



## FlashReports

## Your heart makes my heart move: Cues of social connectedness cause shared emotions and physiological states among strangers

David Cwir<sup>a,\*</sup>, Priyanka B. Carr<sup>b</sup>, Gregory M. Walton<sup>b</sup>, Steven J. Spencer<sup>a</sup><sup>a</sup> University of Waterloo, Canada<sup>b</sup> Stanford University, USA

## ARTICLE INFO

## Article history:

Received 7 October 2010

Revised 13 January 2011

Available online 26 January 2011

## Keywords:

Emotions

Interpersonal interaction

Social interaction

Social behavior

Psychological stress

## ABSTRACT

Two experiments tested the hypothesis that cues of social connectedness could lead even new interaction partners to experience shared emotional and physiological states. In Experiment 1, a confederate prepared for a stress-inducing task. Participants who had been led to feel socially connected to the confederate reported feeling greater stress than participants who had not. In Experiment 2, a confederate ran vigorously in place. Socially-connected participants had greater cardiovascular reactivity (heart rate and blood pressure) than controls. Each study held constant exposure to the confederate. The results suggest that the sharing of psychological and physiological states does not occur only between long-standing relationship partners, but can also result from even subtle experiences of social connectedness. These findings illustrate the dynamic and fluid ways in which important aspects of self can change in response to cues of social relatedness.

© 2011 Elsevier Inc. All rights reserved.

“Emotions, even though their hallmark is the internal state of the individual—the viscera, the gut—are above all social phenomena. They are the basis of social interaction, they are the products of social interaction, their origins, and their currency.”

Zajonc, 1998, pp. 619–620

When a child is teased at school, do her parents feel humiliated too? When a friend sees a buddy panting to finish a race strong, does his heart race too? These examples have powerful intuitive appeal. But do people really feel the same emotions and have the same physiological experiences as those to whom they are socially connected? We argue that they do and, moreover, that a sense of social connectedness can cause shared emotions and physiological experiences, even among strangers with no history of interaction.

One way that people can share and experience other people's feelings is through the simulation of neurological responses (Singer & Lamm, 2009). For example, people may show similar patterns of brain activity when they themselves experience pain and when a romantic partner does (Singer et al., 2004). Additionally, longitudinal research finds that romantic partners become more alike in their emotional experiences over time (Anderson, Keltner, & John, 2003). Of course, shared emotions and physiology could result from the common experiences had by long-standing, well-elaborated relationship partners (Levenson & Reuf, 1992); past research does not test whether a social connection itself—rather than other consequences of long-standing

relationships—causes such shared states. We suggest that a sense of social connectedness, even a sense of connectedness to a new interaction partner, can dynamically shape people's psychological and physiological states (see also Walton, Cohen, Cwir, & Spencer, 2011).

To test this reasoning, we created social connections between participants and strangers in the laboratory and tested whether these connections would lead participants to experience similar emotions and physiological states as the stranger. We manipulated a sense of social connectedness by leading participants to believe that they either shared task-irrelevant preferences with the stranger or not (Walton et al., 2011). We then assessed participants' stress-related emotion as the stranger prepared to deliver a stress-inducing speech (Experiment 1) and physiological arousal after the stranger exercised (Experiment 2). Exposure to the stranger was held constant across conditions.

## Experiment 1

## Participants

Seventy-one White female undergraduates participated ( $M_{age} = 19.24$ ). One participant was excluded as she was an outlier on the key dependent measure ( $>3$  SDs above the mean).

## Prestudy survey

One to ten weeks before the study, participants reported eleven idiosyncratic interests (their favorite actor or actress, movie, type of music, band or musician, music album, book, author, class, and past

\* Corresponding author.

E-mail address: [dcwir@uwaterloo.ca](mailto:dcwir@uwaterloo.ca) (D. Cwir).

travel destination, where they would most like to travel, and where they were born) and rated the importance of each to them ( $1 = \text{not at all meaningful}$ ,  $9 = \text{very meaningful}$ ). Participants also completed the social phobia inventory (17-items; e.g., “I avoid having to give speeches;”  $0 = \text{not at all}$ ,  $4 = \text{extremely}$ ; Connor et al., 2000;  $\alpha = .92$ ).

