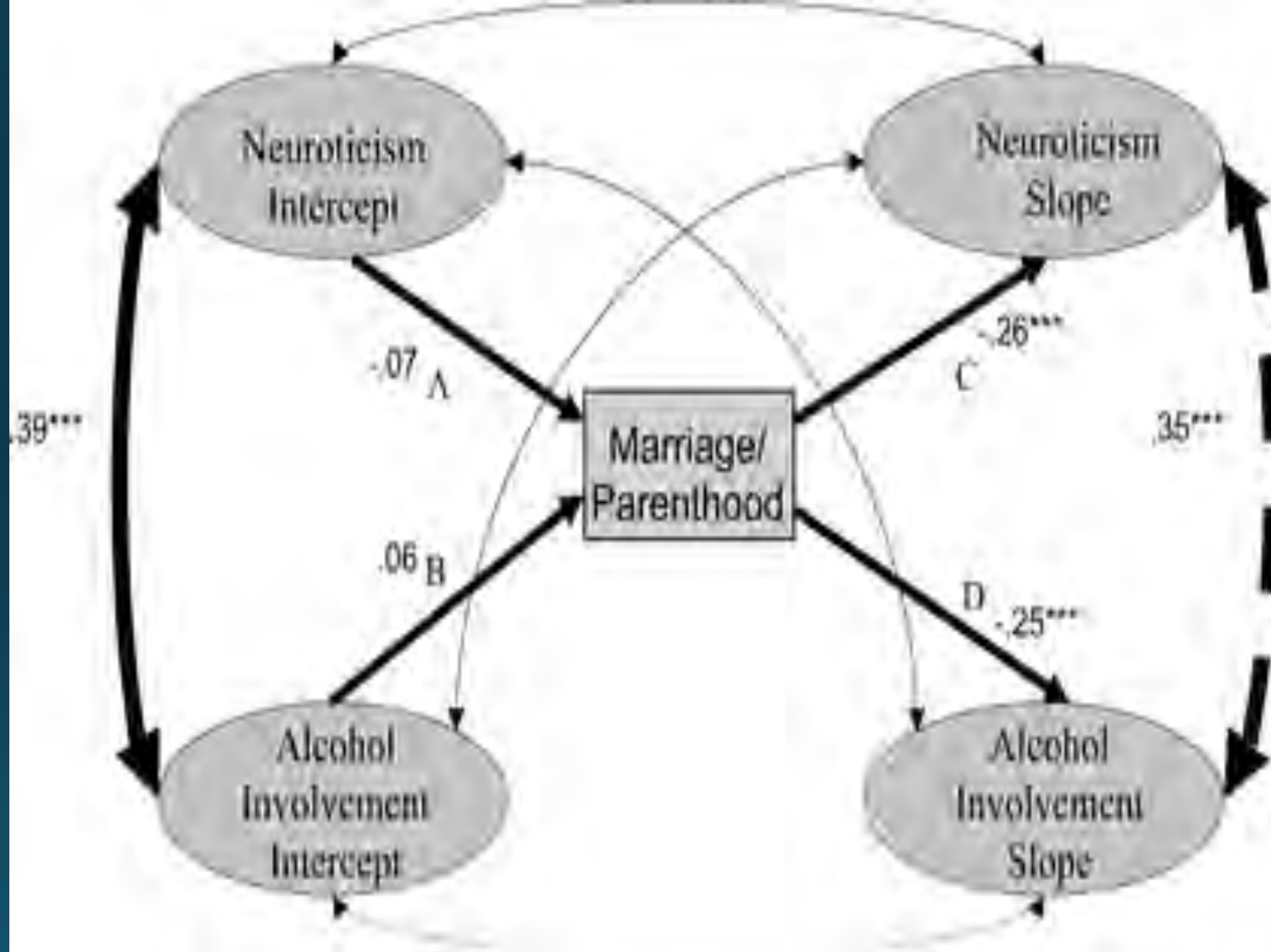


Alcohol Problems



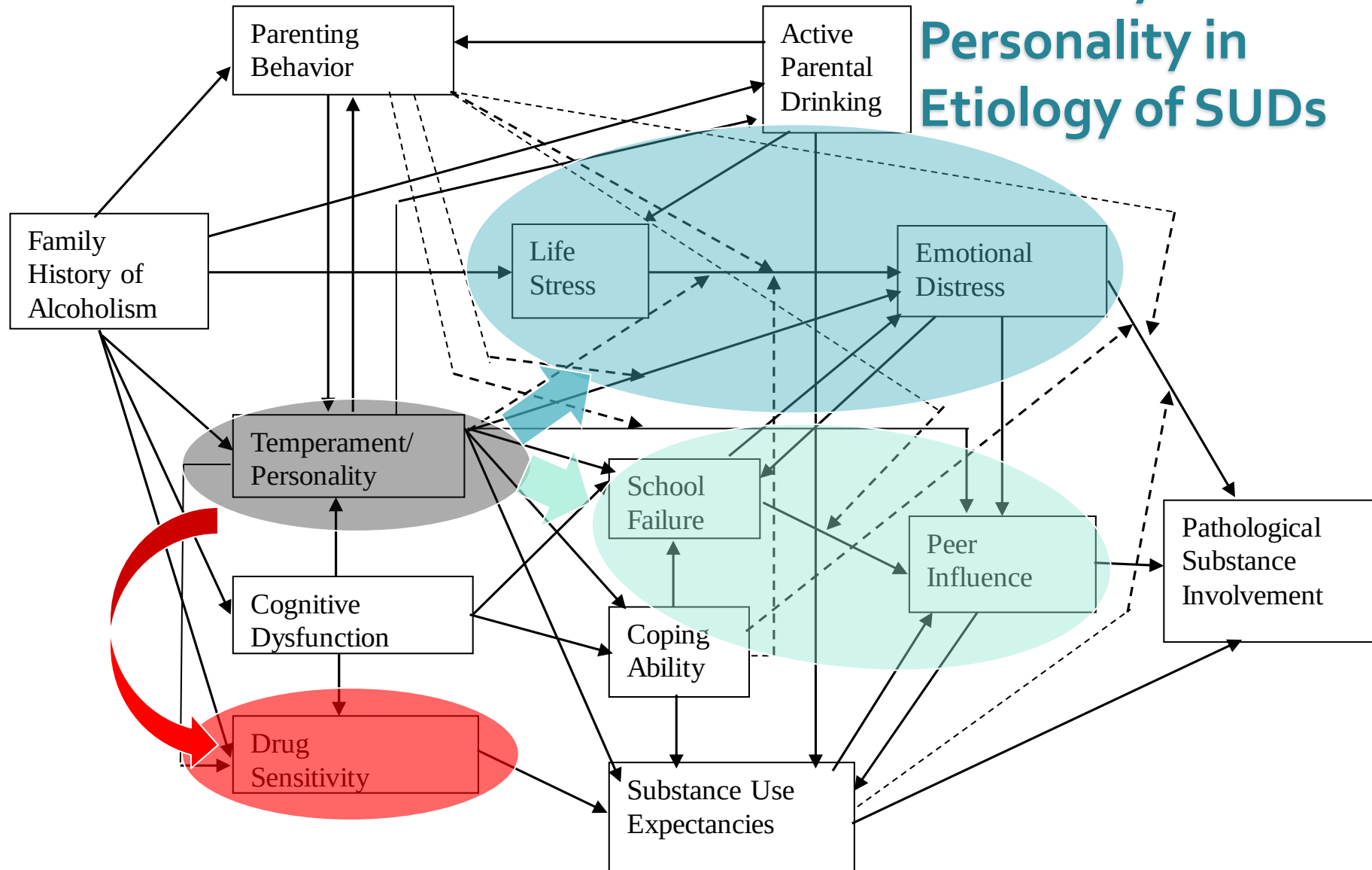
Littlefield, A., Sher, K. J., & Wood, P. K., 2009





Model of SUD Vulnerability (adapted from Sher, 1991)

