

## ORIGINAL ARTICLE

# Nonlocal Intuition: Replication and Paired-subjects Enhancement Effects

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## ABSTRACT

This article reports the results of a study of repeat entrepreneurs in Tehran, Iran, in which nonlocal intuition was investigated in a replication and extension of experiment using measures of heart rate variability (HRV). Nonlocal intuition is the perception of information about a distant or future event by the body's psychophysiological systems, which is not based on reason or memories of prior experience. This study follows up on the McCraty, Radin, and Bradley studies, which found evidence of nonlocal intuition. We used Radin's experimental protocol, with the addition of HRV measures as in the McCraty studies involving computer administration of a random sequence of calm and emotional pictures as the stimulus, and conducted two experiments on mutually exclusive samples—the first on a group of single participants ( $N=15$ ) and the second on a group of co-participant pairs ( $N=30$ )—to investigate the question of the “amplification” of intuition effects by social connection. Each experiment was conducted over 45 trials while heart rate rhythm activity was recorded continuously. Results, using random permutation analysis, a statistically conservative procedure, show significant pre-stimulus results—that is, for the period before the computer had randomly selected the picture stimulus—for both experiments. Moreover, while significant separation between the emotional and calm HRV curves was observed in the single-participant experiment, an even larger separation was apparent for the experiment on co-participant pairs; the difference between the two groups was also significant. Overall, the results of the single-participant experiment confirm previous finding: that electrophysiological measures, especially changes in the heart rhythm, can detect intuitive foreknowledge. This result is notable because it constitutes cross-cultural corroboration in a non-Western context—namely, Iran. In addition, the results for co-participant pairs offer new evidence on the amplification of the nonlocal intuition signal.

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## INTRODUCTION

Entrepreneurship is venture creation based on the recognition of a new opportunity, its development, and exploitation.<sup>1</sup> Cromie defines entrepreneurs as being opportunistic, innovative, creative, and imaginative; “ideas” people who tend to be restless, proactive, and adventurous and thrive in the role of change agent.<sup>2</sup> Moreover, because successful entrepreneurs are innovators and risk assessors who often have extraordinarily accurate hunches—intuitions—about the locus of future opportunities, they are a key element in a healthy, thriving economy.<sup>3</sup> Understanding how successful entrepreneurs recognize such opportunities is a key question that has been at the forefront of entrepreneurship research for many years (eg, Simon<sup>4</sup>; Mitchell, Friga<sup>5</sup>). And yet despite the efforts of more than 50 years of research, there is still no adequate explanation for entrepreneurial success.<sup>6</sup>

The dominant perspective has been a cognitive approach that emphasizes that it is the way in which successful entrepreneurs process information to locate potential future business opportunities that sets them apart from other businesspeople.<sup>7,8</sup> (eg, Agor<sup>9</sup>; Simon<sup>4</sup>; Lieberman<sup>10</sup>). In this viewpoint, causal primacy is accorded to the role of existing knowledge stored in the brain from prior experience in informing entrepreneur-

ial behavior. This reasoning even extends to intuition, where its use has been consistently cited by entrepreneurship practitioners as an important reason for their success (eg, Agor<sup>9</sup>; Block<sup>11</sup>; Hayashi<sup>12</sup>; Klein<sup>13</sup>) and where research has shown that entrepreneurs tend to be more intuitive and less analytic in how they make decisions.<sup>14,15</sup> Moreover, discussions about the role of intuition in healing can be found throughout the medical literature; such papers are especially conspicuous in nursing journals.<sup>16</sup> Thus, as for decisions based on reasoning and logic, such “intuitive” ability is viewed as stemming from both conscious and unconscious knowledge (including templates, concepts, and extrapolations) acquired from prior experience (eg, Simon<sup>4</sup>; Mitchell, Friga<sup>5</sup>). But not only has this perspective been of limited empirical utility in explaining successful foresight, it leaves unaddressed the core question of the internal processes by which intuition occurs.

Extensive research in the field of psychophysiology has shown that there is, in fact, another potential source of intuitive information the clinician can use in diagnosing or treating and entrepreneurs and executives could use in assessing business opportunities: namely, the information about nonlocal—distant or future—events that is received and processed by the body's psychophysiological systems (eg, McCraty,

Atkinson<sup>17</sup>; Radin and Schlitz<sup>16</sup>; Radin<sup>18</sup>). Moreover, there is now evidence from a recent study of repeat entrepreneurs in the Cambridge (United Kingdom) Technopol of a significant nonlocal intuition effect in entrepreneurs.<sup>19</sup> At an applied level, the promise of developing an understanding of the psychophysiological processes that underlie intuition is an important step toward learning how intuition is activated, how this capacity can be consciously developed and enhanced, and, ultimately, how it can be accessed by the individual at will.

The research reported in this article is a follow-up study on the findings of the study by McCraty.<sup>17</sup> The first and second authors (SR and MM) conducted two experiments, both with McCraty's modifications to Radin's computer-administered "emotional/calm" picture-stimulus protocol,<sup>16</sup> using electrophysiological measures of heart rhythm activity to detect nonlocal intuition in a sample of repeat entrepreneurs (N=45) in Tehran, Iran. The first experiment, administered to a group of single participants, and the second experiment, administered to a different group of co-participant pairs, aimed to investigate the question of the "amplification" of intuition effects when in socially connected contexts. The results are promising in that significant pre-stimulus results—in the period before the computer had randomly selected the picture stimulus—were found in both experiments.

