Autonomic responses during Gambling: the Effect of Outcome Type and Sex in a large community sample of young adults

Cathrine Hultman[1,2], Sofia Vadlin[1], Mattias Rehn[1], Guillaume Sescousse[3], Kent W Nilsson[1], Cecilia Åslund[1,2]

1. Centre for Clinical Research, Region Västmanland, Västerås
2. Department of Public Health and Caring Sciences, Uppsala University Sweden
3. Lyon Neuroscience Research Center, PSYR2 Team, INSERM U1028–CNRS UMR5292, University of Lyon, Lyon, France

cathrine.hultman@regionvastmanland.se

cathrine.hultman@regionvastmanland.se
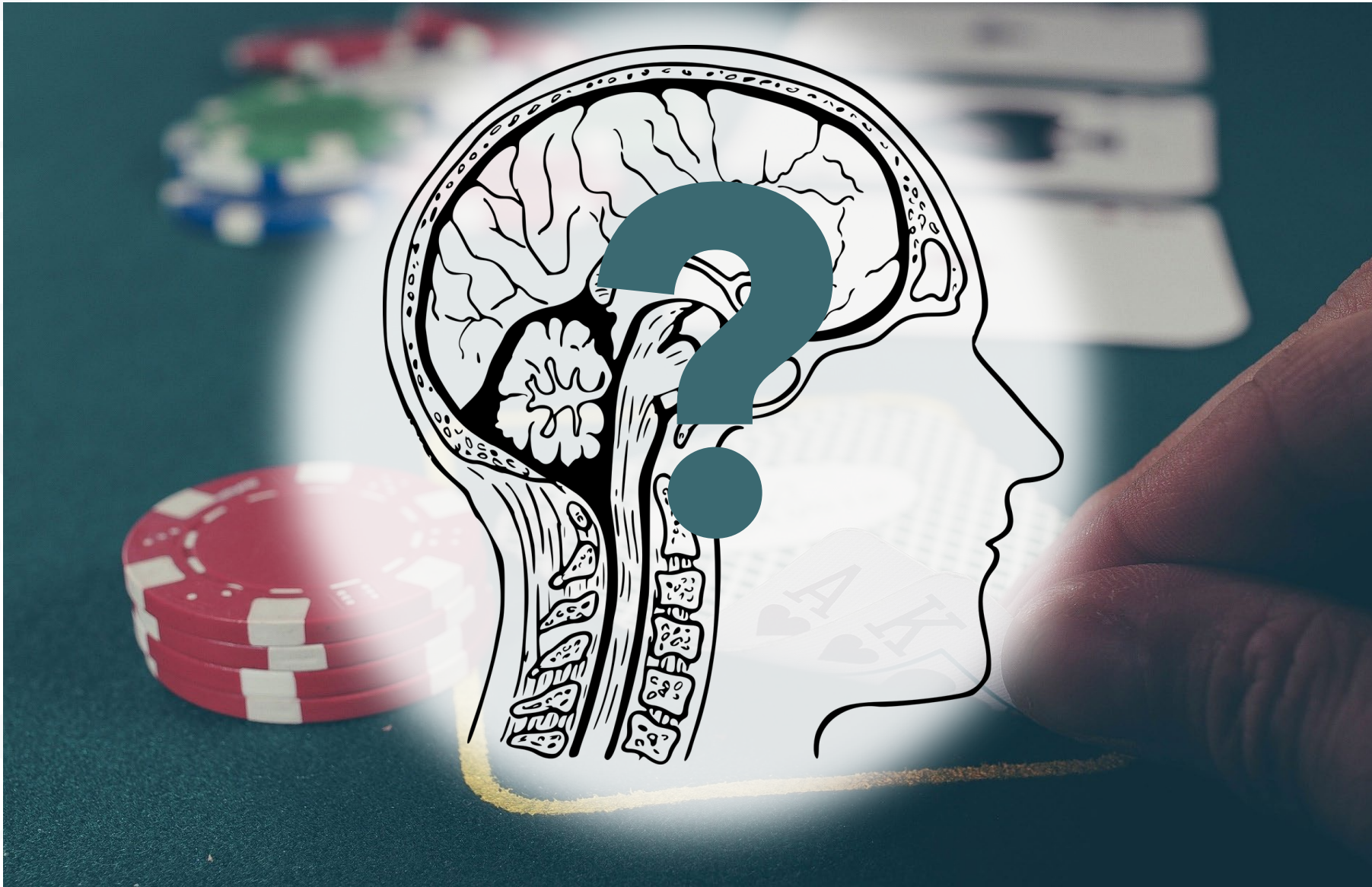
Introduction