Centrality of Personality in Etiology of SUDs

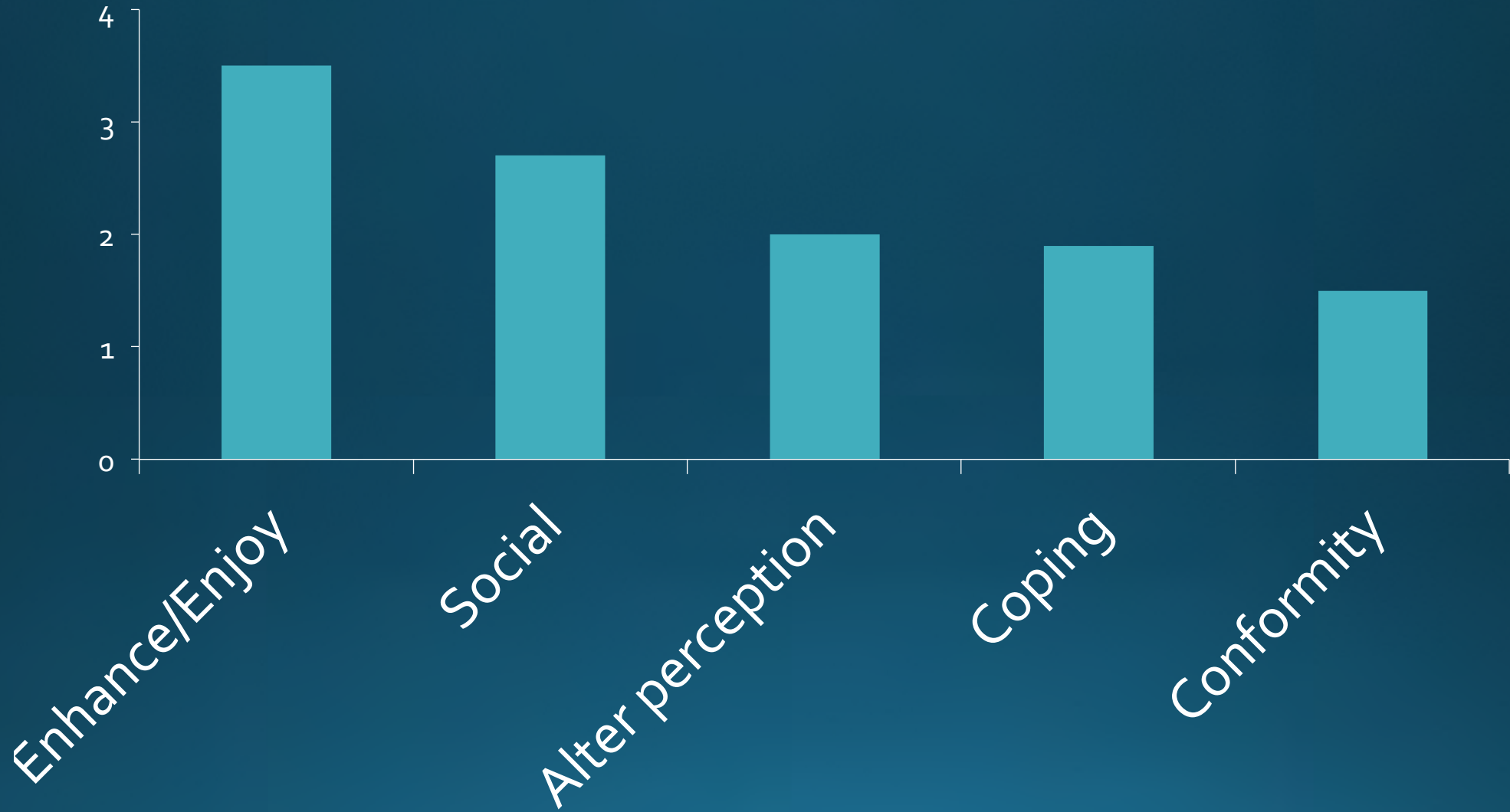


Alcohol Use Motives *ala* Cox and Klinger (1988)

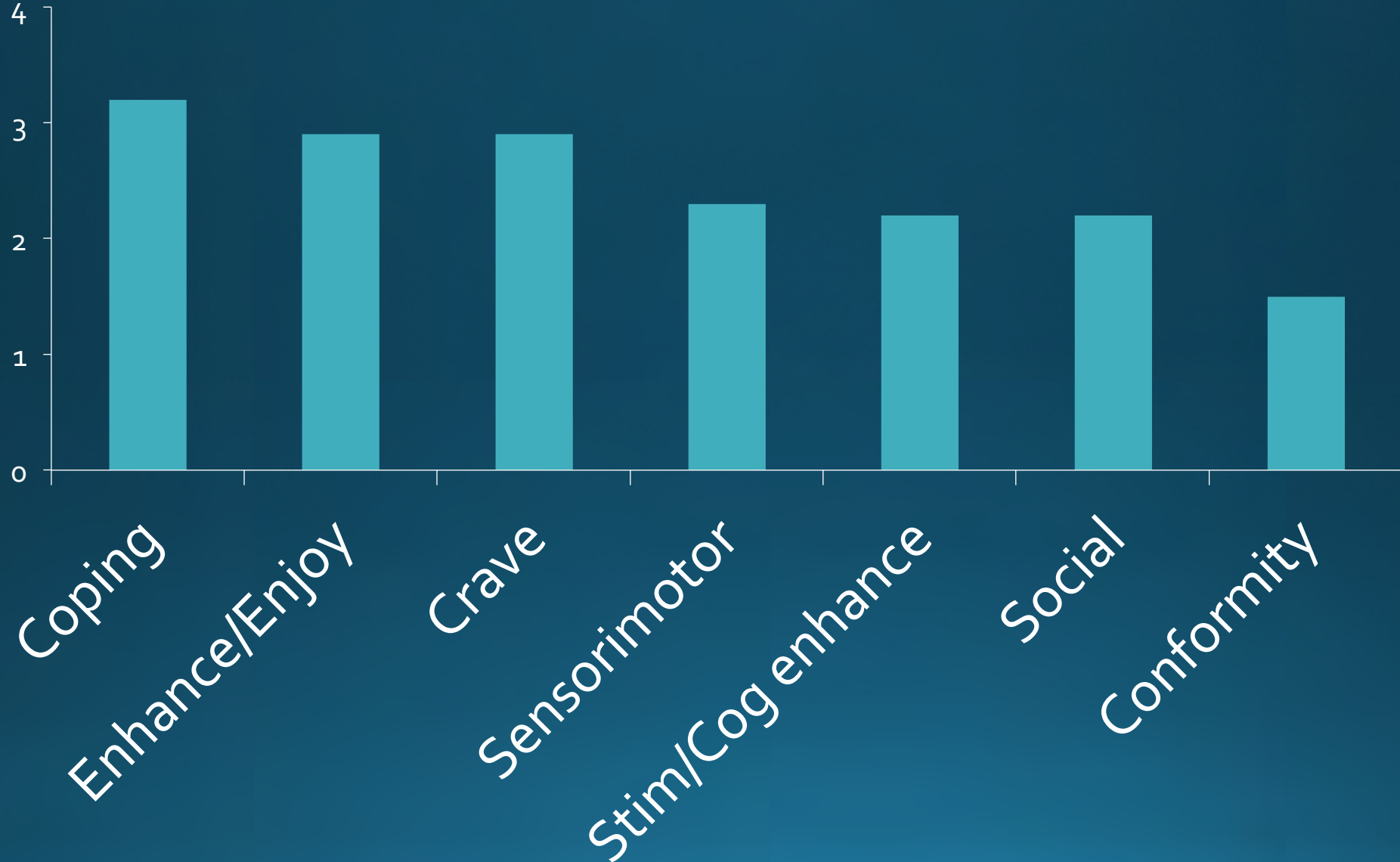
	Internal	External
Positive Reinforcement	Enhancement	Social
Negative Reinforcement	Coping	Conformity



Marijuana Motivation



Tobacco Motivation





Screenshot of clip video 10 to 1:04

Personality Change is Associated with Change in Motives

- As individuals mature they become less impulsive and less neurotic and appear to be less motivated to use alcohol (and presumably other drugs) to cope
 - Presumably developing more constructive ways to regulate emotions
 - Appears to be an important aspect of maturing out

Thus, “Maturing Out”...

- Is not solely due to role incompatibility
- Is related to normative personality change
 - Association may be mediated by motives for use
- Even traditional psychological treatments might have salutary effects due to spurring personality change (Roberts et al., 2017)

Addiction: What is it exactly???



Screenshot of clip video 9 to 1:37

Addiction

- Lack of consensus as to the explicit nature of “addiction”
- Has implications not only for clinical work but for jurisprudence

Traynor v. Turnage **485 U.S. 535 (1988)**

[Syllabus](#) | [Case](#)

U.S. Supreme Court

Traynor v. Turnage, 485 U.S. 535 (1988)

Traynor v. Turnage

No. 86-622

Argued December 7, 1987

Decided April 20, 1988*

Key concepts

- Compulsive Use
- Preoccupation
- Craving
- “Hijacking” of reward systems
- Neuroadaptation
 - Tolerance
 - Withdrawal

Starting Over: What is the Nature of Addiction?