## INTUITION

Broadly speaking, there are two distinct views of intuition. Although almost all definitions of intuition have certain elements in common—such as originating beyond conscious thought, immediate total comprehension and understanding, holistic insights and associations, affectively charged judgments<sup>20</sup>—the more common notion is that intuitive perception is largely the result of past experience: a function of the unconscious mind accessing existing information stored within the brain from prior experience.<sup>9,21-23,24,25</sup> McCraty has proposed that there are three different categories or types of processes that the term *intuition* is used to describe. The first is often referred to as implicit knowledge or implicit learning. It refers to something we learned in the past and either forgot or didn't realize we learned. A number of "pattern-recognition" models have been developed to explain how this fast type of "intuitive" decision and action can be understood purely in terms of neural processes in which the brain matches the patterns of new problems or challenges with stored templates in memory based on prior experience. The second type is called energetic sensitivity and refers to the ability to sense environmental signals such as electromagnetic fields. The third type, which is the subject of this study, is nonlocal intuition, the knowledge or sense of something that cannot be explained by past or forgotten knowledge.<sup>26</sup>

Variations of implicit types of intuition are that intuition is "affectively charged judgments that arise

through rapid, non-conscious, and holistic associations"<sup>27</sup>; a cognitive conclusion that is based on previous experience and emotional inputs<sup>28</sup>; a complex, quick, non-emotional and non-biased psychological process that is based on "chunking" that an expert hones over years of specific task experience<sup>29-31</sup>; a process of pattern recognition<sup>32</sup>; a smooth, automatic performance of learned behavior sequences<sup>33</sup>; a subconscious form of intelligence not accessible through rational thought<sup>29,30,34</sup>; a subjective feeling rooted in past experience.<sup>35</sup>

There is another view that considers instances when so-called "gut feelings" or "intuitive insights" are found to be valid and related to circumstances so unique that these intuitions do not seem explicable on the basis of prior experience. It is postulated that such intuitive perception involves connection to a field of non-local information beyond normal conscious awareness.<sup>36</sup> This source of intuitive information enables the entrepreneur to access information regarding future opportunities—namely, information about nonlocal events that is received and processed by the brain, heart, and autonomic nervous system (ANS).<sup>17,18</sup> McCraty and others call this "nonlocal intuition" to emphasize that it is not based on memory of prior experience and involves the body accessing information about distant or future events. This tacit information is not accessed by the dispassionate cognitive processing that underlies reason and logic. Rather, it is the entrepreneur's passionate focus on his mission in economic life that attunes his body's psychophysiological systems by a process of energetic resonance to intuitive information from nonlocal sources.<sup>37</sup>

The concept of nonlocality originates from quantum physics where, as a concept, it is used to describe the empirical discovery of the fundamental interconnectedness, as in the Aspect and Tittel experiments of the 1980s and 1990s, of everything in the universe at the quantum level—the level of sub-atomic particles.<sup>38</sup> In the words of Bohm and Peat:

*When several particles are treated in the causal interpretation then, in addition to the conventional classical potential that acts between them, there is a quantum potential which now depends upon all the particles. Most importantly, this potential does not fall off with the distance between particles, so that even distant particles can be strongly connected. This feature, in which very distant events can have a strong influence, is what is meant by a non-local interaction and is strongly at variance with the whole spirit of classical mechanics.<sup>39</sup>*

From the above statement, it is concluded that non-local quantum potential directly connects distant particles. This is the essence of interconnectedness in the universe and the means of information transfer across space/time.

The more common conception of intuition, discussed above, is based upon a very linear understanding of cognition in processing information already existing in the data banks of the brain. However, using the concept of nonlocality from physics and the fact that the human body is also composed of energy fields and potentials, it follows that these fields can interact with other fields of energy waveforms both around the body and in the universe. Nonlocal intuition can then be examined as that tacit information available in the quantum field (that is “outside” the body) and its interaction with the field of quantum coherent energy particles of the human body.<sup>14</sup>

Bradley’s quantum-holographic theory postulates that passionate attention—that is, the biological energy activated in his emotional connection to the nonlocal object of interest (eg, the quest for future opportunities in a certain field of business)—attunes him to the object’s unfolding pattern of activity and to the implicit order of its future potential.<sup>40,41</sup> Both the pattern of activity and the potential future order are spectrally encoded as a quantum hologram in a field of potential energy as implicit information in a domain apart from space and time. At a biological level, the body’s psychophysiological systems generate numerous fields of energy at various frequencies that interpenetrate the field of potential energy. When the entrepreneur calms his mind and feelings and adopts a heart-focused state of positive emotion directed to the object, a global shift to psychophysiological coherence is induced that optimizes intentional resonance with the incoming quantum level information from the object of interest. Such attunement brings the outgoing wave field of intentional energy from the entrepreneur’s psychophysiological systems into harmonic resonance with the incoming wave field of energy from the object. The harmonic resonance between the two wave fields of energy creates an optimal channel for communication of nonlocal information (Figure 1).<sup>37,41</sup>

From this view, nonlocal intuition is defined as a process by which implicit information normally outside the range of cognitive processes is sensed and perceived by the body’s psychophysiological systems as certainty of knowledge or positive and negative feel-

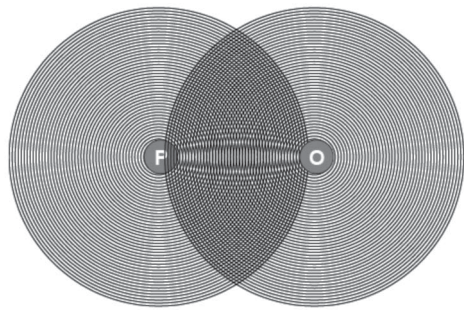
ings about the totality of something distant or yet to happen. It involves the entire psychophysiological system, often manifesting through a wide range of emotional feelings and physiological changes experienced throughout the body.<sup>17</sup>

Virtually all of the studies of intuition have involved administration of the experiment to a single research subject (one individual) in each trial. But Bradley’s theory predicts that it is also likely that intuitive ability is enhanced or inhibited by the degree to which the field of bio-emotional energy activated in the socio-emotional relations among group members is coherently organized.<sup>37,41</sup> Regular interaction within a socio-emotionally coherent group should amplify the harmonic resonance of the group’s bio-emotional energetic field with the energetic field of the object of intentional interest. So besides conducting replication of the previous experiments on nonlocal intuition, we undertook a second experiment using the same experimental protocol to investigate whether there was evidence of an “amplification” of the nonlocal intuition effect by the combined presence of the psychophysiological fields of two entrepreneurs when compared to a single entrepreneur in the first experiment. We (SRT and MM) thought that it would be of interest to find out whether the nonlocal intuitive effect is strengthened when a group of entrepreneurs focus their attention on the same object of intentional interest.