Autonomic nervous system (ANS) arousal indexes emotional intensity and is considered an important component in the development of problem gambling – "The Gamblers Drug".

Examples of cognitive distortions in gambling:

➢ Impaired processing of randomness *(gamblers fallacy)*
➢ Overestimate ability to control the game *(illusion of control)*
➢ Continue gambling despite frequent losses *(loss-chasing)*
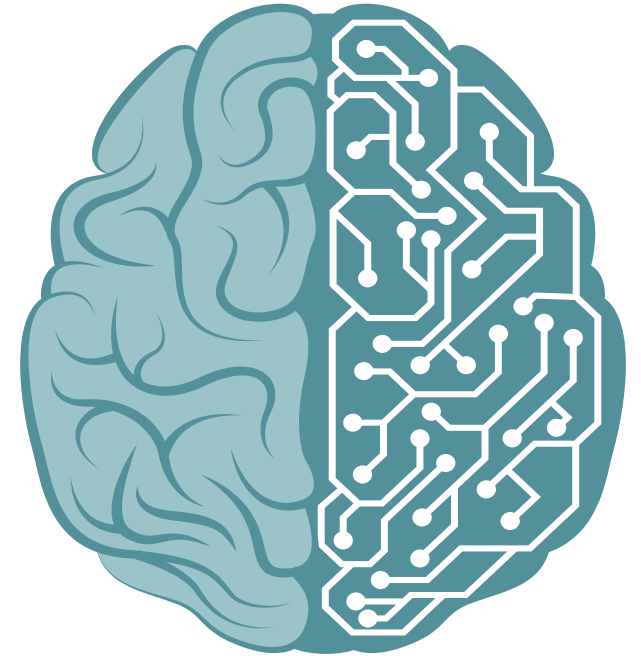
Introduction

Near-misses are non-win outcomes that falls close to a real win.

➢ Moderate rates (30 %) of near-misses lead to persistent slot machine gambling.

➢ Near-misses elicits larger ANS responses compared to regular full-misses.

➢ Near-misses recruites brain reward networks.

Côté et al., 2003; Kassinove & Schare, 2001; Clark et al., 2012, 2013;
Sharman et al., 2015; Dixon et al., 2011; Ulrich et al., 2016; Clark et al., 2009;
Chase & Clark, 2010; Dymond et al., 2014; Sescousse et al., 2016.

cathrine.hultman@regionvastmanland.se

➢ Near-misses are frustrating while motivating ongoing gambling.

➢ Different emotional and motivational effects from near-miss subtypes:

- Near-miss before payline = **motivating**
- Near-miss after payline = **frustrating**

Côté et al., 2003; Kassinove & Schare, 2001; Clark et al., 2012, 2013;
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cathrine.hultman@regionvastmanland.se

cathrine.hultman@regionvastmanland.se

Aims

1. Investigate the phasic psychophysiological responses and subjective ratings (SRs) generated by win, near-miss and full-miss outcomes in a slot machine task, focusing on the differential effects of two subtypes of near-misses.

