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RESEARCH ARTICLE

Investigating Remote Electrogastrogram Modulation Via Emotional and Eating Stimuli: A Sham-Controlled Pilot Study

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ABSTRACT

This pilot study investigated whether gastrointestinal activity, measured via electrogastrography (EGG), can be influenced nonlocally by a distant, emotionally bonded partner. Using a double-blind, sham-controlled design, thirty adult pairs were randomized to a Real or Sham condition. In the Real condition, the Sender experienced sad and food-related stimuli (selecting and eating food) while intending to transmit their experience to the distant Receiver; in the Sham condition, no stimuli were presented. Although the preregistered hypothesis predicting amplitude changes was not supported, a Linear Mixed-Effects analysis identified a significant Condition × Epoch interaction for EGG frequency. Follow-up tests showed unexpectedly large decreases in Receiver gastric frequency during the Sender's "sad" epoch and more robustly during the "eating" epoch. This specific slowing of gastric rhythm aligns with parasympathetic (vagal) modulation rather than a generalized sympathetic response. These preliminary results suggest that EGG frequency may be a sensitive physiological marker of nonlocal interpersonal influence, particularly for enteroceptive states involving eating, although the underlying autonomic pathway cannot be determined from EGG alone.

KEYWORDS

Electrogastrography, Nonlocal interpersonal influence, Gut telepathy, Intuition.

INTRODUCTION

Intuition, or knowing something immediately without relying on logical reasoning or inference, is often associated with the gut. This association is reflected in everyday language across cultures: in English, we "trust our gut" or have a "gut feeling;" in German, *Bauchgefühl* also means "gut feeling;" in French, *un noeud dans l'estomac* refers to "a knot in the stomach." Scientific research supports this association, pointing to the enteric nervous system (ENS) as a key physiological substrate involved in intuitive processes (Mayer, 2011; Soosalu et al., 2019). Often referred to as the body's "second brain," the ENS contains hundreds of millions of neurons and regulates digestion, immunity, and hormone production. It communicates bidirectionally with the brain through the gut–brain axis, forming an integrated system that influences both physiological and psychological states. Emerging evidence suggests that this axis may play a central role in the somatic basis of intuitive cognition, decision-making, and emotional insight (Fleming et al., 2020; Furness et al., 2014; Gershon, 1999; Gershon & Margolis, 2021; Mayer, 2011).

Many intuitive experiences can be attributed to environmental cues, subliminal stimuli, tacit knowledge, and unconscious somatic influences (Bechara et al., 1997; Damasio, 1996; Hodgkinson et al., 2008; Lufityanto et al., 2016). However, a subset of these experiences may suggest a nonlocal component to intuition, where individuals report similar sensations or even physiological changes despite being separated by great distances. In the 1960s, Berthold Schwarz documented numerous such cases and introduced the term "*telesomatic*," derived from Greek roots meaning "distant body," to describe instances in which individuals report feeling the sensations or symptoms of others from a distance (Schwarz, 1967). In a later study, Mann and Jaye (2007) interviewed 20 adult twins who collectively reported over 50 telesomatic events. These events were most commonly felt during significant life events or vulnerable periods such as pregnancy, childbirth, surgery, or accidents. Respondents often described their experiences within the context of strong emotional bonds between empathic twins. The cases generally fell into three categories: (1) both twins experienced similar physical symptoms (e.g., labor pain or nausea); (2) one twin experienced an emotional state that mirrored the other's distress (e.g., anxiety, grief, fear); and (3) one twin experienced a physical symptom associated with the other's condition, even when the originating twin did not exhibit that specific symptom. While such accounts are subjectively vivid, they also prompt inquiry into whether distant interpersonal experiences can produce measurable, subconscious physiological effects.

Scientific investigations have begun to map the physiological signatures that may underlie intuitive experiences, particularly those outside conscious awareness (McCraty et al., 2004a, 2004b; McCraty & Atkinson, 2014; McCraty & Zayas, 2014; Radin, 2008; Rezaei et al., 2014), leading to the emergence of the term *nonlocal intuition.* This term refers to the perception of information about a distant or future event by the body's psychophysiological systems, independent of reason, inference, or prior memories (Rezaei et al., 2014). One notable study by Radin and Schlitz (2005) explored the potential for gut-based registration of distant emotional experiences using cutaneous electrogastrography (EGG), a validated, noninvasive measure of gastric myoelectrical activity (Muth et al., 1999; Stern et al., 2001; Wolpert et al., 2020). Unlike the brain, which is strongly modulated by cognitive filters and conscious attention, the gut operates largely outside of awareness, potentially offering a more direct physiological index of subtle interpersonal influence. Radin and Schlitz found that EGG amplitude was significantly higher when a distant partner was exposed to emotional (positive or negative) stimuli compared to neutral stimuli, with effects reaching statistical significance for both positive ($p = .006$) and negative ($p = .0009$) emotions. These findings suggest that gut-based measures may be sensitive to distant emotional states under controlled conditions.