- Numerous theories of addiction
 - Habit
 - Incentive sensitization
 - Allostasis
 - Shrinking of ones temporal horizon in making decisions

Pharmacological Pathways

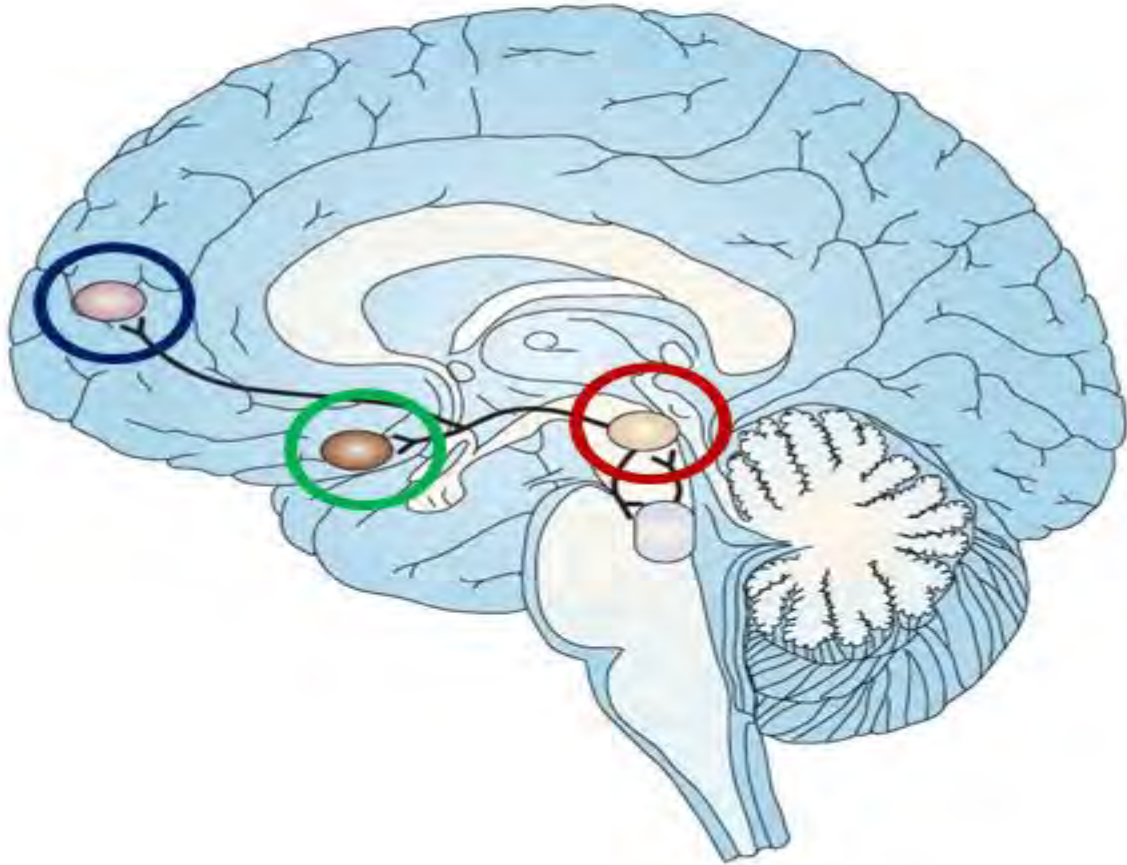
- Key concepts
 - Addictive substances have initial positively valenced effects
 - Over time, the nature of drug responses change
 - Tolerance
 - Withdrawal
 - Incentive motivation
 - These changes are *durable*
 - Multiple processes may be involved
 - Incentive sensitization
 - Allostasis
 - Habit formation

Table 2. Neurobiological Substrates for the Acute Reinforcing Effects of Drugs of Abuse

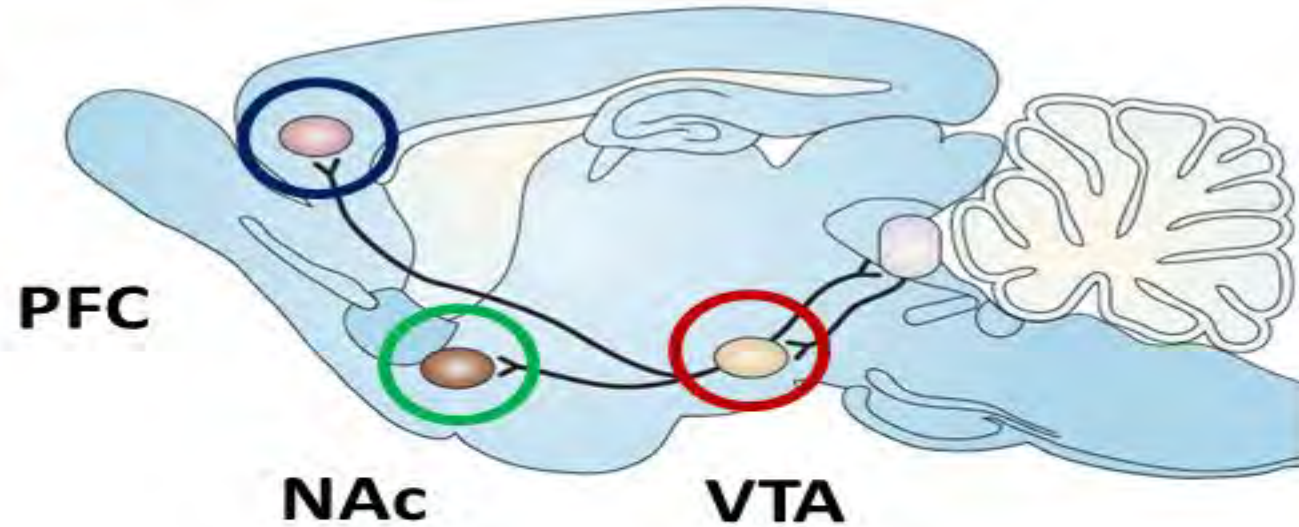
Drug of Abuse	Neurotransmitter	Site
Cocaine and amphetamines	Dopamine γ -Aminobutyric acid	Nucleus accumbens Amygdala
Opioids	Opioid peptides Dopamine Endocannabinoids	Nucleus accumbens Ventral tegmental area
Nicotine	Dopamine γ -Aminobutyric acid Opioid peptides	Nucleus accumbens Ventral tegmental area Amygdala
Δ^9 -Tetrahydrocannabinol	Endocannabinoids Opioid peptides Dopamine	Nucleus accumbens Ventral tegmental area
Alcohol	Dopamine Opioid peptides γ -Aminobutyric acid Glutamate Endocannabinoids	Nucleus accumbens Ventral tegmental area Amygdala

