THE RELATIONSHIPS AMONG MULTIPLE PSYCHOPHYSIOLOGICAL AND SELF-REPORT MEAURES OF NEGATIVE AFFECT INDEXED ACROSS MULTIPLE TASKS WITHIN THE SAME SAMPLE

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Background and Significance

In line with RDoC and related initiatives, psychophysiology research has begun to combine multiple physiological and self-report measures in attempts to better index latent constructs relevant to psychopathology and individual differences in emotion [1].

Reports of low to null correlations between different psychophysiological measures as well as between psychophysiology and self report have been reported for decades . However, assumptions continue to be made that various psychophysiological measures and tasks index the same latent constructs (e.g., negative affectivity, trait fear).

We need more careful evaluations of the commonalities of various methods and measures to better understand their ability to index constructs of interest.

These efforts may be most successful if they include data from both multiple measures and tasks within the same large samples. Here, we assessed two psychophysiological measures across two psychophysiological tasks administered twice to a large sample. We also administered an array of trait negative affect related self-report questionnaires. We examined correlations among all of these psychophysiological and self-report variables across sessions. We then completed an exploratory factor analysis to test evidence for underlying constructs of relevance.

General Procedures

Healthy participants (N = 128, 64 female) aged 18 – 61 (M = 23, SD = 7.7) completed both the No shock Predictable shock Unpredictable shock (NPU) task [2] and International Affective Picture Scale (IAPS) task [3] at two study visits separated by ~one week. The final sample consisted of 108 participants after removal of startle non-responders and artifactual data [4].

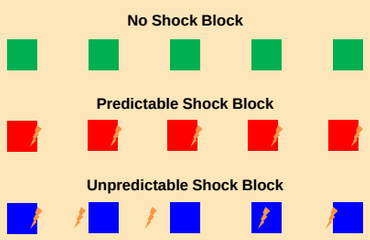
Participants were randomized to a Task Order (1st task: NPU Task or IAPS Task) for both study visits.

Before the NPU task at the first visit, participants reported their maximum tolerance to a series of 200 ms electric shocks of increasing intensity (7 mA max) administered to the index and ring fingers of their left hand . Each participant's maximum tolerated shock level was used in the NPU task to minimize the effect of individual differences in shock tolerance.

At the first study visit only, participants completed a battery of self-report questionnaires to assess trait negative affect.

NPU Task

= Electric Shock



No Shock Block
No shocks at any time

Predictable shock:
Shock during cues only
(4.8 s into cue presentation)

Unpredictable shock:
Shock at any time
(2 or 4.8 s into cue presentation and 4, 8, or 12 s post-cue offset.)

Participants viewed blocks of 5 colored square cues presented for 6 s each with a variable ITI (M = 17, range = 14-20).

Condition order was counterbalanced both within- and between-subjects (i.e., 2 condition orders: PNUNUNP, UNPNPNU) and participants completed the same order at both study visits.

IAPS Task

Participants viewed 36 different pictures (set) at each study visit comprising 12 pleasant, 12 unpleasant and 12 neutral pictures from the International Affective Picture Scale (IAPS) presented for 6 s each with a variable ITI (M = 17, range = 14-20).

All participants saw 2 picture sets, one set at each study visit. We matched the two picture sets on valence and arousal ratings within each condition based on normative ratings as well as picture content (e.g., people, mutilation, erotica, animals, scenery).

Picture condition order was counterbalanced within- & between-subjects and picture set order was counter balanced between-subjects.

Measures

Startle Potentiation: In each task, we measured the EMG eye-blink startle response to acoustic startle probes (50 ms, 102 dB white noise) using standardized procedures [5].

Startle potentiation in the NPU task was calculated as startle during shock cues — no-shock cues separately for the unpredictable (r_{sb} = .61) and predictable (r_{sb} = .81) cues and in the IAPS task as startle during the unpleasant pictures – neutral pictures (r_{sb} = .50). Startle potentiation was averaged across both sessions.

Corrugator Potentiation: In each task, we measured the EMG facial frowning to picture and shock cue onset.

Corrugator potentiation in the NPU task was calculated as corrugator activity during onset of shock cues — no-shock cues separately for the unpredictable (r_{sb} < .00) and predictable cues (r_{sb} = .45) and in the IAPS task as corrugator activity during onset of the unpleasant pictures — neutral pictures (r_{sb} = .54). Corrugator potentiation was averaged across both sessions.

Depression Anxiety Stress Scale: short version (21 item) of a 42-item instrument designed to measure the three named negative emotional states [6]. Total score used. Cronbach's α = .88.

