The NPU-Anxiety Test: A Novel Paradigm for Studying Perseverative Thought in a Social-Evaluative Context

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Introduction

- The No-Predictable-Unpredictable (NPU) threat test is commonly used to study fear by varying the predictability of electric shock and measuring its impact on startle responses (Schmitz & Grillon, 2012). In its current form, however, this laboratory paradigm is specific to fear and is not effective for studying anxiety (Gorka et al., 2017).
- To develop a research tool for advancing understanding of anxiety, we modified the NPU-threat test to elicit anxiety instead of fear. In addition to measuring the anxious affect that was elicited, we measured the cognitive component of anxiety: perseverative thought (PT).
- PT refers to repetitive negative thinking that occurs before or after a perceived stressor (Brosschot et al., 2006). Based on previous research showing that laboratory stressors involving social-evaluative threat evoke the largest cortisol changes and the longest times to recovery (Dickerson & Kemeny, 2004), we used performance tasks with the potential for negative social evaluation as stressors in the paradigm.
- Previous research has measured PT using trait questionnaires, which are susceptible to recall bias and fail to capture how PT changes in response to stress. Our paradigm instead used a recently developed joystick technology to measure PT in real time (Wade et al., 2021).

Method

- A total of 64 undergraduate students were recruited through the Psychology Department subject pool. Participants ranged in age from 18 to 23 years. The sample was 52% female and racially diverse (44% identified as White).
- Participants were informed that they would be completing a series of cognitive tests that would be used to measure their intellectual ability. To heighten social-evaluative pressure, participants completed the tasks in front of a video camera and microphone. They were told that an experimenter would score their performance and provide feedback on how they compared to other Penn students.
- The NPU-anxiety test included three components: countdowns, cognitive tests, and free-thought periods (see Figure 1). In the P condition, each test was immediately preceded by a countdown. In the U condition, tests were unconnected to the countdowns. In the N condition, there were countdowns but no tests.
- Other than during the tests, participants continuously rated the valence and intensity of their thoughts using a joystick. Responses were recorded on a scale from -10 (extremely negative) to 10 (extremely positive) at a rate of one data point per second.
- We extracted three intervals from the joystick data stream: pre-test (10 seconds before each cognitive test), immediate post-test (10 seconds after each test), and extended post-test (10 seconds after immediate post-test).
- After each condition, participants rated how anxious, confident, tense, proud, nervous, and satisfied they felt on separate 1 (*Not at all*) to 7 (*Extremely*) Likert-type scales. These ratings were averaged into Negative Affect and Positive Affect composites (Cronbach's α = .81-.91).
- At the end of the study, participants used the same 1 (*Not at all*) to 7 (*Extremely*) scale to rate their impressions of specific features of the paradigm on a debriefing interview administered by the experimenter.

Figure 1. The NPU-Anxiety Test

KEY	Free-Thought Periods	Countdown	Cognitive Tests						
Condition									
P	30	5	85	70	5	85	70		
N	30	5	155		5	155			
U	30	5	15	85	55	5	30	85	40
Break									
P	30	5	85	70	5	85	70		
N	30	5	155		5	155			
U	30	5	45	85	25	5	70	85	

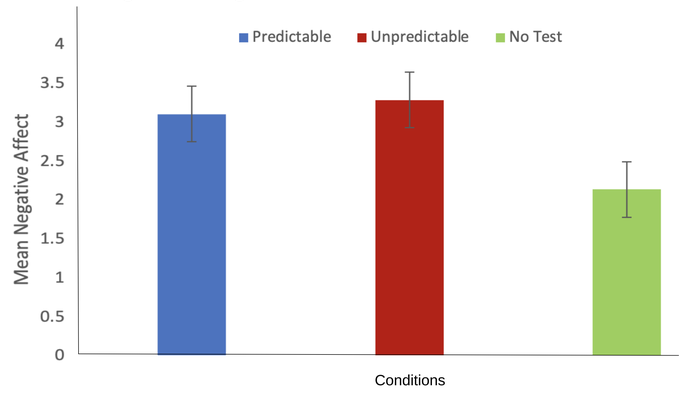
Results

Table 1. Participants' Perceptions of the NPU-Anxiety Test

Debriefing Question	*M*	*SD*	*Min*	*Max*
When you first learned that you would need to perform cognitive tests and that your performance would be compared with other Penn students, how strong was your reaction?	3.81	1.50	1	7
How stressful were the tests?	3.54	1.29	1	7
To what extent did you think about the experimenter watching you through the camera or evaluating your performance?	3.38	1.78	1	7
To what extent did you think about the cognitive tests, or the score you would receive at the end of the experiment?	3.91	1.78	1	7