The Brain's Reward Circuit

Human Brain

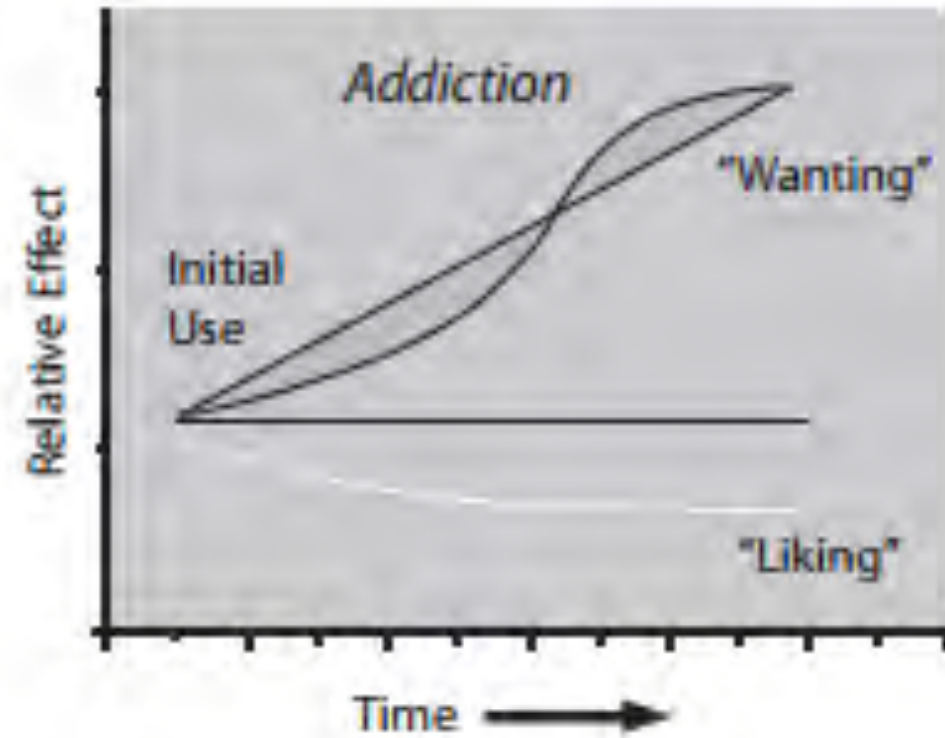
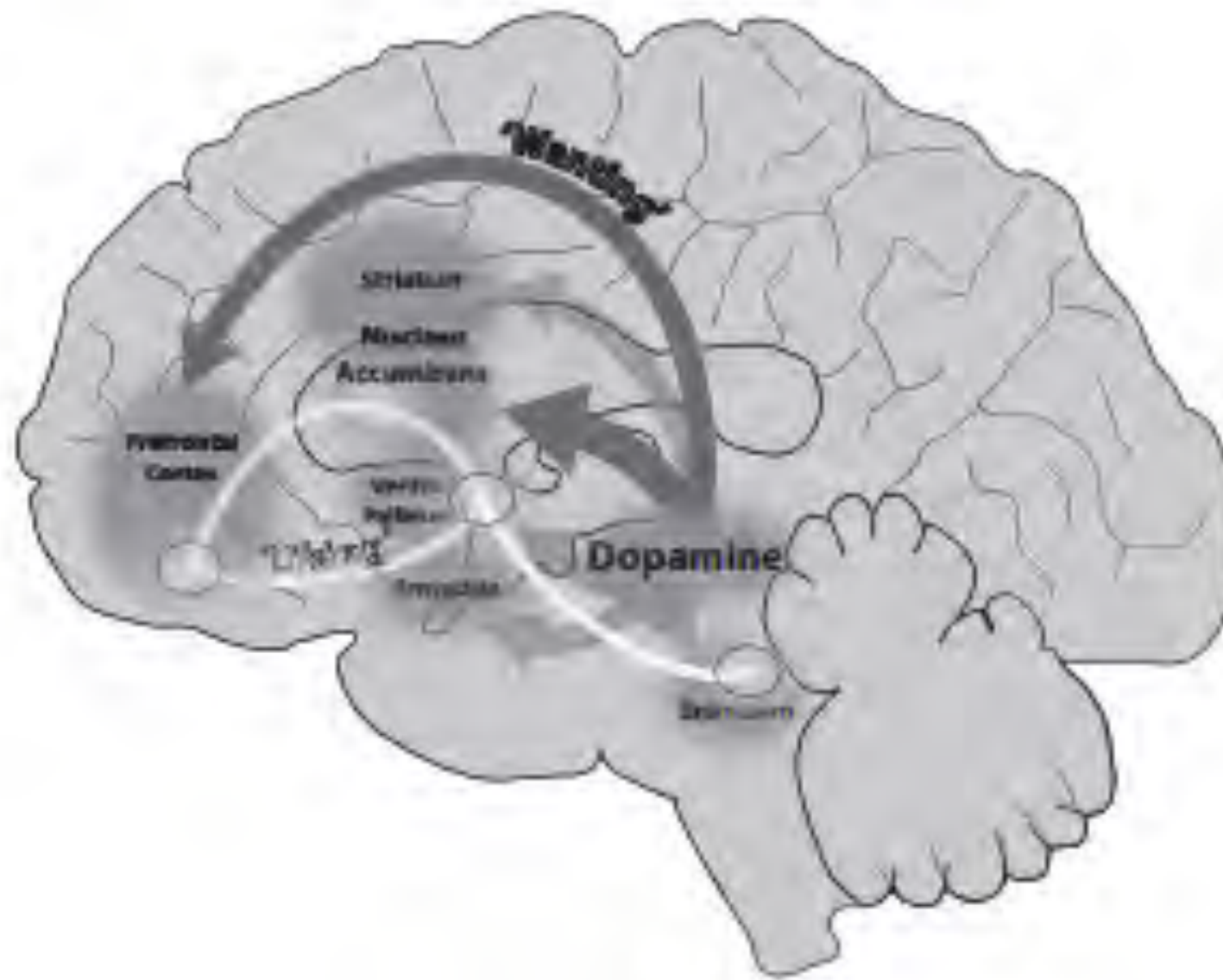


Rat Brain

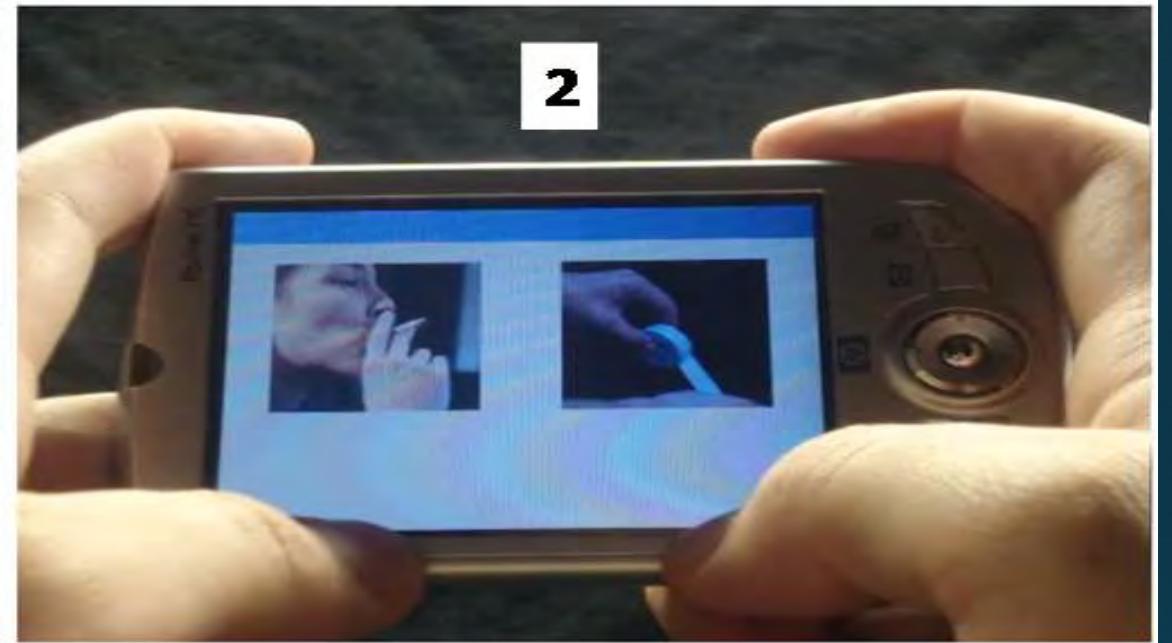


Incentive-Sensitization Theory

- Addictive drugs share the ability to produce long-lasting changes brain organization.
- The brain systems that are changed include those normally involved in the process of incentive motivation and reward.
- The critical neuroadaptations for addiction render these brain reward systems hypersensitive (“sensitized”) to drugs and drug-associated stimuli.
- The brain systems that are sensitized do not mediate the pleasurable or euphoric effects of drugs (drug “liking”), but instead they mediate a subcomponent of reward termed incentive salience or “wanting”



Berridge and Robinson (2016). Liking, wanting, and the incentive-sensitization theory of addiction. American Psychologist, 71, 670-679.



Measuring
Incentive
Salience?

Drug-related
attentional bias

Green Red Blue

Purple Blue Purple

Blue Purple Red

Green Purple Green

the Stroop effect refers to the fact that naming the color of the first set of words is easier and quicker than the second.

Name the color...

