

Burkhart J. Hahn, HSDG., Michael F. Payne, M.A., Natalie Hellman, M.A., Parker A. Kell, B.A., Jamie L. Rhudy, PhD.,
Department of Psychology, The University of Tulsa, 800 South Tucker Drive, Tulsa, OK 74104

Introduction

Temporal summation (TS) of heat pain is used to experimentally assess central sensitization (CS). Unfortunately, the methods used to study TS of heat pain are not standardized, therefore contributing to inter-lab variability, discrepancies in findings, and confusion in the literature. Further, some methods do not reliably elicit TS of heat pain.

Objective

To establish the best method to evoke TS of heat pain using a commercially available thermal stimulator.

Participants

30 healthy, pain-free men (n=9, age M=23.67, SD=7.67) and women (n=21, age M=20.62, SD=2.38) were recruited for this study.

Exclusion criteria:

- < 18 years of age, current acute illness, psychotic symptoms, chronic pain condition, inability to speak/read English, cardiovascular, neurological, and/or circulatory problems, or recent use of analgesic, antidepressant, anxiolytic, antihypertensive medications.

Procedure

Informed Consent and Eligibility Screening

- Participants provided informed consent after the procedures were explained.
- Participants completed a demographics and eligibility form.
- Participants completed a psychosis screen.

Testing

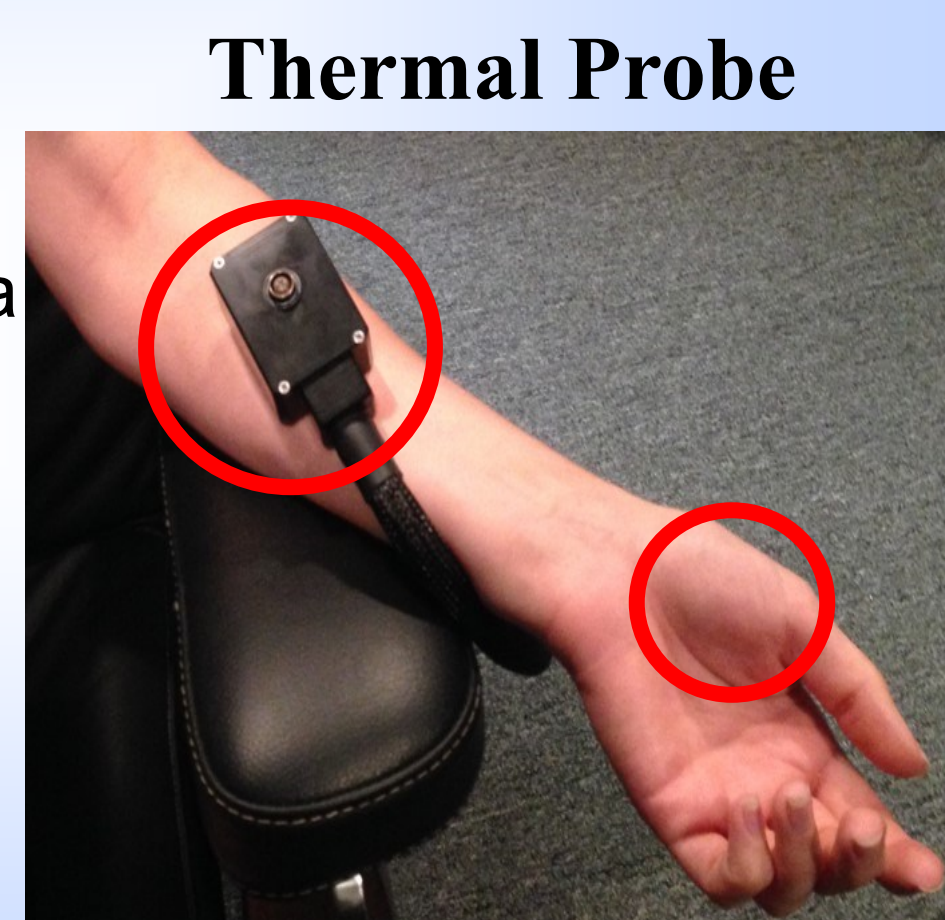
- Participants underwent 3 blocks of painful heat trains with 5 minute breaks in between blocks. Each block consisted of 24 trains, and each train consisted of 10 pulses.

Methods: Heat Pain Testing

Participants completed 3 blocks of 24 trains with 10 pulses each.

