Increasing Experience Sharing Through Regulation Instructions

by

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A thesis submitted to the
School of Graduate and Postdoctoral Studies in partial
fulfillment of the requirements for the degree of

Master of Science in Forensic Psychology

The Faculty of Social Sciences and Humanities

University of Ontario Institute of Technology (Ontario Tech University)

Oshawa, Ontario, Canada

December 2020

THESIS EXAMINATION INFORMATION

Submitted by: **Femi Carrington**

Master of Science in **Forensic Psychology**

Thesis title: Increasing Experience Sharing Through Regulation Instructions

An oral defense of this thesis took place on December 2, 2020 in front of the following examining committee:

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Chair of Examining Committee	Dr. Leigh Harkins
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The above committee determined that the thesis is acceptable in form and content and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate during an oral examination. A signed copy of the Certificate of Approval is available from the School of Graduate and Postdoctoral Studies.

Abstract

Experience sharing is an individual's tendency to resonate with and take on the sensory, motor, and affective experiences of others. While traditional conceptualizations of this process argue its automaticity, recent literature suggests it may have a motivational component. This study aimed to investigate whether individuals can be motivated to increase experience sharing through deliberate instructions. This study also investigated the role of individual differences such as psychopathic traits in this upregulation process. To this end, healthy undergraduates completed two experience sharing-related tasks while having subjective and physiological metrics of experience sharing collected. The results of the study suggest that experience sharing can be increased through deliberate instructions, depending on the valence of the stimulus presented. Moreover, psychopathic traits were associated with greater physiological experience sharing.

Keywords: empathy; experience sharing; psychopathy; facial electromyography

Author's Declaration

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Femi Carrington

Statement of Contributions

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication. I have used standard referencing practices to acknowledge ideas, research techniques, or other materials that belong to others. Furthermore, I hereby certify that I am the sole source of the creative works and/or inventive knowledge described in this thesis.

Acknowledgements

There are several people who I would like to thank for their help along the way: first and foremost, to my supervisor Dr. Matthew Shane, for his insightful advice, kindness, and encouragement. I am grateful to have had the opportunity to work with Dr. Shane on this project. To the CandiLab: William Denomme, Lindsay Groat, and Isabelle Simard for their support along the way and for fostering a sense of community over the last two years. Last, but certainly not least, to my mom, Maggie and sister, Ziyada, for their unwavering support over the last two years – I could not have done this without them.

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Introduction

Empathy is a collection of processes facilitating social interactions that enable an ‘observer’ to identify, experience, and respond to the emotions of a ‘target’ (Zaki, 2020). While there are varying definitions of empathy (Batson, 2009; Cuff, Brown, Taylor, & Howat, 2014), most contemporary definitions converge on the idea that cognitive and affective components combine to comprise the construct. Cognitive empathy is the ability to understand the thoughts and feelings of a target (e.g., perspective-taking; Cuff et al., 2014), while affective empathy is the capacity to respond with an appropriate emotion to an emotional stimulus (Batson, 2009; Shamay-Tsoory, Aharon-Peretz, & Perry, 2009). Affective empathy can be further parsed into empathic concern and experience sharing. Empathic concern is the other-oriented concern for others who experience distress or pain (Davis, 1983), while experience sharing is an observer’s tendency to resonate with and take on the sensory, motor, and affective experiences of targets (Cameron, Cunningham, Saunders, & Inzlicht, 2017; Zaki, 2014; Zaki & Ochsner, 2012). While historical notions of experience sharing theorize it as an automatic process, recent literature suggests that it is capable of being regulated. In the following thesis, I will be focusing on whether individuals can be motivated to increase their experience sharing responses through deliberate regulation instructions, and what role individual differences such as psychopathic traits play in this process.

Theoretical Perspectives of Experience Sharing

Experience Sharing as an Automatic Process

Automaticity has been a central theme in many accounts of empathy, that are directly relevant to experience sharing (Hatfield et al., 1993; Hatfield et al., 2014; Zaki, 2014). For instance, Preston & de Waal (2002) developed the perception-action model of empathy (PAM), within which perceiving a target's emotional state is believed to automatically activate autonomic and somatic responses associated with that emotion (Preston & de Waal, 2002). The model maintains that empathic responding stems from automatic neural representations in the observer, which are similar to those in the target – i.e. self-other overlap (Preston & de Waal, 2002; de Waal, 2008). Work in this area has investigated mirror neurons which are neurons that appear to fire when one engages in an action or emotion, and also when one watches another engage in said action or emotion (Rizzolatti, 2004). Mirror neurons serve as evidence that perceiving an emotion in another person activates one's internal representations of the emotion, and this self-other overlap triggers emotion networks of the brain to produce a similar response (Preston & de Waal, 2002; Shamay-Tsoory, 2011). It has been theorized that when these mirror neurons fire, they also lead to vicarious physiological processes occurring – providing them with a similar sense of the emotion to that of the target (Watson & Greenberg, 2009). This has direct implications for emotion sharing as well as empathy more generally because the IFG is directly linked to affective empathy, including experience sharing (Shamay-Tsoory et al., 2009). Shamay-Tsoory and colleagues (2009) found that patients with lesions to their IFG cortices had significant impairment in emotional empathy relative to those with ventromedial prefrontal lesions. Moreover, cortical mapping indicated that lesions to Brodmann area 44 (IFG), a central component to the mirror neuron system (Rizzolatti, 2005), was critical for emotional empathy. This mirror neuron system has been an appropriate mechanism for proponents of automaticity perspectives of empathy (de Waal & Preston, 2017; Shamay-Tsoory, 2011). However, research on the mirror neuron system is not always consistent regarding its automaticity. There is evidence to suggest that this self-other overlap characterized by neural activity of key regions of the mirror neuron system (e.g., inferior frontal gyrus [IFG], anterior cingulate cortex [ACC]) may have a motivational component. For instance, Cheng, Meltzoff, and Decety (2007) found that motivating participants through hunger led to greater activity of the mirror neuron system, including the IFG, when viewing food-related stimuli. Therefore, while experience sharing undoubtedly has an automatic component, there is evidence suggesting that these empathic responses may have a motivational component.

Theory behind the automaticity of experience sharing (e.g. Hatfield et al., 1993) place considerable emphasis on the role of congruent facial expressions – facial mimicry – in shared emotional experiences. This theory outlines that facial mimicry is the first, and most crucial, component of the experience sharing process. Essentially, perceivers catch others' emotions from the feedback they receive after automatically mimicking the facial expressions of the target (Hatfield et al., 1993, 2014). This theory is particularly relevant for the current thesis as it outlines that facial mimicry is a crucial component of the experience sharing process. Theories about automaticity (e.g. Preston & de Waal's (2002) PAM; Hatfield et al.'s (1993) emotional contagion theory) have been supported by empirical evidence from facial mimicry studies. Typically, these mimicry studies use facial electromyography (EMG), which is the physiological measurement of electrical potentials occurring during muscle fibre contractions (D. L. Neumann & Westbury, 2011). Facial muscles are of particular interest in empathy research because they are involved in the expression of emotions (Davies et al., 2016). Typical facial muscles of interest are the corrugator supercilii (COR), which is involved in frowning, and the zygomaticus major

(ZYG), which is involved in smiling (D. L. Neumann & Westbury, 2011). Experiencing negative emotion typically evokes an increase in COR activity, while experiencing positive emotion evokes an increase in ZYG activity (D. L. Neumann & Westbury, 2011).

Facial mimicry is thought to be central to the empathic process according to proponents of the automaticity of empathy (e.g. Hatfield et al., 2014). These studies have demonstrated that nonclinical perceivers engage in rapid facial mimicry within 500-1000 milliseconds of viewing positive or negative facial expressions of a target (Dimberg & Thunberg, 2012; Dimberg, Thunberg, & Grunedal, 2002; Murata, Saito, Schug, Ogawa, & Kameda, 2016). In a test of whether facial mimicry responses can be controlled, Dimberg et al. (2002) assigned participants to one of two instruction conditions. Participants were told to either react to emotional stimuli as quickly as possible by wrinkling their eyebrows (frowning), or by raising their cheeks (smiling), or to resist reacting (Dimberg et al., 2002). Results indicated that even those told not to react with their facial muscles could not resist automatically producing a facial response that corresponded with positive and negative stimuli (Dimberg et al. 2002). Although the literature has provided support for the notion that experience sharing/facial mimicry is automatic in nature, the literature is not entirely consistent with regards to experience sharing, and empathy as a whole, being strictly an automatic process.