RUM	SOFA	BED	DOG	POT	SODA	BOAR
RAIN	ROACH	BEER	SHOT	HIT	HIKE	BUILD
SMOKE	STEAK	PILLOW	CAT	BIRD	COKE	PILL
CHILD	HOTEL	LAKE	TOKE	PHONE	GIRL	WINE

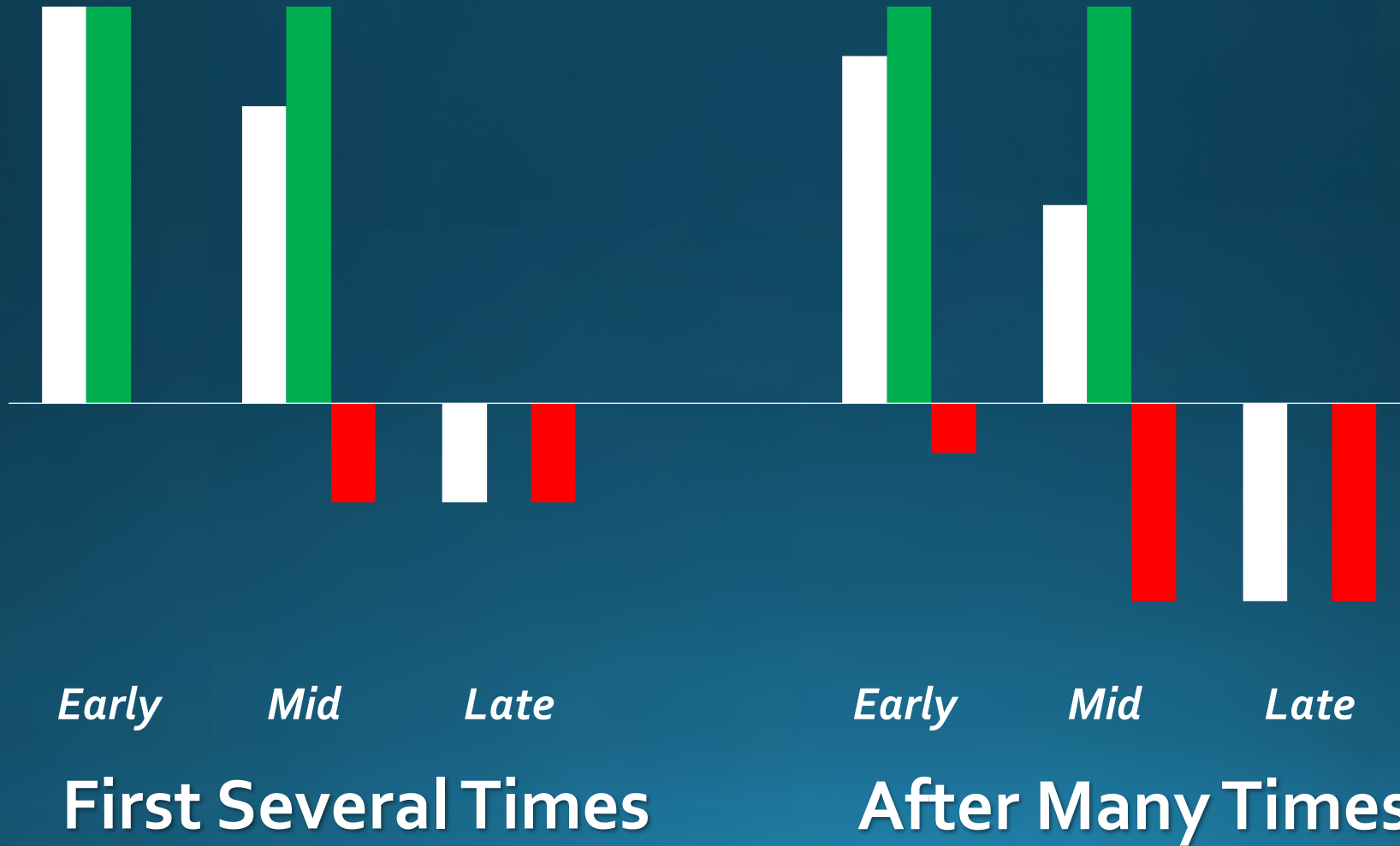
Opponent-Process Theory (Solomon & Corbit 1974)

SELECTED EXAMPLES OF HEDONIC-AFFECTIVE PHENOMENA

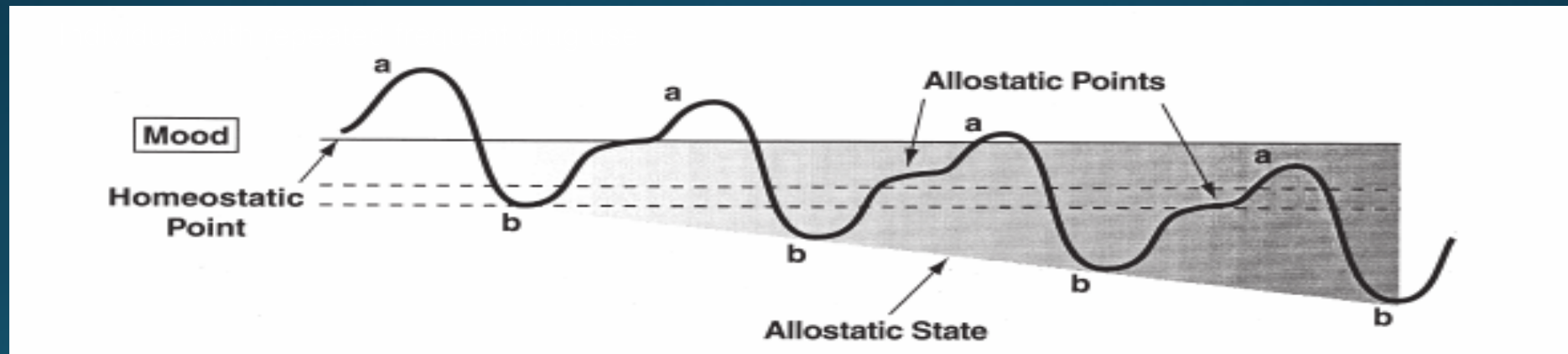
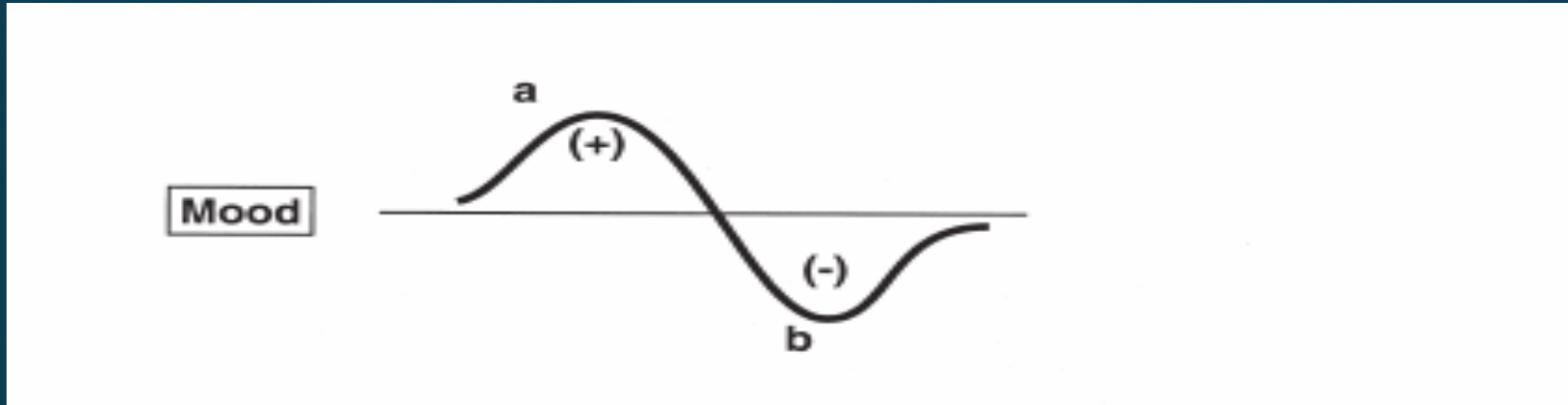
Example	First Few Stimulations		After Many Stimulations	
	State A (input present)	State B (input gone)	State A' (input present)	State B' (input gone)
Dogs receiving electric shocks in harness	large cardiac acceleration	slow deceleration, small overshoot	small acceleration or none	quick deceleration, large overshoot
IV opiate use	euphoria, rush, pleasure	craving, aversive withdrawal signs, short duration	loss of euphoria, normal feeling, relief	intense craving, abstinence agony, <i>long duration</i>

Opponent-Process Theory (Solomon & Corbit 1974)