After each pulse, participants were asked to give pain ratings of “second pain” (measuring C-fiber activation) using a numerical rating scale from 0-100, 0 being “no pain” and 100 being “worst pain possible.”

Heat pulses were delivered to the volar forearm and the palmar hand.



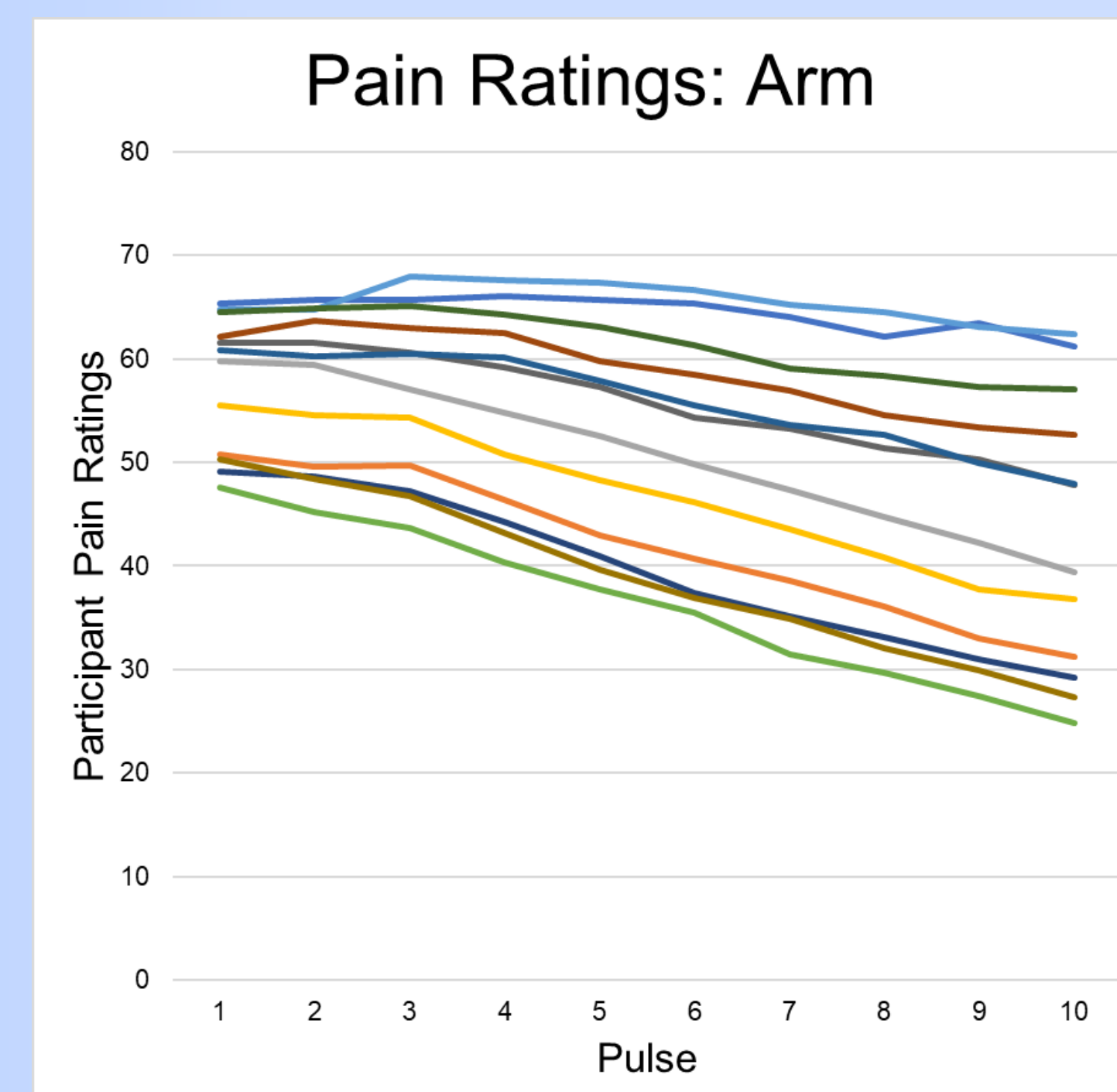
Methods: Heat Train Variables

Each train consisted of 5 variables in order to determine which combination of variables most consistently elicits TS.