## PREVIOUS RESEARCH

Despite a voluminous body of evidence (see Radin<sup>19</sup> and Bradley<sup>42</sup>), mainstream science still regards the findings of intuitive perception as anomalous.<sup>43</sup> And while there are many studies using a cognitive approach to intuition, these researchers interpret intuitive perception largely as the result of past experience.<sup>9,10,21-23,24</sup> But there have been a series of studies using a nonlocal approach, which, by using rigorous experimental protocols and electrophysiological instrumentation, have challenged the central postulate of the cognitive approach by consistently showing that the body typically responds to a future emotionally arousing stimulus 4 to 7 seconds before experiencing the stimulus.<sup>17,18,44-46</sup>

The beginning of this recent approach was Levin and Kennedy’s research.<sup>47</sup> They observed a significantly larger contingent negative variation (CNV), which is a slow brain wave potential associated with anticipation, expectancy, or cortical priming just before subjects were presented a target stimulus. Then Warren et al found significant differences in event-related potentials (ERP) between target and non-target stimuli presented during forced-choice precognition tasks.<sup>48</sup> Studies by Don et al<sup>49</sup> and McDonough et al<sup>50</sup> offered corroborating support for these findings. Because the research subjects’ overt guessing accuracy was no better than chance, the ERP effect was interpreted by these researchers as an indicator of “unconscious precognition.”



**Figure 1** A channel of coherent interaction created by two interpenetrating energy wave fields at the same frequency radiating from a perceptant (P) and an object (O).

In the last decade, researchers have broadened the focus beyond the brain to investigate whether the human autonomic nervous system (ANS) could unconsciously respond to randomly selected future emotional stimuli.<sup>41</sup> Using measures of skin conductance level (SCL) and photoplethysmographic measures of heart rate and blood volume, Radin<sup>18, 44, 49</sup> designed experiments to evoke an emotional response using randomly selected emotionally arousing or calming photographs as the target stimulus.<sup>18,46,51</sup> The experiments indicated a significantly greater change in SCL 5 seconds before a future emotional image than before a future calm one. Subsequent studies corroborated these results.<sup>45,46,51,52</sup> In another study, brain activation in regions near the amygdala (which handle the processing of strong emotions such as fear and sexual drive) was observed before the emotional pictures were presented but not before the calm pictures.<sup>52</sup>

A later study added measures of brain response (electroencephalogram, EEG) and heart rhythm activity (electrocardiogram, ECG) to Radin's protocol and found that not only did both the brain and heart receive the pre-stimulus information some 4 to 5 seconds before a future emotional picture was randomly selected by the computer but that the heart received this information even before the brain.<sup>17</sup> In a follow-up study using random presentation of "pleasant" and "unpleasant" acoustical stimuli, Tressoldi et al found supporting evidence of the heart's involvement in predicting future events.<sup>53</sup>

In a recent experiment tracking pupillary dilation, spontaneous blinking, and eye movements of participants before, during, and after the stimulus, Radin found that there were larger anticipatory responses before randomly administered emotional photos than before calm photos; this was under laboratory-controlled conditions that excluded sensory cues, statistical cues, and other conventional means of inferring the future.<sup>54</sup> Finally, in the only study we are aware of to use electrophysiological measures (SCL and HRV) to investigate nonlocal intuition in entrepreneurs, Bradley, Gillin, McCraty, and Atkinson in two experiments using a gambling protocol found a significant separation between the win and loss curves around 5 seconds before the computer randomly selected the betting outcome.<sup>37</sup> The consistent finding across these studies is that the body typically responds to a future emotionally arousing stimulus 4 to 7 seconds before experiencing the stimulus.

## RESEARCH DESIGN AND METHODS

### Hypotheses

The study was designed to test two hypotheses:

- First, following the hypothesis of the Bradley et al<sup>40</sup> study on repeat entrepreneurs, that the psychophysiological system of entrepreneurs responds to pre-stimulus information about an emotionally arousing future event and

- Second, that perception of a nonlocal event is amplified by a socio-bio-emotional field connecting co-participants.<sup>42,55</sup>

### Participants

Forty-five adult participants—all males, with one exception—ranging in ages from 27 to 54 (mean age 43) years, were recruited by email notices and phone calls from the population of repeat entrepreneurs in the science and technology parks of the city of Tehran, Iran. Repeat entrepreneurs were chosen for this research because they are most likely to have demonstrated that their success is not due to luck alone—that they have beaten the odds against success.<sup>56</sup> Following the operational criteria of previous studies,<sup>14,40</sup> repeat entrepreneurs were defined as those who have had two or more successful ventures; also, only owners of firms with fewer than 199 employees were chosen.

To test the study's hypotheses, the sample was divided into two mutually exclusive groups: for Experiment One, a group of 15 single participants, each of whom was administered the stimulus protocol alone; for Experiment Two, a second group of 15 co-participant pairs (previously not known to each other) who were administered the stimulus protocol simultaneously while sitting facing each other behind two monitors. As the individuals in the co-participant pairs were not allowed any interactions and did not know each other, the second experiment examined only the aggregation effect of the presence of two psychophysiological bio-emotional fields (one from each participant) on intuition quality.

All participants were in good health and had normal or corrected-to-normal vision. As is evident from the data in Table 1, with the exception of a higher proportion with graduate-level education in the co-participant group, the two groups were broadly equivalent in terms of business experience/characteristics.

**Table 1** Sample Characteristics by Experiment

Descriptive Variable	Experiment 1, Single Participant	Experiment 2, Co-Participant	Total
<b>No. of cases</b>	15	30	45
<b>Mean Age (min-max)</b>	43.73 (32-53)	41.90 (27-54)	42.51 (27-54)
<b>Education:</b>	%	%	%
< Bachelors	73.3	60.0	64.4
MA/PhD	26.7	40.0	35.5
<b>Mean no. years Bus. Experience (min-max)</b>	11.07 (3-20)	8.27 (3-19)	9.20 (3-20)
<b>Mean no. Businesses (min-max)</b>	3.00 (2-9)	2.70 (2-6)	2.80 (2-9)
<b>Mean Firm Size<sup>a</sup> (min-max)</b>	42.20 (7-124)	42.56 (12-170)	42.44 (7-170)

<sup>a</sup> No. of employees.

