

Empathy Traits are Associated with a Change in Arousal Levels in Response to Positive and Negative Emotions of Others

Anna Kate Luddy, Rachel Scheub, Sierra Little-Gil & Molly Helt PhD

Social Learning and Development Laboratory: Trinity College, Hartford, CT 06106

Introduction

Contagion

In addition to contagious yawning and laughter, *itching* by contagion represents one of only a few motor programs that can be involuntarily induced by external (seeing or hearing it) or internal (thinking about it) stimuli (Provine, 2012). Between 43-82% of people experience contagious itch when exposed to stimuli of others scratching, establishing that contagious itch occurs as commonly as contagious yawning and laughter (Papoiu, Wang, Coghill, Chan, & Yosipovitch, 2011). Contagious itch, like contagious yawning (Anderson, Myowa-Yamakoshi, & Matsuzawa, 2004) and laughter (Davila-Ross, Allcock, Thomas, & Bard, 2011), has even been demonstrated in non-human primates (Feneran et al., 2013), pointing to its evolutionary history in social species. Evidence from both behavioral studies (Papoiu et al., 2011; Ward, Burckhardt, & Holle, 2013) and neuroimaging (Holle et al., 2012) of typical adults suggest that contagious itching is, like laughter (Scott, Lavan, Chen, & McGettigan, 2014) and yawning (Deputte, 1994), associated with an inner state.

Empathy and Contagion

Both seeing (Provine, 1986) and hearing a yawn (Arnott, Singhal, & Goodale, 2009) elicit yawning in others between 45-92% of the time. Laughter appears to be even more contagious: hearing a laugh produces laughter in approximately half of listeners and smiles in approximately 90% of listeners, even in the absence of humorous context (Provine, 1992). Susceptibility to both contagious yawn and contagious laugh is positively correlated with self-reported levels of global empathy (Chartrand & Bargh, 1999; Sonnby-Borgström, 2002). Contagious yawning (like most measures of empathy), is greatest in response to kin, then friends, then acquaintances, and lastly strangers (Norscia & Palagi, 2011). Individuals with, or at-risk for, clinical disorders affecting empathy often show reduced susceptibility to contagious yawning (Haker & Rössler, 2009) and contagious laughter (O’Nions et al., 2017). Research into contagious itch is in its infancy and it is not yet clear whether it has a relationship to empathy.

Empathy and Arousal

Skin conductance provides evidence for implicit cognitive processes that can occur without conscious knowledge (van Rijn, Barendse, van Goozen & Swaab, 2014). Watching videos of yawning and responding via a contagious yawn has been shown to produce a skin conductance response (Corey, Shoup-Knox, Gordis, & Gallup, 2012) and will provide quantitative results that demonstrate the strength of the participant’s emotional response. Neurotypical individuals typically experience increased arousal in response to seeing affective faces (van Rijn, Barendse, van Goozen & Swaab, 2014). Whether this differs in response to positive and negative stimuli and whether this arousal relates to contagion are yet unknown.