The present study builds upon and seeks to replicate the most robust finding on this subject from Radin and Schlitz (2005): a change in gut activity corresponding to a distant partner's exposure to negative (sad or upsetting) emotional stimuli. To extend this work, we incorporated a sham condition and added behavioral measures to explore correlations with EGG responses. A further novel feature of this study is the inclusion of food-related stimuli, based on the rationale that if some form of unconscious telepathic signaling is an emergent property of the ENS, such effects may be particularly pronounced during digestion-related activity because that is the system's primary function.

This study involved two conditions, Real and Sham, and two participant roles. In the Real condition, one individual in an emotionally bonded pair served as a distant *Sender* exposed to specific stimuli, while the other person served as a *Receiver*, from whom EGG recordings were collected. In the Sham condition, the Sender engaged in a separate distractor task and was not exposed to stimuli, while the Receiver's EGG was recorded.

The first aim of this study was to examine whether the Receiver's EGG activity in the Real condition differed across four 2-minute epochs experienced by the Sender: a neutral emotion, a sad emotion, while selecting food to eat, and when starting to eat food. It was hypothesized that (a) in the Real condition the Receiver's EGG activity would be significantly greater during the last three epochs than during the neutral condition, that (b) in the Sham condition the Receiver's EGG activity across the epochs would not differ, and that (c) the same measures across Real vs. Sham conditions would show differences favoring effects in the Real condition.

A second aim was to compare the Receiver's EGG activity across the entire eating epoch, where it was hypothesized that EGG activity during the eating epoch would be significantly different between the Real and Sham conditions. A third aim was to explore whether differences in participant characteristics might influence the outcomes by assessing correlations between EGG activity and interoceptive decision-making styles, self-reported psi abilities, degree of emotional bondedness between pairs, and personal patterns related to gut health. It was hypothesized that these characteristics may be associated with the degree of any effects observed through the first two aims.

METHODS

Participants

Participants were recruited in pairs through social media advertisements, with a prespecified minimum of 30 pairs. As this was a pilot study, the sample size was based on available funding and in reference to the prior study by Radin and Schlitz (2005), which reported a significant effect for sad emotional stimuli with an overall z-score of 3.13 (p = .0009) based on 26 pairs of participants, Cohen's d = 0.61. To estimate the expected statistical result for a smaller sample, we adapted their statistical model to n = 15 pairs, which yielded an estimated z = 2.34 (p < .05), with one-tailed statistical power ≈ 70%.

The recruitment ads indicated that the study aimed to explore telepathy, and interested individuals were asked to invite a partner with whom they shared an emotional connection. Inclusion criteria included: 1) adults 18 or older, 2) English competency, and 3) belief that telepathy is possible. Exclusion criteria were self-reported: 1) gastric or digestive disorder, 2) current use of prokinetic antiemetic agents, narcotic analgesics, anticholinergic drugs, probiotics or prebiotics, and 3) pregnancy. Participants were recruited and participated on a rolling basis between December 2024 and February 2025. Compensation for each participant in the pair consisted of lunch and $100 via the PayPal app.

Seventy-three individuals provided informed consent and completed the initial questionnaires. Of these, thirteen were excluded due to ineligibility or other reasons (e.g., scheduling issues or declined after enrollment). Sixty participants were enrolled in the study as pairs and randomly assigned to either the experimental (Real) or the control (Sham) group. All 30 pairs completed the study protocol, and data from all 30 Receivers (15 in each group, Real and Sham) were included in the analysis (see Figure 1; note that EGG data were collected and analyzed only from one member of each pair (the Receiver).

Each participating pair attended an individually scheduled laboratory session, arriving at the laboratory (Novato, CA) between 11:15 a.m. and 11:30 a.m. on the day of their scheduled session, after having eaten a standardized breakfast (see details in the next section). The research team assigned roles within each participant pair, designating one as the Sender, who would attempt to transmit telepathic signals, and the other as the Receiver (from whom EGG data were collected and who would ostensibly receive the transmitted signals), based on a decision tree aimed at optimizing EGG recording quality. Role assignment prioritized the amount of torso body hair and body mass index (BMI). The individual with the least torso hair was

