

Nicotine deprivation and craving in smokers are related to inhibitory control in smoking-related contexts

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BACKGROUND

Theory



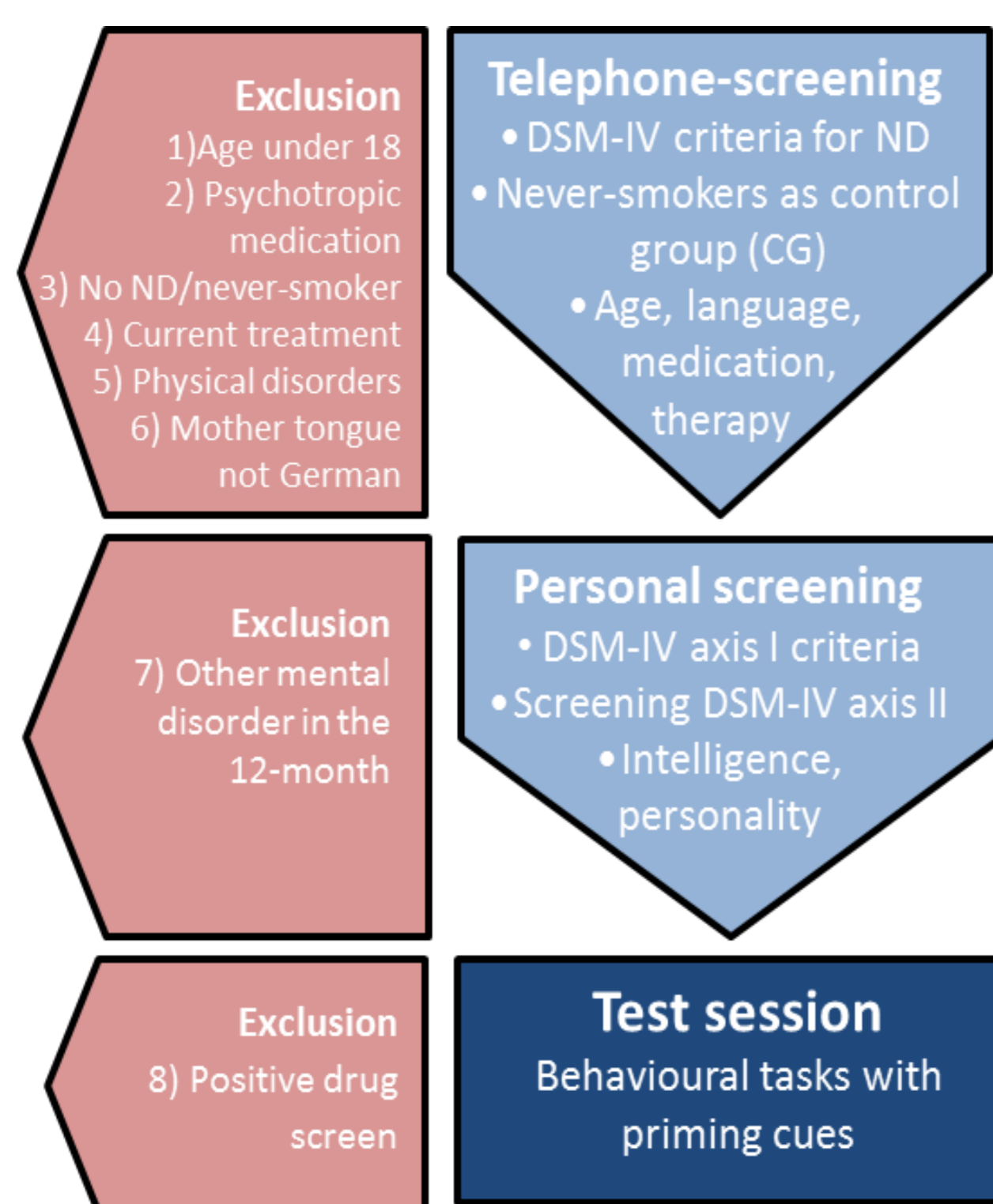
- Dysfunctional inhibitory control is one core mechanism in nicotine dependence (ND)¹
- Furthermore, aberrant reward-based learning results in increased salience of smoking-related cues in ND²
- Nicotine deprivation and craving are positively related to this preferential cognitive processing of smoking-related cues³