2. Investigate whether gambling outcomes are processed differently by males and females regarding psychophysiological and subjective responses.
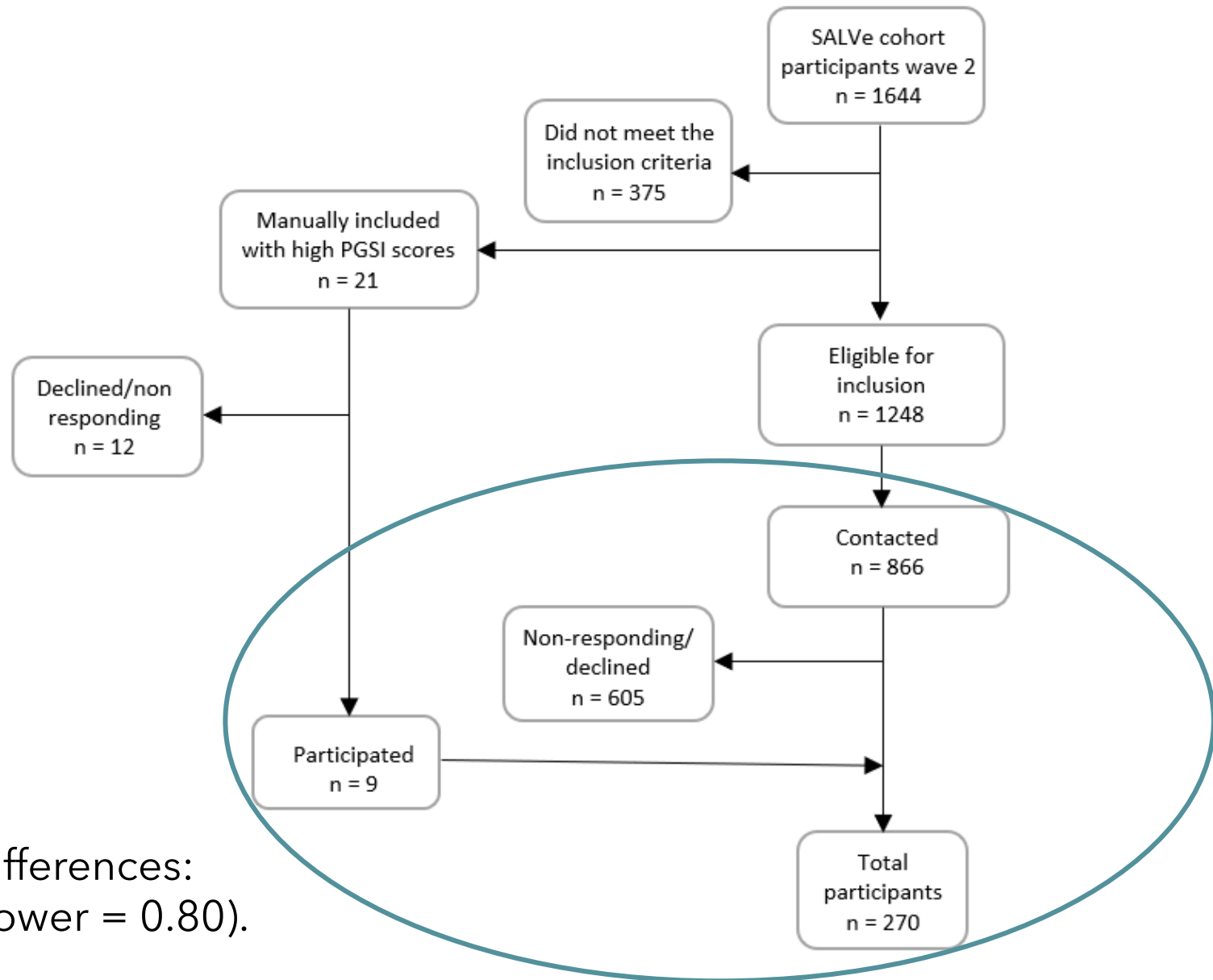
Method

➢ Experimental study based on the Survey of Adolescent Life in Västmanland (SALVe) cohort, wave 2 (2015).

➢ Community-based sample of young adults, N = 270 (140 females, 130 males) age 18-22.

➢ Gambling task: Slot Machine Gambling Task.

➢ Psychophysiological measures: heart rate and skin conductance responses.

➢ Data collection and processing 2017-2020.

cathrine.hultman@regionvastmanland.se

Inclusion

> Response rate 30 %

> Sensitivity power analysis for sex differences:
> MDE of $\eta_p^2 \approx 0.02$ (alpha = 0.05, power = 0.80).