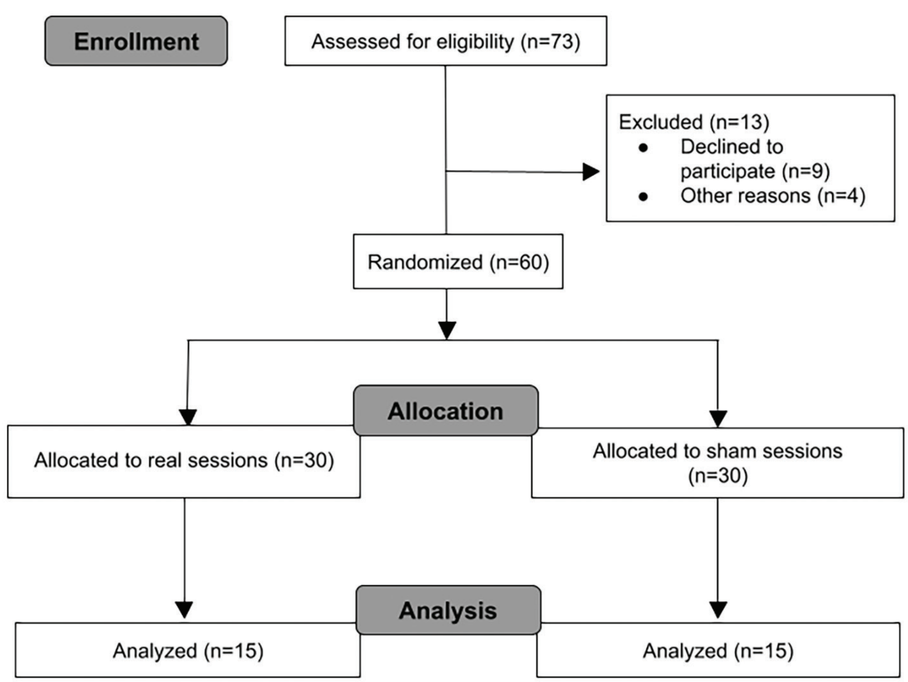

Figure 1. Participant Recruitment and Randomization Flowchart.

preferred as the Receiver because body hair can interfere with proper electrical contact with the skin. This consideration resulted in all male participants in this study being assigned to the Sender role; no men served as Receivers. Regarding BMI, participants with a BMI at or below 25 were preferred as Receivers, since higher BMI is associated with reduced signal sensitivity due to abdominal adiposity (Obioha et al., 2013). To help support a shared sense of connection between the pair, the Sender and Receiver exchanged a personal, meaningful item (e.g., a ring or photograph), which they held during the session.

Standardized Breakfast

On the morning of their experimental session, participants were instructed to eat a standardized breakfast, finishing by 8:30 a.m., and then to consume only water until they arrived at the laboratory. This standardized meal protocol was intended to help ensure consistent hunger levels across participants. Participants were instructed to eat one of several meal options, each containing approximately 300–400 calories and 5–7 grams of dietary fiber. Examples of breakfast options were suggested, but substitutions were permitted, provided that the total caloric and fiber content remained within the specified ranges.

EGG Recording and Processing

Before electrode placement, the designated abdominal areas were cleansed using an unscented astringent for sensitive skin (Witch Hazel) to improve skin conductivity. Three pre-gelled disposable Ag/AgCl surface electrodes were then affixed using a standardized configuration for EGG (Oczka et al., 2024). The central electrode was positioned at the midpoint along a straight line connecting the xiphoid process and the umbilicus. The right lateral electrode was placed approximately 5 cm (two finger widths) below the lower edge of the right rib cage, and the left lateral electrode was placed approximately 5 cm below the lower edge of the left rib cage. EGG signals were amplified by a Biopac EGG100C amplifier (set to 1000 gain, low pass filter at 0.1 Hz, high pass filter at 0.005 Hz) and digitized by a Biopac MP150 physiologic system recording at 100Hz.

Randomization of Treatment Groups (Real vs. Sham)

Randomization to either the Real or Sham group was conducted in advance to ensure balanced group assignment across participant pairs. After all baseline data were collected, the study's research coordinator randomized participants. The research team in the laboratory opened unmarked envelopes that contained the randomization assignment only after electrode placement was completed, ensuring that the setup procedures remained unbiased. Upon completion of the session, the corresponding EGG data were transferred to a remote team member (DR) for blinded analysis.

Receiver Procedures

The procedures for the Receiver were identical for both Real and Sham conditions. After electrode placement, the Receiver moved to a "zero-gravity" reclining chair (Relax the Back, Menlo Park) in a dedicated Receiver Room, with their knees lifted slightly above heart level. After confirming successful data acquisition from the EGG electrodes, the Receiver was instructed to relax, minimize movement, and sustain an intentional mental link with the Sender. The Receiver was informed that the Sender would periodically view them over closed-circuit video, but was unaware of the specific timing or duration of these views. A video camera set on a tripod was placed to capture the Receiver's live image throughout the experimental session. Active noise-cancelling headphones were placed over the Receiver's ears to promote relaxation and mask ambient sounds.