#### Procedure and manipulation

Participants took part in a study on “personality” and “cognitive tasks” with a White female confederate presented as another participant. First, the experimenter asked the participant and the confederate a series of questions about personal interests ostensibly as a “getting-to-know-you” exercise. This conversation contained the social-connection manipulation (Walton et al., 2011). The manipulation drew on research showing that similarity is an important basis of feelings of social connectedness (Byrne, 1997). In the social-connection condition, three of the confederate’s five answers matched the preferences the participant had provided in the prestudy survey. Answers that were relatively rare and which participants had rated as relatively meaningful were selected. In the no-connection condition, participants were yoked to a participant in the social-connection condition: They heard the same interests expressed but those interests did not match their interests. To keep the experimenter and the confederate unaware of the participant’s condition assignment, the script that both used was tailored by another experimenter before each experimental session. In addition, the confederate was unaware of the purpose of the experiment.

The confederate and participant were then ostensibly randomly assigned to complete either a “memory task” or a “personality questionnaire.” They drew slips of paper from a basket; both slips read “personality questionnaire” but the confederate said that hers read “memory task.” The “memory task” was described as memorizing and delivering a speech on “neurophysiology” to a panel of judges. To display feelings of stress, the confederate responded to the instructions by acting stressed and by anxiously saying, for instance, “I’m really bad at giving speeches. Am I going to be evaluated?” As the confederate began preparing for her speech, the experimenter gave the participant a “personality questionnaire” containing the dependent measures. The confederate remained in the room preparing for the speech as the participant completed the measures ( $\approx 5\text{--}10$  min).

#### Dependent measures

##### Stress-related emotion

Participants rated how well a series of emotion words described how they felt “right now” ( $1 = \text{not at all}$ ,  $7 = \text{extremely well}$ ). The key outcome involved the mean response to 11 stress-related words (e.g., *stressed*, *alarmed*;  $\alpha = .91$ ). These words were embedded among 24 words unrelated to stress (e.g., *joyful*).

##### Manipulation checks

We assessed feelings of social connectedness in three ways: (1) interest in “getting to know the other participant better” ( $1 = \text{not at all interested}$ ,  $7 = \text{extremely interested}$ ); (2) projected closeness (2-items modified from Berscheid, Snyder, & Omoto, 1989; e.g., “Relative to your other relationships, if you and this person were to become friends, how close do you think you would be?”;  $1 = \text{not at all close}$ ,  $7 = \text{extremely close}$ ;  $r = .74$ ,  $p < .01$ ); (3) and sense of shared self (Cialdini, Brown, Lewis, Luce, and Neuberger’s (1997) 2-item “oneness” index: Aron, Aron, and Smollan’s (1992) Inclusion of Other in the Self (IOS) Scale and the extent to which participants said they would use the word “we” to describe their relationship with the confederate;  $r = .60$ ,  $p < .001$ ).

**Table 1**  
Mean rating of stress-related emotions by social connection condition.

Condition*	Stress ratings	
	M	SD
Social connection	3.10	1.00
No connection	2.64	.87

Note. \*Means and standard deviations adjusted for social phobia scores.

#### Filler items

To substantiate the cover story, participants also completed several personality measures (e.g., the Prevention/Promotion Scale, Lockwood, Jordan, & Kunda, 2002; an extraversion scale, Buchanan, Johnson, & Goldberg, 2005).

#### Results

##### Manipulation checks

As predicted, participants in the social-connection condition reported a greater desire to get to know the confederate better ( $M = 5.11$ ,  $SD = 1.26$ ) vs. ( $M = 4.00$ ,  $SD = 1.37$ ),  $t(68) = 3.55$ ,  $p = .001$ , a greater sense of closeness to the confederate ( $M = 4.44$ ,  $SD = 1.10$ ) vs. ( $M = 3.69$ ,  $SD = 1.18$ ),  $t(68) = 2.77$ ,  $p = .007$ , and a greater sense of oneness with the confederate ( $M = 3.03$ ,  $SD = 1.44$ ) vs. ( $M = 2.40$ ,  $SD = 1.12$ ),  $t(68) = 2.04$ ,  $p = .045$ .

##### Stress-related emotion

Stress-related emotion was analyzed in an ANCOVA as social phobia was a significant covariate. As predicted, participants reported greater stress in the social-connection condition than in the no-connection condition,  $F(1,67) = 3.92$ ,  $p = .05$  (Table 1).<sup>1</sup>

#### Experiment 2

In Experiment 1, people led to feel socially connected to a confederate preparing for a stress-inducing speech reported experiencing greater stress themselves. Experiment 2 tested whether the effects would extend to physiological arousal. A confederate exercised and we assessed participants’ cardiovascular reactivity. In addition, rather than matching participants’ gender and ethnicity with that of the confederate as in Experiment 1, in Experiment 2 we allowed participants’ social identity to vary to examine whether the effects would be robust to this factor.

