ANTICIPATING WINS AND LOSSES: CNVs APPEAR TO BE SIMILAR BUT REFLECT DIFFERENT TRAITS

Angela Dzyundzyak & Sidney J. Segalowitz

Department of Psychology, Brock University

Background

The Contingent Negative Variation (CNV) is a slow negativity starting after the presentation of warning, reflecting the participant's anticipation of an upcoming stimulus,[1] including anticipating a reward event which activates the reward system.[2]

Previous research in our lab has showed that negative valence traits (e.g., anxiety, worry) are related to medial frontal negativities (ERN and NoGo N2) especially during loss or negatively valenced conditions.[3, 4]

We examined whether the CNV is sensitive to reward-related personality traits (Neuroticism, BIS/BAS, OC, Sensitivity to Reward/Punishment), especially with respect to the difference between anticipation of potential wins versus losses.

Response Task

- Adapted from Bjork et al. (2004)[2], trials began with a cue labelling the trial as a potential win, loss, or no change.

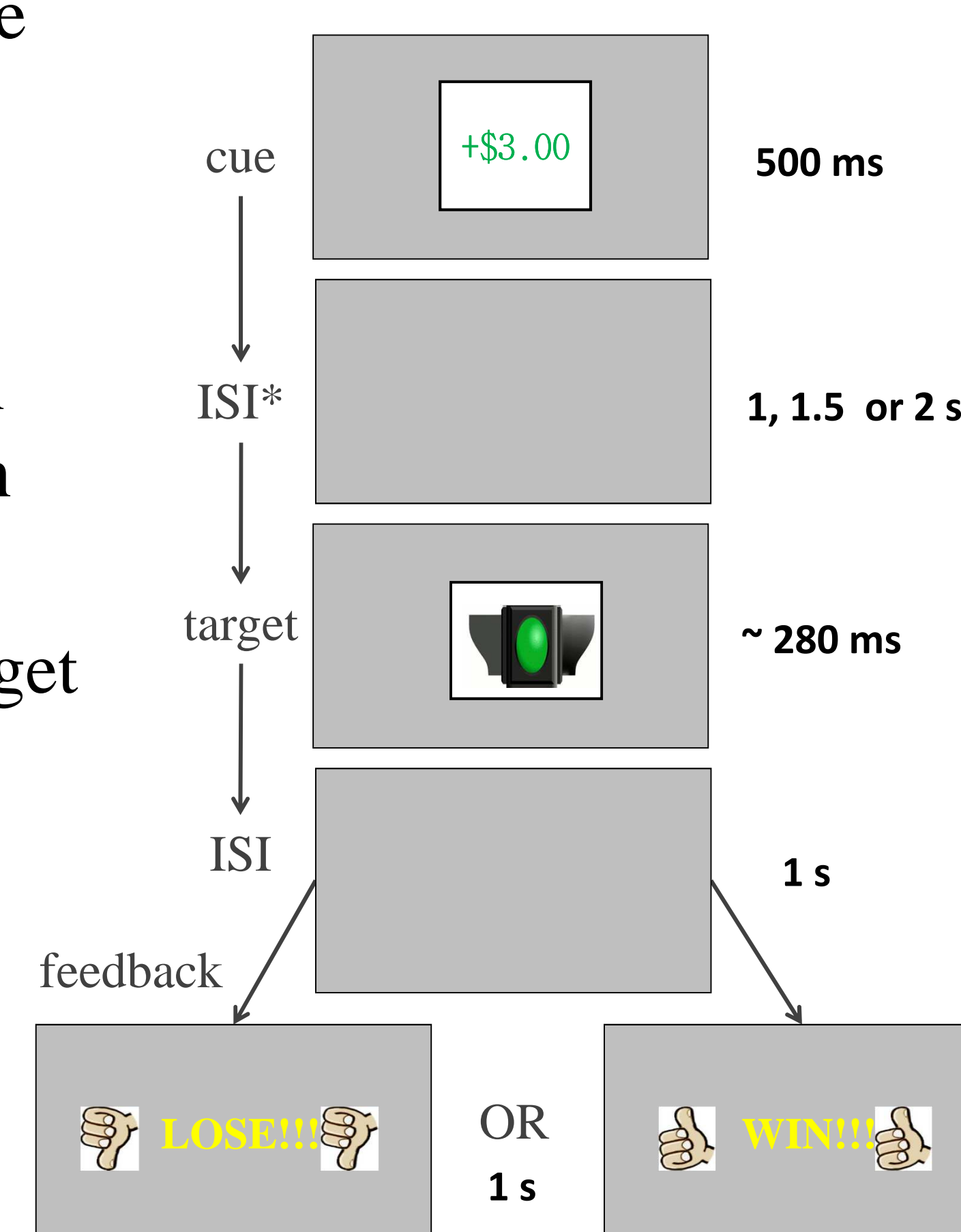- Cues were either of large ($3) or small ($.50) magnitude.

