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**Grundlagen und Störungskonzepte  
internetbezogener Störungen**

*Prof. Dr. Matthias Brand*




General  
Psychology:  
Cognition



CeBAR  
Center for Behavioral  
Addiction Research



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FOR  
MAGNETIC  
RESONANCE  
IMAGING




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**1**

**Einführung**

# Einführung



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ICD-11 for Mortality and Morbidity Statistics (2018)

Search
Home
Coding Tool
Special Views
Info


ICD-11 - Mortality and Morbidity Statistics

- 01 Certain infectious or parasitic diseases
- 02 Neoplasms
- 03 Diseases of the blood or blood-forming organs
- 04 Diseases of the immune system
- 05 Endocrine, nutritional or metabolic diseases
- 06 Mental, behavioural or neurodevelopmental disorders
  - Neurodevelopmental disorders
  - Schizophrenia or other primary psychotic disorders
  - Catatonia
  - Mood disorders
  - Anxiety or fear-related disorders
  - Obsessive-compulsive and related disorders
  - Disorders specifically associated with substance use
  - Disruptive, impulse-control and conduct disorders
  - Feeding or eating disorders
  - Elimination disorders
  - Disorders of bodily experience
  - Disorders due to self-harm or addictive behaviours
  - Disorders due to physical injury
  - Disorders due to addictive behaviours
    - 6C50 Gambling disorder
    - 6C51 Gaming disorder, predominantly online
    - 6C51.1 Gaming disorder, predominantly offline
    - 6C51.Z Gaming disorder, unspecified
    - 6C5Y Other specified disorders due to addictive behaviours
    - 6C5Z Disorders due to addictive behaviours, unspecified


- Disorders due to substance use or addictive behaviours
  - Disorders due to substance use
  - Disorders due to addictive behaviours
    - 6C50 Gambling disorder
    - 6C51 Gaming disorder
      - 6C51.0 Gaming disorder, predominantly online
      - 6C51.1 Gaming disorder, predominantly offline
      - 6C51.Z Gaming disorder, unspecified
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    - 6C5Z Disorders due to addictive behaviours, unspecified

**3 Kerncharakteristika:**


- 1) Beeinträchtigte Kontrolle über das Spielen (Anfang, Häufigkeit, Intensität, Dauer, Zeitpunkt, Kontext)
- 2) Steigende Wichtigkeit des Spielens im Vergleich zu anderen Aktivitäten des Alltags
- 3) Fortsetzung trotz negativer Konsequenzen

Spielmuster ist so ausgeprägt, dass es zu signifikanten Beeinträchtigungen im persönlichen, sozialen, schulischen/beruflichen oder anderen wichtigen Lebensbereichen kommt („functional impairment“)


Typischerweise liegen bei Diagnosestellung die Symptome seit mindestens 12 Monaten vor.



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**Internetnutzungsstörung = Internetnutzungsstörung?**

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**Prävalenzschätzungen:**  
1-3% der Jugendlichen und jungen Erwachsenen

**Spezifische Internetnutzungsstörung**

- Internet-Gaming
- Internet-Gambling
- Internet-Sex
- Internet-Shopping
- Internet-Kommun.

(z.B. Brand et al., 2014, 2016; Davis, 2001; Young, 1998)

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**2**

**Theoretische Annahmen und empirische Befunde**

## Theoretische Annahmen: Suchtperspektive

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**Dysfunction of the prefrontal cortex in addiction: neuroimaging findings and clinical implications**

Rita Z. Goldstein\* and Nora D. Volkow\*

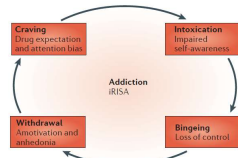


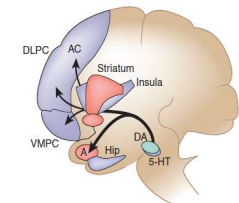
Figure 1 | Behavioural manifestations of the IRISA syndrome of drug addiction. This figure shows the core clinical symptoms of drug addiction — intoxication, bingeing, withdrawal and craving — as behavioural manifestations of the impaired response inhibition and salience attribution (IRISA) syndrome. Drug self-administration may lead to

PERSPECTIVE

nature  
neuroscience

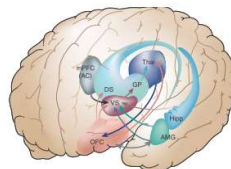
Decision making, impulse control and loss of willpower to resist drugs: a neurocognitive perspective


Antoine Bechara





Neural systems of reinforcement for drug addiction: from actions to habits to compulsion

Barry F. Everitt & Trevor W. Robbins










## Theoretische Modelle internetbezogener Störungen

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Examples for articles on Internet addiction with theoretical models:



Computers in Human Behavior 17 (2001) 187–195  
www.elsevier.com/locate/comphumbeh

A cognitive-behavioral model of pathological Internet use

R.A. Davis  
Psychology Department, Box 305 B.S.R., York University, Toronto, Ontario, Canada M3J 1P3

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/psychires

Review

A cognitive-behavioral model of Internet gaming disorder: Theoretical underpinnings and clinical implications

Guangheng Dong <sup>a,\*</sup>, Marc N. Potenza <sup>b,c,\*</sup>

<sup>a</sup> Department of Psychology, Zhejiang Normal University, 688 Yingbin Road, Jinhua, Zhejiang Province, 321004, PR China  
<sup>b</sup> Departments of Psychiatry, Yale University School of Medicine, New Haven, CT, USA  
<sup>c</sup> Neurobiology and Child Study Center, Yale University School of Medicine, New Haven, CT, USA


frontiers in  
HUMAN NEUROSCIENCE


REVIEW ARTICLE  
published: 27 May 2014  
doi: 10.3389/fnhum.2014.00079


Prefrontal control and Internet addiction: a theoretical model and review of neuropsychological and neuroimaging findings

Matthias Brand<sup>1,2\*</sup>, Kimberly S. Young<sup>3</sup> and Christian Laier<sup>1</sup>

<sup>1</sup> Department of General Psychology, Cognition, University of Duisburg-Essen, Duisburg, Germany  
<sup>2</sup> Erwin L. Hahn Institute for Magnetic Resonance Imaging, Essen, Germany  
<sup>3</sup> Center for Internet Addiction, Russell J. Landoll School of Journalism and Mass Communication, St. Bonaventure University, Olean, NY, USA







## Theoretische Modelle internetbezogener Störungen

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**Journal of Psychiatric Research**  
journal homepage: www.elsevier.com/locate/psychires

Review  
**A cognitive-behavioral model of Internet gaming disorder: Theoretical underpinnings and clinical implications**  
Guangheng Dong<sup>a,\*,†</sup>, Marc N. Potenza<sup>b,c,\*,††</sup>

<sup>a</sup> Department of Psychology, Zhejiang Normal University, 881112 Jinhua Road, Jinhua, Zhejiang Province, 3210  
<sup>b</sup> Department of Psychiatry, Yale University School of Medicine, New Haven, CT, USA  
<sup>c</sup> Neurobiology and Child Study Center, Yale University School of Medicine, New Haven, CT, USA

The diagram illustrates a cognitive-behavioral model of Internet gaming disorder. At the top, 'Executive Control' (Response inhibition, error monitoring, executive function) is shown in a blue box. Below it, 'Decision Making' (Immediate reward or long-term negative consequences) is in a blue box. 'Seeking Motivation' (Craving) is in a light blue circle, and 'Behavior' is in a light blue circle. 'Reward Sensation' (Reward sensitivity, cognitive bias to internet) is in a red box. 'Stress Relief' (Trauma, recent/current stressors) is in an orange box. 'Cognitive Bias Modification' is in a green box. Arrows indicate relationships: 'Executive Control' INHIBITS 'Seeking Motivation'. 'Decision Making' WEIGHS 'Seeking Motivation'. 'Seeking Motivation' WEIGHS 'Behavior'. 'Behavior' ENHANCES 'Reward Sensation'. 'Reward Sensation' MOTIVATES 'Seeking Motivation'. 'Stress Relief' MOTIVATES 'Seeking Motivation'. 'Cognitive Bias Modification' ENHANCES 'Reward Sensation'. Therapeutic interventions are shown in green boxes: 'Cognitive Enhancement Therapy' and 'Cognitive Behavioral Therapy' target 'Executive Control'. 'Mindfulness-based Stress Reduction' targets 'Stress Relief'. 'Cognitive Bias Modification' targets 'Reward Sensation'. Logos for General Psychology: Cognition, CeBAR Center for Behavioral Addiction Research, and ERWIN L. HAHN INSTITUTE FOR MAGNETIC RESONANCE IMAGING are at the bottom.

