Cardiac Control of Fear in Brain (CCFIB): The effect of bodily arousal on anxiety across different mental health diagnoses

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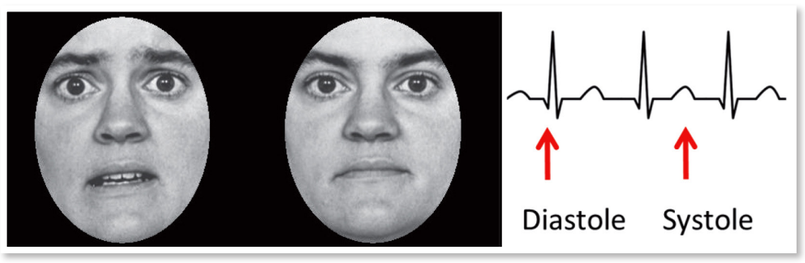
Background

Bodily arousal is closely related to experiences of emotion, with theories suggesting that individuals feel emotions following changes in bodily states (James, 1884; Schachter & Singer, 1962). For instance, individuals feel anxious following changes in the body that are associated with anxiety (such as a racing heart, sweating).

Bodily arousal is also influenced by the natural fluctuations of the heart. Previous research found a heart timing effect (named 'CCFIB'), in which participants rated fear faces as more intense when the heart had just made a beat, compared to when the heart was at rest (Garfinkel et al., 2014).

The current study explored how changes in bodily arousal (through the natural fluctuations of the heart) affects anxiety across individuals with a range of mental health diagnoses, and explores whether feelings that come from the body (heartbeats) influence mood.

Method



Participants:

306 participants (42% male; mean age: 39.6 years (SD: 13.67)) with mental health diagnoses were recruited from primary and secondary care in East and West Sussex, or were self-referred to the study. Primary diagnoses included: major depression, bipolar disorder, mixed anxiety and depressive disorder, anxiety disorder, psychosis, and personality disorder.

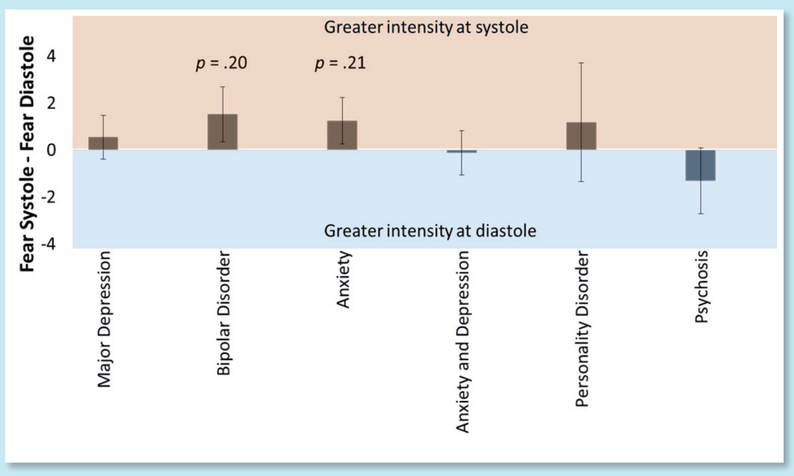
Procedure:

Participants wore a heartrate monitor (pulse oximeter) and were shown fearful and neutral facial expressions on a computer screen. The faces were displayed either on the heartbeat ('systole') or when the heart was at rest ('diastole'). Participants then rated the intensity of the facial expressions using a scale with 'zero' at one end and 'extreme' at the other. Participants also completed questionnaires about symptoms of depression, anxiety, mood, sleep, and quality of life.

Results

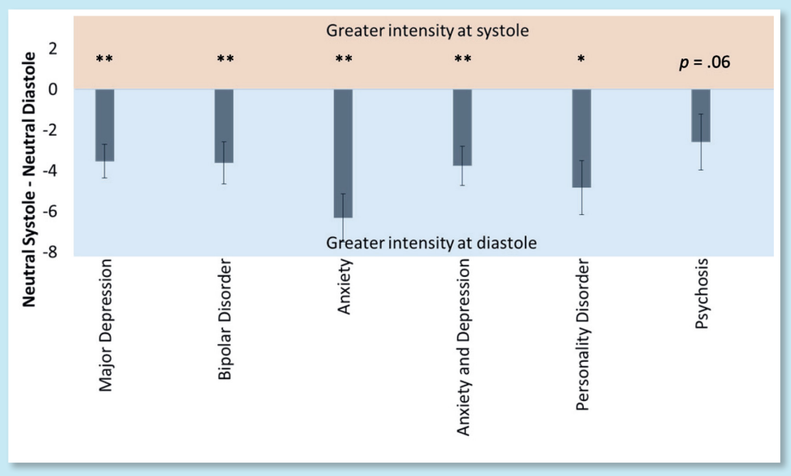
Fear faces were generally rated as more intense when displayed on the heartbeat (systole) compared to when the heart was at rest (diastole), although this effect was not significant [$t(304) = 0.76$, $p=0.45$, $d=0.03$]. The effect was strongest (but still non-significant) for participants with bipolar disorder [$t(53) = 1.31$, $p=0.20$, $d=0.11$] and anxiety disorder [$t(45)=1.26$, $p=0.21$, $d=0.12$].
This effect was also stronger with increased symptoms of trait anxiety for participants with all mental health diagnoses [$R^2=0.02$, $\beta=0.14$, $p=0.02$] and, in particular, for participants with bipolar disorder [$R^2=0.11$, $\beta=0.33$, $p=0.02$]

Figure 2: Non-significant trend for fear faces to be rated as more intense at systole compared to diastole



Neutral faces were rated as more intense when the heart was at rest (diastole) compared to when the heart made a beat (systole) [$t(304)= -9.73$, $p< .001$, $d=-0.30$], with a strong effect found for each of the diagnoses [anxiety: $d=-0.61$; depression: $d=-0.24$; mixed anxiety and depression: $d=-0.25$; bipolar: $d=-0.28$; personality disorder: $d=-0.38$, psychosis: $d=-0.17$] This effect appeared to diminish with age across participants with all mental health diagnoses [$R^2=0.10$, $\beta=0.31$, $p< .001$] and, in particular, for participants with bipolar disorder [$R^2=0.11$, $\beta=0.33$, $p=0.02$], major depression [$R^2=0.08$, $\beta=0.28$, $p=0.017$], and mixed anxiety and depressive disorder [$R^2=0.11$, $\beta=0.33$, $p=0.03$].

Figure 3: Significant trend for neutral faces to be rated as more intense at diastole compared to systole



Overall, the effect of changes in bodily arousal was different depending on the type of emotion rated: In this clinical sample, neutral faces were rated as more intense when the heart was at rest, whereas there was a non-significant trend for fear faces to be rated as more intense when the heart made a beat.

Discussion

Changes in bodily arousal from when the heart makes a beat (at systole) may enhance how individuals with mental health diagnoses process emotional stimuli, such that **fear stimuli are experienced as more intense and neutral stimuli are experienced as less intense** when the heart makes a beat, compared to when the heart is at rest (at diastole).

The mind and body are dynamically linked. This research shows how signals from the heart can alter the way in which emotions are processed, and demonstrates that different patterns of emotion facilitation as a function of heart signals are observed in clinical populations (such as those with anxiety) compared to non-clinical populations (e.g. Garfinkel et al., 2014). Understanding these interactions between body, mind and emotion can help provide insights for future psychological and pharmacological treatments for individuals with different mental health diagnoses.

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