A Motivated Component of Experience Sharing

Recent literature has suggested that empathy may not be as reflexive and automatic as once thought. The first body of evidence comes from social neuroscience research outlining that individuals exhibit different empathic responses in different contextual situations. Moreover, research has further posited that one’s motivation to empathize within a given context moderates their empathic responses (Cameron & Inzlicht, 2020; Tamir, 2016; Zaki, 2014). While the context-dependency of empathy has been widely established, less work has been done for experience sharing. Although the automaticity of empathy has been demonstrated at the physiological, and neural levels, recent approaches to empathy argue that has a motivation component, rendering it capable of being regulated (Cameron, 2018; Keysers & Gazzola, 2014; Tamir, 2016; Zaki, 2014). In an attempt to move away from historical notions of empathy as an automatic process, Keysers and Gazzola (2014) put forward an important distinction between one's ability and propensity to engage in an empathic response: "Two individuals […] may have the same ability, but differ in some aspects of propensity with one experiencing relatively high empathy even in situations discouraging empathy, whereas the other does not" (Keysers & Gazzola, 2014, p. 164).

While several facial mimicry studies (e.g., Dimberg et al., 2002) serve as examples of the automaticity of experience sharing, many did not test whether motivating participants to increase their emotional responses would lead to group differences in facial EMG muscle activity. Moreover, there has only been a handful of studies examining whether motivating individuals through specific instructions lead to changes in facial EMG activity. In one study, top-down cognitive processes could indeed assert control over automatic facial mimicry (Murata et al., 2016). The corrugator and zygomaticus muscle activity of 50 participants were measured using EMG as they viewed 24 morphing video clips of targets making facial expressions of the six basic types of emotions (i.e., happiness, sadness, anger, disgust, fear, and surprise). In this study, participants were assigned to either an emotion-inference condition where they were asked how the individual in the video clip feels or a passive condition where they received no instructions. Results indicated that when specifically instructed to infer the target's emotion, participants had greater experience sharing, as measured by similarities in muscular EMG activity (Murata et al., 2016). These results have important implications for experience sharing as more than just an automatic process – if facial mimicry was strictly a bottom-up process, then there should have been no differences found between participants who were instructed to infer the emotions of targets and those who passively viewed their facial expressions.

A motivational component of empathy has also been demonstrated at the neural level. Work by Arbuckle and Shane (2017) and Meffert and colleagues (2013) utilized MRI paradigms to evaluate participants' ability to regulate their empathy for others in pain. For example, Arbuckle & Shane (2017) asked 22 male offenders to either passively view pictures of other people in painful or non-painful situations or to actively upregulate their empathic concern for the person in pain. The authors found that participants showed little neural activation overall in the passive viewing condition, and no activation in brain regions typically associated with pain empathy (e.g. anterior cingulate cortex [ACC]) (Arbuckle & Shane, 2017). As noted earlier, the ACC is considered to be part of a mirror neuron system for pain (Carrillo et al., 2019), so low neural activation of this important brain region suggests that participants had low experience sharing at baseline, which resulted in low empathy for those in pain. However, they showed statistically significant increases in neural activity in several key brain regions associated with empathy, including the ACC, when specifically instructed to increase their concern for those in pain (Arbuckle & Shane, 2017).

The results from Arbuckle and Shane (2017) provide further support for the notion of a motivational component to affective empathy. Moreover, this study also suggests that experience sharing is capable of being upregulated when instructed to increase concern for others in pain. Likewise, Murata et al. (2016) demonstrated that experience sharing can be upregulated when instructed to identify the emotions of others. However, this deliberate upregulation of experience sharing has yet to be demonstrated with instructed emotion sharing. The current study is particularly concerned with examining whether experience sharing can be deliberately upregulated when asking individuals to do so. This study will evaluate facial EMG while participants view a slideshow of facial expressions of the following basic emotions: happiness, sadness, anger, fear, and surprise. Half of the sample will be instructed to view the slideshow naturally, while the other participants will be instructed to deliberately engage in experience sharing. I hypothesize that those in the deliberate condition will display a greater effect of experience sharing (self-other overlap) across all measures.

Psychopathic Traits

Furthermore, the secondary goals of this thesis aimed to examine the extent to which the motivated regulation of experience sharing will be influenced by one's levels of psychopathic traits. Psychopathic personality traits consist of behavioural, emotional, and interpersonal characteristics (Hare, 2003). In his book *The Mask of Sanity* (1941), Hervey Cleckley first coined the term psychopathy when describing an outwardly normally functioning person, able to mask or disguise the abnormal personality characteristics that lie beneath. These individuals often exhibit emotional callousness, impulsivity, a general poverty of affect, and a lack of empathy. Additionally, the psychopath is described as grandiose, superficially charming, manipulative, and conning (Glenn & Raine, 2009; Hare, 2003; Hare, Frazelle, & Cox, 1978). These characteristics lead individuals high in psychopathic traits to engage in aggressive and antisocial behaviour at high rates (Hare, 2003; Reidy, Shelley-Tremblay, & Lilienfeld, 2011). Additionally, the literature on psychopathy has pointed to psychopathy being a strong predictor of criminal behaviour, including violence (Blais, Solodukhin, & Forth, 2014; Porter & Woodworth, 2006; Reidy et al., 2011; Serin, 1991).

While psychopathic individuals may be capable of mimicking normal emotions (Book et al., 2015), they are thought to suffer from a general poverty of affect, and to be incapable of truly normative affective experiences (Cleckley, 1941, 1988). Thus, traditional conceptualizations of psychopathy suggest that those higher in psychopathic traits are likely to be incapable of engaging in experience sharing (Seara-Cardoso, Sebastian, Viding, & Roiser, 2016). Moreover, psychopathic individuals also have atypical processing of emotions (Vallet, Hone-Blanchet, & Brunelin, 2019), including distress cues (Blair, 2005; Patrick, Cuthbert, & Lang, 1994a), which may contribute to their lack of empathy and aggressive behaviour (Blair, 2018).

These conceptualizations are rooted in physiological research on psychopathy that typically shows attenuated autonomic responses to emotional cues. In a review of autonomic nervous system reactivity in psychopathy, Arnett (1997) noted that psychopathic individuals display a consistently aberrant pattern of task-related physiological reactivity when processing negative stimuli, however, the psychopath's pattern of reactivity to positive stimuli is less known. Of particular relevance to the present study is the more recent empirical evidence indicating that the psychopath exhibits abnormal physiological responses when processing distress cues (Blair, 2018; Marsh et al., 2011), blunted startle responses to aversive stimuli (as measured by facial EMG) (Patrick, Cuthbert, & Lang, 1994b), low facial EMG (Herpertz et al., 2001) activity in response to aversive stimuli, as well as a reduced propensity to engage in facial mimicry (Hagenmuller, Rössler, Endrass, Rossegger, & Haker, 2012; Herpertz et al., 2001).

The atypical processing of emotions and lack of empathy associated with psychopathy make it an ideal empirical tool for trying to understand empathy and experience sharing. However, there is limited and inconsistent work on the influence of psychopathic traits on the process of facial mimicry. For example, Hagenmuller et al. (2012) found less emotional contagion for smiles and yawns for individuals higher in psychopathic traits relative to those lower in psychopathic traits. However, this study used video recordings coded by research assistants to measure mimicry in lieu of facial EMG. Meanwhile, Künecke, Mokros, Olderbak, and Wilhelm (2018) found no evidence for abnormal COR and ZYG activity in offenders high in psychopathic traits when viewing facial expressions, relative to non-offenders, or those low in psychopathic traits. This limited and inconsistent literature demonstrates the need to better our understanding of the role of psychopathic traits in facial mimicry of basic emotions.

