Nonlocal Intuition in Entrepreneurs and Non-entrepreneurs: An Experimental Comparison Using Electrophysiological Measures[1]

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ABSTRACT

What explains the success of repeat entrepreneurs? A team of researchers from the Australian Graduate School of Entrepreneurship (AGSE) and the Institute of HeartMath (IHM) have been investigating the proposition that nonlocal intuition accounts for the repeat entrepreneur's extraordinary ability to locate future business opportunities. *Nonlocal intuition* is the perception of energetically encoded information about a future event by the body's psychophysiological systems, which informs entrepreneurial decision and action; this information is *not* based on reason or memories of prior experience (McCraty et al., 2004a). This paper reports the results of a study testing the measurement efficacy of improvements to an experimental protocol used in a pilot study reported at last year's AGSE. The new study was conducted on a sample of non-entrepreneurs who have been practicing emotional management and coherence building techniques to increase intuition. The study employed both cognitive and electrophysiological measures (skin conductance response and heart rhythm patterns) in an 8 session repeated measures design. In addition to investigating the stability of intuitive ability over time, we also compared data from last year's pilot study of repeat entrepreneurs to examine the degree to which the intuitive ability is comparable to the sample of non-entrepreneurs. The results are quite promising, as the evidence shows that the experimental protocol appears to function as a valid and reliable instrument for measuring nonlocal intuition in both entrepreneurs and non-entrepreneurs. While preliminary, results from an aggregate analysis of the non-entrepreneurs show a consistent pattern of physiological detection of a nonlocal intuitive effect that is evident across the repeated sessions of the experiment. There is strong evidence, especially in the separation of the heart rhythm win/loss curves, of detection of a nonlocal intuitive pre-stimulus effect some *12-14 seconds before* the betting outcome was presented to the participants. The results from the comparison of entrepreneurs with non-entrepreneurs showed similar evidence of the detection of a nonlocal intuitive effect in the recordings of heart rhythm patterns. While these are preliminary results, they are consistent with the findings of previous studies.

INTRODUCTION

Cognitive approaches to understanding successful entrepreneurial behavior have emphasized the concept of opportunity recognition—the *way* successful entrepreneurs process information to locate a future opportunity (Larsen & Bundsen, 1996; Shane & Venkataraman, 2000). Accordingly, there has been an effort to link various pattern recognition models with entrepreneurial decision-making behavior (Mitchell et al., 2002). And while it is increasingly recognized that entrepreneurs tend to be more intuitive and less logical/analytic in how they make decisions (Allison & Hayes, 1966), this "intuitive" ability has been proposed to stem from unconscious memory and extrapolations from prior experience (Mitchell et al., 2005),(Mitchell et al, 2007).

Certainly there is little doubt that prior experience—both conscious and unconscious knowledge—plays an important role in informing entrepreneurial decision and action. However, we contend that there is another source of intuitive information that enables the entrepreneur to access information regarding future

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opportunities—namely, information about future events that is received and processed by the brain, heart, and autonomic nervous system (ANS). We call this nonlocal intuition to emphasize that such intuitive perception is *not* based on memory of prior experience. We have been conducting a series of investigations and experiments over past few years to test the hypothesis that repeat entrepreneurs have a greater ability to perceive and process nonlocal information about future potential business opportunities than unsuccessful entrepreneurs and the ordinary business person.

INTUITION

Intuition has been strongly associated with various models of pattern recognition, mostly devised by cognitive psychologists. For rationalists, opportunity recognition exists in the external world as complex patterns of observable stimuli (Baron 2004). We recognize objects or patterns through a number of interrelated processes. One such process is described by the *feature-analysis model* (Larsen & Budsen, 1996, in Baron). This model suggests that patterns are identified by their distinctive features. In opportunity recognition this may be economic value and newness of a product or service. The drawback with this model is that it is primarily applicable to simple patterns related to past experience.

In contrast *prototype models* apply to more complex patterns. Through experience we construct prototype models that is, what a particular model should look like. Prototypes are the most commonly experienced object or patterns of a prototype. For opportunity recognition an entrepreneur may seek central characteristics such as the likelihood of competition, economic value, desirability and other characteristics critical to their prototype. The likelihood of a match would enable an entrepreneur to conclude whether the opportunity is worth pursuing (Craig & Lindsay, 2001, in Baron).