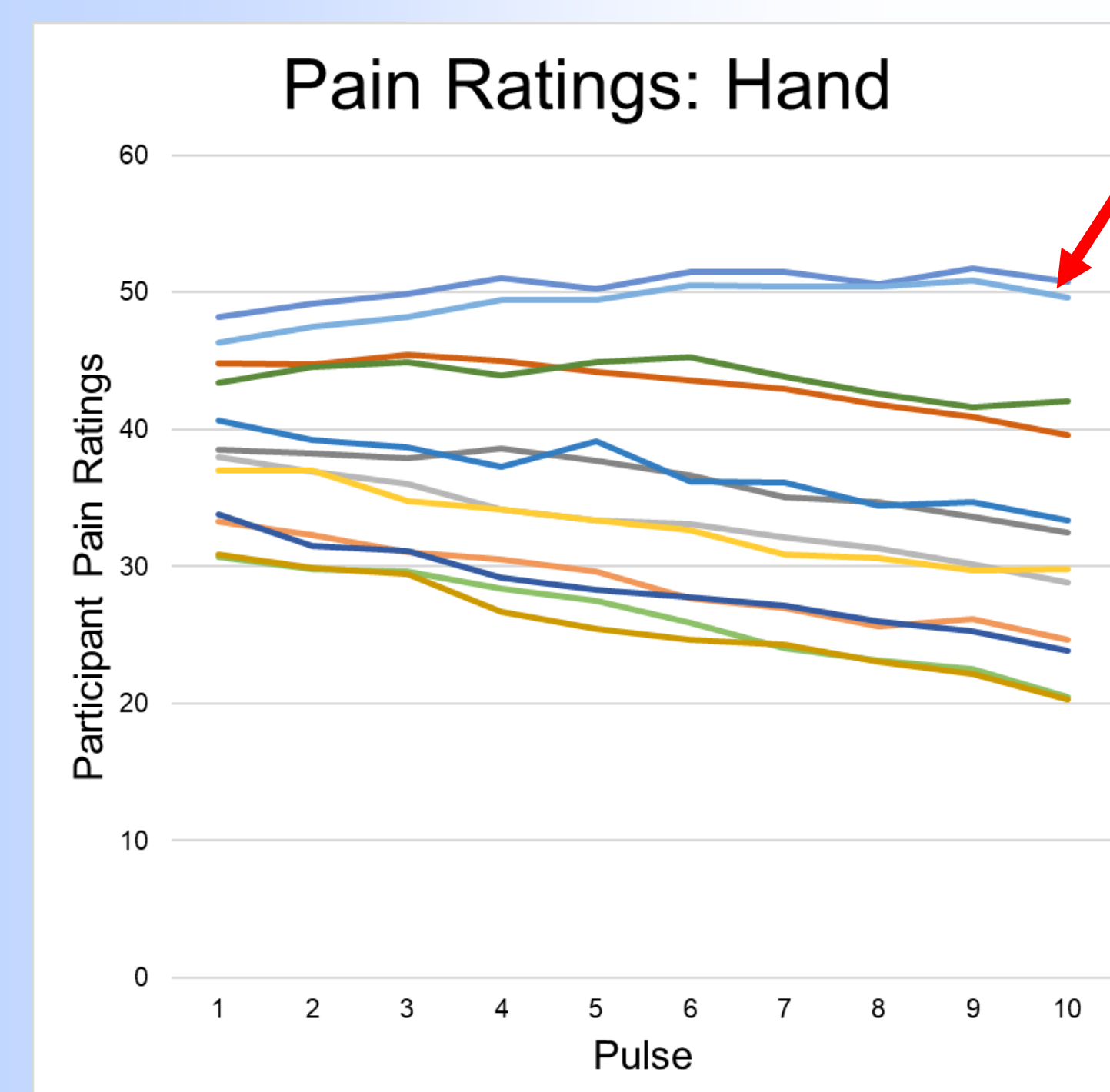
Variable	Values
Pulse baseline temperature	42, 43, 44°C
Pulse peak temperature	48, 49, 50°C
Pulse ramp speed	6 vs. 8 °C/s
Peak temperature duration	0.5, 0.25s
Site of stimulation	palmar hand vs. volar forearm

Results: Pain Ratings

These graphs show the average pain ratings across participants for each heat train. There is no TS in for heat trains on the arm. There are two instances of TS for heat trains on the hand.



This graph describes the average pain ratings for the pulses of each train placed on the arm. There is no temporal summation on any of these trains.