Real Session Sender Procedures

The Sender was seated in front of a split-screen monitor in the Sender Room, approximately 15 meters from the Receiver Room. Between the two rooms was a fully enclosed intervening room with closed doors at both ends, ensuring complete visual and auditory isolation. These doors were never opened simultaneously; when staff entered or exited one room, the opposite door remained closed, preventing any possible sensory leakage between participants. One side of the monitor intermittently displayed a live video feed of the Receiver, while the other side presented stimuli and instructions. The Sender remained seated throughout the session, following the on-screen instructions. Research staff entered the Sender Room only during breaks between stimulus presentation epochs. During each sending epoch, the Sender was instructed to periodically gaze at the Receiver's live feed and deliberately transmit the emotions and sensations elicited by the stimuli. During rest intervals, the Sender was asked to withdraw attention and relax.

Real Session Stimulus Protocol

Digitized signals from the Biopac system and computer were transmitted over a local area network to a separate computer in the Sending Room that controlled the experiment and presented stimuli and instructions to the Sender. Upon initiation, a MATLAB program running on a PC randomly selected a sequence of two 2-minute epochs, one designed to elicit sad emotions and the other to elicit neutral emotions, and simultaneously during these epochs: 1) displayed the Receiver's live video image, 2) displayed the appropriate emotional stimuli, and 3) sent electrical markers indicating the timing and type of stimulus to the Receiver's Biopac system.

The emotional epoch consisted of 20 International Affective Picture System (Lang et al., 2005) sad images (e.g., graveyard), displayed for 6 seconds each, with arousal ratings within 3.67 and 6.36 and valence ratings within 1.78 and 4.08, along with audio of Samuel Barber's *Adagio for Strings*. The neutral emotion epoch consisted of a series of gray-hued rectangles accompanied by pink noise. A two-minute sensory food cue epoch followed these emotional epochs. During the break preceding the food cues epoch, research staff entered the room with a cart loaded with four lunch options. At this point, the Sender was prompted to choose lunch items for themselves and their partner, and the computer monitor displayed the live image of the Receiver alongside the written instruction: "Choose your lunches!" and no audio was played. The final epoch (eating epoch) lasted approximately 20 minutes. During this period, the Sender tasted the lunch items and ate as much as desired while focusing on transmitting the quality of their experience to the Receiver. No audio was played during this time, and the monitor displayed a live image of the Receiver alongside the written instruction: "Taste the Food!" This period was followed by several additional minutes to capture the expected lingering gastric effects of food ingestion, as these physiological responses persist beyond the act of eating (Sheiner et al., 1980). The exact duration of the post-ingestion interval varied slightly due to logistical constraints. During each 30-second inter-epoch rest period, the computer monitor with the Receiver's image switched to black, and the other window presented the word "relax" in green on a black background. The sequence of stimulus epochs and timeline for EGG recording is illustrated in Figure 2.

Sham Session Stimulus Protocol

In the Sham sessions, the timing of stimulus presentation and EGG recording mirrored the Real sessions, but the Sender remained unaware. To maintain blinding, the computer displaying stimuli and the Receiver's video feed was positioned out of the Sender's sight, behind a screen on the opposite side of the Sender Room with its lid pushed nearly closed so the display was not visible from a standing or seated position. Audio was muted throughout. Meanwhile, the Sender was intentionally distracted with a video clip (Dr. Rupert Sheldrake discussing telepathy research involving an African Grey parrot) and a related, nonessential questionnaire, designed to give the impression that the session had not yet begun. The Receiver did not consume