Multidimensional Personality Questionnaire (MPS)- Negative Emotionality: broad trait scale from the brief form (155 item) of a 276 item instrument measuring personality at primary and broad traits levels [7]. Cronbach's α = .87.

Intolerance of Uncertainty Index (IUI): 30 item index evaluating both the excessive tendency of an individual to consider uncertainties in life to be unacceptable, as well as different cognitive and behavioral manifestations or consequences that may result from this excessive tendency [8]. Total score used. Cronbach's α = .94.

Anxiety Sensitivity Index: 16 item scale containing items specifying physical, cognitive, and social concerns someone could have regarding their anxiety [9]. Total score used. Cronbach's α = .83.

Self-reported Anxiety during cues: Participants retrospectively reported their fear/anxiety during each condition of the NPU task on a 5 point scale (1 = Not Anxious/Fearful, 5 = Very Anxious/Fearful) [10]. Scores calculated as increase in anxiety to shock cues — no-shock cues.

Bivariate Correlations

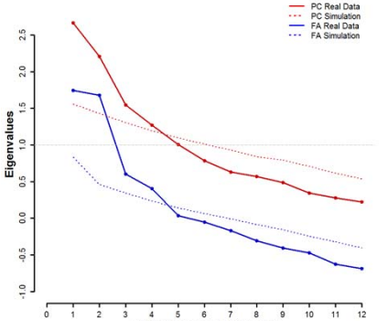
	DEPRESSION ANXIETY STRESS SCALE	MPS-NEGATIVE EMOTIONALITY BROAD TRAIT SCALE	INTOLERANCE OF UNCERTAINTY INDEX	ANXIETY SENSITIVITY INDEX	NPU UNPREDICTABLE STARTLE POTENTIATION	NPU PREDICTABLE STARTLE POTENTIATION	IAPS UNPLEASANT STARTLE POTENTIATION	IAPS UNPLEASANT CORRUGATOR POTENTIATION	NPU UNPREDICTABLE CORRUGATOR POTENTIATION	NPU PREDICTABLE CORRUGATOR POTENTIATION	NPU UNPREDICTABLE SELF-REPORTED ANXIETY	NPU PREDICTABLE SELF-REPORTED ANXIETY
DEPRESSION ANXIETY STRESS SCALE	1	0.36	0.40	0.56	-0.19	-0.12	-0.01	0.16	0.26	0.04	-0.02	0.03
MPS-NEGATIVE EMOTIONALITY BROAD TRAIT SCALE		1	0.51	0.36	0.04	0.05	-0.11	0.04	0.12	0.03	0.11	0.1
INTOLERANCE OF UNCERTAINTY INDEX			1	0.57	0.01	-0.02	-0.01	0.13	0.27	0.16	0.09	0.03
ANXIETY SENSITIVITY INDEX				1	-0.06	-0.09	-0.05	0.07	0.21	-0.01	0.10	0.07
NPU UNPREDICTABLE STARTLE POTENTIATION					1	0.75	0.18	0.04	0.05	0.26	0.31	0.18
NPU PREDICTABLE STARTLE POTENTIATION						1	0.20	0.04	0.00	0.20	0.18	0.14
IAPS UNPLEASANT STARTLE POTENTIATION							1	-0.02	-0.15	-0.14	-0.02	-0.08
IAPS UNPLEASANT CORRUGATOR POTENTIATION								1	0.23	0.10	0.16	0.02
NPU UNPREDICTABLE CORRUGATOR POTENTIATION									1	0.62	0.04	-0.11
NPU PREDICTABLE CORRUGATOR POTENTIATION										1	0.14	0.00
NPU UNPREDICTABLE SELF-REPORTED ANXIETY											1	0.45

p < .05 Unadjusted

p < .05 Holm Adjusted

Bivariate Pearson correlations revealed several moderate but significant correlations between various dependent variables. However, less than half of these correlations remained significant after Holm's correction for multiple comparisons. The surviving correlations reflected associations between variables within methods (e.g., different self-report; startle potentiation variables).

Exploratory Factor Analysis



We conducted an exploratory factor analysis to test for evidence that the dependent variables measured index common latent constructs.

Parallel analysis [11] suggested a 4 component and 4 factor solution (i.e., 4 component/factors greater than simulated data, see figure, left)

Maximum likelihood factor analysis with oblimin rotation produced the loadings in the table (right). Loadings below .32 are masked for easier interpretation [12].

All trait negative affect self report scales loaded on Factor 4. Startle potentiation during unpredictable and predictable cues in the NPU loaded on Factor 3. Corrugator potentiation during unpredictable and predictable cues loaded on Factor 2. Retrospective self reported anxiety during both unpredictable and predictable cues loaded on Factor 1. Measures in the IAPS task did not load well on any of the four factors.