SALVe cohort participants wave 2
n = 1644

Did not meet the inclusion criteria
n = 375

Manually included with high PGSI scores
n = 21

Eligible for inclusion
n = 1248

Declined/non responding
n = 12

Contacted
n = 866

Non-responding/ declined
n = 605

Participated
n = 9

Total participants
n = 270

cathrine.hultman@regionvastmanland.se

Slot Machine Gambling Task

3 practice trials + 60 trials

Clark et al. (2013); Sescousse et al. (2016)

cathrine.hultman@regionvastmanland.se

Slot Machine Gambling Task

3 practice trials + 60 trials

Proportion of outcomes:

10 wins

10 near-misses after

10 near-misses before

30 full-misses

Clark et al. (2013); Sescousse et al. (2016)

cathrine.hultman@regionvastmanland.se

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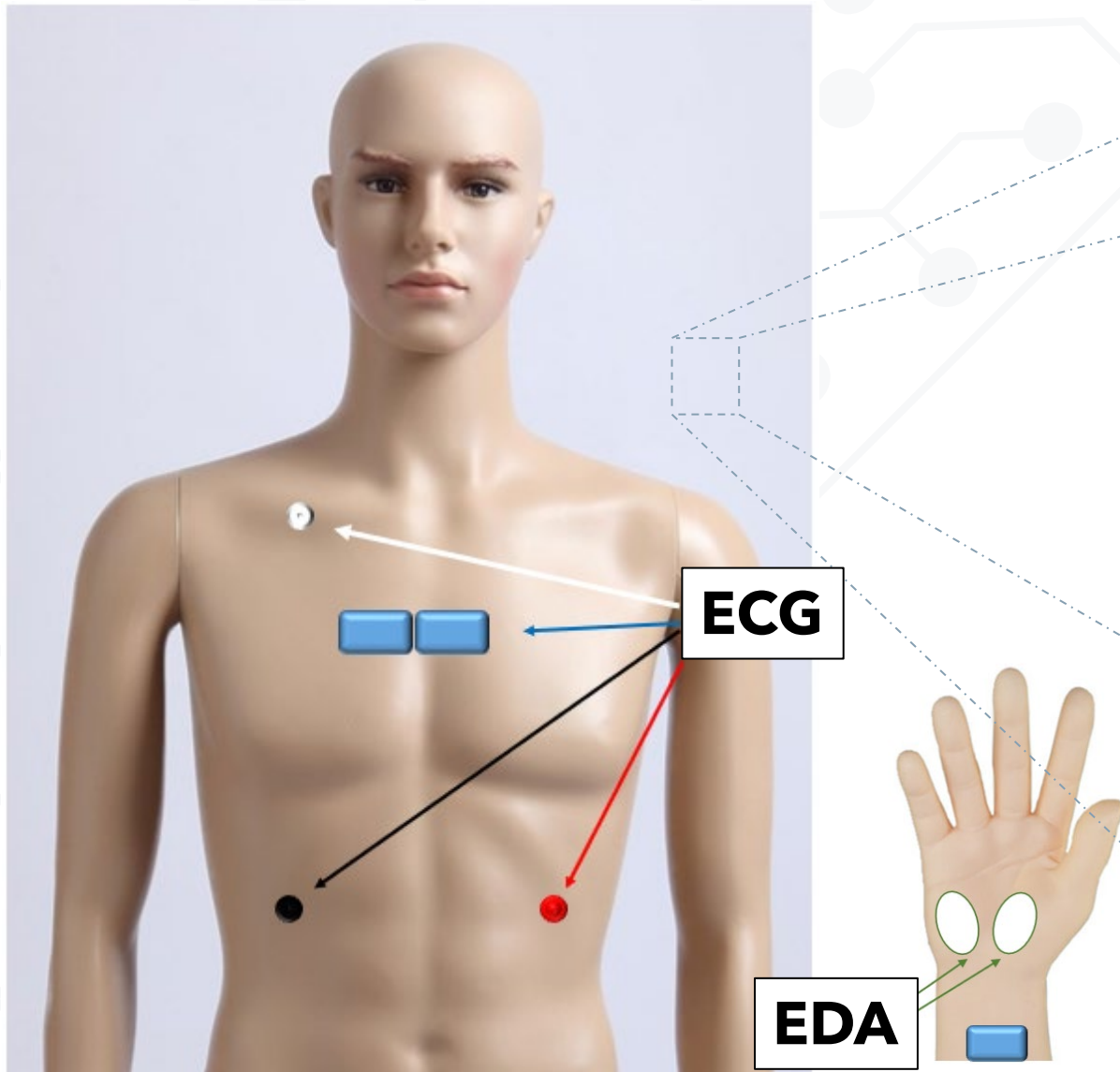
30 full-misses