Hypotheses

- Smoking-related context cues are processed with high priority in ND, resulting in specifically impaired inhibitory control in ND compared to controls after smoking-related compared to neutral cues
- Increased inhibitory control impairments after smoking-related compared to neutral cues in ND are positively related to nicotine deprivation and craving

METHODS

Design and Screening



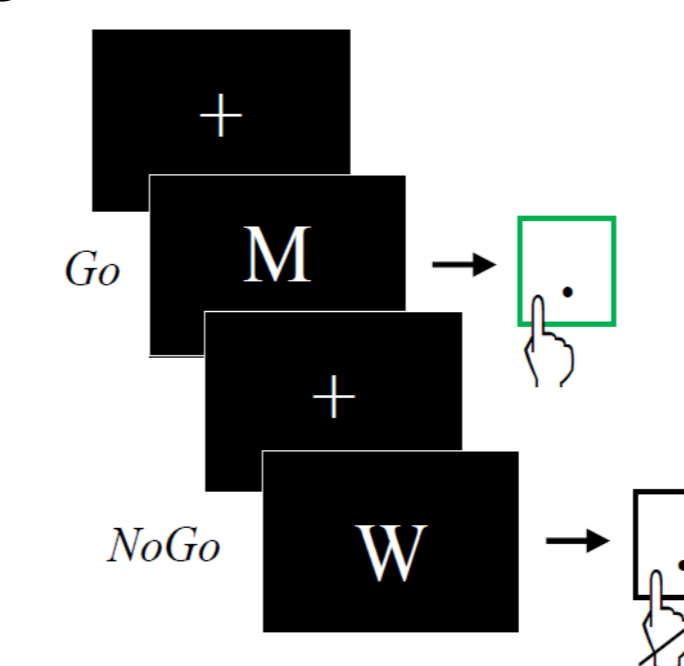
Sample

	Nicotine Dependence (ND)	Control group (CG)	Test
n	27	33	
MW (SD) n (%)	MW (SD) n (%)	MW (SD) n (%)	
Age	26.5 (8.0)	25.7 (7.1)	n.s.
Male	8 (29.6%)	18 (54.6%)	$\chi^2 = 3.75$, $p = 0.05$
Intelligence quotient	100.9 (8.3)	102.3 (6.3)	n.s.
DSM-IV criteria ND	4.6 (1.3)	-	-

Measures

Go-nogo task⁴

- 300 trials, 20% nogo
- Letters presented for 150 ms
- Pictures presented within inter-stimulus interval (1250 - 1750ms)



Smoking vs. neutral pictures

- International Affective Picture System⁵ and non-copyrighted Internet sources
- 77 color photographs for each condition (72 dpi)
- Selected at random
- Presented for 500 ms



Nicotine deprivation

- Minutes since last cigarette before test session

Craving

- Sum score of ratings from 0 to 10 before, during and after test session

RESULTS

Hypothesis 1

Regression analysis

Outcome: Context effect on inhibitory control as difference in IES [inverse efficiency score = $RT/(1-ER)$] of smoking-related minus neutral condition

Inhibitory control IES go-nogo task	ND M (SD)	CG M (SD)
Smoking-related condition	333.71 (26.36)	334.82 (35.44)
Neutral condition	337.82 (24.39)	333.66 (37.58)

↑ IES (ms) = ↓ Inhibitory control

Predictors: Group (ND vs. CG) and inhibitory performance in the neutral condition (baseline-correction)

Context effect on inhibitory control	Beta	Standard error	t	p-value	95% confidence interval
Group	-5.10	2.49	-2.05	0.04	-10.09 - -0.11
Inhibitory control neutral condition	-0.05	0.04	-1.12	0.27	-0.12 - 0.04

➤ Compared to CG, significantly lower IES in ND after smoking-related compared to neutral cues