Current Study

The current study used behavioural and physiological methods to investigate differences between those instructed to deliberately or spontaneously engage in experience sharing. This study also has secondary goals to investigate the relationship between psychopathic traits and subjective and physiological experience sharing. To this end, healthy undergraduates with varying levels of psychopathic traits completed two experience sharing-related tasks: 1) a modified emotion regulation paradigm where participants were given either deliberate or spontaneous experience sharing instructions while viewing facial expressions of basic emotions, and 2) a modified version of the *Empathic Accuracy Task* (Zaki, Bolger, & Ochsner, 2008), where participants were asked to rate how they were feeling as they watched videos of targets describing emotional life events. Based on previous research, the following hypotheses were created:

1) The primary hypothesis of this study predicts that those in the deliberate instruction condition will display greater a) subjective and b) physiological experience sharing relative to those in the spontaneous condition across both tasks.
2) Given the literature outlining emotional deficits in psychopathic individuals during passive processing of emotional stimuli (e.g. Seara-Cardoso et al., 2016), it is predicted that those higher in psychopathy will display reduced a) subjective and b) physiological experience sharing relative to those low in psychopathy (main effect of psychopathy).
3) I predicted that there will an interaction effect between instruction type and psychopathic traits on a) subjective and b) physiological experience sharing. Specifically, I predict a significant effect of psychopathic traits on experience sharing for those in the spontaneous instruction condition, but not for those in the deliberate instruction condition.

Method

Participants

Eighty-four undergraduate students were recruited from the online university participant pool at Ontario Tech and were provided with course credit for their participation. The sample included 49 females (58.3%) and 35 males (41.7%). Participants ranged in age from 18 to 29 years old, with an average age of 20.5 years old (*SD* = 2.11). All participants provided informed consent before participating in the current study. The current study was approved by Ontario Tech's Research Ethics Board (REB Certificate number 15359).

Procedure

Following consent, participants were brought into a quiet testing room and seated in front of a computer monitor where they completed the *Facial Expression* and *Empathic Sharing Tasks* as two measures of experience sharing. During these tasks, facial electromyography (EMG) data were collected via the BIOPAC MP160 system (BIOPAC Systems Inc.; acquisition parameters described below in Physiological measure section). After completing these two tasks, the electrodes were removed, and participants completed a set of self-report questionnaires. In the next section, I provide a detailed description of these measures.

Measures

Facial Expression Task

The *Facial Expression Task* was designed in E-Prime 2.0 (Schneider, Eschman, & Zuccolotto, 2012) and was modified from a well-validated emotion-regulation paradigm

(Arbuckle & Shane, 2017; Ochsner, Silvers, & Buhle, 2012). In this task, participants viewed a series of 40 images depicting facial expressions of basic emotions. First, an instruction appeared on-screen for 2000ms (see below), followed by the facial expression image for 6000ms. Lastly, participants rated how positive or negative they felt using a 7-point Likert-type scale. Experience sharing was defined as the degree of similarity between the valence of the stimulus a participant viewed and his or her own emotional experience, as determined by self-reported as well as physiological responses. For instance, a participant engaged in experience sharing if they viewed a facial expression depicting joy, and displayed responses that also depict joy (e.g. positive self-reported emotional valence, or increased ZYG muscle activity which is associated with experiencing positive emotions).

Instructions. Participants were randomly assigned to either the deliberate or spontaneous experience sharing conditions. In the deliberate condition, participants were instructed to 'Try to feel what the person in the image below is feeling,' while those in the spontaneous condition were instructed to 'View the image below naturally' at the beginning of each trial. These instructions were based on previous research using emotion-regulation paradigms to assess experience sharing and empathy more generally (Cameron et al., 2019; Casey, Rogers, Burns, & Yiend, 2013; Meffert, Gazzola, Den Boer, Bartels, & Keysers, 2013).

Picture Stimuli. Participants viewed a slideshow of 40 static images of actors (four male, four female) displaying facial expressions of five basic emotions: joy, sadness, anger, fear, and surprise. These emotions were selected in order to gain an understanding of behavioural and physiological experience sharing in response to a broad spectrum of emotions.

Empathic Sharing Task

In addition to the *Facial Expression Task,* participants also completed the *Empathic Sharing Task,* a modified version of Zaki and colleagues' (2008, 2009) *Empathic Accuracy Task* as a behavioural measure of experience sharing. This task was included to investigate whether providing participants with regulation instructions would influence downstream tendencies to demonstrate experience sharing. If the regulation instructions given during the *Facial Expression Task* were effective, then participants would naturally demonstrate experience sharing when viewing emotional videos created to elicit empathic responses. This task was conducted in two main phases: target and receiver. In the target phase, social targets were recorded discussing positive and negative emotional autobiographical life events. In the perceiver phase, perceivers' EMG data was recorded while they watched the recorded target videos and rated their own affect using a continuous sliding scale.

Target Phase. As part of a previous study from our lab (Groat & Shane, 2020b), fourteen targets (seven female) were asked to recall and describe their four most positive and four most negative autobiographical life events while being recorded. Immediately after recording the videos, targets watched each of their own videos and provided ratings indicating how they felt as they spoke about each emotional event using a 100-point continuous scale (anchored with Extremely bad on the left, and Extremely good on the right). Each video was subsequently validated by a separate sample of 92 undergraduate students. These participants rated each of the original 56 videos in terms of valence, expressivity, likeability, clarity and believability. All responses were recorded on a 7-point Likert scale, from 1 (low) to 7 (high). A total of eight videos were selected for the Perceiver Phase of the study (see below) that varied in terms of gender (two males and two females), valence (four positive and four negative), and expressivity (four high and four low expressivity). The selected videos ranged in length from 1 minute and 23 seconds to 4 minutes and 5 seconds, with an average length of 2 minutes and 19 seconds.

Perceiver Phase. As part of this study, participants watched eight counterbalanced videos that consisted of four targets (two males and two females) created during the Target Phase. Participants continuously rated how positive or negative they felt as they watched all eight of the videos, using the same continuous scale the targets used in the previous phase. Videos were presented in the centre of the screen, with "how good or bad are you feeling right now?" presented above the video, and the continuous 10-point scale[1] below the video. Throughout the duration of the task, participants were instructed to continuously move their mouse to reflect changes in their own emotional state. These emotion ratings were sampled every 250ms. Video presentation was counterbalanced between participants watching a positively- or negatively-valent video first. Experience sharing was indicated by the strength of the correlation between the target's emotional ratings and the participant's emotional ratings for each video. Stronger correlations between ratings were indicative of higher degrees of experience sharing.

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[1] The discrepancy between the rating scales used during the Target and Perceiver phases was solved by dividing target ratings by 10.

Individual Differences Measures

Trait Empathy. The Interpersonal Reactivity Index (IRI; Davis, 1983) is a widely used measure of individual differences in trait empathy. The IRI is a 28-item self-report questionnaire that assesses four different aspects underlying empathy: Empathic Concern (EC), Fantasy, Personal Distress, and Perspective-Taking. The IRI is a reliable measure of both the affective and cognitive components of empathy (Carey, Fox, & Spraggins, 1988; Davis, 1983). Each item on the scale is rated on a 5-point Likert-type scale ranging from 1 (Does Not Describe Me at All) to 5 (Describes Me Very Well). Of particular interest to this study was the EC scale, as it is the measure of affective empathy. See *Table 1* for descriptive statistics of the IRI.

Psychopathic Traits. The Psychopathic Personality Inventory-Revised (PPI-R; Lilienfeld & Widows, 2005) was used in the current study as a self-report measure of psychopathic personality traits. The PPI-R has demonstrated high validity and reliability in forensic (Gonsalves, McLawsen, Huss, & Scalora, 2013) and community samples (Ruchensky et al., 2018; Sörman et al., 2016). While forensic samples typically have higher average levels of psychopathy, many studies have successfully used the PPI-R to measure psychopathic traits in non-forensic samples, such as undergraduate students (e.g. López, Poy, Patrick, & Moltó, 2013). There are 154 items on the PPI-R, comprising three factors: Fearless Dominance (FD), Self-Centred Impulsivity (SCI), and Coldheartedness (Lilienfeld & Widows, 2005). Participants rated how much each item described them on a four-point scale ranging from “False,” “Mostly False,” “Mostly True,” to “True.” High scores on the FD factor are reflective of an individual who is high in narcissism and thrill-seeking, and low in empathy, anxiety, and depression. High scores on the SCI factor indicates high levels of impulsivity, aggression, and antisocial behaviour. Finally, high scores on the Coldheartedness factor indicates shallow affect, a lack of guilt or remorse, and a disregard for the feelings of others (Lilienfeld & Widows, 2005). See *Table 1* for descriptive statistics of the PPI-R.