Neuroscience and Biobehavioral Reviews 71 (2016) 252–266

Contents lists available at ScienceDirect  
**Neuroscience and Biobehavioral Reviews**  
journal homepage: www.elsevier.com/locate/neubiorev

Review article  
**Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction-Affect-Cognition-Execution (I-PACE) model**

Matthias Brand<sup>a,b,\*,†</sup>, Kimberly S. Young<sup>c</sup>, Christian Laier<sup>d</sup>, Klaus Wölfling<sup>d</sup>, Marc N. Potenza<sup>e,f,g</sup>

The I-PACE model flowchart starts with 'Person's core characteristics' at the top, which includes Biopsychological constitution (Genetic factors, Early childhood experiences, Stress vulnerability) and Psychopathology (Depression, Social anxiety, Compulsive disorder). This leads to 'Subjectively perceived situation' (Coping style, Internet-related cognitive bias, Experience, Heuristic associations). This situation leads to 'Affective and cognitive responses' (Cue reactivity, Craving, Urge for mood regulation, Attentional bias). These responses lead to 'Decision to use a certain application' (Reinforcement, Habit formation). This decision leads to 'Gratification' (Reinforcement, Performance), which leads to 'Specific Internet-use disorder' (Diminished control over Internet use, Negative consequences in daily life). The model is supported by 'Stabilization and Intermediation' at the bottom. Logos for CrossMark and Elsevier are present.

## Kognitive Funktionen

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Cognitive deficits in problematic internet use: meta-analysis of 40 studies

Konstantinos Ioannidis, Roxanne Hook, Anna E. Goudriaan, Simon Vlies, Naomi A. Fineberg, Jon E. Grant and Samuel R. Chamberlain

BJPsych

The British Journal of Psychiatry (2019)  
Page 1 of 8. doi: 10.1192/bjp.2019.3

DECISION MAKING	Chamberlain <i>et al</i> (2017) <sup>20</sup>	0.44 (0.08 to 0.80)
	Lorenz <i>et al</i> (2012) <sup>56</sup>	0.85 (-0.14 to 0.85)
	Metcalfe & Pammer (2014) <sup>33</sup>	-0.05 (-0.64 to 0.54)
	Pawlikowski & Brand (2011) <sup>57</sup>	1.06 (0.38 to 1.74)
	Qi <i>et al</i> (2015) <sup>58</sup>	0.90 (0.30 to 1.50)
	Sun <i>et al</i> (2009) <sup>34</sup>	0.46 (0.09 to 0.84)
	Nikolaïdou <i>et al</i> (2016) <sup>59</sup>	0.32 (-0.16 to 0.80)
RE Model	0.49 (0.28 to 0.70)	

Unspezifizierte Internetnutzungsstörungen (inkl. Gaming, Gambling, Cybersex, Shopping...):

➔ **Signifikante Reduktionen in Inhibitionsleistungen, Entscheidungsverhalten, Arbeitsgedächtnis**

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Neuropsychopharmacology

At the intersection of brain, behavior, and therapeutics

Article | OPEN | Published: 16 April 2019

### Impulsivity in Gambling Disorder and problem gambling: a meta-analysis

Konstantinos Ioannidis, Roxanne Hook, Katie Wickham, Jon E. Grant & Samuel R. Chamberlain

**Discounting**

Author(s), Year		Effect size [95% CI]
Tones <i>et al</i> , 2013		1.46 [0.78, 2.15]
Walter <i>et al</i> , 2015		0.62 [0.02, 1.25]
Albein-Uros <i>et al</i> , 2014		0.68 [0.04, 0.96]
Albein-Uros <i>et al</i> , 2012		1.27 [0.61, 1.93]
Wilde <i>et al</i> , 2013		0.49 [0.17, 1.15]
Contreras-Rodriguez <i>et al</i> , 2015		0.52 [0.11, 1.15]
Mohammadi <i>et al</i> , 2016		0.64 [0.09, 1.38]
Ciccarelli <i>et al</i> , 2016		0.42 [0.04, 0.80]
Ledgerwood <i>et al</i> , 2009		1.26 [0.74, 1.76]
Yan <i>et al</i> , 2016		0.10 [0.17, 0.37]
Kräplin <i>et al</i> , 2015		0.31 [0.30, 0.52]
Kräplin <i>et al</i> , 2014		0.93 [0.26, 1.60]
Miedl <i>et al</i> , 2015		0.64 [0.09, 1.38]
RE Model		0.66 [0.42, 0.90]

**Decision-making**

Author(s), Year		Effect size [95% CI]
Ciccarelli <i>et al</i> , 2017		0.68 [0.29, 1.07]
Power <i>et al</i> , 2012		0.53 [0.25, 1.31]
Brewers <i>et al</i> , 2013		0.76 [0.25, 1.26]
Wilde <i>et al</i> , 2013		0.36 [0.29, 1.01]
Adin <i>et al</i> , 2014		0.99 [0.13, 1.86]
Black <i>et al</i> , 2013		0.35 [0.01, 0.71]
Kräplin <i>et al</i> , 2014		0.60 [0.21, 0.99]
Brewers <i>et al</i> , 2014		0.91 [0.26, 1.56]
Mallorquí-Bague <i>et al</i> , 2016		0.54 [0.33, 0.74]
Cavedini <i>et al</i> , 2002		1.24 [0.66, 1.82]
Bottesi <i>et al</i> , 2014		0.83 [0.39, 1.26]
RE Model		0.63 [0.50, 0.76]