Each task and method pairing loaded on its own separate factor.

	Factor 4	Factor 3	Factor 2	Factor 1
DEPRESSION ANXIETY STRESS SCALE	0.636			
MPS-NEGATIVE EMOTIONALITY BROAD TRAIT SCALE	0.582			
INTOLERANCE OF UNCERTAINTY INDEX	0.714			
ANXIETY SENSITIVITY INDEX	0.783			
NPU UNPREDICTABLE STARTLE POTENTIATION		0.919		
NPU PREDICTABLE STARTLE POTENTIATION		0.827		
IAPS UNPLEASANT STARTLE POTENTIATION				
IAPS UNPLEASANT CORRUGATOR POTENTIATION				
NPU UNPREDICTABLE CORRUGATOR POTENTIATION			0.949	
NPU PREDICTABLE CORRUGATOR POTENTIATION			0.675	
NPU UNPREDICTABLE SELF-REPORTED ANXIETY				0.999
NPU PREDICTABLE SELF-REPORTED ANXIETY				0.431
SS loadings	1.889	1.657	1.466	1.228
Proportion Variance Explained	0.157	0.138	0.22	0.102
Cumulative Variance Explained	0.157	0.295	0.418	0.52

Alternative Factor Solutions

	Factor 5	Factor 4	Factor 1	Factor 2	Factor 3	Factor 2	Factor 1
DEPRESSION ANXIETY STRESS SCALE					0.94	0.643	
MPS-NEGATIVE EMOTIONALITY BROAD TRAIT SCALE			0.419			0.566	
INTOLERANCE OF UNCERTAINTY INDEX			1.005			0.746	
ANXIETY SENSITIVITY INDEX			0.38		0.419	0.744	
NPU UNPREDICTABLE STARTLE POTENTIATION	0.827						0.995
NPU PREDICTABLE STARTLE POTENTIATION	0.902						0.754
IAPS UNPLESANT STARTLE POTENTIATION						0.361	
IAPS UNPLESANT CORRUGATOR POTENTIATION							
NPU UNPREDICTABLE CORRUGATOR POTENTIATION		0.912					
NPU PREDICTABLE CORRUGATOR POTENTIATION		0.694					
NPU UNPREDICTABLE SELF-REPORTED ANXIETY				0.957			0.324
NPU PREDICTABLE SELF-REPORTED ANXIETY				0.462			
SS loadings	1.613	1.418	1.332	1.184	1.155	2.072	1.839
Proportion Variance Explained	0.134	0.118	0.111	0.099	0.096	0.173	0.153
Cumulative Variance Explained	0.134	0.253	0.364	0.462	0.558	0.173	0.326

While both parallel analysis and the classic "eigenvalues greater than 1 rule" for the PCA analysis suggested a 4 factor solution, a 2 factor (based on the FA scree plot) or a 5 factor (based one the 5th PCA eiganvalue being close to 1) could also be justified. The five factor solution was similar to the four factor, but with two self-report factors. The two factor solution generally parsed variables based on method variance (trait self-report vs physiology measures).

Discussion

Trait measures of negative affect all showed modest relationships, both with bivariate correlations and exploratory factor analysis. However, the relationships between self-reported trait negative affect and physiology measures were generally weak or absent. Several possible factor structures failed to find consistent relationships between trait self-report and physiology measures.

Psychophysiology tasks generally did not display strong or consistent relationships either between tasks within measure or between measures within task. Within the NPU task, the same measures were related across conditions (e.g., startle potentiation to predictable and unpredictable threat). However, across both tasks startle and corrugator showed no/weak relationships with each other. These observations highlight the importance of careful selection of task-measure pairing and deserve caution when considering different measures within a task to be tapping the same psychological constructs.

Sample size and measurement reliability remain important considerations in multi-measure/multi-method designs aiming to examine latent constructs. While the sample size of the current study is large relative to much experimental work, it is likely not sufficiently large enough to extract reliable relationships to latent constructs of negative affect if they do exist. Furthermore, the internal consistency of these measures ranged from very reliable to quite poor. Insufficient reliability of some psychophysiology measures within a particular task may lead to difficulty in identifying latent constructs.

Exploratory factor analysis further highlighted that the associations among the measures used in the current study seem to be dominated by method variance. This raises important concerns and questions about the utility of using these measures to index individual differences in constructs such as trait negative affect. At the very least, researchers should be careful when designing experiments as different task and measurement combinations may index different things.

For the current study, we focused on relationships among measures which putatively index trait negative affect broadly. However, future research may focus on associations between measures designed to index more specific emotions such as fear and anxiety.

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