Subjective ratings after outcomes:

How pleased are you with the result?

How much do you want to continue to play?

How do you perceive you chance of winning?

Clark et al. (2013); Sescousse et al. (2016)

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Biopac systems MP150

ECG

EDA

Biopac Systems, Goleta, CA, USA

Electrocardiography (ECG)

Heart rate
(HR in BPM)

- HR deceleration
(min 0-3 s post stimulus)

- HR acceleration
(max 2-6 s post stimulus)

Electrodermal activity (EDA)

Skin conductance responses (SCR)

- Max amplitude 1-4 s post stimulus, minus baseline value

cathrine.hultman@regionvastmanland.se

Statistics

➢ Repeated measures ANOVA (*wins, near-misses, full-misses*).

➢ Repeated measures ANOVA (*near-misses before, near-misses after, full-misses*).

➢ Repeated measures ANOVA (*wins, near-misses, full-misses*) divided by sex.

➢ Two-way ANOVAs per response measure (*HR, SCR and subjective ratings*) and gambling outcome (*wins, near-misses, full-misses*).
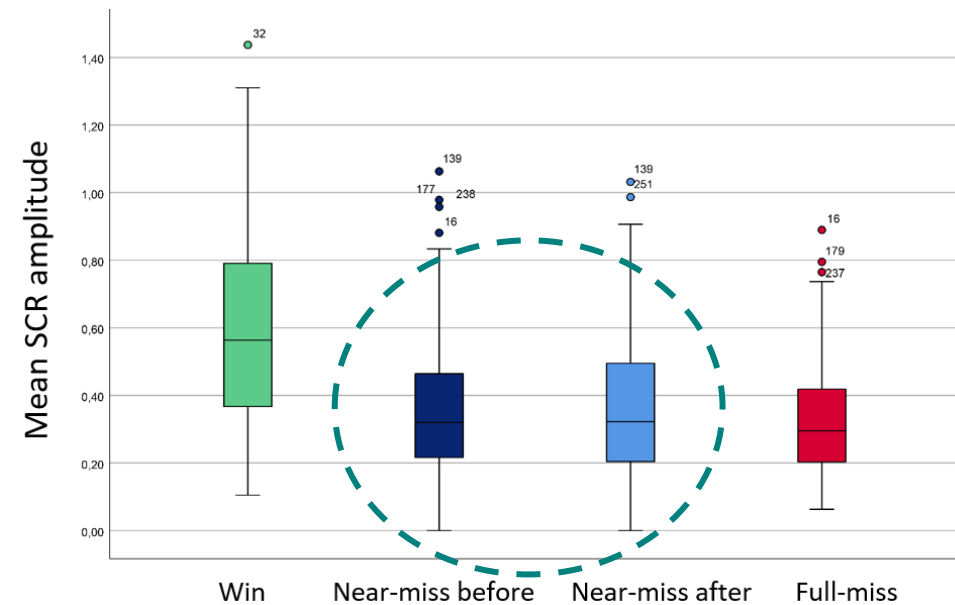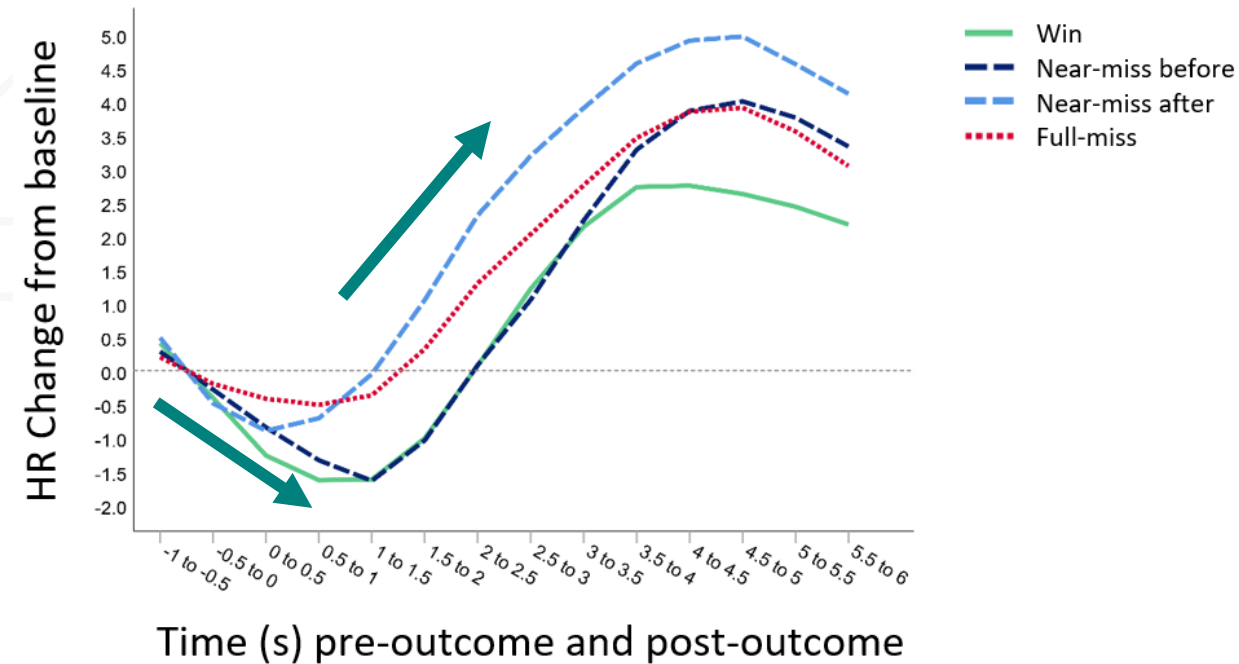
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Results