Table 1.

Descriptive statistics and correlation coefficients for the PPI-R Total, PPI-R Factor, and IRI scales (N = 84).

	M (SD)	PPI-R Total	SCI Factor	FD Factor	*C Factor*	PT Scale	FS Scale	EC Scale
PPI-R Total	2.55 (.26)	--						
SCI Factor	2.95 (.31)	.482**	--					
FD Factor	2.85 (.42)	.791**	0.164	--				
C Factor	1.84 (.43)	.738**	0.017	.369**	--			
PT Scale	2.73 (.66)	-0.200	-0.147	0.042	-.309**	--		
FS Scale	2.50 (.75)	-0.165	0.167	-0.088	-.341**	0.193	--	
EC Scale	2.84 (.66)	-.472**	-0.129	-0.171	-.619**	.398**	.518**	--
PD Scale	1.77 (.71)	-.404**	0.093	-.543**	-.285**	-0.127	.271*	.240*

** Denotes a significant correlation at the 0.01 level (2-tailed).

* Denotes a significant correlation at the 0.05 level (2-tailed).

Note: SCI = Self-centred impulsivity subscale; FD = Fearlessness dominance subscale; C = Coldheartedness subscale; PT = Perspective Taking; FS = Fantasy Scale; EC = Empathic Concern; PD = Personal Distress.

Physiological Data

Data Collection. Facial electromyography (EMG) data were recorded using the MP160 system from BIOPAC (BIOPAC Systems INC). EMG data were recorded continuously from four electrodes placed over the Corrugator Supercilii (COR) and Zygomaticus Major (ZYG) muscles on the non-dominant side of the face, placed according to EMG best practices (Fridlund & Cacioppo, 1986; Van Boxtel, 2010). Skin was prepped by using an alcohol swab before applying two pre-gelled facial EMG electrodes above each site of interest. A ground electrode was placed on the middle finger of the non-dominant hand. The COR and ZYG muscles are respectively associated with negative and positive emotional processing (D. L. Neumann & Westbury, 2011), as well as the facial expression of emotions (Davies et al., 2016; Dimberg & Thunberg, 2012; Dimberg et al., 2002). The electrodes continuously measured electrical contractions of the targeted muscles during the study. After placing the electrodes on the skin, they were then attached to BioNomadix hardware (BIOPAC Systems INC), where the raw EMG data was acquired at a rate of 2000Hz. EMG signals were then preprocessed for subsequent analyses.

Preprocessing. COR and ZYG EMG signals were notch filtered (58-62 Hz) to remove power line frequency noise (De Wied, Van Boxtel, Zaalberg, Goudena, & Matthys, 2006; Van Boxtel, 2010). Next, data were band-pass filtered (20-500 Hz) to remove movement artifacts and baseline noise that is known to contaminate the EMG signal (De Luca, Donald Gilmore, Kuznetsov, & Roy, 2010; Van Boxtel, 2010). Then, data were rectified using a Root Mean Square (RMS) approach, which was done to ensure that all EMG values were positive. All filtering was performed using a basic FIR filter implemented in AcqKnowledge software (BIOPAC Systems INC).

Filtered EMG data for the *Facial Expression Task* were subsequently extracted. First, mean baseline EMG data were extracted from the pre-stimulus period for each trial (i.e., two seconds pre-stimulus onset for a duration of two seconds). Next, EMG data of interest for each trial was extracted for each trial (i.e., from image onset until 1000ms post-stimulus onset).

Data Standardization. It is important to standardize physiological data, as response magnitudes may vary greatly between individuals, which would impact group means (Boxtel et al., 2010). In order to standardize COR and ZYG data, proportion scores were calculated for each signal as a proportion of the baseline value. To obtain these proportions, mean peak amplitudes of each signal were divided by their respective baseline values. Next, in order to understand the magnitude of experience sharing, these standardized values were then used to calculate difference scores based on picture type. For positive facial expressions (i.e., joy), COR proportion scores were subtracted from ZYG proportion scores, while for negative expressions (i.e., sad, anger, fear, and surprise) the opposite subtraction was undertaken. In each case, a positive value was interpreted as a congruent facial expression, which is a marker of experience sharing (Drimalla, Landwehr, Hess, & Dziobek, 2019). These difference scores were used as dependent variables in the subsequent analyses involving physiological data for this task.

Results

Facial Expression Task

Behavioural Results

Data Screening. Subjective emotional valence ratings beyond three standard deviations were considered outliers and subsequently removed from the dataset (n = 44, 1.33%). Additionally, individual trials with RTs below 250ms were removed (n = 18, 0.54%) because the average human reaction time to visual stimuli is 150-250ms (Thorpe, Fize, & Marlot, 1996), therefore, responses faster than 250ms were considered to be premature responses. In total, this led to 1.87 % of all trials being removed from the dataset.

Calculating Subjective Experience Sharing. First, mean valence ratings were recalculated separately for each type of stimulus presented. Emotional valence ratings for negative images were reversed scored during this recalculation process. This was done so that greater scores would reflect greater experience sharing across all picture types. These mean ratings were subsequently assessed for outliers (i.e., >3 SDs from the mean). A boxplot analysis revealed no univariate outliers. Additionally, a Shapiro-Wilk's test of normality indicated that emotion ratings were normally distributed within each condition ($p > .05$). Therefore, all 83 participants were included in the analyses of behavioural data for this task.

Main Analyses. A 2 (Instruction Type: *deliberate; spontaneous*) by 5 (Picture Type: *joy; sadness; anger; fear; surprise*) mixed ANOVA model was run to evaluate differences in subjective experience sharing. Mauchly's Test of Sphericity indicated that sphericity was violated, $\chi^2(9) = 156.56$, $p < .001$, therefore, a Greenhouse-Geisser correction was used. The ANOVA produced no statistically significant main effect of instruction type (p = .39), indicating that subjective experience sharing did not statistically differ based on the type of instruction participants received. The model did, however, produce a statistically significant main effect of picture type, F(1.85, 150.21) = 367.27, p < .001, η^2 = .82, such that subjective emotional valence ratings differed based on the type of facial expression participants viewed, with the greatest ratings for facial expressions depicting joy (see *Figure 1*). In addition, a statistically significant interaction between instruction type and picture type was produced, F(1.85, 150.21) = 3.67, p = .03, η^2 = .04 (see *Figure 2*). Post-hoc contrasts indicated that the pattern of emotion ratings between instruction conditions was statistically significantly different when viewing facial expressions depicting joy relative to each of the other picture types (all ps < .05). Alternatively, none of the contrasts between the other picture type conditions reached significance (all ps > .05), indicating that the joy condition was driving the interaction effect. An independent samples t-test was subsequently run to evaluate the pattern of emotion ratings across instruction conditions specifically for joy trials. The result of the t-test indicated that participants in the deliberate condition (M = 5.78, SD = .70) displayed statistically greater experience sharing when viewing facial expressions depicting joy relative to those in the spontaneous condition (M = 5.42, SD = .87), t(81) = 2.09, p = .04, 95%CI[.02, .71], d = .46. In order to investigate the influence of psychopathic traits on subjective experience sharing, this ANOVA was followed up with an identical ANCOVA model that added psychopathic traits as a covariate of interest. This ANCOVA model indicated that there was no statistically significant main- or interaction effects involving psychopathic traits (all ps > .05).

Figure 1.

Main effect of picture type on subjective experience sharing.