➔ **Signifikante Reduktionen in Inhibitionsleistungen (Stroop-Paradigma), Entscheidungsverhalten (IGT), Delay Discounting**

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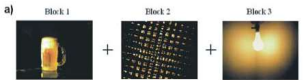
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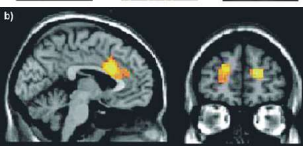
## Neurale Korrelate

**...Substanzabhängigkeit**

a) Block 1 + Block 2 + Block 3

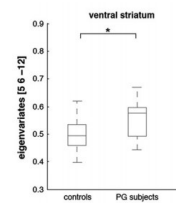


b)

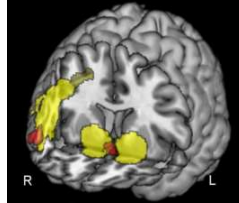


(Grüsser et al., 2004)

**...Gambling disorder**



ventral striatum

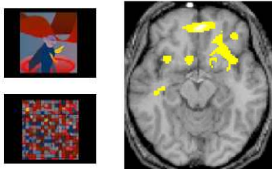


(Koehler et al., 2013)


**→ ventrales Striatum**

WOW  
Block


Neutral  
Block




(Ko et al., 2009)



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## Neurale Korrelate

REVIEW ARTICLE Journal of Behavioral Addictions  
DOI: 10.1556/2006.7.2018.39

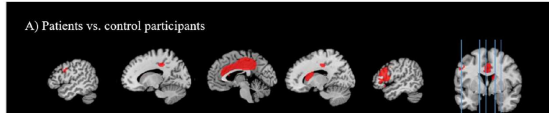
**Cue-reactivity in behavioral addictions: A meta-analysis and methodological considerations**

KATRIN STARCKE<sup>1,2</sup>, STEPHANIE ANTONS<sup>1,2</sup>, PATRICK TROTZKE<sup>1,2</sup> and MATTHIAS BRAND<sup>1,2\*</sup>

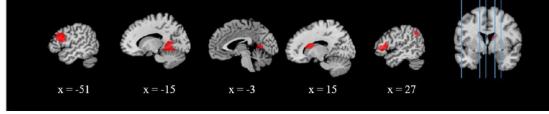
<sup>1</sup>Department of General Psychology: Cognition and Center for Behavioral Addiction Research (CeBAR), University of Duisburg-Essen, Duisburg, Germany

<sup>2</sup>Erwin L. Hahn Institute for Magnetic Resonance Imaging, Essen, Germany

A) Patients vs. control participants




B) Patients




x = -51    x = -15    x = -3    x = 15    x = 27


Figure 2. Brain activations in response to addiction-relevant cues: (A) in patients in contrast to control participants and (B) in patients in contrast to control cues. Blue lines display location of slices on the coronal axis



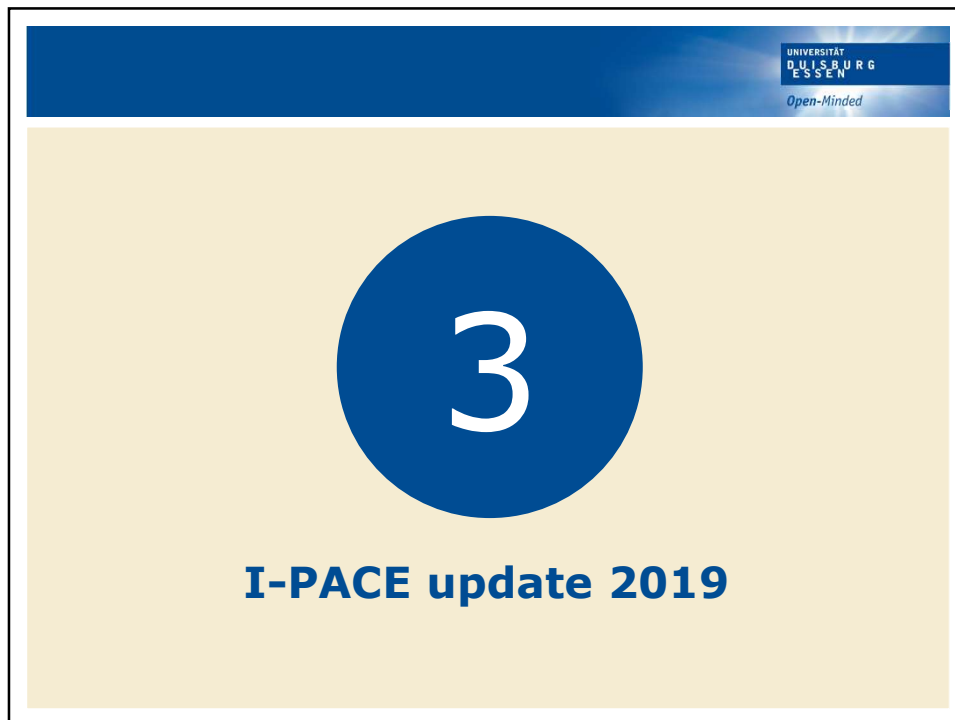
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Neuroscience and Biobehavioral Reviews 104 (2019) 1–10