## Equipment

Heart rate rhythm data were recorded using a bio-feedback device manufactured by Thought Technology Ltd (Quebec, Canada). Data acquisition occurred at a rate of eight samples per second. The presentation and random selection of stimuli were controlled by a program called “Picture viewer” written by Heshmat Baharlou in Microsoft visual C# 2005 (Microsoft Corp, Redmond, Washington). A Microsoft Windows XP computer was used to run the “Picture viewer” program and display the picture images on the monitors; a splitter shared the displayed image on the monitors. A second Microsoft Windows XP computer was used to record the heart activity data for each participant using BioGraph Infiniti software (a multimedia biofeedback and data-acquisition system; Thought Technology Ltd, Quebec, Canada).

## Testing Procedure

We used Radin’s experiment protocol,<sup>18,46</sup> in which the research participants were presented via computer a random sequence of 30/60 calm and 15/30 emotional color pictures—rated for emotional arousal level—from the International Affective Picture System (IAPS) while noninvasive electrophysiological recordings of HRV (per McCraty et al<sup>17,57</sup> and Bradley et al<sup>40</sup>) were continuously gathered throughout each experiment’s 45 trials (Table 2). In order to prevent physiolog-

ic habituation to the emotional pictures, a ratio of 2:1 calm/emotional pictures was used. Calm pictures (land/seascapes, fruit, pets, common objects, etc) were randomly selected from a set of 60 images with the lowest arousal ratings, and the emotional pictures (depicting scenes of violent/emotionally arousing content) were randomly chosen from a set of 30 images with the highest arousal ratings. Seventeen-inch monitors were used to display the pictures at 600 x 800 resolution. No picture was presented more than once. The total number of trials was 2025 (45 pictures x 45 participants).

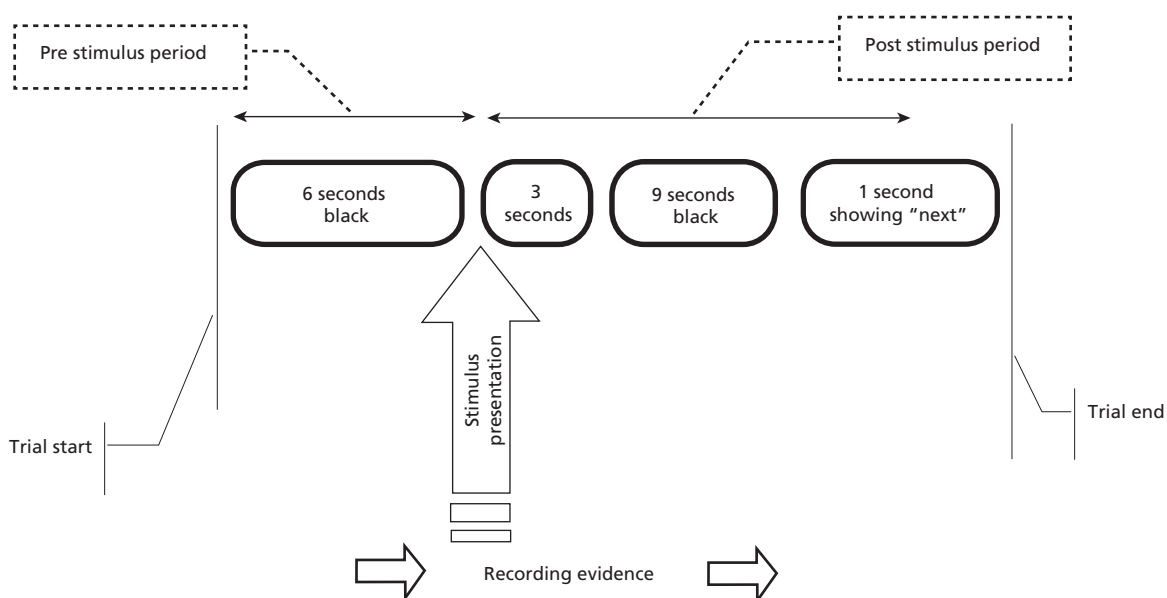
The basic procedure for the two experiments was the same. After a participant (P) entered the lab, he or she was told that the purpose of the research was to study reactions to emotional stimuli; the participants were not aware of the study’s real purpose. They were seated in chairs in a room with a comfortable room temperature (~24°C) about 0.5 of a meter in front of an eye-level computer monitor with a sensor attached to the wrist. The participant was instructed to look at the monitor and follow the onscreen instructions and then was left alone to begin the experiment.

To begin the trial sequence, the subject pressed the “Start” button, after which there was a delay period of 6 seconds (the pre-stimulus period) before the stimulus was randomly selected and displayed for 3 seconds. A delay period of 9 seconds followed, after which the “Next” button appeared for 1 second to begin the next trial (Figure 2). Each experiment was repeated over 45 trials.