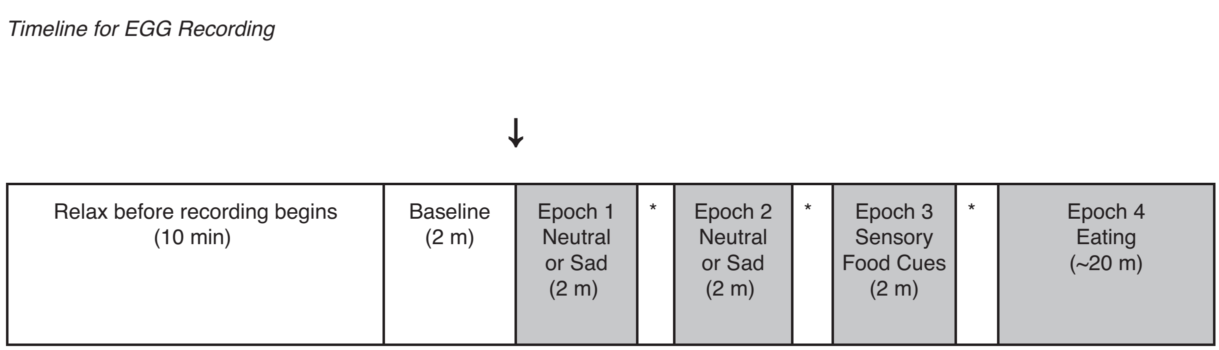

Figure 2 Timeline for EGG Recording. *Note*: EGG recording for each session began with a 10-minute relaxation period and a 2-minute baseline period. Stimulus presentation epochs 1 and 2 consisted of neutral or sad emotions presented randomly (2 minutes each). Epoch 3 consisted of sensory food cues (2 minutes), and epoch 4 consisted of ingesting the chosen lunch (~20 minutes). Shaded blocks indicate when the closed-circuit video of the Receiver was visible to the Sender during Real sessions. For Sham sessions, the stimulus presentation epochs and EGG recording were identical to the Real sessions. However, the computer presenting the stimuli and the closed-circuit video of the Receiver was not visible to the Sender, and the audio was muted. The arrow denotes the "start" condition mark that indicates the beginning of the experiment. *30-second rest periods between epochs.

any food during the session. There were no indications of experimental group assignment in computer signaling and data acquisition. When the session was complete, the pair was informed that they had been randomly assigned to the Sham condition, and then both parties were allowed to select and eat their lunch options.

Questionnaires

All participants completed questionnaires to assess relevant psychological and physiological characteristics before participating in the study. These included the Multiple Brain Preference Questionnaire, which evaluates intuitive versus cognitive decision-making styles across domains of head, heart, and gut interoception (Soosalu et al., 2019), and the Noetic Signature™ Inventory, which measures sensitivity to experiences and information perceived to transcend space and time (Wahbeh et al., 2022). Participants also completed an assessment of bondedness using a Likert-scale measure of emotional closeness between partners, as well as the Gastrointestinal Symptom Rating Scale (AstraZeneca, 1995), a 15-item questionnaire that assesses five gastrointestinal symptom clusters on a 7-point scale, commonly used in adults with irritable bowel syndrome and peptic ulcer disease.

Analysis

Analytic Approach

This study served as an exploratory conceptual replication of Radin and Schlitz (2005), incorporating several design modifications, including the introduction of a sham control and a more sophisticated analytical approach. In the 2005 study, spikes in Receiver EGG activity were anecdotally observed when images of food (e.g., an ice cream sundae) were displayed to the Sender during positive emotion epochs. The present study formally tested this observation by incorporating explicit sensory food cues and eating epochs. All study procedures were registered before data analysis with the Koestler Parapsychology Unit (#1095).

The registered goals addressed three specific aims: **(1)** to examine changes in the Receiver's EGG activity across emotional and food-related epochs within each Real and Sham session relative to an initial baseline period, **(2)** to compare the Receiver's EGG activity during the entire eating epoch across Real and Sham conditions, and **(3)** to explore correlations between Receiver's EGG activity and individual or dyadic characteristics as assessed through the questionnaires. These aims were first addressed through analysis of EGG amplitude, following the procedures outlined below, and then through an exploratory analysis of EGG frequency.

Aims 1 and 2

Each raw EGG record per session was preprocessed to extract the segment of data relevant to that experimental session. For each segment, a "begin" condition mark defined the start of the session and an accompanying baseline epoch, which consisted of a two-minute window immediately preceding that mark. The end of the segment was defined as an "end" mark at the session's close. Once extracted, the segment was filtered using a low-pass filter with a cutoff frequency of 0.2 Hz to suppress electromyographic and motion artifacts while retaining the gastric slow-wave band (Parkman et al., 2003). The segment was then linearly detrended and down sampled by a factor of 10, reducing the 100 Hz sample rate to 10 Hz. This segment was used for subsequent EGG frequency analyses (EGG_F, for filtered). For EGG amplitude analyses, the same segment was first normalized (using the segment's mean and standard deviation) and then the absolute values of those values were determined (EGG_Z, for z-score normalized).

For the amplitude analysis, following the approach used in the Radin and Schlitz (2005) study, the maximum value of the EGG_Z signal associated with each of the two-minute baseline, neutral, sad, select food, and start of the eating food epochs was determined, as well as the mean of the full ~20-minute eating epoch. The maximum of each shorter epoch was used to more closely conform to the analytical method used in Radin and Schlitz (2005), and to provide a means of capturing the sudden "spikes" in Receiver EGG reported in that study when images of food were used as stimuli. If a mean value were used to summarize the shorter epochs, that may have washed out the purported spikes of interest. For the frequency analysis, the dominant frequency was determined for each of these epochs using the EGG_F signal (Chen et al., 1996).