■ Observed ■ A State ■ B State

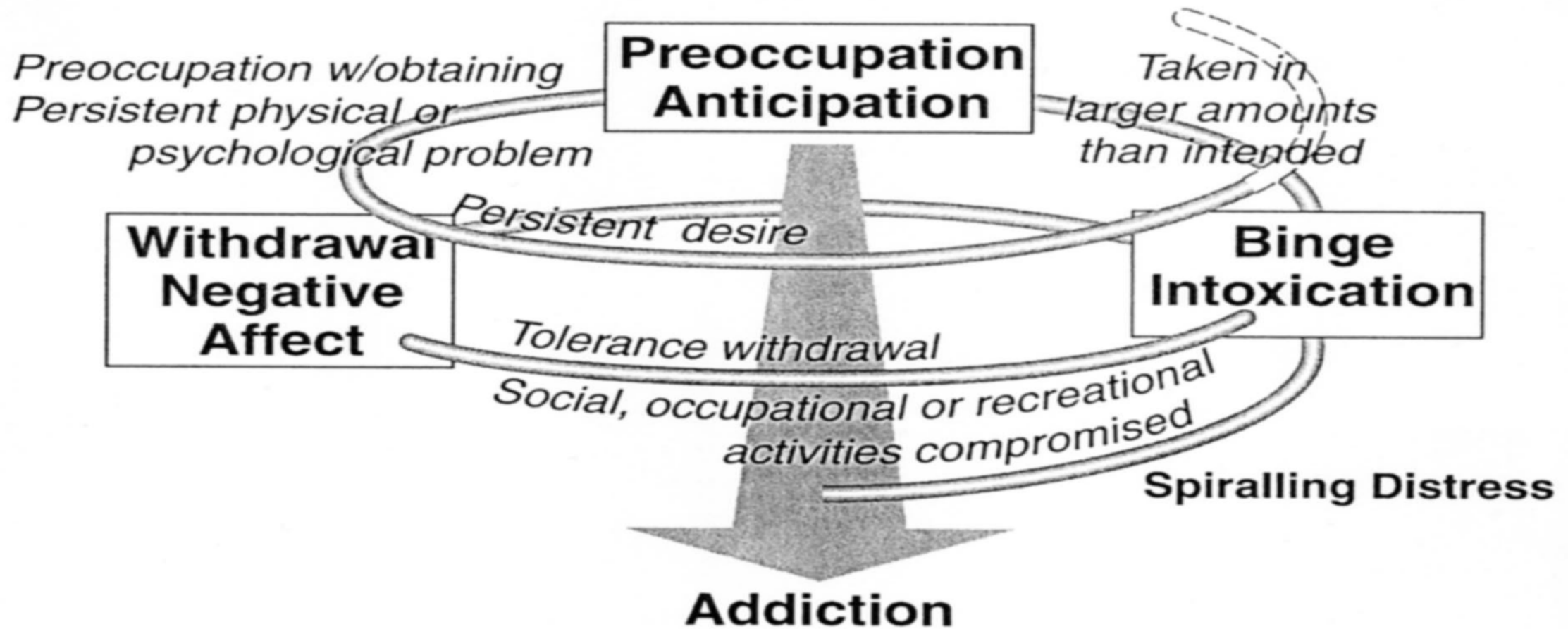


Affective Response to the presentation of a drug

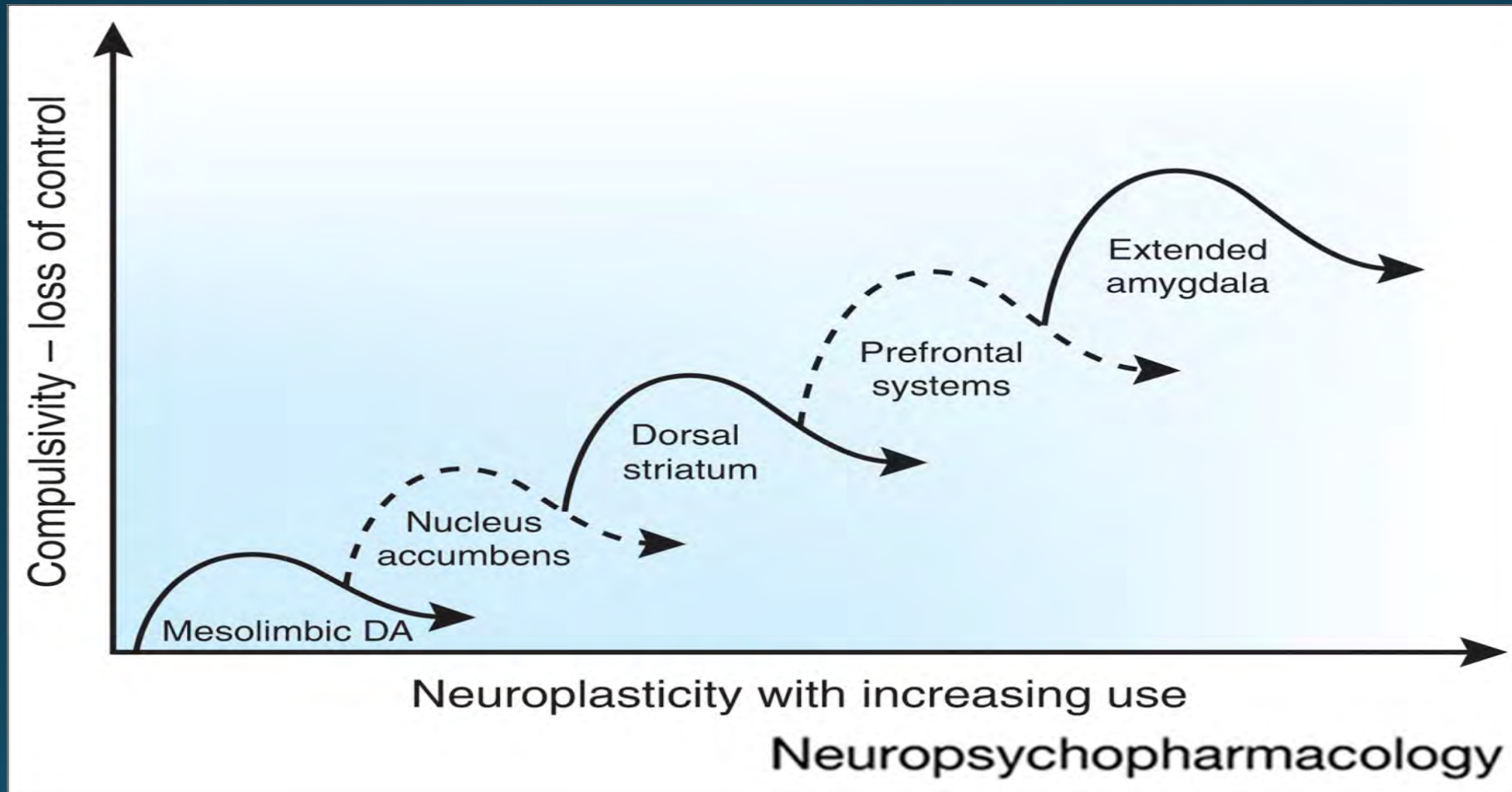


Koob, G. F., & Le Moal, M. (2001). Drug addiction, dysregulation of reward, and allostasis. *Neuropsychopharmacology*, 24, 97-129.

Criteria for Substance Dependence (DSM-IV)