Near-misses overall elicited greater responses than regular full-misses (SCR, HR deceleration) and wins (HR acceleration).

Near-misses AFTER payline:

- Largest HR acceleration

- Lower motivation ratings

- Lower pleasure ratings

Near-misses BEFORE payline:

- Larger HR deceleration

- Higher motivation and percieved chance of winning

cathrine.hultman@regionvastmanland.se

Results

Responses devided by sex

♂

SCR:
Wins > Near-misses ≈ Full-misses

HR acceleration:
Wins **< Near-misses >** Full-misses

HR deceleration:
Wins > Near-misses > Full-misses

♀

SCR:
Wins > Near-misses > Full-misses

HR acceleration:
Wins **< Near-misses >** Full-misses

HR deceleration:
Wins ≈ Near-misses ≈ Full-misses

cathrine.hultman@regionvastmanland.se

Results

Responses devided by sex

♂

Pleased with results:
Wins > Near-misses ≈ Full-misses

Continue gambling:
Wins > Near-misses ≈ Full-misses

Chance of winning:
Wins ≈ Near-misses ≈ Full-misses

♀

Pleased with results:
Wins > Near-misses ≈ Full-misses

Continue gambling:
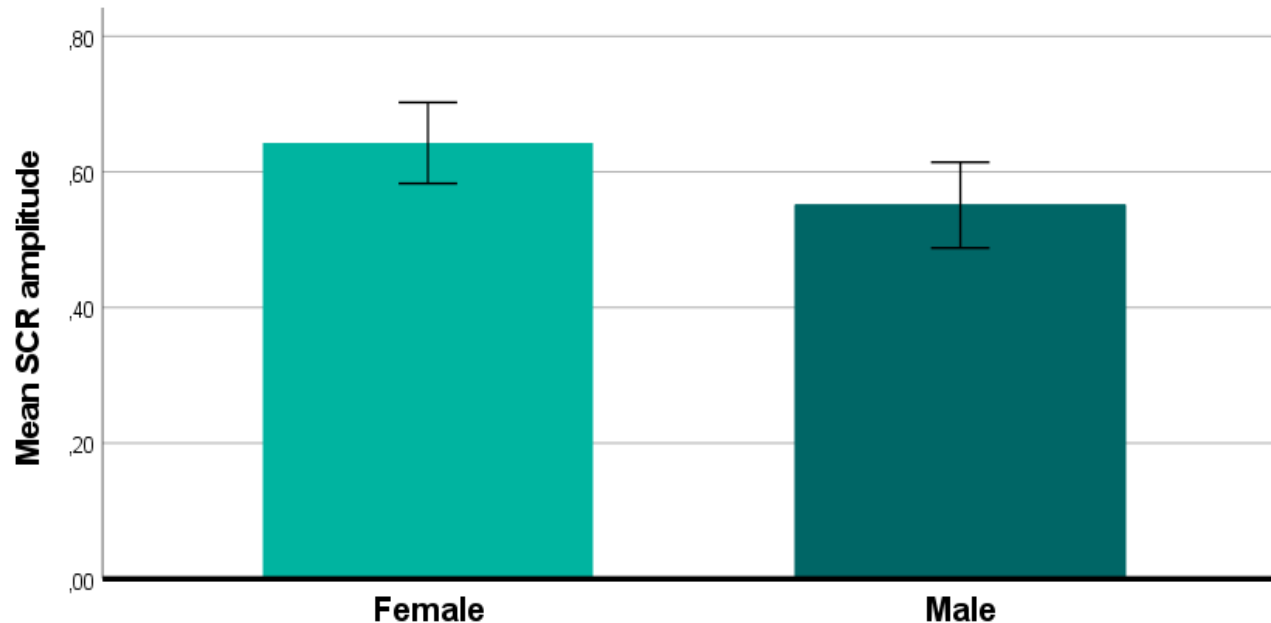**Wins >** Near-misses ≈ Full-misses

Chance of winning:
Wins > Near-misses ≈ Full-misses

cathrine.hultman@regionvastmanland.se

Sex differences

➢ **Wins** elicited larger SCRs ($p = 0.039$, $\eta_P^2 = 0.024$) and increased motivation to continue gambling among *females* compared to males ($p = 0.022$, η_P^2 0.019).

cathrine.hultman@regionvastmanland.se

Discussion

➢ Replicates previous research - near-misses elicits larger autonomic responses compared to regular full-misses in a larger community sample of young adults.