The final model of pattern recognition emphasizes the importance of specific knowledge. It is known as an *exemplar model* (Hahn & Chater, 1997, in Baron). Hahn & Chater (1997) would argue that an individual would compare existing opportunities with exemplar models of excellent and poor business opportunities. This fits well with the argument that entrepreneurs' "just know a good opportunity when they see one". Simon's (1983) intuition is merely the application of one's professional judgment to the situation. It could use any of the aforementioned pattern recognition models. Simon's makes his point on a Grand Chess Master's ability to make strong moves quickly. He argues that his skill is in his knowledge, acquired by long experience of the kinds of patterns and clusters of pieces that occur on chessboards. For a Chess Master a chess board is not an arrangement of 25 pieces but an arrangement of a half a dozen familiar patterns that previous experience recognizes. The skills of the manager depend on the same kind of intuitive skills of chess masters (Simon 1983). Interestingly Barnard (1938) does not regard the non-logical processes of decision making as magical in any sense, he argues that they are grounded in knowledge and experience.

Nonlocal Intuition

However, while there is little doubt that prior experience—both conscious and unconscious knowledge—plays an important role in informing entrepreneurial decision and action, we believe that there is another source of intuitive information that also enables the entrepreneur to assess future opportunities—namely, information about future (nonlocal) events that is received and processed by the heart, brain, and autonomic nervous system (ANS). Not only is there clear experimental evidence that the body's psychophysiological systems can receive and process information about a future event *before* the event happens (e.g., Bierman & Scholte, 2002; McCraty et al., 2004a & 2004b; Radin, 1997 & 2004), but there is now also a theory describing how such nonlocal communication may occur (Bradley, 2006 & 2007). The theory explains how the entrepreneur's passionately focused attention directed to an object of interest (e.g., a future business opportunity) attunes the bio-emotional energy generated by the body's psychophysiological systems to a domain of quantum-holographical information, which contains implicit, energetically encoded information about the object.

Taking an information processing perspective, we view nonlocal intuition as a process by which information normally outside the range of cognitive processes is sensed and perceived in the body and mind as certainty of knowledge or feeling (positive or negative) about the totality of a thing distant or yet to happen (McCraty, Atkinson, & Bradley, 2004a; 2004b) and their experience will raise the physiological signal levels to possible measurement levels (Tiller 2001). This “thing” can be a material object or event, or a mental construct such as a thought or idea. Often the feeling is one of certainty and absolute—the intuition is experienced as beyond question or doubt—and the feeling can encompass positive emotions, such as optimism and excitement, or negative emotions like dread, fear, or terror. This experience of an immediate, total sense of the thing as a whole is quite unlike the informational processing experience of normal awareness. In normal awareness, the contents of the mind are updated incrementally, as the moment-by-moment sequences of sensory experience unfold. Also, the experience of intuition is not confined to cognitive perception, but involves the *entire* psychophysiological system, often manifesting through a wide range of emotional feelings and physiological changes experienced throughout the body. The involvement of the entire psychophysiological system in processing intuitive perception is the basis of its detection and measurement using electrophysiological instrumentation, as shown below (Bradley 2006; La Pira & Gillin, 2006).

PREVIOUS RESEARCH

Although there is now a voluminous body of rigorous experimental research documenting the phenomenon of intuitive perception (see Radin’s review, 1997a), mainstream science still regards the findings of these studies as anomalous (Walach & Schmidt, 2005). Even among those who study it, intuition is viewed largely as the result of past experience—a function of the unconscious mind accessing existing information within the brain from forgotten experience (Agor, 1984; Eisenhardt & Zbaracki, 1992; Hogarth, 2001; Laughlin, 1997; Lieberman, 2000; Myers, 2002). In presenting a very brief review of the evidence from studies that challenge this view, we draw heavily on McCraty et al. (2004a).

The notion that intuitive perception is purely a function of the unconscious mind accessing forgotten prior experience has been challenged by several recent studies. Using rigorous experimental protocols and electrophysiological instrumentation, these studies have shown that the body often responds to a future emotionally arousing stimulus four to seven seconds *prior* to experiencing the stimulus (Radin, 1997b; Bierman, 2000; Radin, 2003; Spottiswoode and May, 2003).

The first studies we are aware of to examine changes in brain activity that preceded an unknown stimulus were conducted by Levin and Kennedy (1975). 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. Warren et al. later found significant differences in event-related potentials (ERP) between target and non-target stimuli presented during forced-choice precognition tasks (Warren et al., 1992). Don et al. extended these ERP findings in a series of gambling studies in which they found enhanced negativity in the ERP’s was widely distributed across the scalp in response to future targets (Don et al., 1998; McDonough et al., 2002). The authors concluded from these studies that the ERP effect was an indicator of “unconscious precognition,” since the study participants’ overt guessing accuracy did not differ from chance expectations.