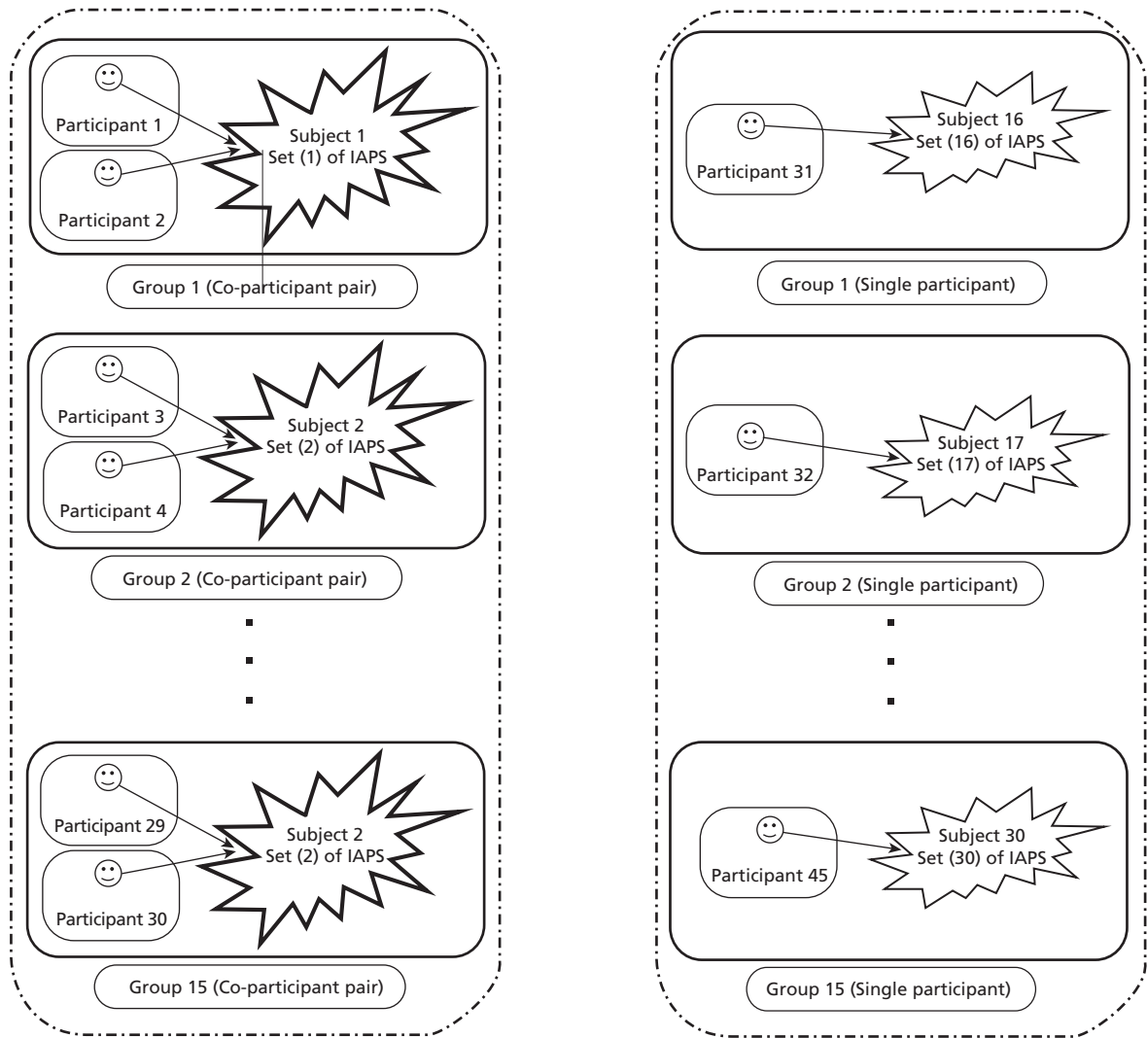
The study used two mutually exclusive groups for the two experiments to eliminate all “learning” artifacts from prior exposure so that each research subject participated in the protocol once. One group consisted of 15 single participants, and the other one consisted of 15 co-participant pairs, as illustrated in Figure 3.

**Table 2** Research Design

Experimental Conditions	Stimulus Conditions	
	Calm	Emotional
1. Single Participant	30 trials	15 trials
2. Co-participant	30 trials	15 trials



**Figure 2** Operational logic of experiment protocol.



**Figure 3** Stimulus setup and data organization. Left, co-participant experiment; right, single-participant experiment. Abbreviation: IAPS, International Affective Picture System.

In the experiment for single participants, the participant watched the pictures in a monitor alone, while in the experiment for co-participant pairs, each pair watched the same pictures simultaneously, via the splitter, on two monitors while they were sitting in front of each other, as illustrated in Figure 4.

**DATA AND STATISTICAL ANALYSIS**

Within each session, each of the 45 trials was divided into two segments: the pre-stimulus period (6 sec), and the post-stimulus period (12 sec). The post-stimulus period is important because it is a validation of the expected emotional response of the participant when seeing and responding to the stimulus image of the trial at hand. In the absence of evidence of a post-stimulus deflection, spuriousness becomes an issue: one might question the emotional engagement of the participants in the experimental or the veracity of data recorded in the period before the stimulus was known.

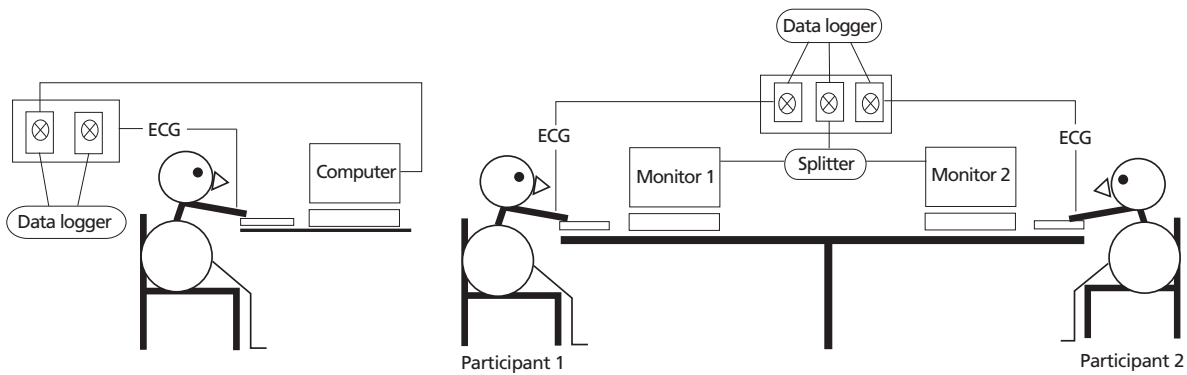
To evaluate the hypotheses, we applied randomized permutation analysis (RPA), described below, to

each individual’s data, then calculated the Z-scores per person and used the Stouffer method to combine the Z-scores to provide an overall measure across subjects. Then we followed Radin’s (2010) Stouffer procedure to compare the single participant and co-participant groups’ Z-scores.

**Heart Rate Variability**

The ECG data used for HRV analysis were all normal sinus intervals. All aberrant beats and artifacts were removed from the records: a computer algorithm eliminated intervals that varied by more than 30% of the mean of the previous four intervals; they were substituted by linear interpolation.

A percentage difference score relative to the HRV baseline value was computed because measurement focused on how the participant’s physiology changed from the moment a given trial was initiated. For each trial, the HRV values transformed into a percentage difference score based on the first data point in each trial. (The first data point is 6 seconds before each picture in



**Figure 4** Setup for single-participant experiment and co-participant pair experiment.

each trial, and the last data point is 10 seconds after the 3-second interval while the picture is presented.) Each of the 152 data points (19 seconds x 8 samples per second) in the series were transformed into percentage difference scores, thus:

$D = \text{Hrv}\%_{(n)} = 100 \times \left( \frac{\text{Hrv}_{(n)} - \text{Hr}_{(6)}}{\text{Hr}_{(6)}} \right)$ . The first data point is always zero,  $\text{Hrv}\%_{(6)} = 0$ .