The originally preregistered analysis plan called for assessing within-session differences among the epochs using a circular-shift permutation method. That approach was intended to create a nonparametric estimate of the null distribution by cyclically shifting the time series, thereby preserving local autocorrelation while randomizing temporal alignment between stimulus epochs. However, upon closer inspection, three reasons were found to make this method inappropriate for the present dataset.

First, the EGG signals, especially the amplitude measures, were distinctly non-stationary, exhibiting drifts and a relaxation phase during the first several minutes of each session. The circular-shift procedure assumes temporal stationarity, where statistical properties, such as the mean and variance, are constant throughout the recording. The observed data violated that assumption, so applying time shifts would have distorted the underlying structure and obscured or inflated any apparent differences. Second, the experiment involved discrete, non-exchangeable epochs (neutral, upset, select, and eat), each representing different experimental conditions. Circular shifting would have mixed data across these conditions, thereby obscuring any meaningful correspondence between the hypothesized physiological responses in the various epochs. Third, the study aimed to assess systematic within-session modulations, specifically whether EGG amplitude or frequency changed in predictable ways during particular epochs, rather than testing a global null hypothesis of no temporal structure.

For these reasons, analysis was shifted to a Linear Mixed-Effects (LME) framework, which more accurately accommodates both the repeated-measures structure and inter-subject physiological variability of the EGG signals. The LME approach allowed for fixed effects for the experimental conditions and random effects for the participants, capturing both population-level trends and individual differences while avoiding violations of temporal dependencies. This provided a statistically robust and conceptually more appropriate method for testing both the hypothesized within-session epoch differences and cross-condition (i.e., Real vs. Sham) effects during the longer eating period. Due to the shift in analytical methods, the results of this study should be interpreted with caution as exploratory.

Aim 3 Analysis

To test Pearson's correlations between the EGG outcomes and participant characteristics, the EGG data were reduced to average amplitude and average frequency, and then the indicated surveys were each reduced to a single summary variable. Variables were assessed for normality using the Anderson-Darling normality test. Where data were collected from both parties, the data from the Receiver was taken as the best representative of the information received for that pair. Data were then separated by group - Real or Sham -, and each was separately analyzed to test each pairwise correlation between the six variables: average EGG amplitude, average EGG frequency, Bondedness, Multiple Brain Preference, Gastrointestinal Symptom Rating Scale, and Noetic Signature Index. To compare each correlation observed for the experimental vs. sham groups, Fisher's *r* to *Z* transformation was used, followed by two-sample *Z* tests.

RESULT

The demographic characteristics of the randomized participants in the two experimental groups (Real and Sham) did not differ significantly in terms of age, sex, race, or the questionnaire responses (see Table 1). Regarding Aims 1 and 2, which examined changes in the Receiver's EGG activity during the Sender's emotional and food-related epochs both within and across sessions, descriptive statistics are provided in Table 2, and an equivalence test for the amplitude and frequency baselines in the Real and Sham conditions is shown in Table 3. The results of the LME analysis are presented in Table 4. Table 5 lists the post-hoc comparisons and their

Table 1. Sample Demographics and Questionnaire Outcomes.

Measure	Units / Categories	Real Group	Sham Group
		Values M (SD) or n (%)	
Age (60)	Years	57.3 (15.5)	55.9 (15.6)
Sex (60)	Female	23 (76.6%)	18 (60%)
	Male	7 (23.4%)	12 (40%)
Race* (60)	Native American	0	0
	Asian	0	1 (3.3%)
	African	1 (3.3%)	0
	Middle Eastern	0	0
	Native Pacific Islander	0	1 (3.3%)
	Latinx/Hispanic	8 (26.7%)	3 (10%)
	European	16 (53.3%)	18 (60%)
	Other	3 (10%)	6 (20%)
	Decline to Answer	2 (6.7%)	1 (3.3%)
Bondedness (30)	Likert-scale scores	25.60 (20.40)	38.00 (23.59)
Multiple Brain Preference (30)	Dimensionless %	61.18 (5.18)	61.03 (3.65)
GI Symptom Rating Scale (30)	Likert-scale scores	0.75 (0.54)	0.65 (0.60)
Noetic Signature (30)	Not Applicable	59.61 (14.90)	53.86 (13.14)

* Participants could check more than one race. Values in parentheses in the first column indicate the number of participants completing each measure. Data on emotional bondedness with one's partner, interoceptive decision-making styles, personal patterns related to gut health, and self-reported psi abilities were analyzed only from one member of each pair (the Receiver).

Table 2. Descriptive Statistics for EGG Amplitude and Frequency in the Real and Sham Conditions, Based on 15 Pairs of Participants in Each Condition.