More recently, a number of researchers have explored physiological predictors of future events by investigating whether the human autonomic nervous system could unconsciously respond to randomly selected future emotional stimuli. Radin (1997a, 1997b, 2004) designed elegant experiments to evoke an emotional response using randomly selected emotionally arousing or calming photographs, with measures of skin conductance level (SCL) and photoplethysmographic measures of heart rate and blood volume. Comparison of SCL response between emotional and calm trials showed a significantly greater change in electrodermal activity around 5 seconds before a future emotional picture than before a future calm picture. These results have since been replicated (Bem, 2003; Bierman, 2000; Bierman & Radin, 1997; Bierman & Scholte, 2002; Radin, 2004), and a follow-up study, using functional magnetic resonance imaging, found brain activation in regions near the amygdala (which handles the processing of strong emotions such as fear and rage) *before* emotional pictures were shown, but not before the calm pictures (Bierman & Scholte, 2002). Finally, a recent study, conducted by McCraty, Atkinson, and Bradley (2004a & 2004b), augmented Radin's protocol by adding measures of brain response (EEG) and heart rhythm activity (ECG) and found that not only did both the brain and heart receive the pre-stimulus information some 4-5seconds before a future emotional picture was randomly selected by the computer, but that the heart appeared to receive this information even before the brain.

To explore the efficacy of this approach to measuring intuition in entrepreneurs, a team of researchers from the AGSE and the Institute of HeartMath have been conducting a series of investigations using both cognitive and electrophysiological measures of intuitive perception. At last year's AGSE, Gillin, et al. (2007) reported promising results from the pilot test of a new experimental protocol designed to measure pre-stimulus effects which reflect nonlocal intuitive perception in a sample of serial entrepreneurs with usable data (N=8) from the Cambridge Technopol. Averaged across all subjects, the results showed that pre-stimulus responses were found indicating that informational input was received in the psychophysiological systems that were predictive of the outcome some *6 to 7 seconds before* the actual outcome of an investment choice was known.

The consistent finding across these studies is that the *body typically responds to a future emotionally arousing stimulus four to seven seconds prior to experiencing the stimulus*. In short, the important conclusion from these studies, for our purpose here, is that intuitive perception of a future event is related to the degree of emotional significance of that event. Moreover, that the response to and processing of pre-stimulus information about a future event is not confined to the brain. Instead, the evidence suggests that the heart responds first and then the brain and possibly other organs in the body are all involved together in responding to intuitive information.

HYPOTHESIS OF NONLOCAL INTUITION

As part of HeartMath's research effort on intuition, Bradley (2006; 2007) has developed a quantum-holographic theory of entrepreneurial intuition which offers an understanding of the psychophysiological basis of entrepreneurial intuition. Drawing on the principles of quantum holography (Gabor, 1946; Pribram, 1991; Bradley & Pribram, 1998), the theory views the perception of things remote in space or ahead in time—nonlocal communication—as involving processes of energetic resonance connecting the body's psychophysiological systems to the quantum level. The theory explains how focused emotional attention directed to the nonlocal object of interest attunes the bio-emotional energy generated by the body's psychophysiological systems to a domain of quantum-holographical information, which contains implicit, energetically encoded information about the object. The body's perception of such implicit information about things distant in space/time is experienced as an intuition:

> The entrepreneur's passionate attention—that is, the biological energy activated in his emotional connection to the object of interest (e.g., 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. 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. Of these, the heart generates the most powerful rhythmic electromagnetic field, which radiates out from the body in all directions.
>
> 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 which optimizes attentional resonance with the incoming quantum level information from the object of interest. Such attunement brings the outgoing wave field of attentional 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 (Bradley, 2006: 15).

The theory leads to the following hypothesis: "The more the entrepreneur maintains coherent attentional interest directed to the object of interest, the greater the psychophysiological systems' access to an implicit field of quantum-holographic information and the greater the intuitive foreknowledge about the object of interest" (Bradley, 2006: 15). Also, drawing on HeartMath's research documenting a physiological mode frequently associated with sustained positive emotions—described as *psychophysiological coherence*—which conforms to the state of energetic resonance described in the theory, it can be further postulated that being in a state of psychophysiological coherence is expected to enhance intuitive ability. [2]

RESEARCH DESIGN AND METHOD

The present investigation is the fourth in a series of pilot studies, previously reported (La Pira & Gillin, 2006; Gillin et al., 2006; Gillin et al., 2007), conducted to test the measurement efficacy of a new experimental protocol for measuring nonlocal intuition, in preparation for a large-scale study. One key aspect of the protocol is a computer-administered gambling experiment with a roulette wheel stimulus designed and pretested at the Institute of HeartMath by McCraty and Atkinson (2003).

For the present study, we obtained a sample of non-entrepreneurs (N = 13) from the U.S. who have been practicing specific emotion self-regulation techniques for more than 10 years. All individuals were administered both the Cognitive Styles Index (CSI)—a self-report measure of intuitive ability—and the roulette experiment. In the analysis reported below, their results were compared to the previously obtained usable data from a sample of repeat entrepreneurs (N = 8) from the Cambridge Technopol (see Gillin et al., 2007, for the details).