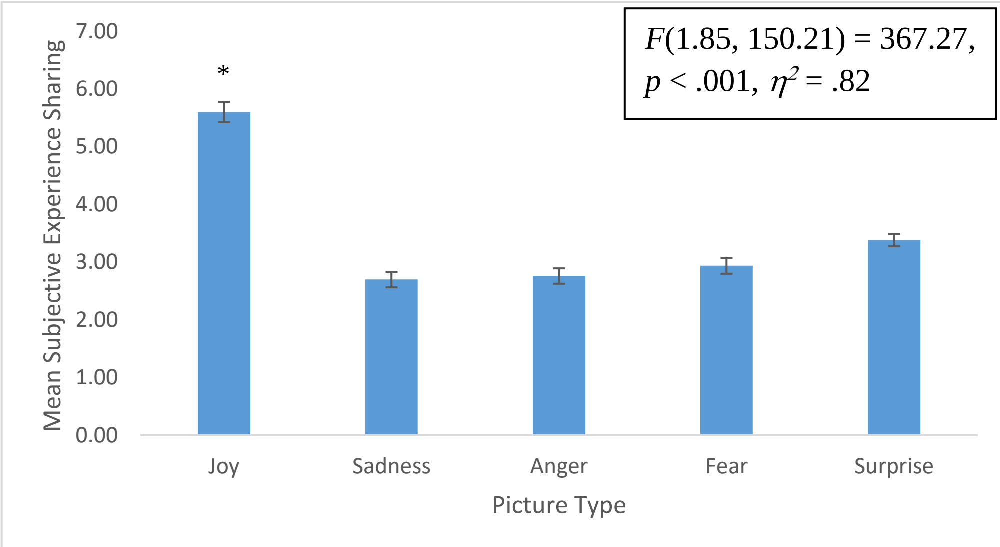
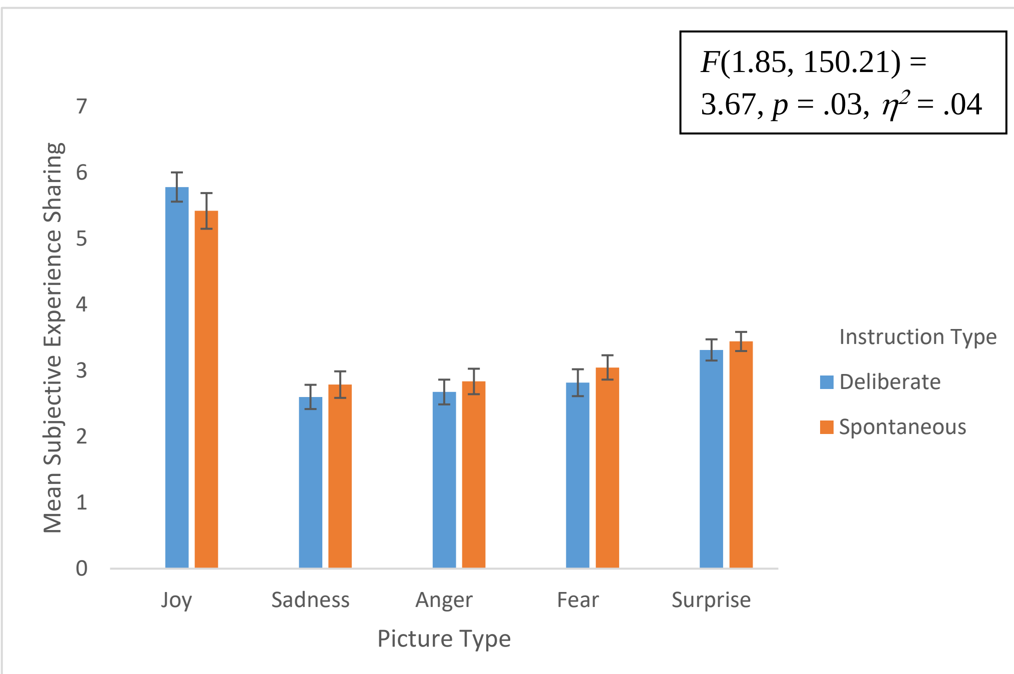


Figure 2.

Instruction type x picture type interaction.



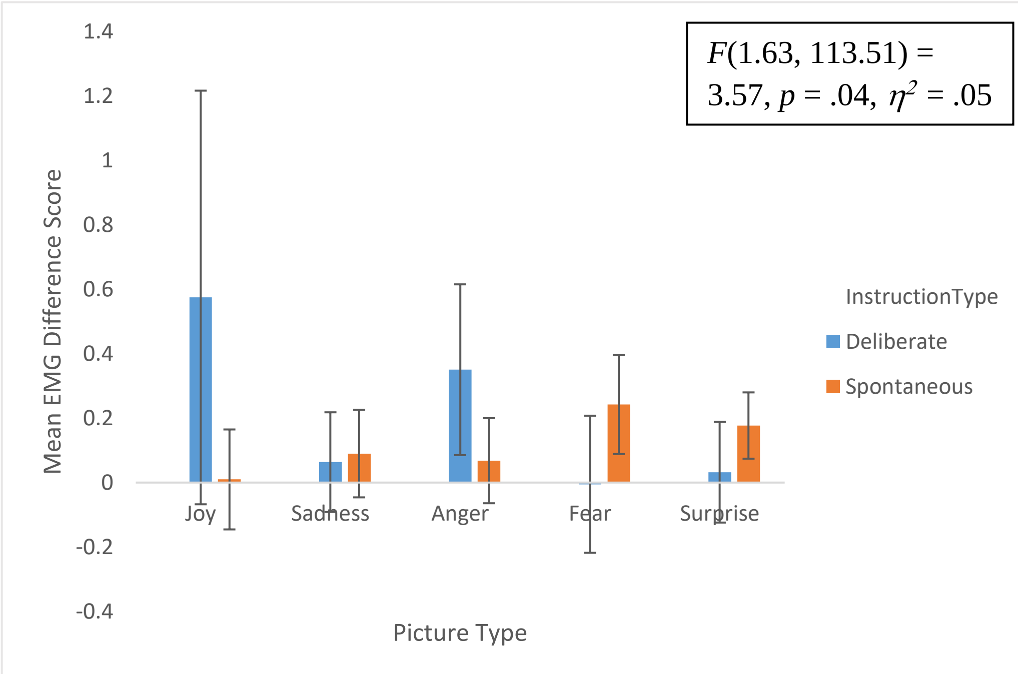
Physiological Results

Data screening. Three participants' physiological data were not collected due to a technical error, one because they did not consent to the physiological methodology part of the study. Moreover, four participants did not have ZYG data collected because of facial hair. Lastly, two participants' physiological data were excluded for poor data quality. As a result, a total of 73 participants were included in physiological analyses for this task. COR and ZYG data from these 73 participants were screened for outliers (+/- 3 SDs away from mean). As there were no outliers across all picture types, data from all 73 participants were retained in subsequent analyses.

Main Analyses. A 2 (Instruction Type: *deliberate; spontaneous*) by 2 (Picture Type: *joy; sadness; anger; fear; surprise*) mixed ANOVA model was run to evaluate differences in EMG difference scores. Mauchly's Test of Sphericity indicated that sphericity was violated, χ^2 (9) = 175.50, p < .001, therefore, a Greenhouse-Geisser correction was used. While there were no statistically significant main effects of instruction type or picture type (*p*s > .05), the model did produce a statistically significant interaction effect between instruction type and picture type, $F(1.63, 113.51) = 3.57$, $p = .04$, $\eta^2 = .05$ (see *Figure 3*). In order to investigate the nature of this significant two-way interaction, post-hoc contrasts between each picture type condition were run. As seen in *Figure 3*, both joy and anger displayed a similar pattern of physiological experience sharing between deliberate and spontaneous conditions for both joy ($t(39.09) = 1.74$, $p = .09$, $d = .41$) and anger ($t(51.47) = 1.94$, $p = .06$, $d = .46$.), while the opposite pattern was seen for fear ($t(71) = -1.92$, $p = .06$, $d = -.45$) and surprise ($t(60.84) = -1.57$, $p = .12$, $d = -.37$) picture type conditions. In order to investigate the influence of psychopathic traits on physiological experience sharing, this ANOVA was also followed up with an ANCOVA model that added psychopathic traits as a covariate of interest. This ANCOVA model indicated that there was no statistically significant main- or interaction effects involving psychopathic traits (all *p*s > .05).

Figure 3.

Instruction x picture type interaction.