- Targets presented after the cue with ISI of either 1, 1.5 or 2 seconds

- To win or avoid losing, participants pressed a key when the target was still on the screen

- The feedback to the trial (i.e., valence) was given after the target disappeared
    o 9 blocks, 45 trials/block
    o Task Length: ~ 50 min

Figure 1. Sequence of events in the response task

Method

Participants
- 31 participants (age M = 22, SD = 2.82; 18 female, 13 male)
    - 23 undergraduate and 8 graduate (or graduated) students
    - 18 with some gambling activities
    - No neurological conditions or psychiatric difficulties

Personality Measures
- 20-item Neuroticism scale from the IPIP database[5]
- Behaviour Inhibition (BIS) and Activation (BAS) Scales[6]
- 18-item Obsessive Compulsive Inventory Revised[7]
- 47 item Sensitivity to reward/punishment[8]

Electrophysiological Measurements
- 128 site EGI system, 500 samples/sec
- 4 midline sites were scored: Fz, Cz, Pz
- ERPs were time locked to the presentation of the cue
- CNV was scored as averaged amplitude in 3 epochs (see Figure 2).

Results: Win vs. Loss

Figure 2. CNV amplitude observed after win (green) and loss (red) cues

- CNV was largest at Cz, $F(2,60) = 19.16$, $p < .001$

- CNV was equivalent after the win and loss cues, $F(1,30) = .01$, $p = .929$

- Furthermore, there was an interaction effect of site by epoch such that the CNV increased over time at Cz, $F(4, 120) = 7.81$, $p = .001$.
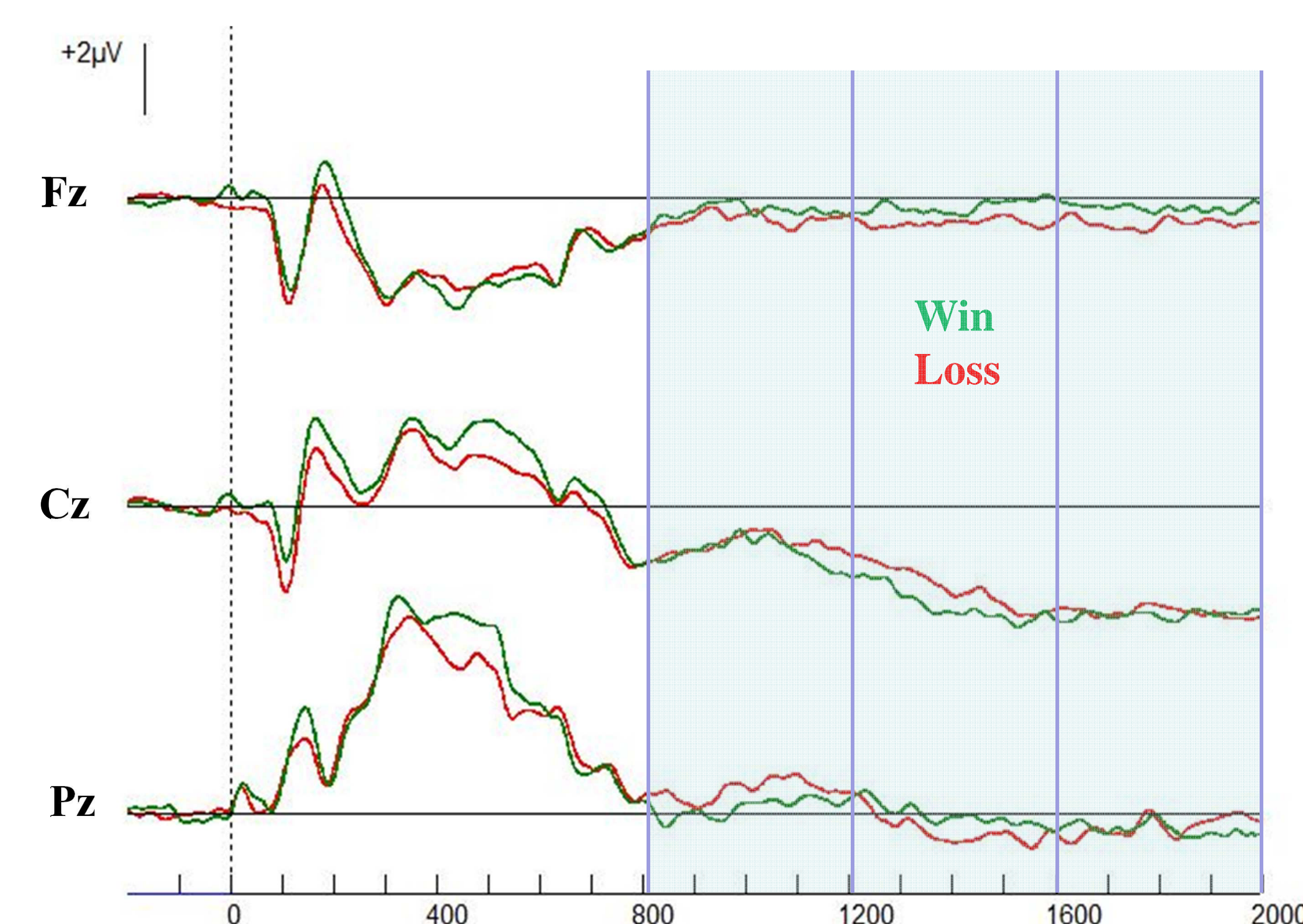
Results: Personality Measures