Used in this earlier pilot study, the roulette protocol was designed to obtain a generic baseline electrophysiological measure of intuitive ability that could be administered to any population. Conducted over 26 individual trials, the protocol stimulates the creation of nonlocal information by having the participant make an investment decision about a future opportunity (without knowing the future outcome) while the participant's psychophysiological activity (skin conductance and ECG) is continuously recorded. Using a repeated-measures design, the roulette protocol was administered eight times (2 sessions, back-to-back (± 3 days) followed by a two week interval between the back-to-back sessions—repeated over a two month time frame) to the U.S. sample of non-entrepreneurs. Only one data point was gathered from the Cambridge Technopol sample, due to geographical constraints.

The study was designed to address three questions:[3]

1. The extent to which the intuitive ability of repeat entrepreneurs differs from that of a group of non-entrepreneurs who have been practicing emotional management techniques designed to

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[2] HeartMath's research has shown that psychophysiological coherence mode encompasses distinct but related physiological phenomena including entrainment, resonance, and synchronization, which reflect more efficient and harmonious interactions among the body's subsystems (McCraty and Childre, 2002, 2004; Tiller et al., 1996). Correlates of psychophysiological coherence include: increased synchronization between the two branches of the autonomic nervous system, a shift in autonomic balance toward increased parasympathetic activity, increased heart-brain synchronization, increased vascular resonance, and entrainment between diverse physiologic oscillatory systems. The coherent mode is reflected by a smooth, sine wave-like pattern in the heart rhythms and a narrow-band, high-amplitude peak in the low frequency range of the heart rate variability power spectrum, at a frequency of about 0.1 Hz (Tiller et al., 1996). McCraty, (2002) and McCraty and Atkinson, (2003) have previously found that increased heart rhythm coherence correlates with significant improvements in performance on tasks requiring attentional focus and subtle discrimination which may be important elements of the intuitive effect studied here (see McCraty et al., 2007, for a review).

[3] Because we have only just completed assembling, cleaning, and processing the data for statistical analysis, only the results from a preliminary analysis of the aggregated data were available before the conference to address the first two questions.

enhance intuitive ability. The evidence on this issue has implications for the all-important applied question of whether intuitive ability can be intentionally developed and enhanced (Tomasino, 2007).

2. The degree to which a nonlocal intuitive effect, as detected by electrophysiological measures, remains stable (consistent within an individual) over time—an important matter, since there is some evidence that repeated administration of an experiment involving nonlocal information/interaction leads to a decline in the experimental nonlocal effect observed (Jahn et al., 2003). This involves a complex statistical analysis within a repeated-measures frame, using ANCOVA and other multivariate procedures.

3. On a longer term basis we will address a third question: the relationship between the CSI and the electrophysiological measures—the degree to which each predicts future outcomes of the roulette experiment, and also whether there is a difference between entrepreneurs and non-entrepreneurs on these measures. Since the CSI measure is cognitive and subjective whereas the electrophysiological measures are biological and objective, there is an opportunity to investigate the role and contribution of each in the processing of intuitive information.

Testing Procedure

We utilized McCraty et al's. (2004a & 2004b) basic experimental protocol in which skin conductance level (SCL) and the electrocardiogram (ECG) for heart rate variability (beat-to-beat decelerations/accelerations) measurement was included. These measures have all been used to index specific aspects of sensory information processing, and can be interpreted according to well-established operational criteria.

Thirteen non-entrepreneur participants took part in this experiment (usable data were obtained from 12 participants). In the experimental sessions for the study, each participant was seated in a comfortable chair. A video monitor was located approximately one meter in front of the participant at eye level, and a computer mouse was attached for the participant to click when ready to initiate each trial. Participants were told that they were participating in a gambling experiment to win as much as possible over the course of 26 bets. As an incentive, the participants began with a $20.00 credit and were told that they would be paid in cash any amount that they won beyond the $20.00. At the start of each session there was a four-minute period for recording baseline physiological data. Once the instructions were read, the participant completed the experiment alone—without the presence of the experimenter.

The following hardware was used in the experimental protocol. A Biopac MP30 was used to record the ECG and skin conductance data. All recordings were performed using disposable ECG electrodes. DC Skin Conductance levels (SCL) was measured using disposable electrodes attached to the pads of the participant's index and second fingers of the non-dominant hand. Data processing and statistical analysis were performed using DADISP and SPSS software. The Random Number Generator was an Araneus Alea 1, which provides high quality, unbiased and uncorrelated random numbers that pass a number of stringent statistical tests, including the Diehard and NIST test.