Empathic Sharing Task

Behavioural Results

Data Screening. Of the original sample of 83 participants, one participant was excluded because they withdrew from the study before completing the task, and three participants were excluded because of bad data (i.e., not continuously moving rating scale, distracted by phone). Therefore, a total of 79 participants were included in behavioural analyses for this task.

Perceiver's Empathic Sharing (ES) scores (Mean r = .25, SD = .15) were significantly above chance ($t(78) = 14.91$, p <.001, 95% CI[.22 - .28]), suggesting that they displayed moderate experience sharing throughout the task. ES scores were moderately positively correlated with trait empathy (r = .26, p = .02), but not psychopathic traits (r = .02, p = .84) or any of the PPI-R's subscales (all ps > .43).

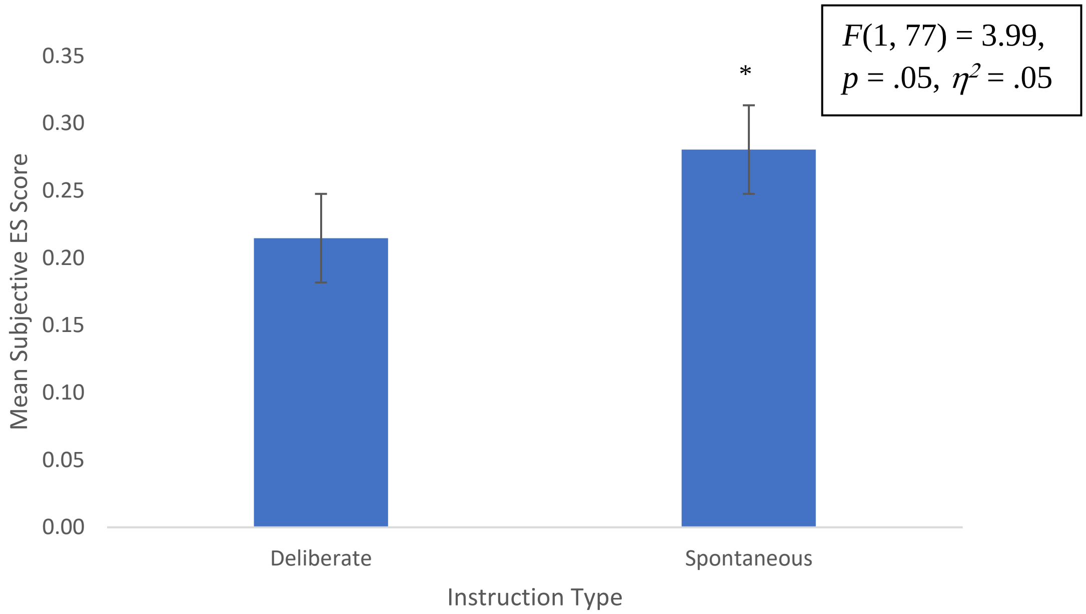
Each participant's ES scores for positive (ESPos) and negative (ESNeg) videos were also calculated. Overall, participants displayed weak to moderate experience sharing for positive videos (Mean r = .22, SD = .14) and negative videos (Mean r = .28, SD = .19). There was a weak, positive, statistically significant association between ESPos scores and trait empathy, r = .22, p = .05, but no relationship with psychopathic traits (r = -.02, p = .86), or any of its subscales (all ps > .35). ESNeg scores were also associated with trait empathy, r = .23, p = .04, but not with psychopathic traits (r = -.03, p = .80), or any of the PPI-R's subscales (all ps > .53).

Main Analyses. A 2 (Instruction Type: *deliberate; spontaneous*) 2 (Valence: *positive; negative*) mixed ANOVA model with ES scores as the dependent variable was run. The model produced statistically significant main effect of instruction type, $F(1, 77)$

= 3.99, p = .05, η^2 = .05, indicating that ES scores differed as a function of the type of instruction participants received in the previous task (see *Figure 4*). Post-hoc contrasts indicated that participants who were previously given deliberate instructions (M = .22, SD = .02) demonstrated lower ES scores relative to those who received spontaneous instructions in the previous task (M = .28, SD = .02). However, the direction of this effect was opposite of hypotheses, and suggested that participants engaged in less experience sharing when they were deliberately instructed to share in the emotions of the target in the previous task. The model also produced a statistically significant main effect of valence, $F(1, 77) = 12.53$, p = .001, η^2 = .14. Post-hoc contrasts indicated that participants demonstrated greater ES scores when viewing negatively-valenced videos (M = .28; SD = .02) relative to positively-valenced videos (M = .22; SD = .02). In order to investigate the influence of psychopathic traits on subjective experience sharing during this task, psychopathic traits were introduced to the main ANOVA model as a covariate of interest. This ANCOVA model indicated that there was no statistically significant main- or interaction effects involving psychopathic traits (all ps > .05).

Figure 4.

Main effect of instruction type on subjective ES scores.



Physiological Results

Data Screening. Of the 73 participants used for physiological analyses for the Facial Expression Task, an additional four participants were excluded for bad data during this ES task (i.e., did not move the rating scale at all during at least one target video). Thus, physiological analyses were run on 69 participants who had completed both tasks. ES scores were first calculated by correlating targets' self-reported affect and perceivers' COR and ZYG physiological signals. As a result, there were a total of two correlation coefficients produced for each participant, subsequently referred to as ESCOR and ESZYG scores, respectively.

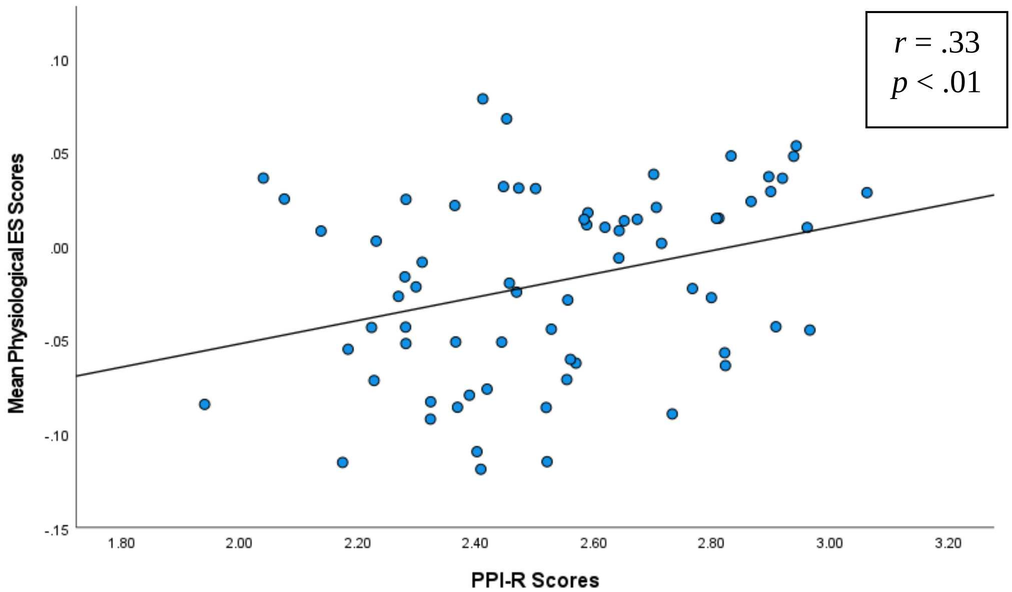
Participants displayed weak negative ESCOR scores on average (Mean r = -.07). As targets rated their videos more negatively (i.e., closer to 0), perceivers' COR activity increased. This makes theoretical sense as COR activity is typically associated with negative emotions (D. L. Neumann & Westbury, 2011). Alternatively, participants displayed weak, positive ESZYG scores on average (Mean r = .03). These ES scores were used as dependent variables in the following analyses.