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journal homepage: [www.elsevier.com/locate/neubiorev](http://www.elsevier.com/locate/neubiorev)

Review article

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond internet-use disorders, and specification of the process character of addictive behaviors

Matthias Brand<sup>a,b,c</sup>, Elisa Wegmann<sup>a</sup>, Rudolf Stark<sup>c,d</sup>, Astrid Müller<sup>e</sup>, Klaus Wölfling<sup>f</sup>, Trevor W. Robbins<sup>g</sup>, Marc N. Potenza<sup>h,i,j</sup>

**Das update beinhaltet 3 Schritte:**

1. Generalisierung auf Verhaltenssuchte und Differenzierung von generellen und spezifischen prädisponierenden Variablen
2. Spezifikation der affektiven und kognitiven Prozesse
3. Differenzierung von frühen und späteren Stadien des Suchtprozesses

```

graph LR
    A["Medium/environmental context:  
(e.g., application, casino, shopping environment):  
- Delivery of reward options  
- Intermittent reinforcement  
- Availability/Accessibility  
- Affordability"] --> B["Person reacts with:  
- Specific behavior  
- Rewarding experiences  
- Feelings of pleasure and reduced negative mood  
- Development of cue-reactivity  
- Development of implicit cognitions  
- Changes in expectancies"]
    B --> C["Consequences:  
- Neural adaptations  
- Habits and compulsions  
- Continuing behavior despite experiencing negative consequences"]
  
```

**Medium/environmental context:**  
(e.g., application, casino, shopping environment):

- Delivery of reward options
- Intermittent reinforcement
- Availability/Accessibility
- Affordability

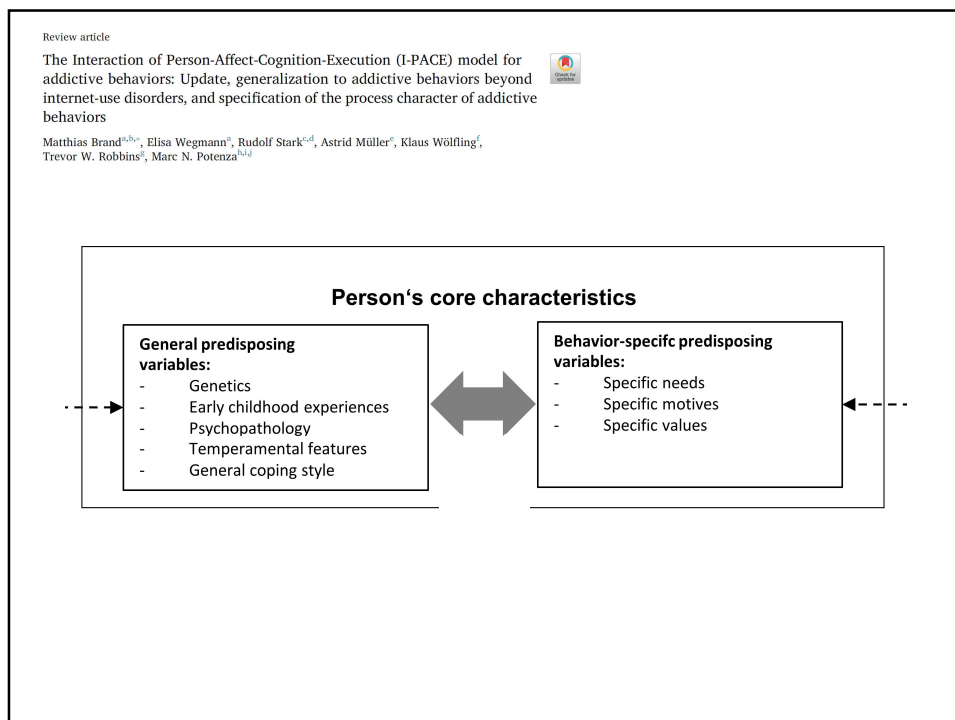
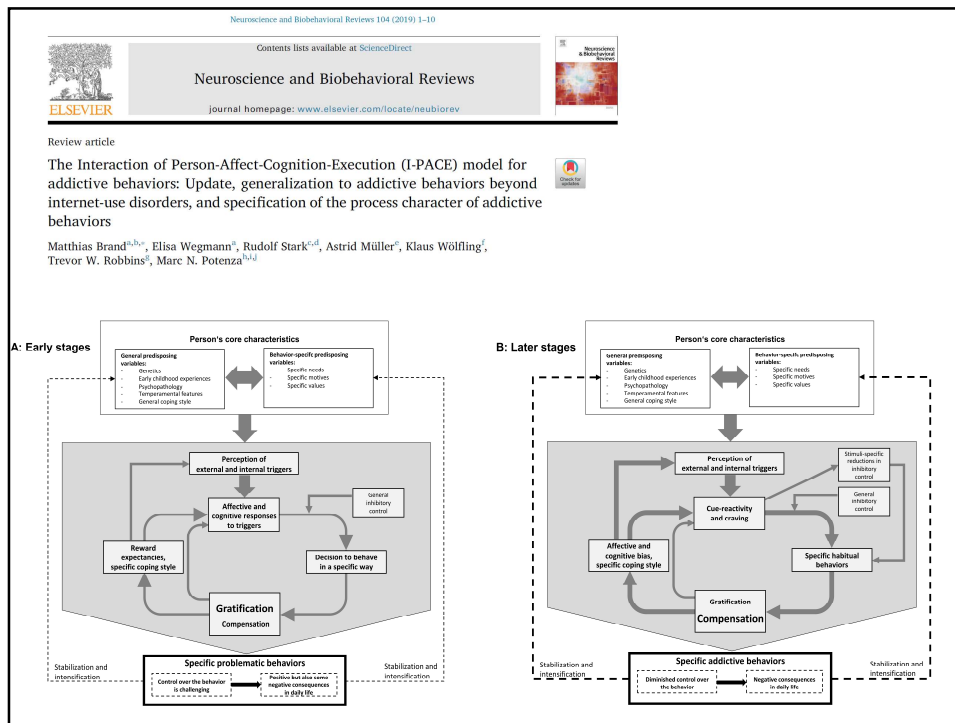
**Person reacts with:**