1. The mean of the percentage difference scores were calculated over trials for the 15 emotional ( $D_e$ ) and 30 calm trials ( $D_c$ ).
2.  $d = D_e - D_c$  was computed for each of the 152 samples.
3. All these differences were summed as  $\sum d_o$ , the sum of the observed differences.

### Statistical Analysis

RPA was used to determine statistical significance of the differences between emotional and calm curves during the pre-stimulus period and also during the post-stimulus period. RPA controls for autocorrelations inherent in physiologic signals and their underlying non-normal distributions<sup>58</sup> and reduces the possibility of false-positive findings. Applied separately to each individual's HRV data, RPA generates two standard deviates, or z scores, per person:  $z_{pre}$ , the differential pre-stimulus value, and  $z_{post}$ , the differential post-stimulus value.<sup>18</sup> For the RPA, we calculated a random distribution that was constructed over 2000 permutations, per McCraty et al.<sup>17,57</sup> Operationally, RPA involved the following:

1. Classification of the calm and emotional stimulus targets was randomized, while retaining the original form of the data.
2. Steps 1 and 2 (above) for these new data were repeated, and summed differences (Step 3) were calculated, sum ( $d$ ), as before.
3.  $d_1 + d_2 + \dots + d_{152} = \sum d$ .
4. This process was repeated 2000 times to construct a distribution of randomly permuted  $d$  values. Each time the new permuted value was generated, the mean ( $m$ ) and the standard deviation ( $s$ ) of the distribution along with a standard normal deviate measure,  $Z = (\sum d_o - m)/s$ , was updated.

5. This z score (calculated using the mean and standard deviation from the 2000 randomized summed differences) is a statistical measure of the difference between emotional and calm physiological responses and was computed separately for the pre-stimulus and post-stimulus response periods. The z scores of the single participant group, which are 15 zs ( $z_1, z_2, \dots, z_{15}$ ), and the z scores of the co-participant group, which are 30 zs ( $z_1, z_2, \dots, z_{30}$ ), were combined separately using the Stouffer z method  $Z_{\text{Stouffer}} = \left( \frac{z_1 + z_2 + \dots + z_n}{\sqrt{n}} \right)$ , to provide an overall measure of the pre-stimulus differential, or the post-stimulus orienting response, across the single participant and co-participant groups.
6. Finally, in order to compare the Stouffer zs of single participant and co-participant groups, the  $Z_{\text{Compare}}(\text{co-sub} \& \text{non-co-sub}) = \frac{Z_{\text{Stouffer co-sub}} - Z_{\text{Stouffer non-co-sub}}}{\sqrt{2}}$  method was used, per Radin.<sup>54</sup>

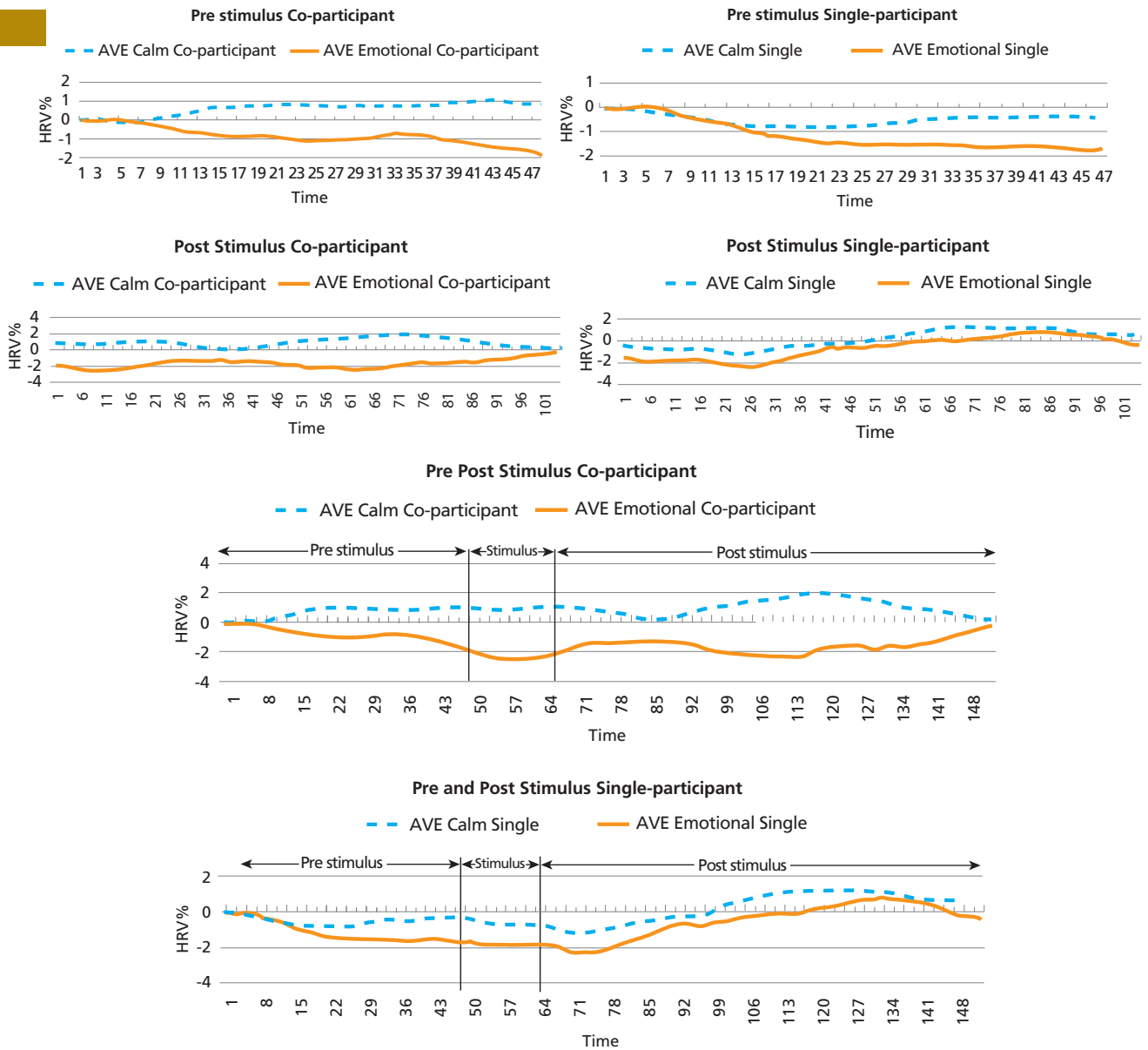
## RESULTS

The results of the aggregated RPA analysis are presented in Figure 5 and Table 3; we have not yet had time to conduct an RPA by individual.