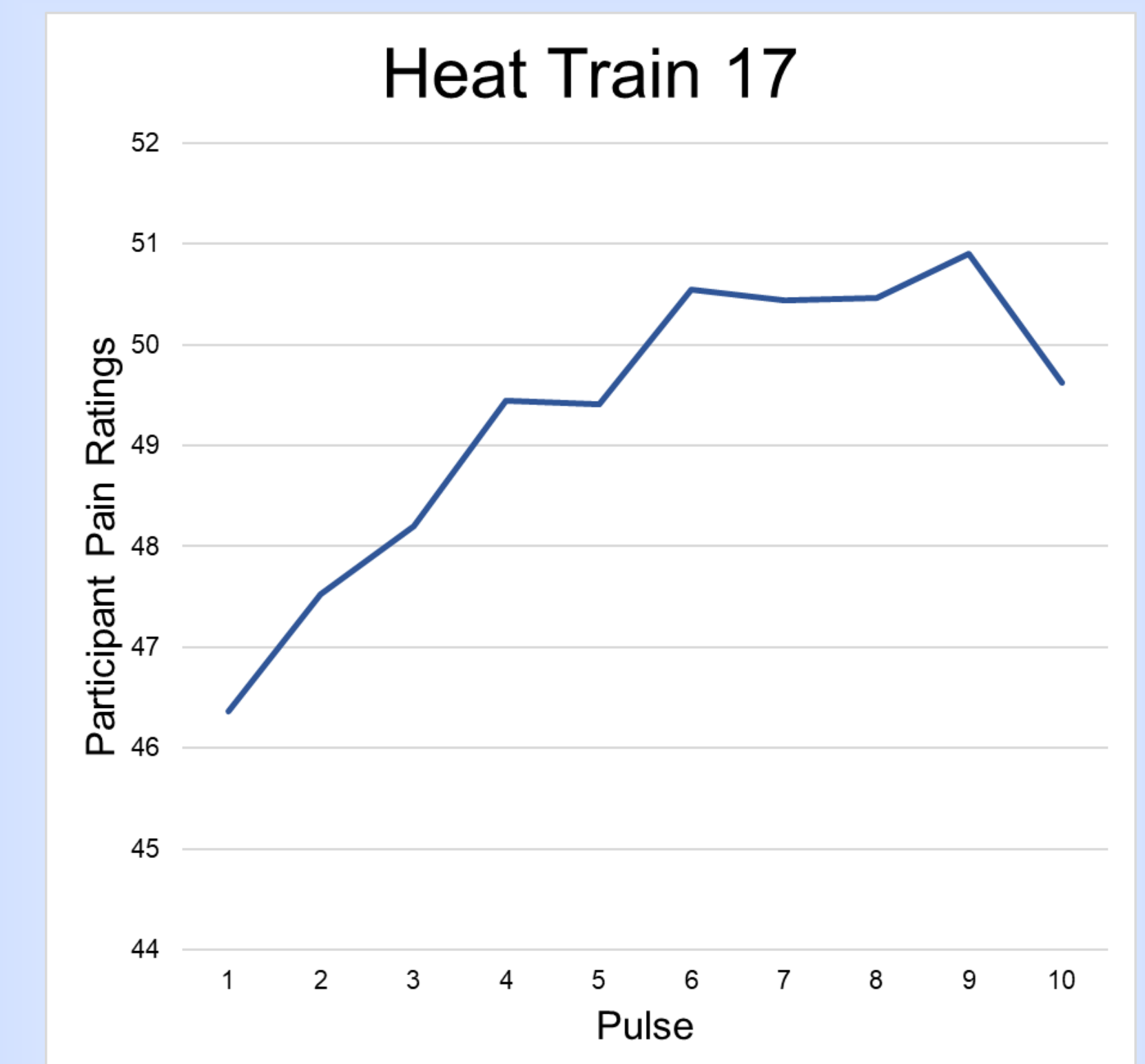


Train 13 (top) and Train 17 (bottom)

This graph describes the average pain ratings for the pulses of each train placed on the hand. There is temporal summation on two trains. These trains (Train 13 and Train 17) were analyzed to find significance.

Results: Heat Train 17

This graph shows the temporal summation averaged across all participants for Heat Train 17, which successfully elicited TS. Only Heat Train 17 significantly elicited TS. The table describes the variable values for this heat train.

