

Background

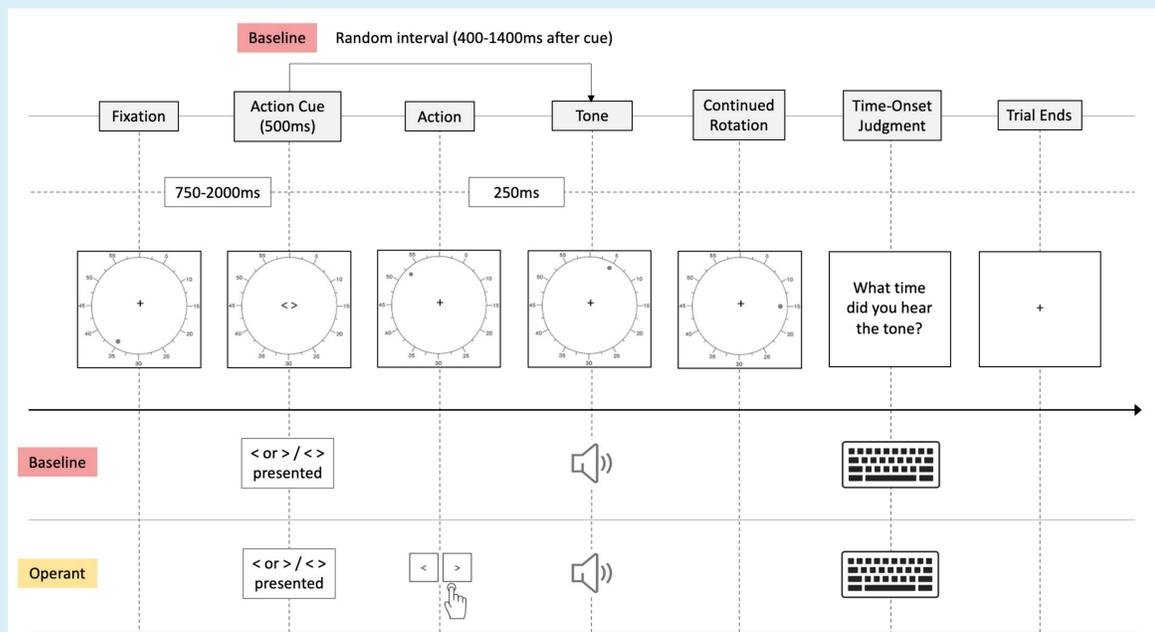
- Sense of agency (SoA), the feeling of ownership over our actions and their outcomes, is fundamental for human experience (Gallagher, 2000; Haggard & Chambon, 2012).
- Agency is influenced by prospective and retrospective processes, including:
 - **Action choice** (Barlas et al., 2017).
 - **The affective valence of the outcome** (Takahata et al., 2012; Yoshie & Haggard, 2013).
- Limited research has combined choice and valence of outcomes. For example, it is unclear how increasing the number of choices or the meaningfulness of the choice, interacts with valence and affects SoA.
- Altered SoA experiences have been demonstrated in several clinical populations and reflect differences in either prospective and/or retrospective processes (Haggard, 2017). However, no research to date has focused on the link between both depressive- and psychosis-like traits and SoA.

Aims

- **Study 1:** how do both prospective (free / forced choice) and retrospective (+ / - outcome valence) factors influence SoA? What is the relationship with depressive- and psychosis-like traits?
- **Study 2:** does *increasing choice alternatives* influence our SoA?
- **Study 3:** does a more *meaningful* choice influence our SoA?

SoA Libet Clock Task

- Libet Clock Task with both factors of choice (prospective) and outcome valence (retrospective)
- SoA assessed by measuring intentional binding (IB)



Study 1: SoA & the MH Continuum

Participants: $N = 150$, 18-30 y/o ($M = 19.31$, $SD = 1.71$)

Completed both:

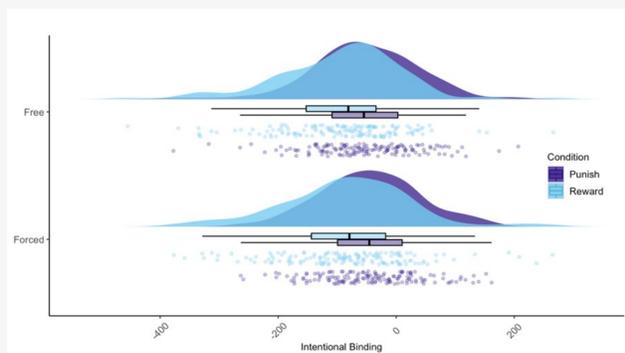
- Depression (**BDI**; Beck et al., 1996) and Psychosis (**PQ-B**; Loewy et al., 2011) questionnaires
- **Libet clock task:** free / forced choice, received a rewarding / punishing tone – then reported the time onset of the tone

Analyses:

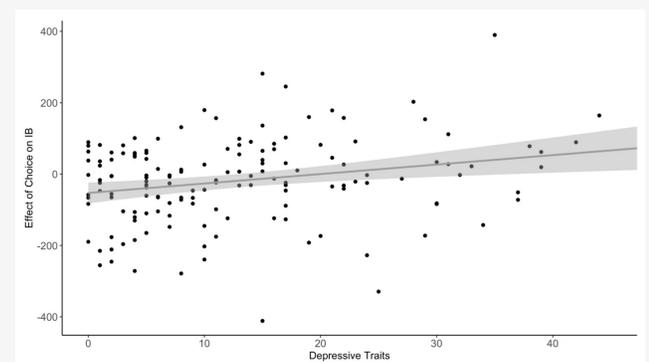
- **IB:** 2 x 2 RM-ANOVA, choice (free / forced), outcome (+ / -) within-subjects
- **Correlation:** assess the relationship with MH traits

Results:

- Identified greater IB for positive outcomes, $F(1, 149) = 51.93$, $p < .001$, $[BF_{10} = 1.17e+10]$, $\eta^2_p = .26$
- But no overall effect of choice, $F(1, 149) = 3.50$, $p = .06$, $[BF_{10} = 0.39]$, $\eta^2_p = .02$



- Higher depressive traits were associated with reduced IB when having freedom of choice, $r(148) = .25$ $[BF_{10} = 10.26]$, $p = .002$



Study 2: SoA & Increased Choice

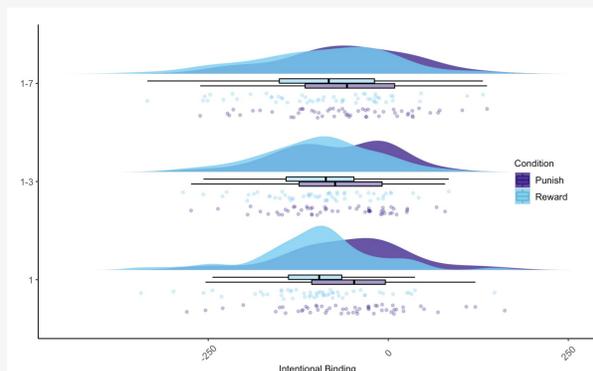
Participants: $N = 54$, 18-30 y/o ($M = 25.39$, $SD = 4.93$)

Libet clock task: 1 / 1-3 / 1-7 choices (received a rewarding / punishing tone – then reported the time onset of the tone)

Analysis: IB: 3 x 2 RM-ANOVA, choice (1 / 1-3 / 1-7), outcome (+ / -) within subjects

Results:

- Supported the finding of greater IB for positive outcomes, $F(1, 53) = 18.30$, $p < .001$, $\eta^2_p = .26$
- Even when increasing choice alternatives, no overall effect of choice was identified, $F(1, 53) = .203$, $p = .654$, $\eta^2_p = .004$



Study 3: SoA & Meaningful Choice

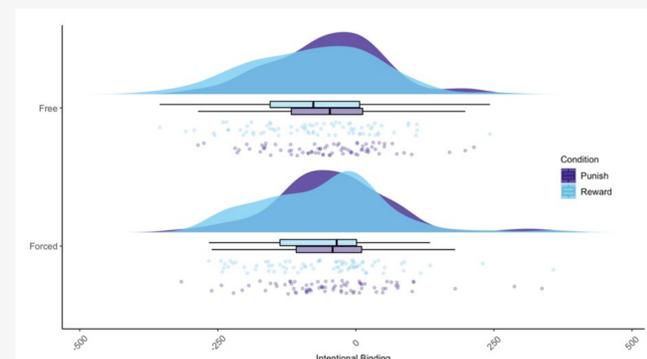
Participants: $N = 77$, 18-30 y/o ($M = 27.06$, $SD = 4.55$)

Libet clock task: same as *study 1* – but – action-outcome predictability set to **75:25** (75% likelihood producing a + tone)

Analysis: IB: 2 x 2 RM-ANOVA, choice (free / forced), outcome (+ / -) within-subjects

Results:

- Supported the finding of greater IB for positive outcomes, $F(1, 76) = 6.57$, $p = .012$, $\eta^2_p = .08$
- Despite providing a meaningful choice, no overall effect of choice was identified $F(1, 76) = 2.552$, $p = .114$, $\eta^2_p = .032$



Discussion

- Supporting previous literature, we provide strong evidence of a retrospective effect of outcome on IB, reflecting a self-serving positivity bias (Takahata et al., 2012; Yoshie & Haggard, 2013).
- Although choice is previously shown to influence IB (Barlas & Obhi, 2014; Moore & Haggard, 2008), we show no effect of choice, even when increasing choice and the meaningfulness of a choice.
- We provide the first evidence of reduced SoA in depressive-like traits. Future studies in clinical depression are warranted.
- Our findings therefore provide important insight into the factors that influence our SoA, and how it might differ across the depression continuum.

Limitations and further work:

- IB constitutes both outcome- and action-binding (Wolpe et al., 2013). Our studies were limited to outcome-binding and did not measure action-binding. Future research is required to understand how SoA is influenced by prospective and retrospective factors, when measuring both action- and outcome-binding.
- Further work is required to show how both prospective and retrospective factors might interact according to optimal cue integration and underpin altered SoA experiences across the MH continuum.