#### Methods

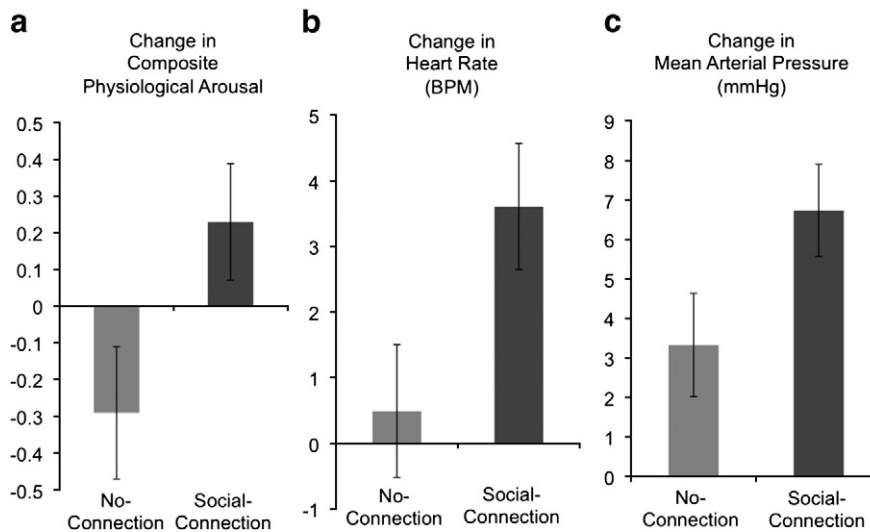
##### Participants

Forty-five undergraduates participated (16 White, 17 Asian, 2 Black, 2 Latino, 8 other; 29 female;  $M_{age} = 18.91$ ). Two participants were excluded, one because of errors recording data and one for failing to follow instructions. Participants completed the same prestudy interest survey as in Experiment 1.

##### Procedure and measures

Participants reported for a study on “the physiological effects of exercise,” briefly met a White female confederate, and rested alone for

<sup>1</sup> Statistical tests of mediation involve many complexities and assumptions (Bullock, Green, & Ha, 2010; see also Spencer, Zanna, & Fong, 2005). Therefore, a definitive test of mediation is beyond the scope of this paper. Nonetheless, standard analyses suggest that the sense of shared self may have mediated the condition effect on stress-related emotion (but there was no evidence for a mediating role of relationship interest or projected closeness). Controlling for felt oneness with the confederate rendered the condition effect on stress-related emotion nonsignificant,  $t(67) = 1.47$ ,  $p = .15$ . Simultaneously, felt oneness predicted stress-related emotion,  $t(67) = 1.88$ ,  $p = .06$ . The reduction of the condition effect was marginally significant, asymmetric distribution of products test (ADPT) 90% confidence interval: .33–.001,  $p < .10$  (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).



**Fig. 1.** Change from baseline to after the confederate exercised by social-connection condition in (a) composite physiological arousal (the average of the standardized change in heart rate and standardized change in mean arterial pressure), (b) heart rate (BPM), and (c) mean arterial pressure (mm Hg) (Experiment 3). Means are adjusted for the baseline level of the relevant measure of physiological arousal. Error bars represent  $\pm 1$  standard error.

3 min. Next participants' baseline heart rate (HR) and blood pressure (BP) were assessed, participants were reintroduced to the confederate, and had the getting-to-know-you conversation described in Experiment 1 to manipulate social connectedness. As in Experiment 1, prior to each experimental session another researcher individually-tailored scripts for this conversation so both the confederate and the experimenter remained unaware of participants' condition assignment. In addition, the confederate was unaware of the hypothesis. Participants were then led to believe that they had been assigned to sit while the confederate had been assigned to run in place. Participants were seated beside the confederate as she ran vigorously in place for 3 min, after which the participant's HR and BP were assessed. Participants were then taken to a private room where they completed manipulation check measures. Change in HR and BP (calculated as Mean Arterial Pressure, MAP) from baseline to after the confederate exercised was computed. The change scores correlated ( $r = .32$ ,  $p < .05$ ) and were standardized and averaged to form a measure of change in composite physiological arousal.

As in Experiment 1, participants' sense of shared self with the confederate was assessed using Cialdini et al.'s (1997) oneness index. In addition, we assessed perceived similarity to the confederate (2-items, e.g., "How similar are you to the other participant (confederate)?"; 1 = not at all similar, 7 = very similar;  $r = .80$ ,  $p < .01$ ).