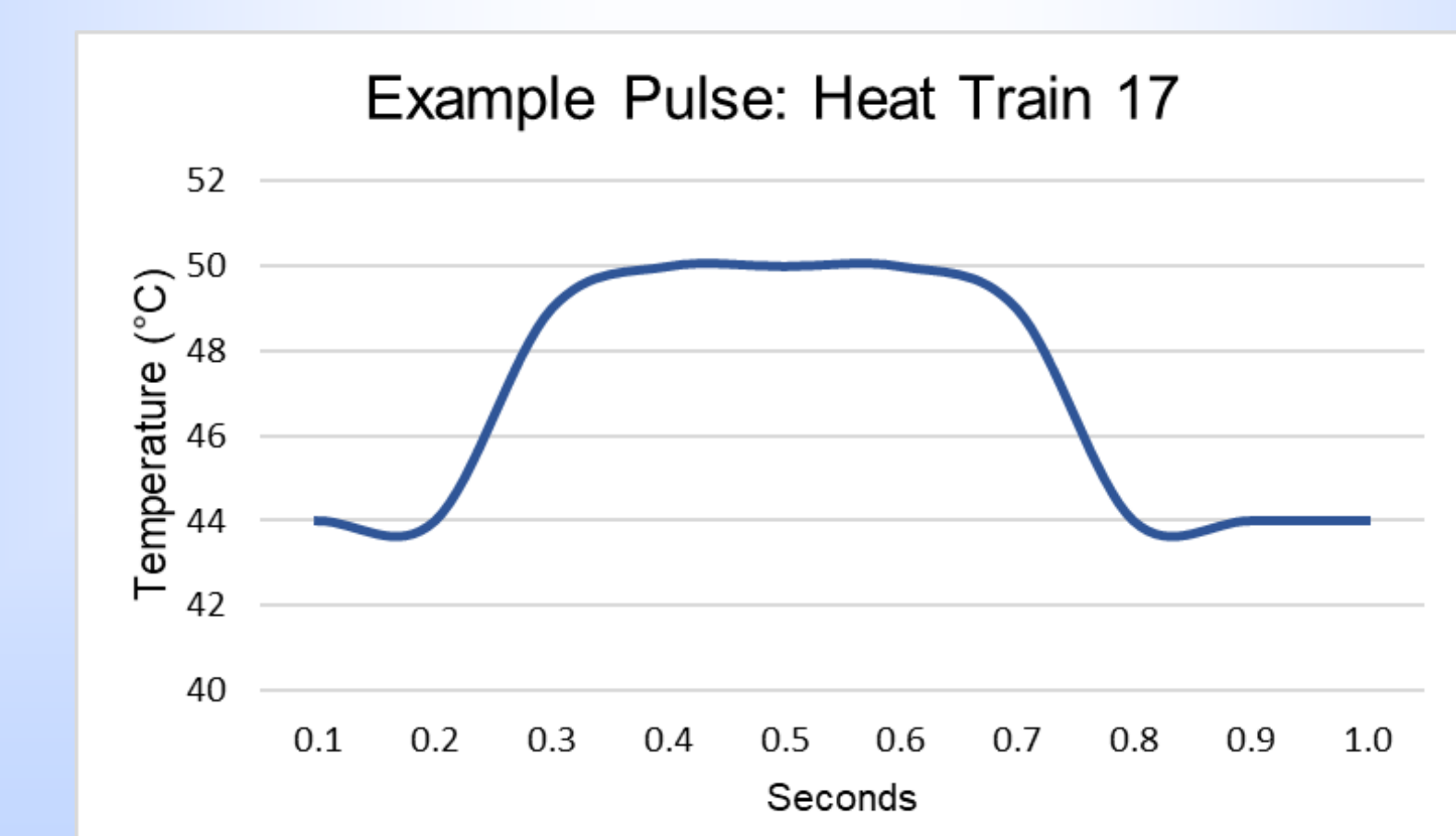


Variable	Values (Heat Train 17)
Pulse baseline temperature	44°C
Pulse peak temperature	50°C
Pulse ramp speed	8°C/s
Peak temperature duration	0.5s
Site of stimulation	Palmar hand

Conclusions

These results suggest that using heat pulse variables of 1) baseline temp of 44°C, 2) peak temp of 50°C, 3) ramped speed of 8°C/s, 4) peak temp duration of 0.5s, and 5) on the palmar surface of the hand should produce the best and most consistent TS of heat pain and therefore CS.

This provides an initial step forward to establishing a standard for assessing central sensitization from temporal summation of heat pain, reducing interlab variability, discrepancies in findings, and confusion in the literature.



Data Analysis

Heat pain ratings were averaged across all participants to show which heat trains successfully elicited at least some TS. Then, Train 13 and 17 (successful TS) were regressed through the origin to show which had a significantly positive slope, and therefore significant TS of heat pain.

Funding Source: No funding to report.