Measure	Epoch	Real (Mean ± SD)	Sham (Mean ± SD)
Amplitude (µV)	Baseline	3.82 ± 3.22	4.86 ± 4.20
	Neutral	4.65 ± 4.84	4.27 ± 4.06
	Upset	2.93 ± 1.18	5.27 ± 4.16
	Select	4.98 ± 6.70	4.44 ± 5.33
	Eat	2.49 ± 1.19	3.19 ± 1.46
	Eat all	0.64 ± 0.18	0.62 ± 0.23
Frequency (Hz)	Baseline	3.38 ± 0.81	3.63 ± 1.18
	Neutral	3.89 ± 1.18	3.38 ± 1.19
	Upset	2.99 ± 0.61	3.87 ± 1.14
	Select	3.26 ± 0.88	3.89 ± 1.10
	Eat	3.13 ± 0.83	3.46 ± 0.79
	Eat all	2.66 ± 0.42	3.46 ± 0.96

Table 3. Equivalence Tests for EGG Amplitude and Frequency Baselines.

Measure	Condition	Mean ± SD	*t*(28)	*p*
Amplitude (µV)	Real	3.82 ± 3.22	−0.76	.45
	Sham	4.86 ± 4.20		
Frequency (Hz)	Real	3.38 ± 0.81	−0.69	.50
	Sham	3.63 ± 1.18		

Note: Values represent baseline EGG measures prior to stimulation. No significant differences were found between the REAL and SHAM groups.

Table 4. Linear Mixed-Effects Model Results for Epochs within Real and Sham Conditions, and Interactions between Real and Sham Conditions.

Term	$F(df_1, df_2)$	*p*
Amplitude ANOVA		
Intercept	17.23 (1, 168)	< .001
Condition	0.64 (1, 168)	.425
Epoch	3.01 (5, 168)	.013*
Condition × Epoch	0.69 (5, 168)	.631
Frequency ANOVA		
Intercept	202.16 (1, 168)	< .001
Condition	0.57 (1, 168)	.451
Epoch	3.02 (5, 168)	.012*
Condition × Epoch	2.29 (5, 168)	.048*

Note: p values < .05 are marked with an (*).

associated FDR-adjusted *p*-values. These results are summarized visually in Figure 3.

DISCUSSION

This double-blind sham-controlled study tested whether the gastrointestinal activity of one individual was

Table 5. Post-hoc Tests for EGG Amplitude and Frequency Across Epochs.

Measure	Epoch	Cohen's *d*	*p- value*	FDR-adjusted *p*
Amplitude (µV)	Baseline	−0.28	.45	.82
	Neutral	0.09	.82	.82
	Upset	−0.77	.045*	.27
	Select	0.09	.81	.82
	Eat	−0.53	.16	.48
	Eat all	0.12	.76	.82
Frequency (Hz)	Baseline	−0.25	.50	.50
	Neutral	0.43	.25	.33
	Upset	−0.97	.013*	.04*
	Select	−0.63	.10	.20
	Eat	−0.41	.27	.33
	Eat all	−1.08	.006*	.04*

Note: Post-hoc comparisons were conducted for each epoch using Cohen's d, raw p, and FDR-adjusted p values (Benjamini–Hochberg correction). Asterisks (*) indicate p < .05. FDR adjustments can result in identical adjusted values when smaller p-values are "pulled down" to match larger ones, as is standard for the Benjamini–Hochberg method.

associated with the emotional or sensory experience of a distant, emotionally bonded partner. The primary hypothesis was that a Receiver's physiological state, specifically their "gut feelings" as measured by EGG, would resonate with the emotional state of a distant sender. The results provide nuanced support for this hypothesis. The findings suggested the presence of a "resonance" effect but one different from what was originally assumed, manifesting as a significant change in gastric frequency rather than amplitude.

The central finding of this study was a statistically significant Condition × Epoch interaction for EGG frequency ($p = 0.048$), indicating that the pattern of change in the Real group differed significantly from that of the Sham group over the course of the experiment. Conversely, no such interaction was found for maximum amplitude ($p = 0.630$). This provides an important refinement for the results reported in the Radin & Schlitz (2005) study. It suggests the effect is not a "jolt" or "tensing" of the gut (an amplitude effect) but rather a change in its fundamental rhythm (frequency).