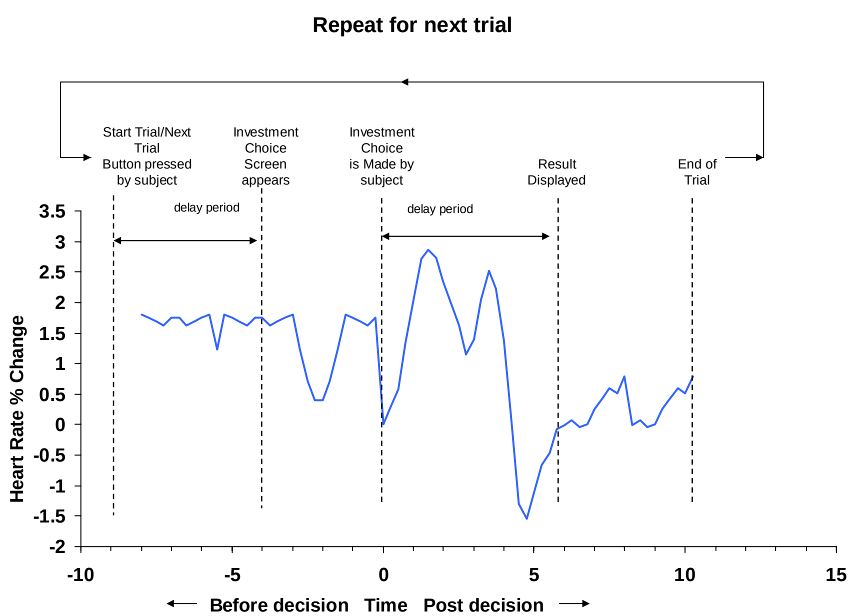
Roulette Experiment

Using the principle of a roulette wheel, this test is based on choosing an investment amount (a bet) and then making a choice of red or black, followed by feedback on the result generated by a random number generator (see Figure 1). The participants had the option of choosing from four investment amounts, ranging from 25 cents, 50 cents, $1, or $2. Once the bet was placed, a six-second period of silence followed, after which the sound of a roulette wheel was played for six seconds. The result of each run is tallied on the bottom left-hand side of the screen so that the participant knows whether he/she is winning or losing, and by how much. After a cool down period a prompt appears to repeat the betting process. Within each session, this process was replayed 26 times (trials) for each participant. The whole process was then repeated for each of the 8 identical administrations of the experiment.

Data and Statistical Analysis

Within each session, each of the 26 trials was divided into three segments: the pre-bet period (4 seconds), the post-bet period (12 seconds), and the post-result period (6 seconds). The post-result period is important because it is a validation of the expected emotional response of the participant to finding out whether they won or lost their bet. In the absence of evidence of a post-result deflection, spuriousness becomes an issue: one might question the emotional investment of the participants in the outcomes of experimental protocol or the veracity of data recorded in the period before the outcome was known.

Figure 1. Format of Test Protocol for the Roulette Experiment



Skin conductance

Because measurement focused on how the physiology changed from the moment a given segment was initiated, each sample in each segment was transformed into a percentage difference score relative to the *baseline* SCL value at the moment the segment begins. To compute the percentage difference score (D), the first data point in each trial was subtracted from each of the remaining data points in the segment (e.g., the pre-bet period of 4 seconds sampled at 10 samples/second yields 40 data points). Then each point in the segment was divided by the original value of the first data point of the segment to yield the percentage difference series, in which the first data point is always zero.

Heart rate variability

ECG data used for heart rate variability (HRV) analysis were all derived from 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, and any remaining artifacts were removed during second-stage editing by an experienced technician who visually inspected the records. A regularly spaced time series was derived from the succession of normal RR intervals by linear interpolation of the irregularly spaced series and then re-sampled at 10 samples per second. The HRV data were then transformed into percent difference scores, as just described for the skin conductance data.

Statistics for SCL and HRV

To reduce the possibility of false-positive findings, a decision was made to use statistically conservative procedures for data analysis, following McCraty et al. (2004a & 2004b). Therefore, because it controls for autocorrelations inherent to physiological signals and their underlying non-normal distributions (Blair & Karniski, 1993), randomized permutation analysis (RPA) was used to determine statistical significance of the differences between win and loss curves during the three segments—pre-bet, post-bet, and post-result periods. Applied separately to each individual's SCL and HRV data, RPA generates one standard deviate, or z score, per segment for each subject, which is the win/loss difference for each segment (Good, 1994; Hjorth, 1994; Radin, 1997b). For the RPA, a random distribution was constructed over 1,000,000 permutations.

