Pain catastrophizing is related to temporal summation of pain, but not temporal summation of spinal nociceptive processes
Department of Psychology, The University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104

Introduction
Repeated exposure to brief, nociceptive stimuli at a brief inter-stimulus interval elicits enhanced pain on the last stimulus relative to the first stimulus—a phenomenon known as temporal summation. Temporal summation is believed to result from sensitization of spinal cord neurons (akin to wind-up in animals). However, most studies assess subjective ratings of pain as the outcome. By contrast, relatively few studies have assessed temporal summation of the nociceptive flexion reflex (NFR), a physiological correlate of spinal nociceptive processes. Pain catastrophizing is a maladaptive coping strategy associated with enhanced pain, and has been associated with higher pain ratings during NFR testing as well as enhanced temporal summation of pain. Importantly, pain catastrophizing is not associated with enhanced NFR, suggesting catastrophizing is not a mediator of temporal summation of pain. Therefore, it is unclear whether pain catastrophizing is associated with temporal summation of NFR. The present study investigated whether state (situation-specific) and trait (traditional) pain catastrophizing were associated with temporal summation of NFR and pain.

Participants
- Healthy Participants
  - Participant Characteristics: White, non-Hispanic (87%); female (63%); employed fewer than 40 hours per week (63%); yrs of education < 14 (50%); average age = 21 yrs (SD = 2.8)
- Exclusion Criteria:
  - <18 years of age
  - Current acute illness
  - Cardiovascular, neurological, circulatory and/or hearing problems
  - Chronic pain condition (e.g., back pain)
  - Recent use of analgesic medication
  - Current use of antidepressant, anxiolytic and/or antihypertensive medication
  - Recent psychological trauma
  - Body mass index (BMI) > 35

Experimental Procedure
- Informed Consent
- Pain Catastrophizing Scale (Trait) & CES-D depression scale administration
- NFR Threshold Testing
  - Electrocutaneous Pain Threshold Testing
  - Pain Catastrophizing Scale (Situation-Specific)
  - McGill Pain Questionnaire (short form)
- Phase 2 (electrical stimulations in a 5-pulse series at 2 Hz (0.5-s inter-stimulus interval))
  - Temporal Summation of Pain and NFR Testing
  - Pain Catastrophizing Scale (Situation-Specific), Pain-related anxiety given midway through testing
- Debriefing

Pain Catastrophizing Scale
- 13 item self-report measure for use in clinical and non-clinical samples; used for persons with and without pain
- Traditional (trait) PCS Instructions: “Please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.”
- Situation-Specific (state) PCS Instructions: “Thinking back to your experience during the electrical stimulations, please indicate the degree to which you had these thoughts and feelings.”

Results: Descriptive Statistics for Variables
- Pain Catastrophizing Scale: Trait (PCS) Instructions, State/Specific (SS) Instructions
- McGill Pain Questionnaire: Sensory, Affective, Pain or NFR responses to the first 3-pulses in the 5-pulse series (due to NFR asymptote after 3rd pulse)

Results: Predicting NFR threshold, pain threshold, and MPQ-SF ratings
- Results: Temporal Summation of Pain Ratings
- State catastrophizing was associated with enhanced TS of pain (p < .05)
  - Trait catastrophizing was not related to TS of pain (p > .05)

Results: Temporal Summation—Inter-individual Variance in Intercept & Slope
- Significant TS of pain and NFR was observed (p < .05)

Conclusions
- Results confirm prior studies suggesting catastrophizing may enhance pain via supraspinal processes rather than spinal processes.
- Caution is warranted when using pain ratings to infer temporal summation of spinal nociceptive processes, given that catastrophizing was associated with temporal summation of pain but not NFR.