➢ Differential autonomic responses paired with differences in motivation and perceived chance of winning, is concurrent with the theory that near-miss subtypes constitute two directions of counterfactual thinking (additive and subtractive) affecting emotion and motivation.

➢ Sex differences in ANS responses during gambling may depend on type of gambling and level of risk involved.

➢ SCRs are sensitive to environmental factors, especially among females.

Clark et al., 2013

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Strengths

➢ Large sample of young adults from a community-based cohort.

➢ First study to investigate sex differences during slot machine gambling.

➢ Ecological validity?

➢ Part of a larger experimental session – potential effects on investment?

➢ Reliability of the subjective ratings?

➢ Not generalizable to problem gamblers.

➢ No control for individual differences e. g. psychiatric, neuropsychiatric disorders, personality traits, hormonal levels, or medication.

cathrine.hultman@regionvastmanland.se

Conclusions

➢ Near-misses overall elicits large autonomic responses compared to full-misses, but also differential responses depending on near-miss subtype.

➢ Subtypes of near-misses can produce conflicting emotional responses depending upon their characterization. This distinction is relevant to the understanding of near-miss psychology and their effect on gambling behavior.

➢ Differences in autonomic and subjective responses between males and females emphasize the need to consider sex differences in experimental gambling research.

cathrine.hultman@regionvastmanland.se

Thank you!

Correspondence to: cathrine.hultman@regionvastmanland.se

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