Methods

Participants were students at Trinity College aged 18-23

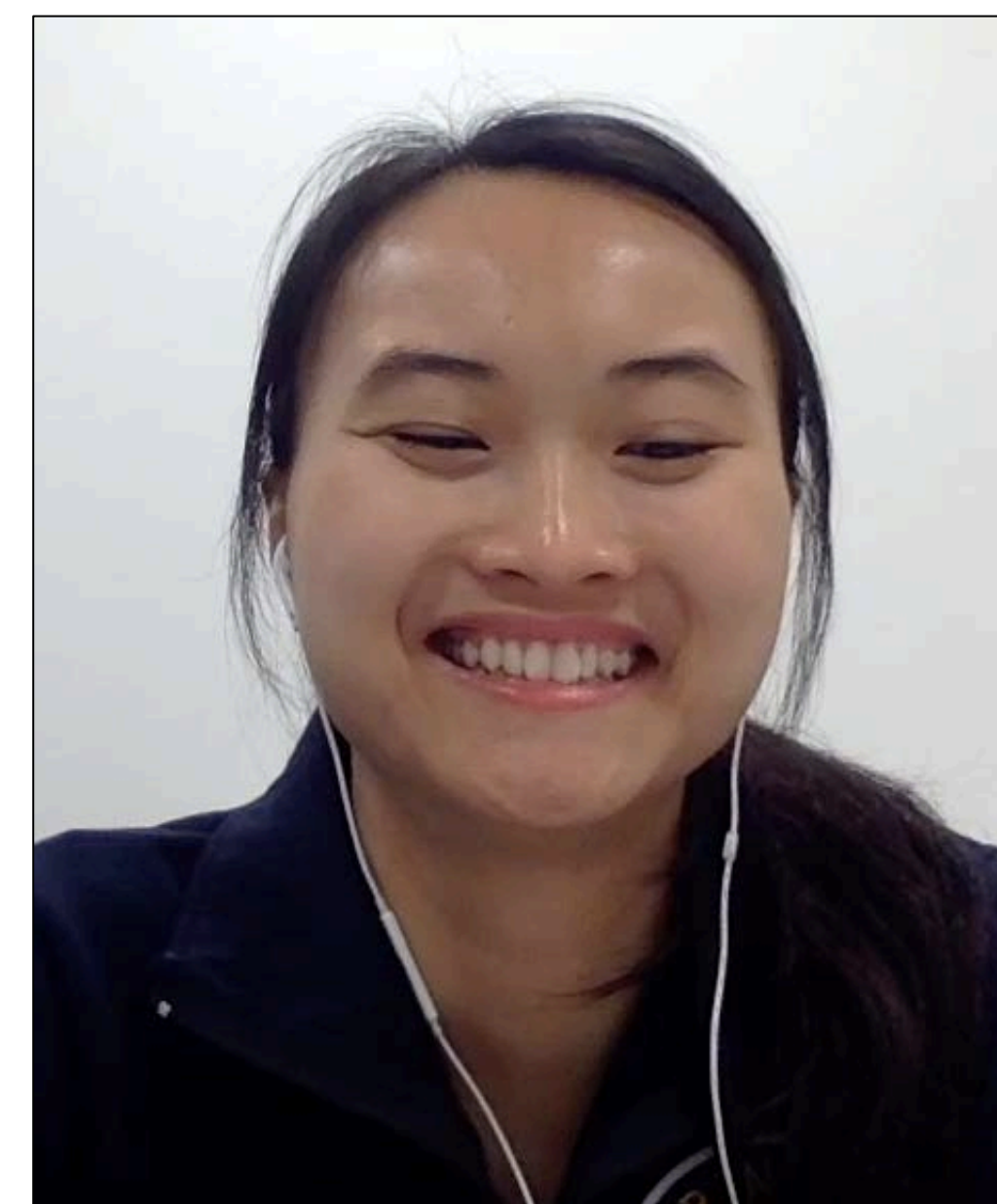
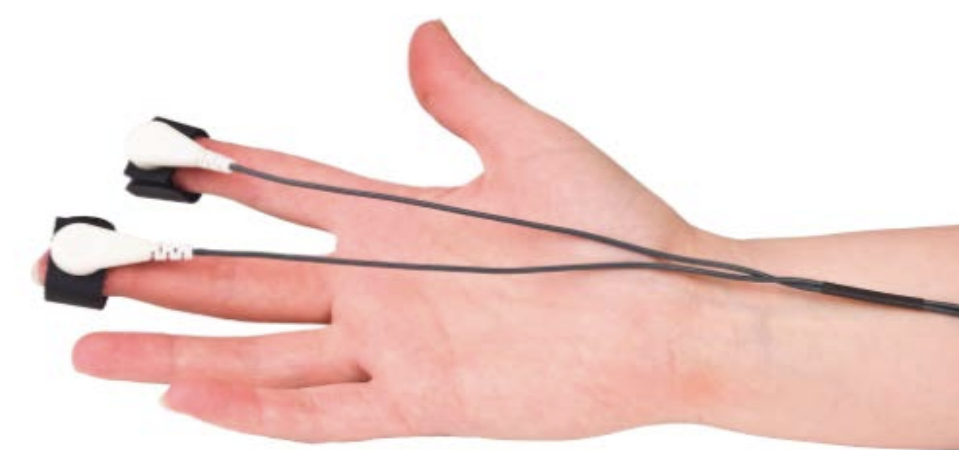
(41% male, 59% female), n = 73