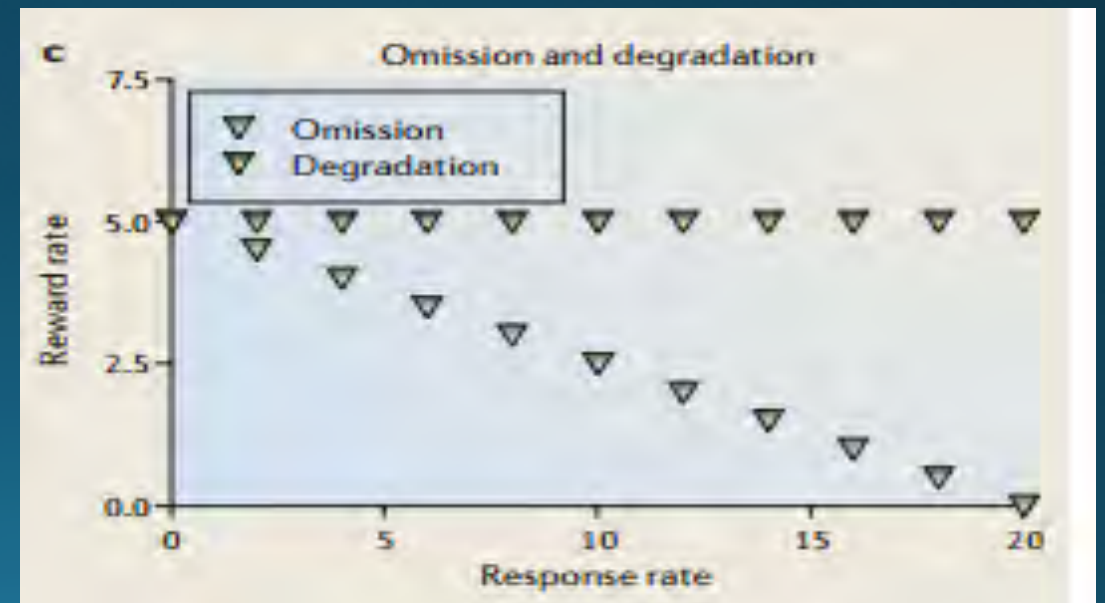


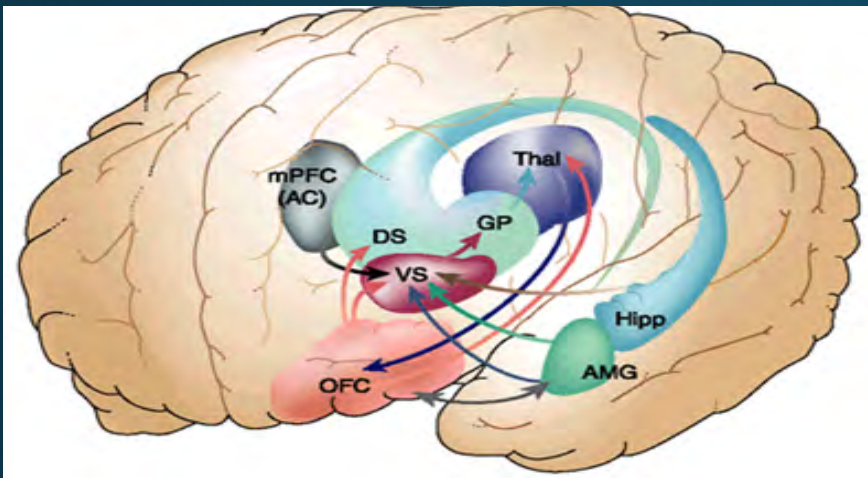
Neuroplasticity in Brain Circuits associated with the Development of Addiction



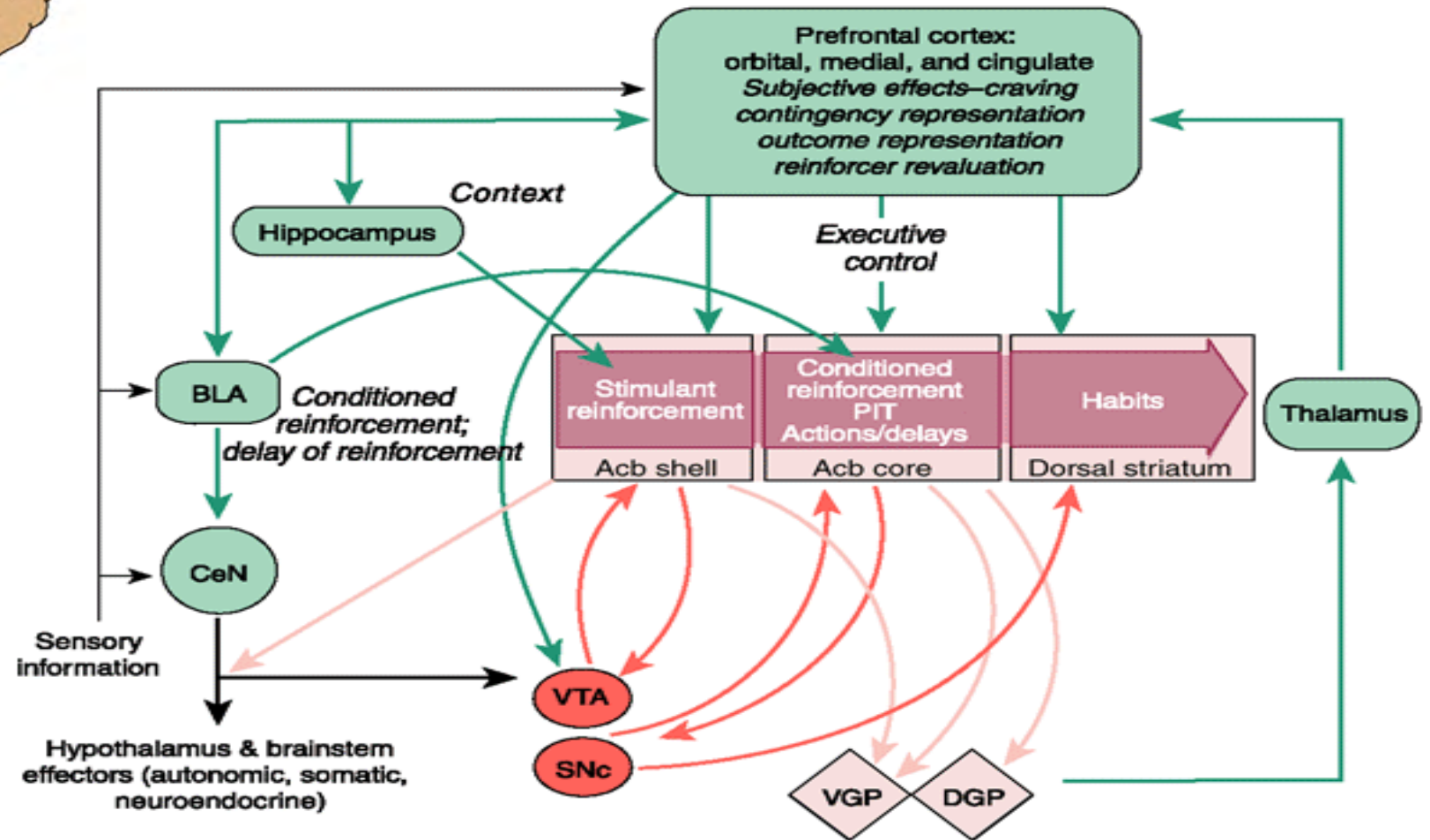
Habit Learning

Habitual control of instrumental behavior emerges gradually with repeated performance and is relatively unaffected by changes either in outcome value (e.g., devaluation) or in instrumental contingency



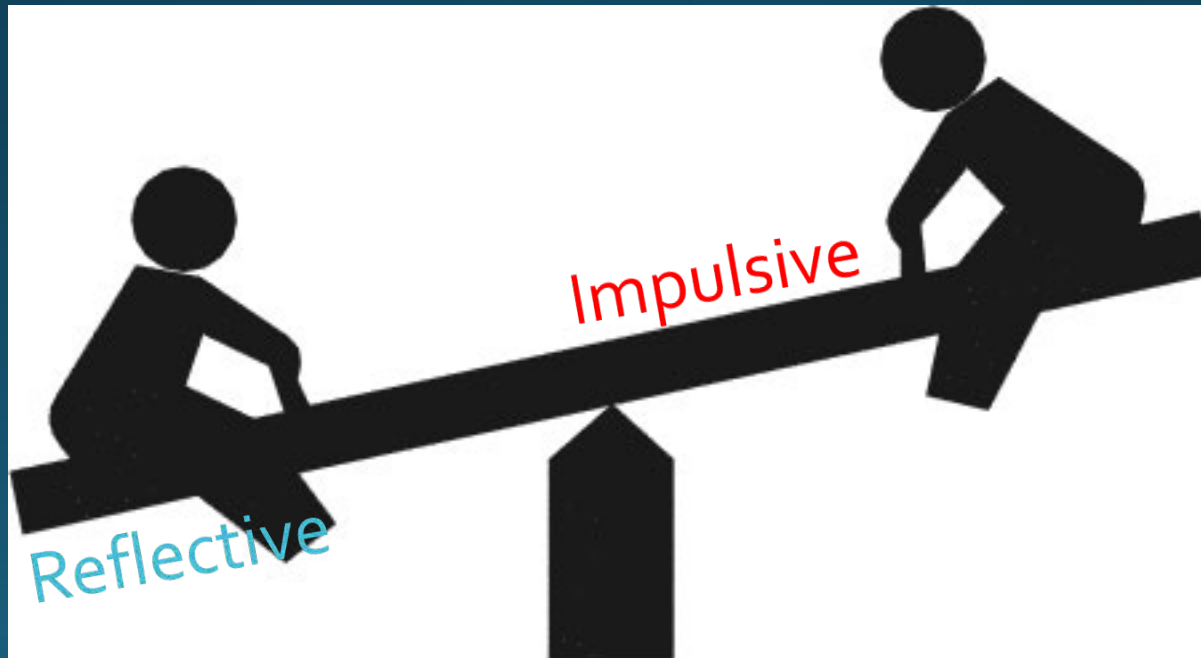


Representation of limbic circuitry, with tentative localization of functions involved in drug addiction