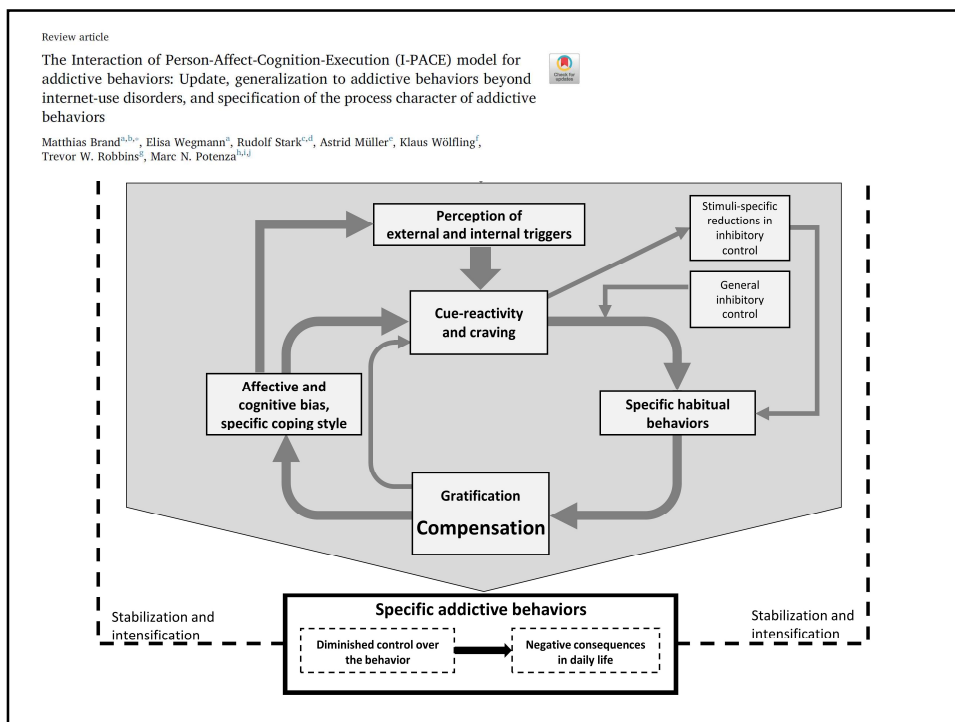
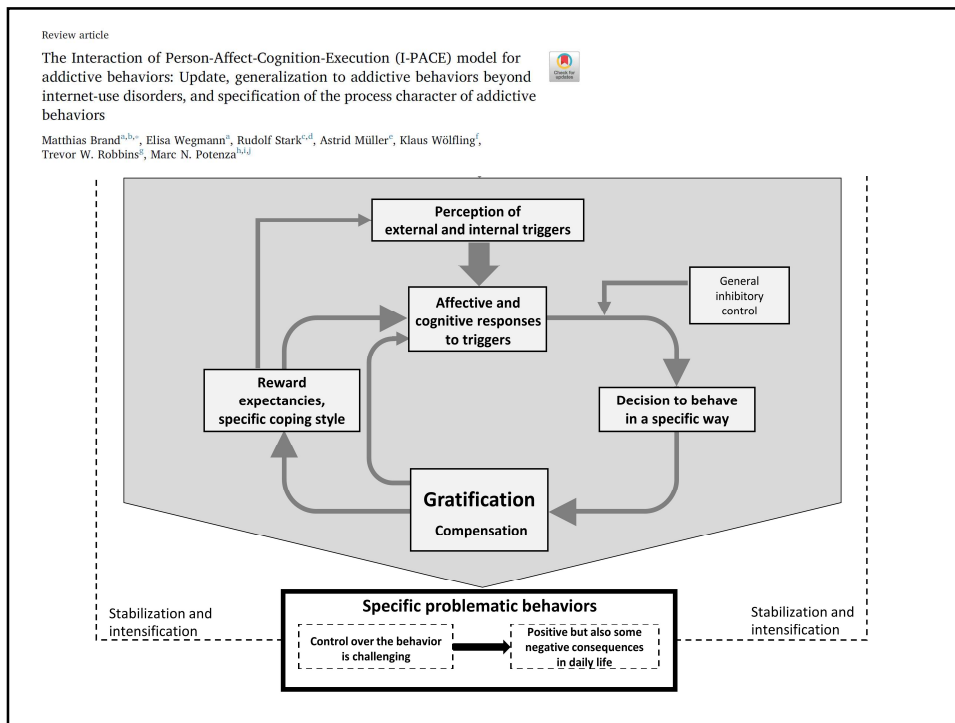
- Specific behavior
- Rewarding experiences
- Feelings of pleasure and reduced negative mood
- Development of cue-reactivity
- Development of implicit cognitions
- Changes in expectancies

