Practicing inhibitory control on a smartphone leads to improvements in inhibition but not reductions in alcohol consumption

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Measuring inhibitory control: the stop-signal task

Go Trial (75%):
- Fixation
- Go Stimuli
- Correct!

Go reaction time

Participants are required to press a button corresponding to the go stimulus as fast as possible.

Stop Trial (25%):
- Fixation
- Go Stimuli
- Auditory Stop Stimulus

Participants are required to inhibit a response to the go stimulus when the stop signal is presented.
Disinhibition and alcohol use disorders

- Alcohol–dependent patients have relatively poor performance on the stop–signal and related tasks (e.g. Goudriaan et al., 2006).

- Disinhibition is positively correlated with alcohol consumption and problems in ‘social’ drinkers (Christiansen et al., 2012; Houston et al., 2014).
Predicts prospective use?

- Disinhibition predicts future drinking in adolescents (Fernie et al., 2013) and the development of alcohol dependence in adults (Rubio et al., 2008).

- Predicts relapse after treatment in problem gamblers (Goudriaan et al., 2008).

- Stevens et al. (2014) review suggests no consistent predictive relationship with relapse across 6 studies with substance abusers (but none used SST).

- Lab studies: people drink more when in disinhibited ‘state’ (Jones et al., 2011a, b).
Disinhibited people are more likely to become addicted and less likely to quit.

People are more likely to use drugs when in a disinhibited state.

If we can ‘train’ people to improve their inhibitory control, this may be a viable intervention for prevention or treatment of addiction.
Practice makes perfect

Behavioral/Cognitive

Training-Induced Changes in Inhibitory Control Network Activity

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Despite extensive research on how the associated neural regions changes with training, a proactive control model that activity in key parts of the brain can be improved with training. Results on IC tasks improve IV related brain activation in IC-related brain regions. The use of cues that anticipated the loss of control (i.e., stopping) and increased during cues that precede the implementation of IC from pre-training to post-training. Also, steeper behavioral improvement in the training group correlated with activation increases during the cue phase and decreases during implementation in the dorsolateral prefrontal cortex. These results are the first to uncover the neural pathways for training-related improvements in IC and can explain previous null findings of IC training transfer.
More effective ways of administering inhibition training?
Study aims

- Pilot project to investigate effects of smartphone ‘inhibition training’ on inhibitory control and alcohol intake in problem drinkers

- Participants (N = 44) randomly allocated to one of three groups:
  - ‘Standard’ stop–signal task (SST)
  - Modified SST (difficulty tracks performance; stop signal delay ↑ 10ms if inhibition accuracy > 50% on previous block)
  - ‘Disinhibition’ control (never required to inhibit)
Sample characteristics

- 50% Male
- Mean age = 36.53 (SD = 10.39)
- AUDIT = 14.08 (SD = 5.59)
- Alcohol consumption in previous fortnight = 64.07 units (SD = 30.64)
  - (UK govt guidelines: 2–3 units per day for women, 3–4 units per day for men; 14 / 21 per week)
We recruited participants who drank in excess of govt. guidelines, and who were motivated to try to ‘cut down’ for two weeks.

All participants received a brief intervention (‘Down your drink’) at the beginning of the study before completing stop–signal task (SST) in laboratory.

Participants loaned a smartphone and instructed to complete SST on phone twice a day (1000–1330 & 1430–1800).

All participants completed assessment version of SST on phone after one week and two weeks.

Recorded alcohol consumption each morning.

Returned to lab after one week and two weeks to check compliance.

Also recorded drinking intentions (data not shown).
Significant time x group interaction (F(4, 78) = 2.60, p = .04)

Practicing a standard stop signal task leads to improvement in SSRT.
Results: Alcohol consumption (quantity)

Main effects time and group, no interaction \((F(2, 37 = .54, \ p = .59)\)

Reduction in drinking during study (non-specific)
Group difference at baseline
Results: Alcohol consumption (frequency)

Main effect of group, no interaction \( (F(2, 42) = .62, p = .54) \)

Regression to the mean?
This was a pilot study!

Best way to improve inhibitory control may be to practice a standard stop–signal task rather than attempt to ramp up the difficulty

- But method devised by Berkman et al (2014) may have been more suitable
- Our ‘modified’ SST could have primed a waiting strategy

No suggestion of any effects on alcohol consumption (quantity or frequency)

Need to control for monitoring / non–specific effects and regression to the mean?

Participants not sufficiently motivated? Or too motivated?
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