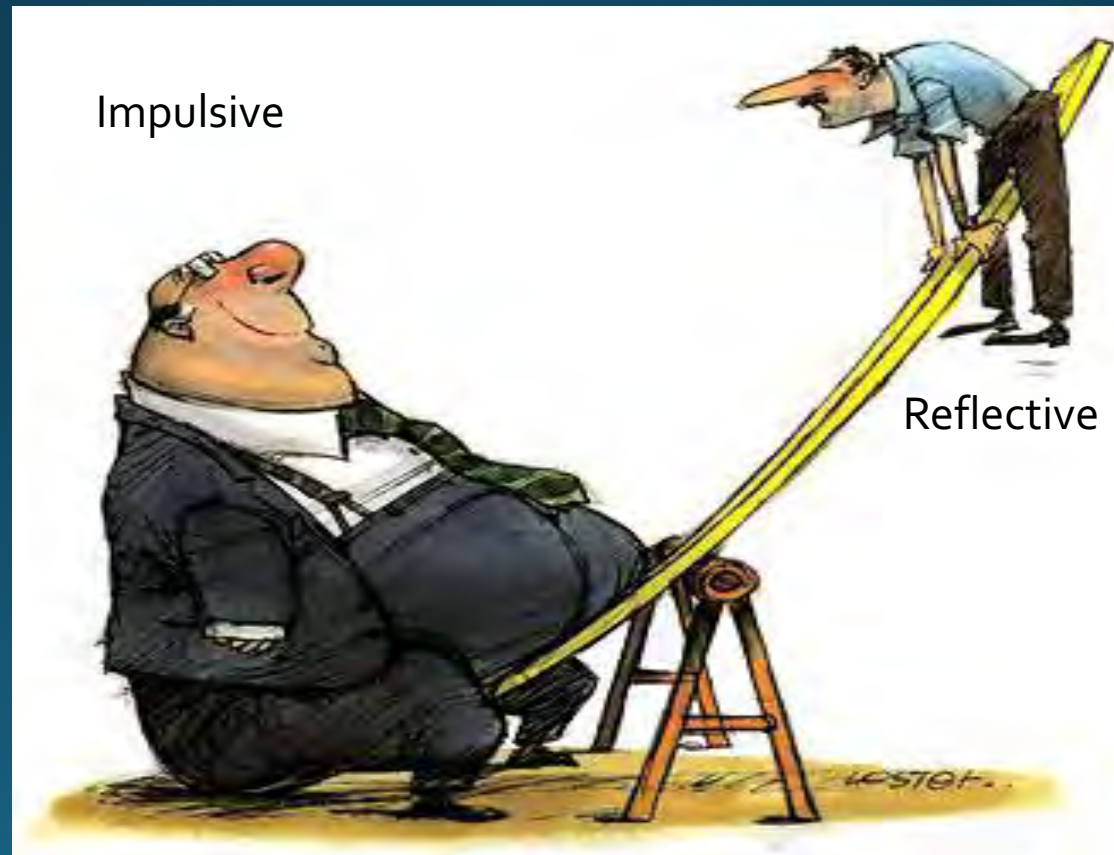


Dual-Process Theory

- Reflective systems versus Impulsive systems
 - In order to conceptualize compulsive use it's necessary to jointly consider approach and restraint



Problems Occur When Impulse Greatly Outweighs Constraint



Impulsivity

Breaking Apart a Heterogeneous Construct

- Behavioral Models of Impulsivity
 - Inhibition of prepotent responses
 - Temporal and probability discounting
- Self-report Models of Impulsivity (UPPS-P model)
 - Negative urgency
 - Positive urgency
 - Premeditation (lack of)
 - Perseverance (lack of)
 - Sensation Seeking

Self-Report Measures of Impulsivity

(after Whiteside & Lynam, 2001, and Cyders & Smith, 2008)

- Types
 - Positive urgency
 - Negative urgency
 - Sensation seeking
 - (lack of) Perseverance
 - (lack of) Premeditation
- These different types reflect very different personality traits

Behavioral Measures of Impulsivity

<i>Construct</i>	<i>Example tasks</i>	<i>Brief description</i>	<i>Reference</i>
Prepotent response inhibition	Go/no-go tasks	Suppress an inclination to provide a previously reinforced response	Marczinski & Fillmore (2003)
	Stop-signal task	Learn to categorize words, try to withhold learned response on some trials	Logan (1994)
	Continuous performance task	Respond as quickly as possible to target stimulus, refrain response on rarer nontarget	Conners & MHS Staff (2000)
	Antisaccade task	Suppress a reflexive saccade toward a cue	Friedman & Miyake (2004)
Resistance to distractor interference	Eriksen Flanker task	Identify target letter presented by itself or flanked by incompatible letters	Eriksen & Eriksen (1974)
	Word naming task	Name target word, presented in green, alone or with distractor red word	Kane <i>et al.</i> (1994)
	Shape matching task	Same as above, but with shapes instead of words	DeSchepper & Treisman (1996)
Resistance to proactive Interference	Brown–Peterson task	Learn and later recall successive lists made up of words taken from same category	Kane & Engle (2000)
	Cued recall task	View one of two lists of words, then recall word on most recent list, ignoring previous list words	Tolan & Tehan (1999)
Delay response	Two choice impulsivity paradigm	Choices between smaller reward more quickly, and larger reward with delay	Dougherty <i>et al.</i> (2005b)
	Single key impulsivity paradigm	Respond as desired, size of reward related to length of delay between responses	Dougherty <i>et al.</i> (2005b)
Distortions in elapsed time	TIME paradigm	Estimate how much time has elapsed	Dougherty <i>et al.</i> (2005b)

Externalizing Pathway

- Key Concepts
 - Shared pathology with other externalizing spectrum disorders
 - Deficits in executive control/problems in impulsivity
 - Multidimensional constructs
 - Excessive reward seeking/approach motivation
 - Associated with early onset problems
 - Associated with poor parenting and association with deviant peers

Can we develop a diagnostic approach that targets key addiction constructs?

- Incentive salience
- Habit strength
- Allostasis
- Executive functioning
- Reward seeking

Diagnosis Revisited

Towards an Addiction RDoC

- “Addiction has a long history of well established preclinical neurobiological models, leading to a history of translational approaches”¹
- Understanding mechanisms aids in assessment and treatment of heterogeneous AUDs^{2,3}
- Domains: reward, stress and affect regulation, incentive salience, executive function, social processes²

Some Quick Notes on Treatment

- A Large Range of Treatment Modalities are Available for Treating Various SUDs
 - Medications
 - Psychological/psychosocial treatments

Medications to Treat SUDs

- Tobacco
 - Varenicline (Chantix), Bupropion (Zyban/Wellbutrin)
- Opioid Dependence
 - Methadone (Generic), Buprenorphine (Buprenex)
- Alcohol Dependence
 - Disulfiram (Antabuse), Naltrexone (ReVia, Depade), Acamprosate (Campral), Ondansetron (Zofran), Topiramate (Topamax)

*** note that drugs that directly block dopamine receptors are not effective drugs in treating SUDs***

Psychosocial Approaches to Treating Dependence

Motivational Interviewing (MI)

Cognitive Behavioral Therapy (CBT)

Contingency Management (CM)

Interpersonal Therapies

Aversive Conditioning

Marital and Family Therapies

12- Step Programs

Conceptualizing Treatment with Respect to Targets from a Dual-Process Perspective

Impulsive/Automatic/Fast	Reflective/Controlled/Slow
Attentional Retraining	Self-control training
Approach Retraining	Motivational Interviewing
Cue exposure	Various forms of CBT
Drug Rx's targeting relevant neurocircuitry associated with behavioral targets (or modulation of learning) reward or habit	Drug Rx's targeting relevant neurocircuitry with behavioral targets (or modulation of learning) on executive function

The
End