Main Analyses. A 2 (Instruction Type: *deliberate; spontaneous*) by 2 (EMG muscle: *COR; ZYG*) by 2 (Valence: *positive; negative*) mixed ANOVA model with physiological ES scores as the dependent variable was run. While the model did not produce a statistically significant main effect of instruction type, (p > .05), it did produce a statistically significant main effect of valence, $F(1, 67) = 6.21$, p = .02, η^2 = .09. Post-hoc contrasts indicated that participants demonstrated greater physiological ES scores when viewing negatively-valenced videos (M = -.03; SD = .01) relative to positively-valenced videos (M = -.01; SD = .01). Moreover, the model also produced a statistically significant main effect of EMG muscle, $F(1, 67) = 37.08$, $p < .001$, $\eta^2 = .36$. Post-hoc contrasts indicated that participants demonstrated greater physiological ES scores COR muscle activity ($M = -.07$; $SD = .01$) relative to ZYG muscle activity ($M = .03$; $SD = .01$). The model also produced a statistically significant valence by EMG muscle interaction, $F(1, 67) = 29.41$, $p < .001$, $\eta^2 = .31$. No other main- or interaction effects reached statistical significance (all *p*s > .05).

In order to investigate the influence of psychopathic traits on subjective experience sharing during this task, psychopathic traits were introduced to the main ANOVA model as a covariate of interest. This ANCOVA model produced a statistically significant main effect of psychopathic traits, $F(1, 66) = 7.58$, $p = .01$, $\eta^2 = .10$, such that greater psychopathic traits were associated with greater physiological ES scores (see *Figure 5*). No other main effects or interactions reached significance (all *p*s > .05). In addition, the valence by psychopathic traits interaction effect approached significance, $F(1, 66) = 3.24$, $p = .08$, $\eta^2 = .05$. To investigate this trending interaction, simple main effects were conducted. Psychopathic traits were median-split into higher- and lower- psychopathy groups for this analysis. There was a statistically significant effect of valence on ES scores for the lower-psychopathy group, $F(1, 34) = 10.23$, $p = .003$, $\eta^2 = .23$. Bonferroni-adjusted pairwise comparisons indicated that those lower in psychopathic traits displayed greater ES scores for negative videos ($M = -.06$, $SD = .02$) relative to positive videos ($M = -.01$, $SD = .01$). There was no effect of valence on ES scores for the higher-psychopathy group, $F(1, 31) = .08$, $p = .78$.

Figure 5.

Main effect of PPI-R scores on Physiological ES Scores.



Discussion

The primary aim of the current thesis was to investigate whether individuals can be motivated to increase subjective and physiological experience sharing through regulation instructions. To this end, healthy undergraduates completed two experience sharing-related tasks (a modified emotion regulation task – *Facial Expression Task*, and a modified emotion sharing task *Empathic Sharing Task*) while behavioural and facial electromyography (COR and ZYG activity) metrics of experience sharing were collected.

Subjective Experience Sharing

With regards to subjective experience sharing, the results of this study found that participants who were deliberately instructed to engage in experience sharing (i.e., share the emotion) demonstrated increased subjective experience sharing, but only for some types of facial expressions. The deliberate instruction condition elicited greater experience sharing when viewing facial expressions depicting joy, but not when viewing expressions of sadness, anger, fear, or surprise. This partially supports the existing literature on the regulation of experience sharing and empathy more generally (Arbuckle & Shane, 2017; Meffert et al., 2013; Murata et al., 2016), suggesting that it is possible to upregulate experience sharing by motivating individuals through instructions. Individuals also demonstrated an overall tendency to display greater experience sharing when viewing facial expressions depicting joy, as indicated by a main effect of picture type on subjective experience sharing scores. It is possible that participants in the current study displayed greater experience sharing for joy because it is an emotion that is more pleasant to experience, leading to greater engagement with the emotion. Indeed, positive affect (e.g., joy) has been associated with the activation of approach motivational systems

(Higgins, 2006). As the only positive facial expression included in this task, it makes sense that participants would display a differential pattern of subjective experience sharing for this emotion. This would explain why participants were more likely to engage with this emotion, both spontaneously, and when instructed to increase experience sharing.

The results of this study also found a main effect of regulation instructions on subjective experience sharing during the *Empathic Sharing Task*. Interestingly, the direction of this effect was opposite of that hypothesized, such that participants displayed *less* subjective experience sharing when they were previously instructed to engage in experience sharing. This opposes previous literature which suggests that deliberately instructing participants to empathize leads to greater demonstrations of experience sharing. The cognitive psychology literature provides several possible explanations for these counteractive effects. Ironic process theory is the cognitive process whereby deliberate attempts to suppress thoughts makes them more likely to surface (Wegner, Schneider, Carter, & White, 1987). In this classic social cognition study, Wegner and colleagues (1987) found that deliberately asking individuals to “try not to think of a white bear” (pp. 6-7) led to significantly more thoughts of said white bear. Essentially, asking individuals to bring attention away from the white bear led to counteractive effects, hence the term ironic process. Although speculative in nature, it is possible that the opposite ironic process happened in the current study. Specifically, bringing participants’ attention towards experience sharing via the deliberate instructions may have led to counteractive effects leading to avoidance of the experience sharing process. This also ties into the notion that there is a regulatory component of experience sharing and empathy more generally (Cameron, 2018; Zaki, 2014, 2020). It is possible that making participants aware of the experience sharing process through explicit instructions caused avoidance rather than approach behaviour, since empathy is taxing on the emotional systems (Cameron et al., 2019; Tamir, 2016; Zaki, 2014). As a result, individuals may avoid empathic responses if they find empathy distressing. For example, Cameron and colleagues (2019) demonstrated that individuals consistently prefer to avoid experience sharing when given the opportunity. In a series of studies involving a free-choice empathy task, participants were given the choice to either objectively describe the person in the image, and write a sentence describing their age and gender, or to try to feel what the person in the image was feeling, and subsequently write a sentence describing the experiences and feelings of the person. Meta-analytic results across 11 studies indicated a large and robust empathy avoidance effect (Cameron et al., 2019). It is important to note that this empathy instruction is in line with the one used in the current thesis. Therefore, this study is extremely relevant in explaining this unexpected effect. If this is the case, then future research should investigate motivating experience sharing through more implicit instructions.

Physiological Experience Sharing

With regard to physiological experience sharing, the results of this study indicated that participants displayed greater facial mimicry when deliberately instructed to engage in experience sharing, but only when viewing certain types of emotional facial expressions. Specifically, a significant interaction effect between the type of instruction participants were given and the facial expression they were shown on physiological experience sharing. Greater physiological experience sharing for the deliberate instruction condition was seen when participants viewed expressions of joy or anger, while the opposite pattern was demonstrated when viewing expressions of fear or surprise. It has been suggested that emotional facial expressions trigger rapid motivational behavioural responses in perceivers, such as approach or avoidance responses (Hans Phaf, Mohr, Rotteveel, & Wicherts, 2014). It is possible that increasing experience sharing through instructions depended on the type of facial expression shown because different emotions activated different motivational systems within participants. As previously mentioned, experiencing joy is associated with approach behaviours (Higgins, 2006). This is the only type of emotional facial expression that elicited greater subjective *and* physiological experience sharing for those in the deliberate instruction condition. While approach motivation is often associated with positive affect, it can also be associated with negatively-valent emotions such as anger. Previous work has indicated that facial expressions depicting anger may activate an approach motivational system, with empirical evidence suggesting that individuals pay more attention to, and are faster to approach expressions of anger relative to neutral expressions (Adams, Ambady, Macrae, & Kleck, 2006; Wilkowski & Meier, 2010). Moreover, first-hand experience of anger is associated with approach behaviours such as aggression and violence (Harmon-Jones, Price, Gable, & Peterson, 2014).

The results of this study indicated that facial expressions of surprise and fear elicited decreased physiological experience sharing for those in the deliberate instruction condition. It is likely that participants processed expressions of fear and surprise differently than expressions of joy and anger. According to the Cognitive-Evolutionary Model of Surprise (Meyer, Reisenzein, & Schützwohl, 1997), this emotion activates an aversive or avoidance motivational system. This is theorized to occur because surprising events were associated with dangerous or potentially life-threatening events during evolutionary history. As a result, the ability to rapidly detect and avoid surprise and surprising events developed over time (Meyer et al., 1997; Schützwohl, 2018). Therefore, I can speculate that being instructed to share emotions with someone who is experiencing surprise activated this avoidance response in the current study. On the other hand, It has been argued that fear produces a behavioural inhibition or freezing response, as opposed to an approach or avoidance response (Adams et al., 2006). While I can only speculate, it is possible that encouraging experience sharing through deliberate instructions led to an enhanced freezing response relative to those in the spontaneous instruction condition. This would explain why participants in the deliberate condition demonstrated the lowest physiological experience sharing when viewing expressions of fear.