### Single-participant Experiment

Beginning with the results for the single participant experiment (middle row, right), the post-stimulus period data show a modest separation between the calm and emotional HRV curves. Even so, the RPA results confirmed a significant difference between the two curves: a  $z_{post}$  difference statistic of  $-1.70$ ,  $P=.045$ . This results indicates that the participant's physiological response upon being presented with the stimulus was emotionally consistent with his or her expected reaction, and likely attests to his or her emotional engagement with the experiment as a whole.

Moving to the pre-stimulus results, a greater degree of separation between the calm and emotional HRV curves is evident in Figure 5 (top right graph). This begins about 2 seconds into the pre-stimulus period and continues increasing slightly for the next 4 seconds, before the stimulus is presented. The results of the aggregated RPA (Table 3) produced a  $z_{post}$  difference statistic of  $-2.13$ , which is significant ( $P=.017$ ).



**Figure 5** Mean heart rate variability (HRV) response for the group as a whole for calm vs emotional trials. The left column shows the HRV curves for the group of co-participant pairs (n=30), and the right column shows the HRV curves for the group of single subject (n=15).

This result suggests that the heart rhythm activity (HRV) of the entrepreneurs in the single participant group correctly perceived the emotional valence of the future stimulus some 4 seconds before the computer had randomly selected and presented the picture.

**Co-participant Experiment**

Somewhat stronger results are evident for the co-participant experiment. The post-stimulus calm and emotional curves in Figure 5 (middle row, left), evidence greater separation, which is confirmed by the significant RPA results: zpost difference statistic of -5.13,  $P < .001$ . The physiological manifestation of an emotional response upon seeing the stimulus that is consistent with expectations indicates that these participants were emotionally involved and attests to the

validity of the experiment.

For the pre-stimulus results, again, a greater separation between the calm and emotional HRV curves is observed (Figure 5, top left). The separation starts less than a second into the beginning of the trials and increases throughout the remaining 5 seconds of the pre-stimulus period. This result is confirmed by the RPA (Table 3), which produced a significant zpost difference statistic of -4.54, with  $P < .001$ . These aggregated data suggest, on average, that the HRV patterns in the co-participant pairs indicate that these entrepreneurs were able to perceive the emotional significance of the future stimulus some 5 seconds before it had been randomly chosen and presented by the computer. These results are consistent with the theoretical expectations of Hypothesis 1.



### Comparing the Single-participant and Co-participant Results

Using the method described by Radin<sup>54</sup>—Step 6, above—we compared the aggregated RPA results for the two experiments. For the post-stimulus comparison (bottom of Table 3), the RPA produced a  $z$ post difference statistic of  $-2.42$ , which is significant ( $P=.008$ ), suggesting a difference in the emotional involvement of the two groups of participants, where, ideally, none should be expected. Insofar as the groups were emotionally engaged in the two experiments (which had identical protocols) to the same degree, no post-stimulus difference between the calm and emotional HRV curves would be expected.

Turning to the pre-stimulus comparison, the aggregated RPA results also indicate a significant difference between the two experiments; the  $z$ post difference statistic is  $-1.71$ ,  $P=.044$ . While requiring further analysis to confirm this result, taken at face value, this is evidence that is consistent with the amplification effect postulated in Hypothesis 2. In other words, the data suggest that there appears to be a significant boost in the body's perceptual foresight of a nonlocal signal when two (or

more?) individuals have their attention focused on the same nonlocal target of interest.

### Analysis by Entrepreneur Characteristics

Table 4 presents the results of the aggregated RPA analysis for the pre-stimulus data broken out in a bivariate analysis by the five variables we used to characterize the two samples in Table 2, above: age, firm size, number of businesses, years of business experience, and level of education. With the relatively small case counts in each sample (single participant sample:  $N=15$ ; co-participant sample:  $N=30$ ), these variables were recoded into dichotomous categories for this analysis.

Starting with the single-participant results, each of the two categories of all five variables still manifests a significant RPA  $z$ pre statistic measuring the difference between the calm and emotional HRV curves.<sup>a</sup> this is a notable result, for it shows that the pre-stimulus effect observed above is invariant across each of these entrepreneur characteristics. In other words, the nonlocal intuition effect detected by the HRV measure does not vary and therefore is not explained by the entrepreneur characteristics we have examined in this research.

The same pattern of pre-stimulus bi-variate results is also evident for the co-participant group. For each of the two categories for all five variables, a significant RPA  $z$  score on the difference between the calm and emotional HRV curves is observed. Furthermore, both the  $z$  score values and level of significance are of greater magnitude than those for the single participant experiment. In short, not only does the nonlocal intuition effect detected by the difference between the calm and emotional HRV curves appear stronger by each of these categories than for the single participant group, but this intuitive foresight ability is invariant, and, therefore, not a function of the entrepreneur characteristics analyzed here.