## Results

### Manipulation checks

As predicted, participants in the social-connection condition perceived themselves as more similar to the confederate ( $M = 5.13$ ,  $SD = 1.34$ ) vs. ( $M = 3.16$ ,  $SD = 1.28$ ),  $t(41) = 4.88$ ,  $p < .001$ . Unlike Experiment 1, the two oneness items were uncorrelated,  $r = .26$ ,  $ns$ , and so were analyzed separately. On the IOS, as predicted, participants reported greater overlap between themselves and the confederate in the social-connection condition ( $M = 3.08$ ,  $SD = 1.50$ ) vs. ( $M = 2.11$ ,  $SD = 1.05$ ),  $t(41) = 2.41$ ,  $p = .02$ . There was no effect on the "we-ness" item,  $t < 1.84$ ,  $ns$ .<sup>2</sup>

<sup>2</sup> Although unexpected, procedural details may account for the null effect on the "we-ness" item. Unlike Experiment 1, in Experiment 2 the confederate and the participant physically did different things, with the confederate running and the participant sitting, and participants completed the we-ness item in a separate room from the confederate. If participants interpreted the we-ness question in a concrete way rather than in terms of the nature of their relationship with the confederate this could have compromised the measure.

### Physiological arousal

Following Blascovich and Kelsey (1990), analysis of change in physiological arousal controlled for the average of standardized HR and MAP at baseline (excluding this covariate does not change the results). Participants had a greater rise in composite physiological arousal in the social-connection condition than in the no-connection condition,  $F(1,40) = 4.78$ ,  $p = .035$ . This effect was significant for change in HR, controlling for baseline HR,  $F(1,40) = 4.43$ ,  $p = .042$ , and marginal for change in MAP, controlling for baseline MAP,  $F(1,40) = 3.72$ ,  $p = .061$  (Fig. 1).<sup>3,4</sup>

### General discussion

Two experiments showed that a sense of social connectedness to a stranger caused people to experience the stranger's emotional states (Experiment 1) and physiological arousal (Experiment 2). The relatively minimal basis of the social connection in these studies, and the fact that the connection was experimentally manipulated rather than observed, suggests that a sense of social connectedness itself apart from other factors that arise in ongoing social relationships can cause shared emotions and physiology.

Notably, the reverse causal path—from shared psychological states to feelings of connectedness—is also important (Anderson et al., 2003). An interesting question is whether these processes mutually reinforce each other and, if so, what mechanisms are involved. For instance, people who feel connected to one another may experience greater merging of self and other, resulting in greater sharing of psychological states, which, in turn, may further reinforce self-other overlap and

<sup>3</sup> There was some evidence that inclusion of the other in the self mediated the condition effect on physiological arousal. Controlling for IOS rendered the condition effect on physiological arousal nonsignificant,  $t(39) = 1.48$ ,  $p = .22$ . Simultaneously, IOS affected physiological arousal,  $t(39) = 2.98$ ,  $p = .005$ . The reduction of the condition effect was significant, ADPT 95% confidence interval: .19–.06,  $p < .05$ . By contrast, there was no evidence for a mediating role for perceived similarity. Although a more systematic investigation of psychological processes awaits future research, the results suggest the potential importance of a sense of shared self in mediating the results.

<sup>4</sup> If a sense of social connectedness leads to shared physiological arousal, the manipulation should increase arousal only after the confederate exercised. To test this prediction, we also assessed participants' arousal after the getting-to-know-you conversation but before the confederate exercised. There was no condition difference in change in composite physiological arousal from baseline to this assessment, controlling for baseline arousal,  $F < 1.50$ ,  $p > .20$ .

strengthen the relationship. Future experimental and longitudinal research should explore these processes.

Another interesting question involves the nature of the social-connection manipulation used in the present research. In both experiments, a sense of social connectedness was created by matching a stranger's preferences to participants' valued, idiosyncratic preferences. What type of shared preferences is most likely to create a sense of social connection? An intriguing possibility is that the specificity or novelty of the connection may matter more than its importance to the self—even a shared interest in an esoteric author or something as trivial as a shared birthday (Walton et al., 2011) may facilitate feelings of connectedness perhaps even more than shared and deeply valued but relatively common identities (e.g., shared gender identities, Goldstein, Cialdini, & Griskevicius, 2008).

Another question involves how the process by which people develop shared psychological states with relationship partners relates to other forms of social influence, such as conformity to group norms (Cialdini & Goldstein, 2004). In many cases, we suspect these processes co-occur and contribute to similar outcomes. Indeed, norms could have contributed to the present results. However, the present research is novel relative to research on norms in that it examines dyadic processes rather than conformity to a group norm. Additionally, whereas past research on norms has tended to focus on shared behaviors and attitudes, the present research finds effects on shared emotions and physiology. An important direction for future research involves investigating the relationship between these processes.