ANALYSIS AND RESULTS

Non-entrepreneurs

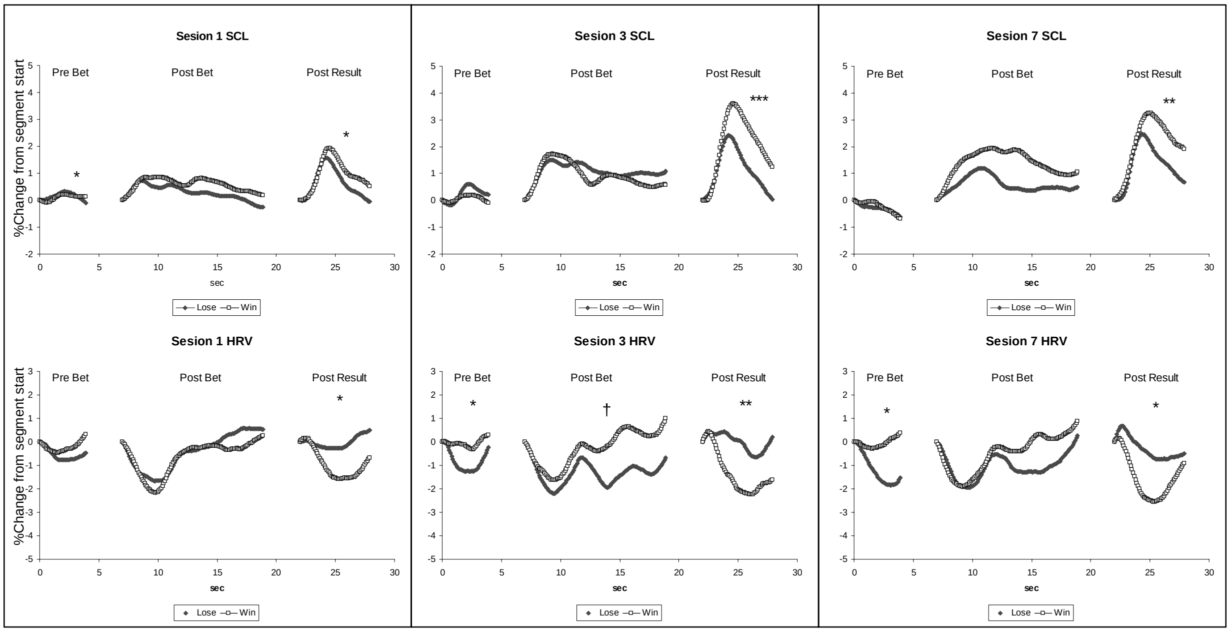
Before addressing the research questions, the variability of the skin conductance and the heart rhythm patterns indicate that the participants were emotionally engaged across the three segments of the experiment. This attests to the face validity of the results.

With respect to the question of the over-time stability of physiological measures of nonlocal intuition, we present preliminary results from the first, third, and seventh experimental sessions to give the reader a sense of the patterns in the physiological data in relation to win/loss outcomes at the beginning, middle, and end of the 8 experimental sessions.

Figure 2 presents the grand average for the physiological recordings by win/loss outcome for these three sessions for all 12 participants with usable data for the three segments of the experiment: the pre-bet period, the post-bet period (these two segments are the pre-stimulus periods (time *prior* to the randomly chosen bet red/black outcome)), and the post-result period. The graphs in the top half of the figure show the mean pattern of the skin conductance recordings for each experiment session. While there is limited separation between the win/loss curves in the pre-bet period, and somewhat greater separation in the post-bet period, the strongest separation, as expected, occurs between the two curves during the post-result period—when the participant experiences whether they won or lost their bet. This attests to the validity of the protocol and the participants' emotional engagement in the experiment.

The graphs in the bottom half of the figure show the mean pattern of the recordings for beat-to-beat heart rate in the three sessions. There is clear evidence of separation between the win and loss curves in all three time-frames during the experiment. Of interest is the strong separation in both pre-stimulus periods, especially in Sessions 3 and 7, where a large separation between the HRV curves for wins and losses is evident. This is notable, because this is the period before random selection of the outcome, and the data suggest clear evidence of an intuitive effect begins some *12-14 seconds before* the betting result is presented to the participant. Moreover, this pre-stimulus effect appears to remain relatively consistent and stable over time. There is also evidence of reasonable separation between the heart rate variability win/loss curves in both the post-bet period and also for the post result period.

Figure 2. Grand Average (All Subjects; N = 12) of Physiological Recordings for Non-entrepreneurs for Sessions 1, 3, and 7 During the Pre-Bet, Post-Bet, and Post-Result Segments



† p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Table 1 presents the results of a random permutation analysis (RPA) across all 12 subjects, which found, despite the small sample size (N = 9-11/sessions), some significant separations between the win and loss curves for the skin conductance recordings (Session 1: pre-bet period, $p < 0.04$; post-result period, $p < 0.05$. Session 3: post-result period, $p < 0.001$. Session 7: post-result period, $p < 0.01$). There were also significant findings for heart rate variability win/loss curves, two of which were in the pre-stimulus period of Session 3 and Session 7 (Session 1: post-result period, $p < 0.01$. Session 3: pre-bet period, $p <0.05$; post-bet period, $p < 0.10$; post-result period, $p < 0.01$. Session 7: pre-bet period, $p < 0.05$; post-result period, $p < 0.05$). Overall, in relation to physiological measures of an intuitive effect (the pre-bet period), the results of the RPA show more evidence of a consistent intuitive ability over time in the heart rate variability recordings than for skin conductance.