**Table 3** Results of Random Permutation Analysis (Aggregated Data) for the Single-subject and Co-participant Experiments and Compared

Post-Stimulus Period				
Experiment	N	z sum	z post	P <
Single Subject	15	-86.45	-1.70	.05
Co-participant	30	-294.78	-5.13	.001
Compared	45		-2.42	.01
Pre-Stimulus Period				
Experiment	N	z sum	z post	P <
Single Subject	15	-26.84	-2.13	.05
Co-participant	30	-63.75	-4.54	.001
Compared	45		-1.70	.05

**Table 4** Random Permutation Analysis Results by Entrepreneur Characteristics for Single-subject and Co-participant Groups

		Single-subject Group			Co-Participant Group		
		Z pre	P <	N	Z pre	P <	N
Age	$x < 36$	-2.40	.01	8	-3.52	.01	18
	$x > 36$	-2.21	.05	7	-2.87	.01	12
Firm Size	$x < 42$	-2.09	.05	10	-3.80	.01	21
	$x > 42$	-1.70	.05	5	-2.49	.01	9
No. of Businesses	$x < 3$	-2.09	.05	11	-3.19	.01	15
	$x \geq 3$	-1.72	.05	4	-3.23	.01	15
Years of Business Experience	$x < 9$	-2.19	.05	6	-3.60	.01	19
	$x \geq 9$	-2.00	.05	9	-.277	.01	11
Education Level	BA and below BA	-2.23	.05	11	-.353	.01	18
	MA and PhD	-1.96	.05	4	-.285	.01	12

Abbreviations: BA, Bachelor of Arts degree; MA, Master of Arts degree; PhD, Doctor of Philosophy degree.

<sup>a</sup> There are too many values to give each of the specific  $z$  statistics and their associated  $P$  level in the text—see Table 4.

## DISCUSSION

The post-stimulus results for both the single-participant and co-participant experiments revealed a significant difference between the emotional and calm HRV curves, which reflected the participant's expected emotional response upon being shown the stimulus. This is evidence of the face validity of the experiment.

Significant results also were found for both experiments in the pre-stimulus period—the period before the computer had randomly selected the picture stimulus for the trial. While significant separation between the emotional and calm HRV curves was observed for the single-participant experiment, an even larger separation was found for the co-participant pairs. The separation between the calm and emotional HRV curves occurred at about 4 seconds and 5 seconds, respectively, in the pre-stimulus period. The difference between the results for the single-participant group and the co-participant pairs group was statistically significant. This result for the single-participant experiment is notable because it constitutes cross-corroboratory evidence of nonlocal perceptual ability in entrepreneurs in a different, non-Western cultural context—namely, repeat entrepreneurs in Iran.

In addition, the bi-variate analysis of the association between the five entrepreneur characteristics and the pre-stimulus effects observed revealed that the detection of the nonlocal stimulus target by the HRV measure remained present for all 10 dichotomous categories of the variables involved. If confirmed by further research, this is a notable finding, for it suggests that such intuitive foresight in these “successful” repeat entrepreneurs does not appear to be associated with age, firm size, number of businesses, years of business experience, and level of (university) education. While not investigated here, it increases the plausibility of Tomasino's proposition<sup>59,60</sup>: that the acquisition of such intuitive ability has more to do with emotional and psychophysiological factors—namely, positive emotions and psychophysiological coherence.

While these results are of a preliminary nature, as there are some issues to be addressed to achieve full confidence in the validity of the findings as discussed in the next section, the results appear to offer empirical support for the two hypotheses. More specifically, the single-participant experiment's results are consistent with Hypothesis 1 and corroborate the Bradley et al<sup>40</sup> study's finding that electrophysiological measures can detect nonlocal intuition in repeat entrepreneurs. And the results of the co-participant experiment—in particular the analysis of the comparison between single-participant and co-participant pre-stimulus effects—are consistent with Hypothesis 2's expectation of an amplification of the nonlocal signal when two entrepreneurs have their attention focused on the same nonlocal target. However, both the degree of socio-emotional coherence in the two interacting HRV fields of bio-emotional energy radiating from the two individuals in the co-participant pair experiment (the individuals were seated well within the range of heart

rhythm activity detectable by current magnetometer technology, ~15' from a body), and the physiological mechanism of interaction, both postulated in Bradley's theory,<sup>37,40,42</sup> are not considered in this study and require empirical investigation.

## LIMITATIONS

A number of limitations must be borne in mind when interpreting the study's results, the first of which concerns the preliminary nature of findings. There are two issues to be addressed in further analysis of the study's data. The first concerns what appear to be aberrant or anomalous measures in the HRV records of two or three individuals in the database of the single participant experiment. This issue is being investigated currently, and if the lack of data integrity in these (or any other) records is confirmed, the records involved will be removed and the analyses re-run. If this occurs, there may be some small changes in the final results.

The second issue, which will be pursued once the first issue is resolved, concerns the need to rule out two potential methodological artifacts, per McCraty et al.<sup>17</sup> The first is the need to verify an expected positive relationship between the perceived emotionality of the stimulus and the pre-stimulus response. This is important because it constitutes solid evidence attesting to the face validity of the experiment. The second is the need to test for a photo sequence expectancy artifact. Both of these issues can be addressed using multiple regression analysis, as described in McCraty et al.<sup>17</sup>

Another question to be addressed concerns a so-called “psi field” effect. Tiller, Bradley, and others have postulated a nonlocal communication field effect that can be strengthened when certain conditions are present. This is an important aspect of the idea underlying Hypothesis 2, in the second experiment with co-subject participants. The basic question at issue concerns the degree to which there is evidence of an accumulation effect—an increasing separation between the calm and emotional HRV curves over time, which would be expected to be evident in two distinct ways:

1. By an increasing separation between the calm and emotional HRV curves across the set of trials for each individual;
2. And in the aggregated data for all participants, evidenced by an increasing separation between the two curves in direct association with the addition of each new subject's participation in the experiment.

We will investigate each of these expectations with regression analysis as we work to complete the analysis.

Finally, there is the small (in terms of execution) but important methodological question of the strength of the effects the study has found. This can be addressed by computing effect size—a standardized measure of the statistical power of the difference between two or more statistical comparisons, where appropriate, as an element in all final analyses.

## CONCLUSION

In sum, the study's results corroborate the Bradley et al study's finding that electrophysiological measures can detect nonlocal intuition in repeat entrepreneurs.<sup>40</sup> This result is notable because it constitutes cross-corroboration in a different, non-Western cultural context—namely, repeat entrepreneurs in Iran. In addition, the results for co-participant pairs offer new evidence on the amplification of the nonlocal intuition signal by socio-psychophysiological fields. Finally, the results of the bi-variate analysis suggest that the entrepreneur's body's ability to detect the signal for intuitive foresight does not appear related to the personal (age, level of education) or business experience (firm size, number businesses, years of experience) characteristics investigated in this research.

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