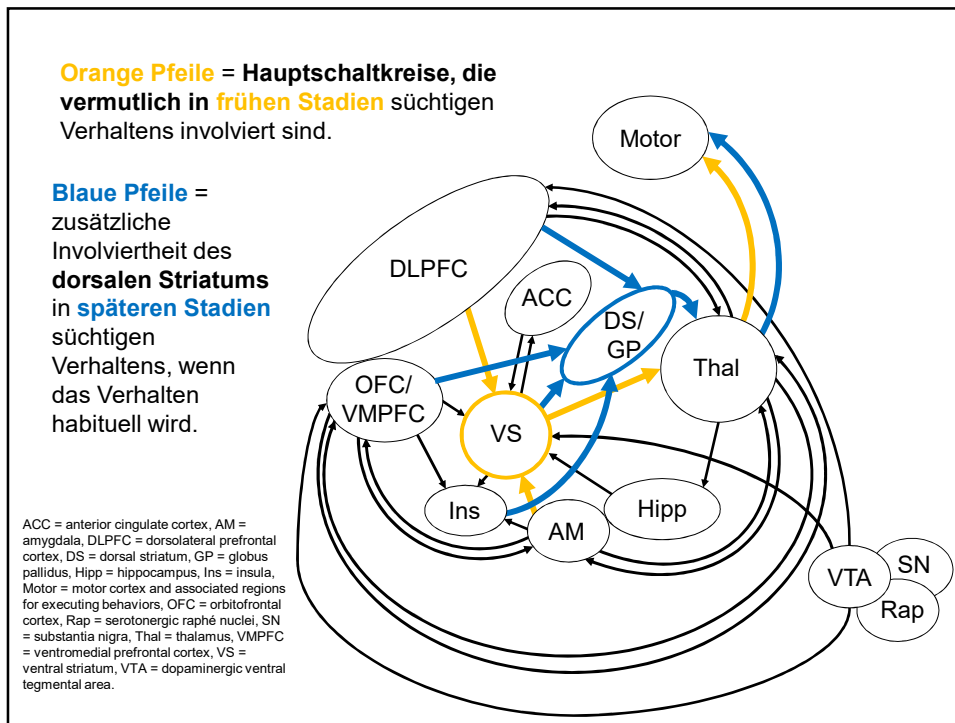
**Consequences:**

- Neural adaptations
- Habits and compulsions
- Continuing behavior despite experiencing negative consequences





