

## INTRODUCTION

• Brain regions related to autonomic control have been shown to overlap with many regions related to emotional processing (Critchley, 2000) and chronic pain (Geha, 2008).

• Autonomic signaling has been proposed as a non-subjective and quantifiable method to study emotional processing (James 1894). Analysis of these signals may allow us to differentiate between pain conditions.

• Autonomic signals (heart rate and respiratory rate) were collected from 1) a chronic back pain group that has suffered back pain for an average of at least 5 years, 2) a subacute back pain group with symptoms lasting 3 months or less, and 3) a healthy control group performing 2 different tasks while functional magnetic resonance imaging BOLD activity was recorded.

• We show differences in brain regions related to autonomic control as well as patterns of autonomic activity depending on pain condition.

## METHODS

• Autonomic signals from all subjects were recorded with ADInstruments 4/30 Powerlab recording system and LabChart software while subjects performed tasks (panel 1).

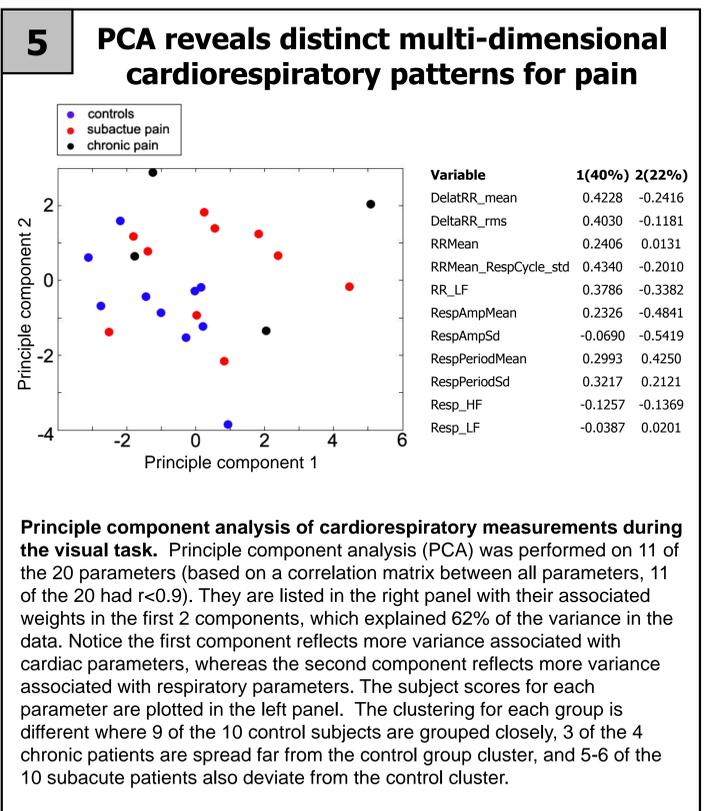
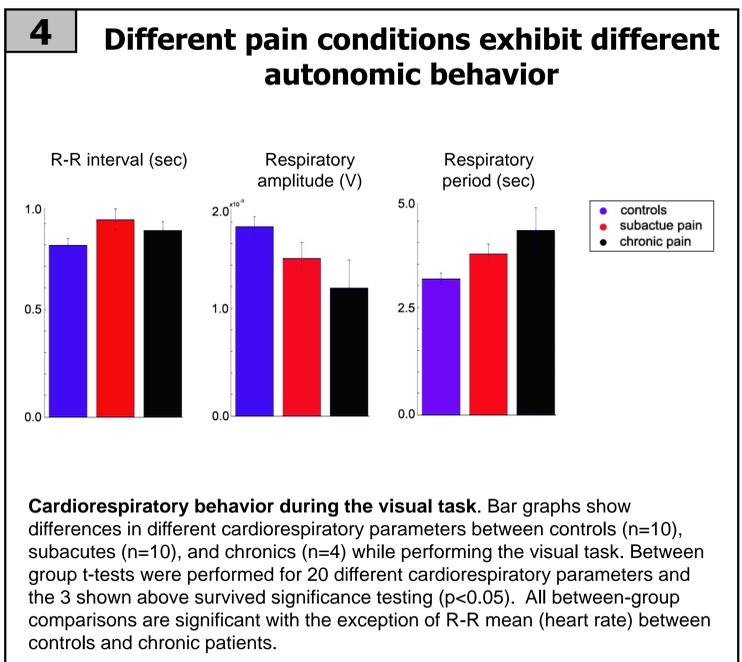
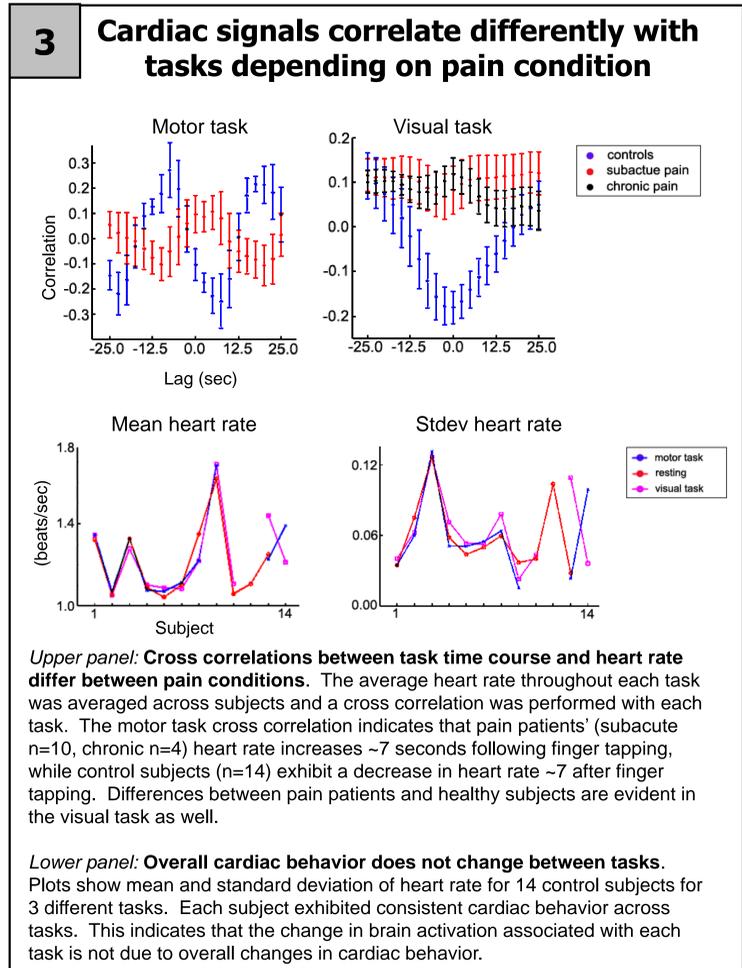
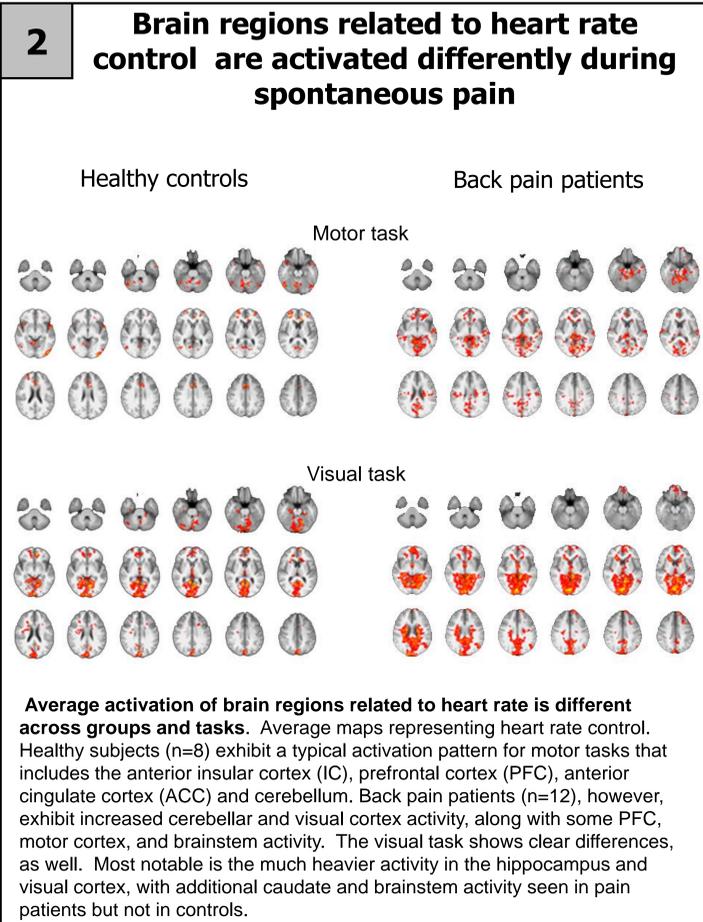
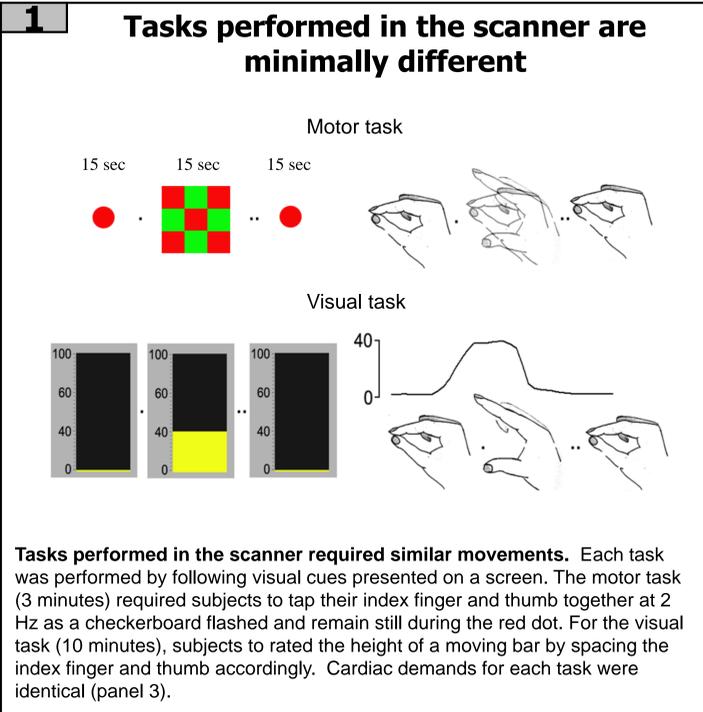
• Functional images were obtained with a 3T scanner (Siemens, Germany) using spin-echo echo-planar imaging.

• Brain regions related to heart rate control were determined using FEAT (FSL software; FMRIB; Smith et al., 2001) and were compared between groups (panel 2).

• Temporal relationships between heart rate and task performance were compared between groups by cross-correlation (panel 3).

• Cardiorespiratory measures across groups were compared by t-test (panel 4).

• Principle component analysis was used to uncover multi-dimensional cardiorespiratory differences between groups (panel 5).



## CONCLUSION

• Individuals who experience spontaneous pain for an extended period exhibit supraspinal control of heart rate that is different from pain-free subjects.

• The temporal relation between task and autonomic signals, and multi-dimensional cardiorespiratory parameters were not the same between controls and pain patients, where pain patients tend to exhibit more variable cardiorespiratory measures.

• Even though the tasks performed were minimally different and required identical cardiorespiratory demands, brain activation associated with heart rate control during each task showed different patterns.

• Taken together, these results indicate that autonomic control and function is altered in pain patients. Additionally, control of heart rate may depend on cognitive task demands. The study of autonomic signals in pain patients may provide a deeper understanding to the underlying sources of their pain.