Measures of Arousal: *Neulog* Skin Conduction Reactivity (SCR) system:

Participants were connected to a *Neulog* skin conductance to measure neural activity while being shown video stimuli with college-aged men and women yawning, scratching, laughing, and demonstrating fear.

Video Stimuli

❖ Participants were recorded while viewing stimuli videos in order to determine whether or not they yawned and/or itched contagiously in response to stimuli videos and were then given measures of empathy and clinical traits.



Measures

- ❖ *The Autism Spectrum Quotient*
- ❖ *The Psychopathic Personality Inventory-Revised*
- ❖ *Adult/Adolescent Interpersonal Reactivity Index*
- ❖ *Self-report on desire to yawn and itch*

Statistical Analyses

Median splits were performed to create a high IRI (empathy) group and a low IRI (empathy group), for the PPI scores to create a high PPI-2 (psychopathy trait) and low (psychopathy trait group), and for the AQ to create groups high and low in ASD traits.

Hypotheses

	Yawn	Laugh	Itch	Fear
	“Positive”		“Negative”	
ASD	Less Arousal		More Arousal	
Psychopathy	Less Arousal			
High Empathy	More Arousal			

Results

	Yawn	Laugh	Itch	Fear
	“Positive”		“Negative”	
ASD	Less Arousal		More Arousal	
Psychopathy	Less Arousal			
High Empathy	More Arousal			

Results

A correlation matrix revealed that AQ scores has no significant relationship to any other variable in the study. However, the average AQ score in our sample was 15 whereas the typical clinical cutoff is 35. Only one participant in our sample scored in clinical range and only one other participant even scored within 10 points of that cutoff. Thus, there was not enough variation to capture how ASD traits may be related to these phenomena. The participant sample included normal distributions on the Interpersonal Reactivity Index and the Psychopathy Personality Inventory. The results paint an interesting picture of how empathy may relate to various forms of contagion.

The IRI was positively correlated to both yawn contagion, $r=0.228$, $p=0.045$, and laugh contagion, $r=0.221$, $p = 0.055$ as well as itch contagion, $r=0.291$, $p = 0.039$.

In terms of arousal level, the IRI was positively correlated with change in arousal to yawn, $r=0.297$, $p<0.001$, and inversely correlated with change in arousal to itch, $r = -0.238$, $p = .06$. Psychopathy traits were inversely correlated with IRI scores and PPI-2 scores largely followed the inverse pattern as IRI scores. PPI-2 scores were inversely correlated to yawn ($r = 0.212$, $p=0.05$) and laugh ($r= 0.302$, $p = 0.025$) contagion, as well as change in arousal to yawn ($r= , p<0.01$) and laugh ($r= , p<0.01$) stimuli. PPI-2 scores were inversely correlated with itch contagion ($r=0.199$, $p=0.035$) and change in arousal to itch ($r =0.239$, $p =0.052$). Thus, arousal to itch stimuli actually followed a U-Shaped function in which those with very high levels and very low levels of empathy were less susceptible to arousal during contagious itch.

Discussion

We speculate that empathetic individuals readily take on the positive (in this case, laughter) and neutral (in this case, yawning) inner states of others, and that this contagion is accompanied by changes in skin conductance. However, when viewing negative inner states of others, empathetic individuals may use top down cognitive strategies to calm their own contagious arousal – perhaps allowing them to mobilize and prepare a response. We speculate that individuals with high levels of psychopathy, and thus low levels of empathy, experience low levels of arousal to the inner states of others whether they are positively or negatively valenced.

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