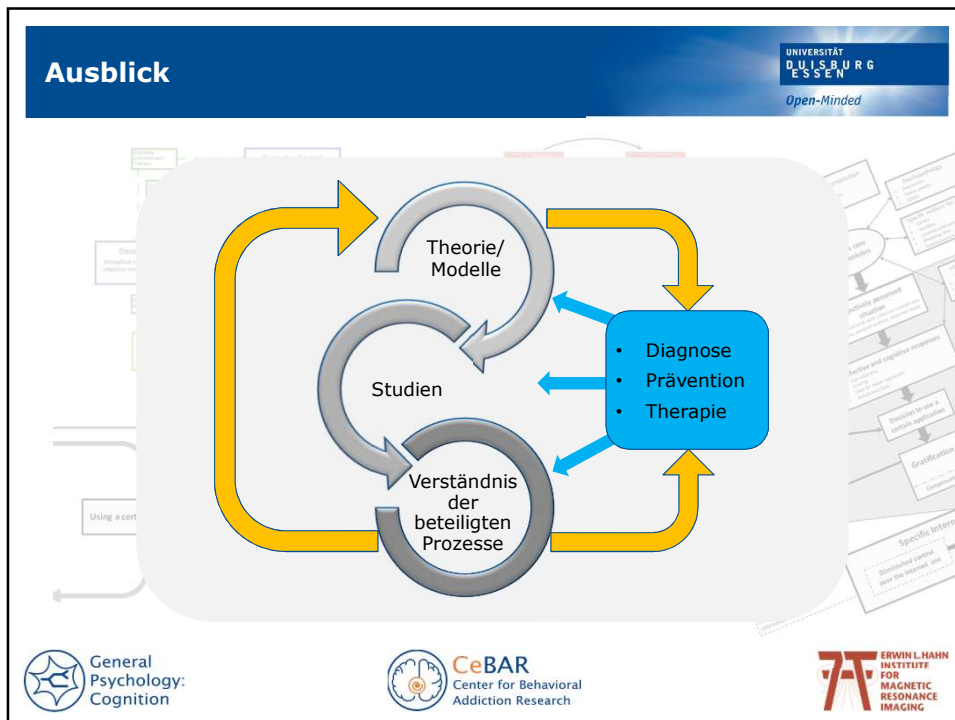
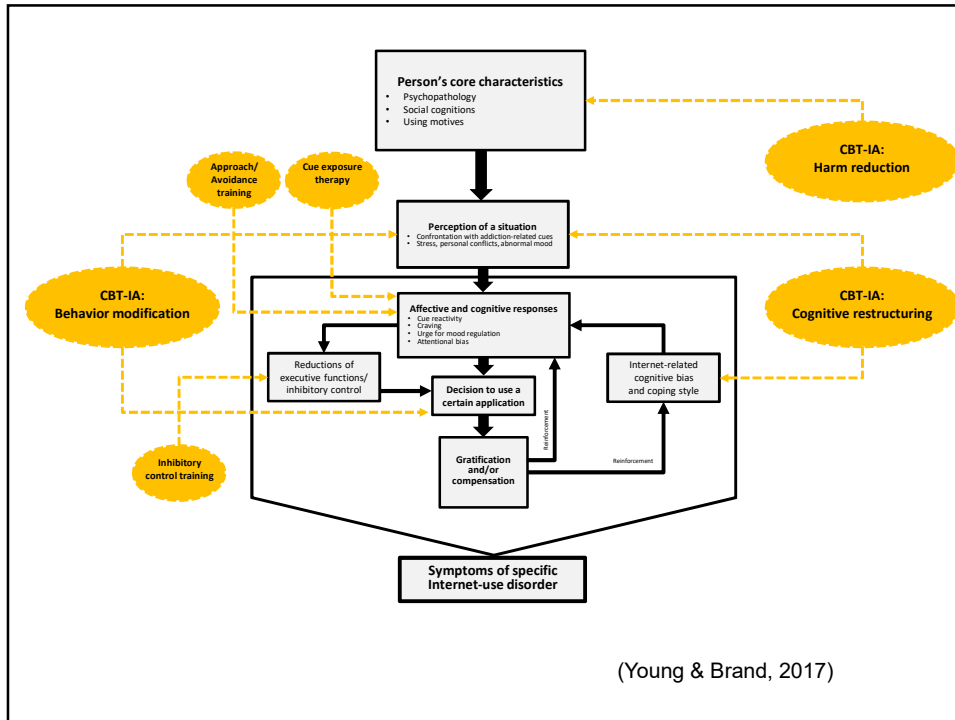




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# 4

## Therapeutische Implikationen



**DANKE!**

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Forschungsgemeinschaft



**LANDESANSTALT FÜR MEDIEN NRW**  
Der Meinungsfreiheit verpflichtet.



**Bundesministerium  
für Bildung  
und Forschung**



**Bundesministerium  
für Gesundheit**



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Investition in unsere Zukunft  
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