Despite CNV being greatest for Cz, the significant relations with personality were *only* at Fz during the early CNV period (800-1200ms), presumably reflecting the O-Wave:

- After win cues, CNV was reduced by
    Greater *obsessive compulsiveness*: zero-order $r = .45$, $p = .014$,
        unique variance (adjusting for loss trials) $r = .53$, $p = .004$.
    Increased *sensitivity to punishment*: zero-order $r=.43$, $p = .016$,
        unique variance $r = .43$, $p = .018$.
    Increased *neuroticism*: zero-order $r = .40$, $p = .028$, unique variance $r = .31$, $p = .089$.

- After loss cues: CNV was reduced by
    Greater *behaviour inhibition* score: zero-order $r = .42$, $p = .003$,
        unique variance (adjusting for win trials) $r = .42$, $p = .016$

Conclusion

- The early CNV (classic O-Wave) following the cue was related to personality.
- Win and loss cues did not lead to differences in anticipation of the target
- Unique variance in CNVs following win and loss cues was accounted for by different personality variables.
- Thus, despite similar CNVs for anticipating wins versus losses, the variance sources differed considerably by condition.

References

1. Walter, W.G., Cooper, R., Aldridge, V.J., McCalum, W.C. & Winter, A.L. (1964). Contingent Negative Variation: An electric sign of sensori-motor association and expectancy in human brain. *Nature, 203*, 380-385.
2. Bjork, J., Knutson, B., Fong, G., Caggiano, D., Bennet, S., & Hommer, D. (2004). Incentive-elicited brain activation in adolescents: similarities and differences from young adults. *Journal of Neuroscience, 24*(8), 1793-1802
3. Santesso, D.L., Dywan, J., Wade, T.J., & Segalowitz, S.J. (2010). Enhanced Feedback Related ACC Activity in relation to negative emotionality during adolescence. (Poster presented at SPR).
4. Lackner, C.L., Santesso, D.L., Dywan, J., Wade, T.J. & Segalowitz, S.J. (2010). Medial prefrontal NoGo activation during an emotional Go/NoGo task is related to worrying in adolescents. (Poster presented at SPR).
5. Hofstee, W. K. B., de Raad, B., & Goldberg, L. R. (1992). Integration of the Big Five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology, 63*, 146-163.
6. Carver, C., & White, T. (1994). Behavioural inhibition, behavioural activation, and affective responses to impending reward and punishment: the BIS/BAS scales. *Journal of Personality and Social Psychology, 67*(2), 319-333
7. Foa,E., Huppert, J., Leiberg, S., Langner, R., Kichic, R., Hajcak, G. et al (2002). Obsessive-Compulsive Inventory: Development of a short version. *Psychological Assessment, 14*, 485-496
8. Torrubia, R., Avila, C., Molto, J., & Caseras, X. (2001). The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) as a measure of Grey's anxiety and impulsivity dimensions. *Personality and Individual Differences, 31*, 873-862