Table 1. Results of Random Permutation Analysis (Aggregated Data for All Subjects) of Physiological Measures for Non-Entrepreneurs for Sessions 1, 3, and 7 by Segment

		Pre Bet		Post Bet		Post Result	
Session #	N	Stoffer Z	*p* <	Stoffer Z	*p* <	Stoffer Z	*p* <
Skin Conductance							
1	11	-1.705	0.05	-0.663	ns	1.861	0.05
3	10	-0.703	ns	0.262	ns	3.237	0.001
7	9	0.042	ns	0.781	ns	2.487	0.01
Heart Rate Variability							
1	11	0.872	ns	-0.198	ns	-2.458	0.01
3	10	1.993	0.05	1.468	0.1	-2.628	0.01
7	9	2.173	0.05	0.760	ns	-2.029	0.05

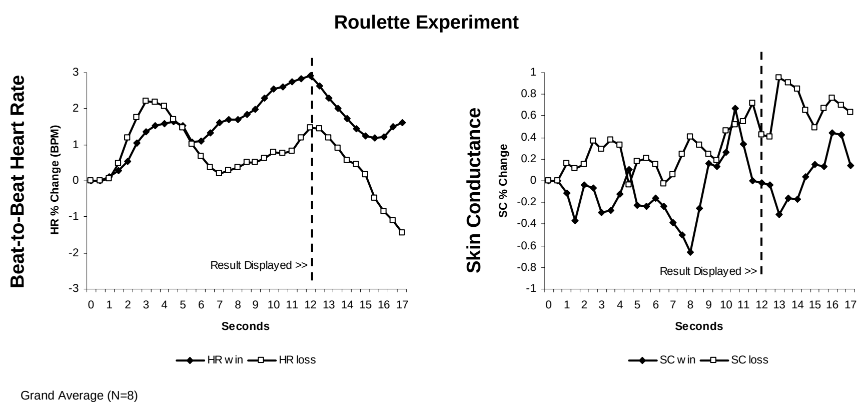
Comparing Entrepreneurs and Non-entrepreneurs

We now turn the question of the degree to which the intuitive ability of repeat entrepreneurs differs from that of a group of non-entrepreneurs who have been practicing emotional management and coherence building techniques designed to enhance intuitive ability. For this analysis we used the data for the Roulette Experiment and compared the aggregated results for our sample of repeat entrepreneurs, previously obtained from the Cambridge Technopol, with the aggregated results of our present sample of nonentrepreneurs.[4]

Figure 3 presents the grand average of the physiological recordings, showing win/loss curves, for all 8 participants during the post-bet and post-result periods (the separation between the two is shown in Figure 3 by a dashed vertical line labeled "Result Displayed"). The graph in the top half of the figure show the mean pattern of recordings for beat-to-beat heart changes in heat rate. Clearly apparent is the separation between the win and loss curves in the heart rhythm pattern that begins at about *6 seconds prior* to the occurrence outcome result being displayed. The separation between the win/loss curves is also clearly evident during the post-result period. These results are similar to those just reported above from our analysis of the non-entrepreneurs.

The graph in the bottom half of Figure 3 show the mean pattern of skin conductance recordings broken out in terms of the win/loss curves. While mean skin conductance patterns, across all subjects, appears somewhat greater for losses than that for wins (prior to the bet result being displayed), the erratic nature of patterns likely due to the small case counts, and the small magnitude of difference, strongly suggest there is little measurement integrity in these data. In other words, there is little of consequence here.

Figure 3. Grand Average (All Subjects; N = 8) of Physiological Recordings for Repeat Entrepreneurs During the Post-Bet and Post-Result Period



The results of a random permutation analysis across all 8 subjects (not shown) produced no significant findings for the entrepreneurs as a group. This is not surprising given the high degree of individual variation in the physiological measures and the small sample size. It should be noted, though, that the results of the RPA by individual (not shown) were more promising, in that there were five instances,

[4] Before presenting the results, the reader is reminded that only a single experimental session was conducted on the sample of entrepreneurs, and that we did not clearly demarcate the pre-bet period from the post-bet pre-result period in last year's pilot study. The latter has been corrected for our new study of non-entrepreneurs, as is evident in the data just presented above.

involving four entrepreneurs, in which the physiological measures had significant or marginally significant predictive power in discriminating future outcomes.