Much research in psychology emphasizes affective and cognitive processes that occur in the isolated minds of individuals. This research treats the social context as providing input into basic internal processes (e.g., Bargh, Chen, & Burrows, 1996; Kunda, 1999). Complementing this approach, the present research suggests that psychologically the self and the other can blur (Aron et al., 2004). Even minimally instantiated social relationships can lead people to experience common psychological and physiological states (see also Walton & Cohen, *in press*). If brief social ties can have such effects, the degree to which individuals' psychological experiences arise in tandem with the psychological experiences of others may be more pervasive than now understood.

## Acknowledgments

We thank James Gross for insightful feedback. The research was supported by a SSHRC of Canada grant to Steven Spencer.

## References

- Anderson, C., Keltner, D., & John, O. P. (2003). Emotional convergence between people over time. *Journal of Personality and Social Psychology*, *84*, 1054–1068.
- Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of Other in the Self Scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, *63*, 596–612.
- Aron, A., McLaughlin-Volpe, T., Mashek, D., Lewandowski, G., Wright, S. C., & Aron, E. N. (2004). Including others in the self. *European Review of Social Psychology*, *15*, 101–132.
- Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, *71*, 230–244.
- Berscheid, E., Snyder, M., & Omoto, A. M. (1989). The Relationship Closeness Inventory: Assessing the closeness of interpersonal relationships. *Journal of Personality and Social Psychology*, *57*, 792–807.
- Blascovich, J., & Kelsey, R. M. (1990). Using cardiovascular and electrodermal measures of arousal in social psychological research. In C. Hendrick, & M. S. Clark (Eds.), *Review of personality and social psychology*, *11*. Newbury Park, CA: Sage.
- Bullock, J. G., Green, D. P., & Ha, S. E. (2010). Yes, but what's the mechanism? (Don't expect an easy answer). *Journal of Personality and Social Psychology*, *98*, 550–558.
- Buchanan, T., Johnson, J. A., & Goldberg, L. R. (2005). Implementing a five-factor personality inventory for use on the internet. *European Journal of Psychological Assessment*, *21*, 115–127.
- Byrne, D. (1997). An overview (and underview) of research and theory within the attraction paradigm. *Journal of Social and Personal Relationships*, *14*, 417–431.
- Cialdini, R. B., Brown, S. L., Lewis, B. P., Luce, C., & Neuberg, S. L. (1997). Reinterpreting the empathy–altruism relationship: When one into one equals oneness. *Journal of Personality and Social Psychology*, *73*, 481–494.
- Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Review of Psychology*, *55*, 591–621.
- Connor, K. M., Davidson, J. R. T., Churchill, L. E., Sherwood, A., Foa, E. B., & Weisler, R. H. (2000). Psychometric properties of the Social Phobia Inventory (SPIN): A new self-rating scale. *The British Journal of Psychiatry*, *176*, 379–386.
- Goldstein, N. J., Cialdini, R. B., & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research*, *35*, 472–482.
- Kunda, Z. (1999). *Social cognition: Making sense of people*. Cambridge, MA: MIT Press.
- Levenson, R. W., & Ruef, A. M. (1992). Empathy: A physiological substrate. *Journal of Personality and Social Psychology*, *63*, 234–246.
- Lockwood, P., Jordan, C. H., & Kunda, Z. (2002). Motivation by positive or negative role models: Regulatory focus determines who will best inspire us. *Journal of Personality and Social Psychology*, *83*, 854–864.
- Mackinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, *7*, 83–104.
- Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *The Year in Cognitive Neuroscience 2009: Annals of the New York Academy of Sciences*, *1156*, 81–96.
- Singer, T., Seymour, B., O'Doherty, J., Kaube, H., Dolan, R. J., & Frith, C. D. (2004). Empathy for pain involves the affective but not sensory components of pain. *Science*, *303*, 1157–1162.
- Spencer, S. J., Zanna, M. P., & Fong, G. T. (2005). Establishing a causal chain: Why experiments are often more effective than mediational analysis in examining psychological processes. *Journal of Personality and Social Psychology*, *89*, 845–851.
- Walton, G. M., & Cohen, G. L. (in press). Sharing motivation. To appear in D. Dunning (Ed.) *The handbook of social motivation*.
- Walton, G. M., Cohen, G. L., Cwir, D., & Spencer, S. J. (2011). Mere belonging: The power of social connections. Under review.
- Zajonc, R. B. (1998). Emotions. In D. T. Gilbert, S. T. Fiske, & G. Lindsay (Eds.), (4th ed.) *The handbook of social psychology*, Vol. 1. (pp. 591–632) Boston: McGraw-Hill.