Resting Cardiac Vagal Activity Predicts Heart Rate Change during Compassion for Physical Pain
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INTRODUCTION
Resting cardiac vagal activity has been proposed as a physiological index for individual differences in emotion regulation capacity between people1. For example, resting cardiac vagal activity is positively correlated with trait measures like positive emotionality and with ability to cope with daily stressors2. At the same time, the relationship between resting cardiac vagal activity and phasic emotion function is mixed. High resting cardiac vagal activity has been linked to fewer spontaneous negative facial expressions3, but also to higher levels of expressed negative emotion during a conversation4. Positive correlation between resting cardiac vagal activity and self-reported emotion experience has been found in some experiments5, but not others6. Given that emotional behavior is a manifestation of complex interactions among neurological and physiological systems, these mixed results point to a need to understand the underlying neurological and physiological processes.

Here we used a time-varying heart rate variability algorithm7 to track the dynamic changes in cardiac vagal activity during an emotion induction and regulation task, and probed their relationship to patterns of heart rate change. Based on the shape of subjects’ averaged heart rate change pattern, a clustering algorithm produced 5 groups, which corresponded by experimenter analysis to 3 qualitatively different relationships between cardiac vagal activity and heart rate change.

METHOD
30 subjects (14 males and 16 females) viewed a series of movie clips involving physical injury, to which they expressed compassion for the protagonist’s physical pain. Only trials that subjects reported upsetting or arousing were included in the final analysis. ECG was recorded continuously during the task.

Correlation

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Heart Rate Response</th>
<th>Dynamic Vagal Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13, 6 males, 7 females</td>
<td>vagal mediated HR increase</td>
<td>resting cardiac vagal activity (% of total power)</td>
</tr>
<tr>
<td>2</td>
<td>6, 4 males, 2 females</td>
<td>vagal mediated HR decrease</td>
<td>resting cardiac vagal activity (% of total power)</td>
</tr>
<tr>
<td>3</td>
<td>11, 4 males, 7 females</td>
<td>sympathetic mediated HR increase</td>
<td>resting cardiac vagal activity (% of total power)</td>
</tr>
</tbody>
</table>

SUMMARY

:: Subjects’ heart rate response patterns fell into 3 distinct groups.
:: Heart rate response in Groups 1 and 2 appeared to be vagal mediated, as the amount of heart rate change correlated positively with resting cardiac vagal activity.
:: Heart rate increase in Group 3 was negatively correlated with vagal activity, and likely reflects a sympathetic contribution counteracted by vagal activity.

REFERENCES