DISCUSSION

In relation to a key methodological purpose of this research, the improvements to the new experimental appear successful, as evidenced by the strong data patterns which are consistent with a pattern of expected results indicative of the participants' emotional engagement and pre-stimulus responsiveness to the Roulette protocol. Measurement discrimination between the wins and loss curves for the physiological data appear valid and robust, as confirmed by the random permutation analysis, which is a highly conservative statistical procedure. And there is strong and compelling evidence of measurement of nonlocal intuition, especially by the heart rhythm measures, which shows a pre-stimulus response to the future outcome some 12-14 seconds before the result was made known to the participant. This finding is consistent with the results of a growing body of previous research (see McCraty et al., 2004a, or Bradley, 2007).

A major concern of the study was the degree to which a nonlocal intuitive effect, as detected by electrophysiological measures, remains stable (consistent within an individual) over time. While we have yet to conduct an analysis of the repeated measures by individual, the aggregated results are promising. We believe that it is important to establish the session to session variability in order to rigorously determine if interventions or other factors, such as baseline affective state, environmental factors, socio-emotional fields, etc, can affect intuitive ability. While our results are preliminary, there is compelling evidence of consistent patterns both by experimental segment (pre-bet, post-bet, and post-result) and also across the three sessions we presented here indicating that a nonlocal intuitive effect appears present throughout the 8 repeated administrations of the experiment. This is a potentially important finding, since there is some evidence from prior research that repeated administration of an experiment involving nonlocal information/interaction tends to leads to a decline in the experimental nonlocal effect observed (see Jahn et al., 2003).

The comparison of the new data on non-entrepreneurs collected in this study with the data on entrepreneurs from last year's pilot study is noteworthy, especially because the sample of non-entrepreneurs had been practicing emotional coherence building techniques specifically designed to develop and enhance intuitive ability. While the skin conductance results for the entrepreneur sample are of questionable value, there are similar positive results in the heart rhythm data for both entrepreneurs and non-entrepreneurs. To the degree that future research can link emotional management techniques, such as HeartMath's, with the enhancement of nonlocal intuitive ability, it may be possible train entrepreneurs to develop their intuitive ability even further. It is also likely, as described in another paper at this conference (Bradley, et al. 2008), that the intuitive ability of both entrepreneurs and non-entrepeneurs alike, is significantly affected by the overall degree of socioemotional coherence of the relations in the individual's social group. Regular interaction within a coherent group, should amplify the harmonic resonance of the group's energetic field with the energetic field of an object of attentional interest, which, in turn, will strengthen the signal the individual receives from the field of nonlocal intuitive information. This should produce stronger intuitive ability than when the individual is operating in isolation.

Limitations

The primary limitation of the work presented here is that the results are preliminary. We have only just begun analysis of the newly collected data on non-entrepreneurs. While the results from our analysis of the aggregated data are unlikely to change, we have only presented results for three of the eight repeated experimental sessions administered in the study. This was done due to time constraints, and will be rectified as we complete a full analysis of the data from all eight experimental sessions.

A second limitation is that we have yet to conduct analysis at the individual level of analysis, and thus cannot address the question of the degree to which the results observed at the aggregate level hold for all or subgroups of individuals. Moreover, there are a number of additional variables HeartMath measured (such as sociodemographic characteristics, emotional state, activation of psychophysiological coherence, and so forth) that we hope will provide a clearer picture of factors that facilitate or inhibit the individual's nonlocal intuitive ability.

Finally, the limitations pertaining to last year's pilot study of repeat entrepreneurs still hold to the data from that study that we drew on for our comparison with the newly collected data on non-entrepreneurs. In short, given these limitations, the reader is cautioned to treat the results presented as preliminary and await further confirmation from additional analysis before drawing any definitive conclusions.

CONCLUSION

The results of this study are promising, in that the evidence shows that the Roulette experimental protocol appears to function as a valid and reliable instrument for measuring nonlocal intuition in both entrepreneurs and non-entrepreneurs. While preliminary, results from an aggregate analysis of the newly collected data on a sample of non-entrepreneurs in a repeated measures experimental design, show a consistent pattern of physiological detection of a nonlocal intuitive effect that consistently appears in the data recorded from three sessions analyzed at the beginning, middle, and toward the end of the replications of the experiment. There appears to be strong evidence, especially in the separation of the heart rhythm win/loss curves, of a pre-stimulus difference reflecting a nonlocal intuitive effect some *12-14 seconds before* the betting outcome was presented to the participants. And the results from the comparison of entrepreneurs with non-entrepreneurs showed similar evidence of the detection of a nonlocal intuitive effect in the recordings of heart rhythm patterns.

Overall, while these are preliminary results, which must await confirmation from further analysis of the data, they are consistent with a previous study which found that heart rate decelerations/accelerations and changes in skin conductance were able to significantly predict emotionally arousing future events (McCraty et al. 2004a & 2004b). These results move us significantly closer to a large-scale field study on nonlocal intuition in which a statistically adequate sample of repeat entrepreneurs is compared with samples of unsuccessful entrepreneurs and ordinary business people.

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