➤ Effect driven by reaction times

Hypothesis 2

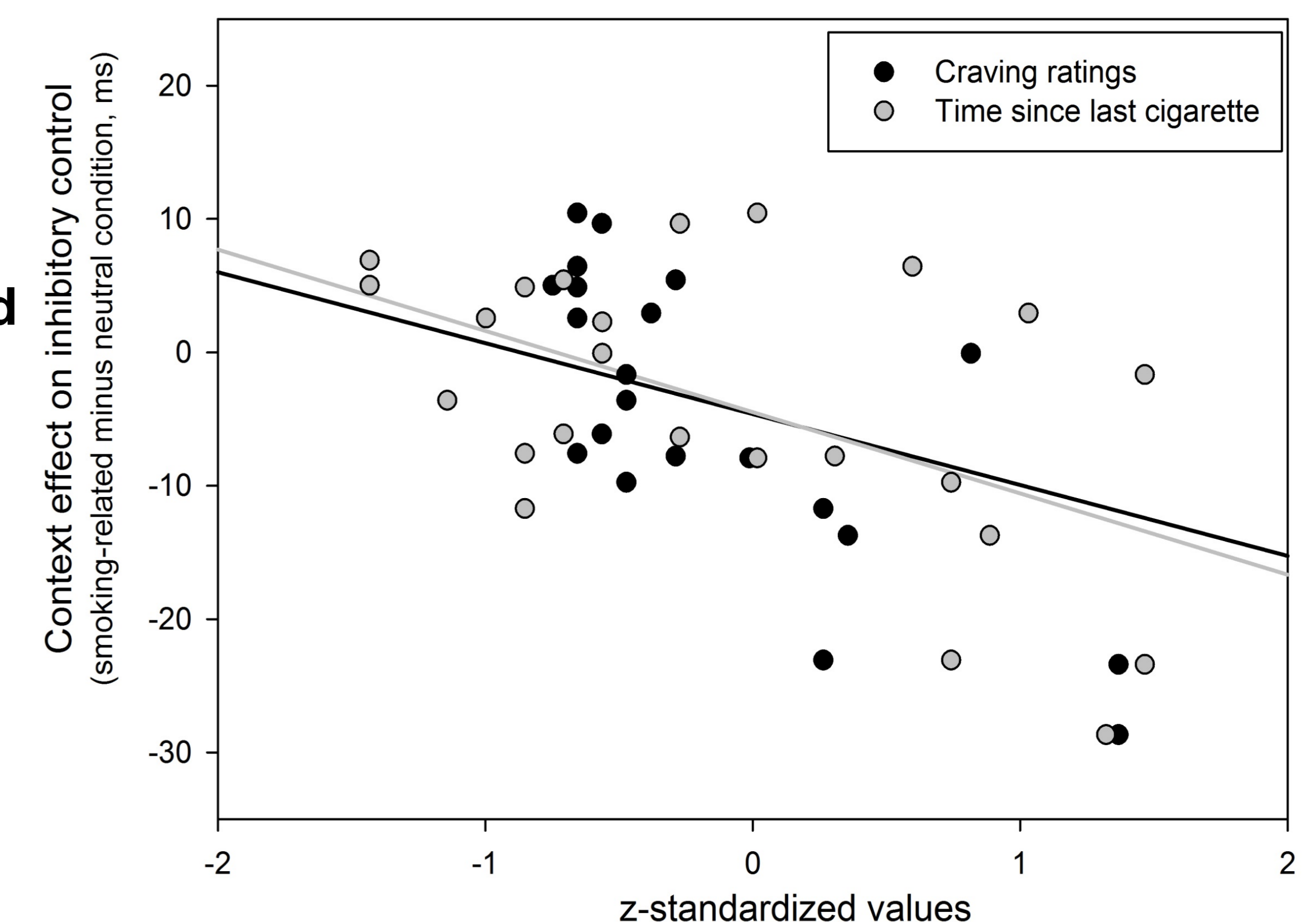
Spearman correlation

Between the context effect on inhibitory control (IES smoking-related minus neutral condition) and nicotine deprivation and craving in ND

Significant negative correlations between context effect on inhibitory control and

➤ Nicotine deprivation (grey): $\rho = -0.68$, $p < .001$

➤ Craving-ratings (black): $\rho = -0.43$, $p = .03$



DISCUSSION

Conclusions

- Smoking-related cues may trigger emotional (positive affect)⁶, attentional (bias)⁷ and/ or motivational processes (impulsivity)⁸ that affect inhibitory control performance differently in ND compared to CG
- Nicotine deprivation and craving may further enhance positive valuation, attentional focus and impulsive reactions towards smoking-related cues in ND
- This could explain why patients show failures of inhibitory control performance in substance-related contexts (lapse or relapse) even if general self-control competences have been strengthened with specific interventions

Further research

- Studies may apply task sets that disentangle task-relevant and substance-related cues in different samples with substance use disorders
- Models of ND may profit from focusing on interactions and connectivity between brain networks in order to understand how cognitive control is moderated by attentional, motivational, and emotional processes¹

LITERATURE

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