

LEARNING TO PREDICT PAIN THROUGH THE AUTONOMIC AND MOTOR SYSTEMS

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BACKGROUND

When we learn that environmental cues predict pain, our body prepares in advance. Pain anticipation is typically studied in the *autonomic system*, which controls involuntary responses^{1,2}. However, much less is known about the *motor system*. Recent findings show that, similarly to what occurs after receiving pain, corticospinal excitability (CSE) is also suppressed immediately before its timing³.

RESEARCH GOALS

Investigate how autonomic and motor systems modulate depending on the **timing** and **aversiveness** of predicted shock

Explore how motor system's responses dynamically evolve across **Pavlovian learning phases**: acquisition, extinction, and return of fear

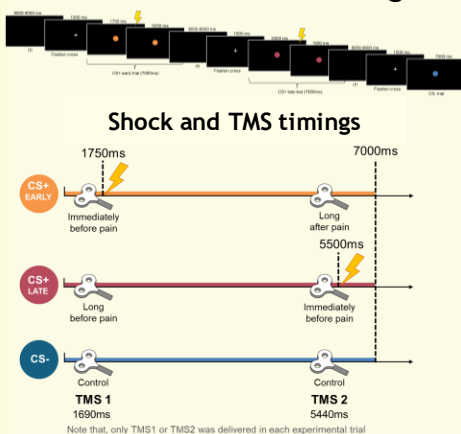
OUTCOMES

Autonomic and motor systems both anticipate pain, but they respond differently depending on specific features of the predicted pain. This highlights the complexity of how the body prepares for aversive events. Understanding these mechanisms may offer insights into altered pain anticipation in clinical populations, such as individuals with anxiety or chronic pain disorders.

EXPERIMENTAL APPROACH

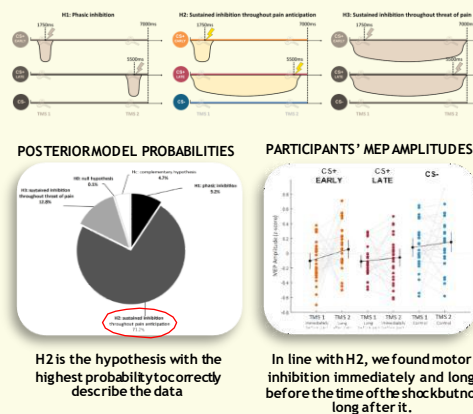
PAINFUL SHOCK TIMING

Pavlovian threat conditioning task

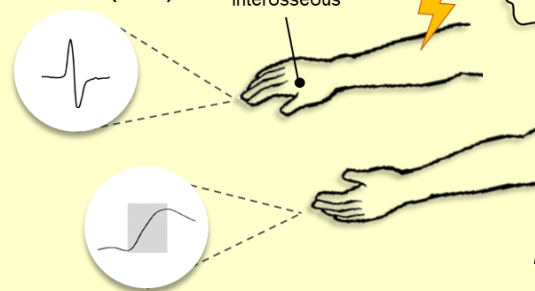


Results

We tested three corticospinal excitability reduction *a-priori* hypotheses through Bayesian Informative Hypothesis analysis



MOTOR EVOKED POTENTIAL (MEP)



SKIN CONDUCTANCE RESPONSE (SCR)

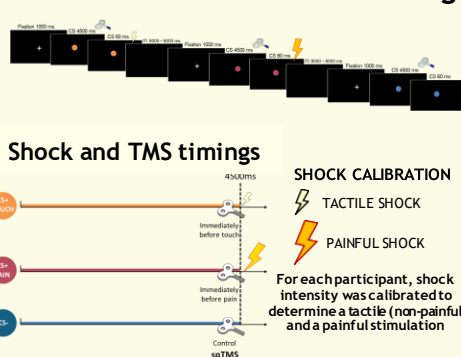
Single pulse **TRANSCRANIAL MAGNETIC STIMULATION** (spTMS) over the left primary motor cortex

DEPENDENT VARIABLES
SCR: measure of autonomic arousal
MEP: corticospinal excitability measure as a readout of motor system activity

The cortical motor system encodes the time of pain, modulating CSE, by showing sustained motor inhibition throughout pain anticipation.

SHOCK AVERSIVENESS

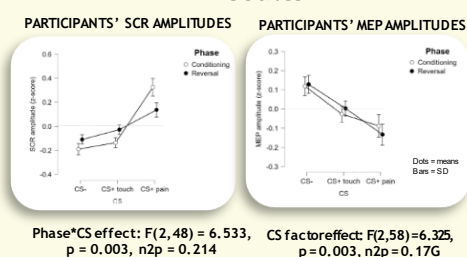
Pavlovian threat conditioning task



CONDITIONING PHASE CS+ TOUCH, CS+ PAIN, CS-
REVERSAL PHASE CS+ TOUCH, CS+ PAIN, CS-

To test the flexibility of autonomic and motor responses, we included a reversal phase in the contingencies between CS+ and shock were switched

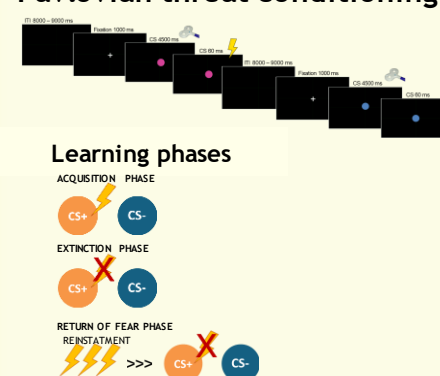
Results



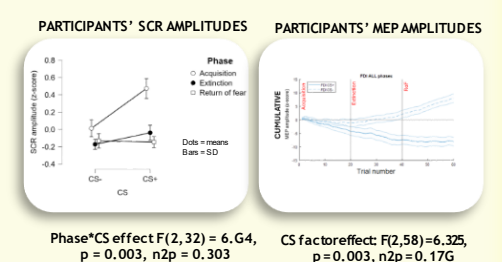
While the autonomic system, modulating SCR, takes into account the aversiveness of the predicted shock, the cortical motor system, modulating CSE, responds depending on the intensity of that shock

PAVLOVIAN LEARNING PHASES

Pavlovian threat conditioning task



Preliminary results



While the autonomic system, modulating SCR, is sensitive to extinction and return of fear, the cortical motor system, measured through CSE, seems not to be able to extinguish the previous learning.