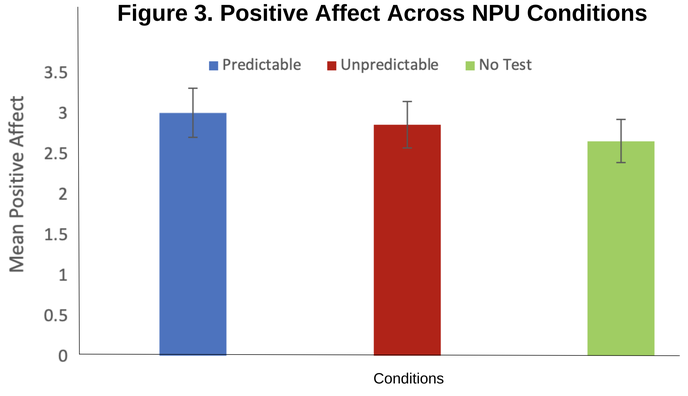
- Overall, the paradigm was successful at eliciting a stress response: Participants rated the social evaluation instructions and the cognitive tests as moderately stressful on average, and reported near-moderate levels of thoughts about being watched and being scored while completing the paradigm.
- At the same time, there were robust individual differences in the magnitude of perceived stress.

Figure 2. Negative Affect Across NPU Conditions



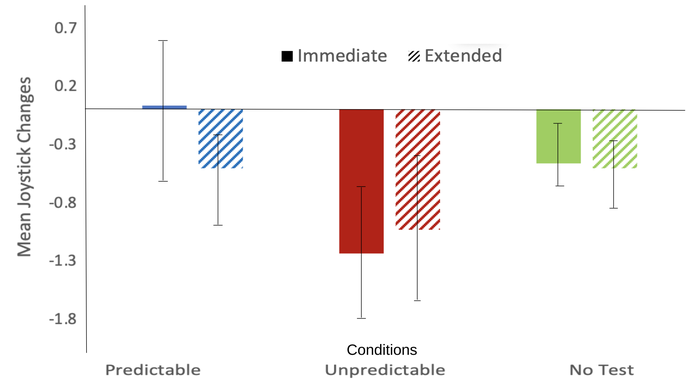
- A repeated-measures ANOVA revealed large, statistically significant differences in negative (anxious) affect across conditions, $F(2, 126) = 34.68$, $p < .001$, $\eta_p^2 = .36$. Pairwise comparisons indicated that negative affect was higher in the test conditions (U and P) than in the no-test condition. However, negative affect did not differ across the U and P conditions.

Figure 3. Positive Affect Across NPU Conditions



- Differences in positive affect were smaller than for negative affect, and distinguished only the P and N conditions, $F(2, 126) = 3.36$, $p = .038$, $\eta_p^2 = .05$.

Figure 4. Declines in Joystick Values in the Immediate and Extended Post-Test Periods



- Change scores for the immediate post-test period, minus pre-test levels, revealed that thoughts became more negative after tests in the U condition than the P condition, $F(2, 116) = 5.69$, $p = .004$, $\eta_p^2 = .09$. However, the difference between conditions was short-lived, disappearing by the extended post-test period, $F(2, 126) = 1.52$ $p = .223$, $\eta_p^2 = .03$.

Discussion

- Our results provide support for the NPU-anxiety test as a new paradigm for provoking a modest but reliable anxiety response in the laboratory.
- The paradigm had more robust effects on affect than cognition. This may be because affect ratings were retrospective and interpreted to be task-focused, whereas ratings of cognition were continuous and may have included thoughts unrelated to the experimental tasks.
- The paradigm's effects on PT were limited to unpredictable stress and dissipated quickly, suggesting that participants' stress responses were transient and tied to the immediate completion of each test.
- While individual differences in anxiety were expected, a key limitation of our study is that some participants had a neutral or even positive reaction to some tests. This contrasts with the original NPU-threat paradigm, in which the stimulus (electric shock) was universally aversive.
- Future research should explore different cognitive tests or additional stressful elements (e.g., experimenter in the room during testing; real-time negative feedback about performance) that could strengthen the stress response. It would also be valuable to administer the paradigm to clinical samples, especially those prone to PT (e.g., individuals with generalized anxiety disorder), to determine whether a more homogeneous or stress-sensitive sample might exhibit more uniform responses.

References

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