Overall, it is worth noting that the only type of facial expression that elicited enhanced subjective and physiological experience sharing was joy. It is worth noting that deliberate regulation instructions only elicited enhanced subjective *and* physiological experience sharing for facial expressions depicting joy. Looking at this result through an instrumental emotion regulation lens may explain this finding. According to this account of emotion regulation, individuals are motivated to experience certain emotions based on two different classes of motivations: hedonic and instrumental (Tamir, 2016; Tamir, Chiu, & Gross, 2007; Tamir, Ford, & Gilliam, 2012). Hedonic motivations are concerned with the immediate experiences of emotions (e.g., avoiding negative feelings because of the way they make you feel), and regulating emotions that increase the ratio of pleasure to pain (Tamir, 2016). Therefore, participants in the current study likely increased subjective and physiological experience sharing when instructed to do so while viewing facial expressions of joy because it was a pleasant emotion to feel.

Relationship with Psychopathic Traits

This study also had secondary aims involving the relation between psychopathic traits and spontaneous versus deliberate experience sharing. Although there was no effect of psychopathic traits on subjective experience sharing, a positive association between psychopathic traits and physiological experience sharing was found. More specifically, psychopathic traits were associated with greater physiological experience sharing while viewing videos of targets recounting emotional autobiographical life events, regardless of the emotional valence of the videos. This opposes previous research which demonstrated that psychopathic traits were associated with reduced spontaneous emotional contagion for smiles and yawns (Hagenmuller et al., 2012) and reduced facial mimicry (Khvatskaya & Lenzenweger, 2016).

The deficit model of psychopathy posits that psychopathic traits are associated with a general incapacity to display normative affective responses, including empathy and its related subcomponents (Cleckley, 1941, 1988; Seara-Cardoso et al., 2016). If psychopathic individuals were incapable of experiencing empathy and its related subcomponents such as experience sharing, then there would have been a negative relationship between psychopathic traits and physiological experience sharing in the current study. A motivational framework of psychopathy (Groat & Shane, 2020a) argues that the emotion sharing deficits typically associated with psychopathic traits may stem, in part, from the individual habitually choosing not to share in others' emotions, unless sufficient motivations are in place (Groat & Shane, 2020a). This account has been supported by a recent set of studies indicating that although individuals high in psychopathic traits exhibit aberrant responses to emotional stimuli (Shane & Groat, 2018), and aberrant empathic responses (Arbuckle & Shane, 2017; Meffert et al., 2013) at baseline, they demonstrate that they are capable of engaging with the emotional stimuli when they are tasked with doing so – as indicated by no significant group differences between those high and low in psychopathic traits. This suggests that psychopathic individuals are indeed capable of processing emotional stimuli, having an affective response, and empathizing… but only when they are *motivated* to do so (Groat & Shane, 2020a). It is possible, then, that the normative experience sharing seen in this study was a result of providing individuals with sufficient motivations to share in others' emotions. Therefore, the psychopathy-related results of the current thesis support this notion, as providing task-related instructions led to participants demonstrating increased physiological experience sharing. This is because even those in the spontaneous instruction condition were instructed to direct their attentional resources towards the stimulus, which potentially led to increased processing of the affective facial expressions. Essentially, if psychopathy was truly characterized by an incapacity to process emotional stimuli, as well as share in others' emotions, then we would expect that increased psychopathic traits would be associated with decreased physiological experience sharing, regardless of the type of instruction they were given. However, the results of this study do not support this notion. Rather, these results provide evidence that psychopathic traits may be associated with a lack of motivation to share in emotions, rather than an incapacity to do so.

Limitations and Future Directions

Although the current study adds to the broader literature on experience sharing and psychopathy, it is not without its limitations. First, this study used an undergraduate sample which limits its generalizability. Moreover, this limited sample could explain the psychopathy-related results of this study, as university samples are typically lower in psychopathic traits (Lilienfeld & Andrews, 1996; C. S. Neumann & Hare, 2008). Therefore, this study should be replicated with community and antisocial samples in order to better understand the relationship between psychopathy and the regulation of experience sharing, as these samples tend to have higher levels of psychopathy that reach diagnostic cut-offs.

Another limitation of the current study is that physiological target data for the *Empathic Sharing (ES) Task* was not used to calculate empathic sharing (ES) scores. Instead, changes in a participant's physiological data were correlated with changes in a given target's behavioural data, resulting in the physiological ES scores. Archival target data was used for this study, as time and resources did not allow for the collection of new target data. To get a true understanding of physiological experience sharing using this *ES Task*, future studies should collect behavioural and physiological target data so that correlations can be run between participant and target physiological data.

Furthermore, cognitive load, the used amount of working memory (Paas, Tuovinen, Tabbers, & Van Gerven, 2003; Paas, Van Merriënboer, & Adam, 1994; Sweller, 1988), could have impaired participants' empathic processes. Participants who received the deliberate experience sharing instruction had the additional task of upregulating this response. It is possible that receiving the experience sharing instruction, and subsequently completing other cognitively-demanding parts of the tasks, could have resulted in a greater amount of cognitive load relative to those in the control condition. Increased cognitive load has been previously associated with impaired subjective and neurophysiological empathic responses (Morelli & Lieberman, 2013). Indeed, if providing explicit regulation instructions are too cognitively demanding, then perhaps future studies should explore methodologies which would be more effective at increasing experience sharing without increasing cognitive load. One potential methodology is non-invasive neuromodulation, such as repetitive Transcranial Magnetic Stimulation (rTMS) or transcranial Direct Current Stimulation (tDCS). rTMS alters neural activity by applying brief high-intensity magnetic pulses to the scalp over targeted brain regions (Luber & Lisanby, 2014), whereas tDCS achieves this by applying a small electrical current (typically 1 to 2 mV) to the scalp through small electrodes (Thair, Holloway, Newport, & Smith, 2017; Woods et al., 2016). Previous work has provided evidence for both rTMS (Yang, Khalifa, & Vollm, 2018) and tDCS (Sergiou, Santarnecchi, Franken, & van Dongen, 2020; Wu et al., 2018) as effective methods to improve cognitive and emotional processes such as empathy. Future research should attempt to increase experience sharing using these neuromodulation strategies.

Conclusions and Implications

In sum, the current thesis adds to our current understanding of experience sharing, by demonstrating that there is a motivational component to the process. Specifically, individuals can demonstrate increased subjective and physiological experience sharing when motivated to do so through regulation instructions. However, the results of this thesis indicated that the effectiveness of these regulation instructions depended on the valence of the emotion participants were instructed to share in.

Demonstrating that experience sharing can be increased has considerable treatment implications. This is most relevant for disorders that have been historically characterized as lacking affective empathy, such as Psychopathy, Borderline Personality Disorder, and Autism Spectrum Disorder (Decety & Moriguchi, 2007). Although individuals high in psychopathic traits demonstrate normative cognitive empathy (understanding/mentalizing), they demonstrate abnormal affective empathy including experience sharing (Lockwood, 2016; Marsh, 2013; Wai & Tiliopoulos, 2012). The affective deficits associated with psychopathy are thought to be treatment resistant (Olver, 2016). However, the results of the current thesis indicated that psychopathic traits are associated with increased physiological experience sharing. This may suggest that motivating individuals (even those high in psychopathic traits) can have a positive effect on the naturally occurring affective deficits seen in the disorder. This suggests that motivating experience sharing may be an appropriate target for treatment. Further research is needed to demonstrate whether these results are replicated in an antisocial sample. Demonstrating increased experience sharing in this group of individuals is promising, as experience sharing is associated with prosocial behaviour (Brethel-Haurwitz et al., 2018; O'Connell et al., 2019). Increasing prosocial behaviour within this group, who are at increased risk to engage in antisocial behaviour (Hare, 2003), has potential benefits for society at large. Therefore, the results of this study could be used to inform clinical treatment strategies.

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