The LME analysis, which is statistically appropriate for handling subject-level variability and the time-based habituation present in the data, supersedes our original 2005 finding. The LME's detection of a significant main effect of Epoch for amplitude ($p = 0.0125$) confirms that EGG amplitude habituation is a real factor, and by modeling

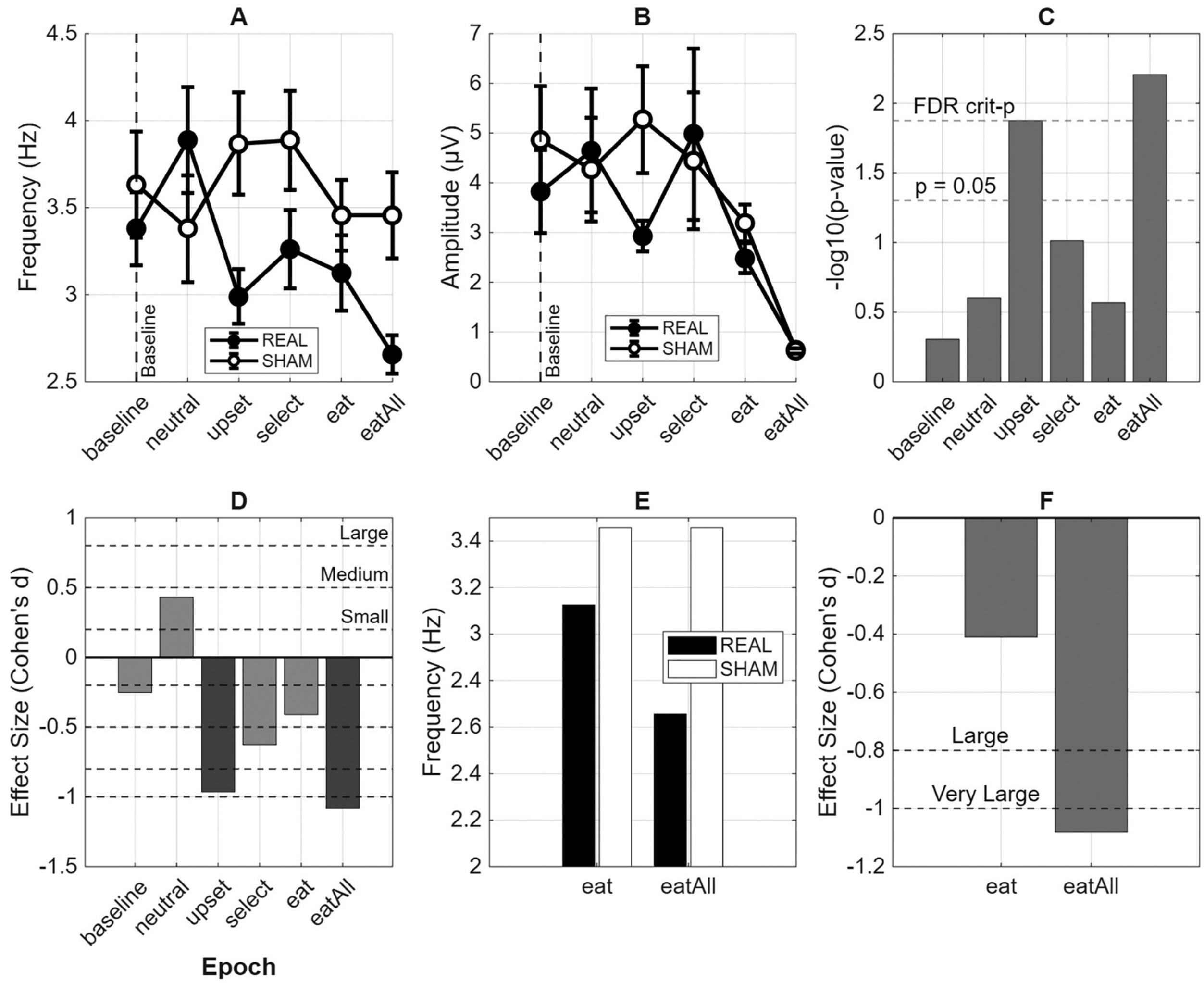

Figure 3. Comparisons of EGG Activity Across Experimental Epochs Over Time, Post-hoc Effect Sizes, and Frequency and Post-hoc Effect Sizes for the First Two Minutes of the Eating Period ("eat"; Consistent with the Other Experimental Epochs) Versus the Entire Eating Period ("eatAll"). *Note:* (A) Frequency trajectory (raw means ± SEM) across the emotional and food-related epochs in both Real and Sham conditions. (B) Amplitude trajectory (raw means ± SEM) for the same epochs, showing overall signal magnitude over time. (C) Post-hoc t-test p-values for frequency, illustrating where statistically significant differences occurred across epochs and conditions. (D) Corresponding post-hoc effect sizes (Cohen's d) for frequency, comparing Real vs. Sham conditions. (E) Comparison of starting to eat and the entire eating epoch, showing mean frequency and amplitude values across the two periods. (F) Post-hoc effect sizes for the "eat" vs. "eatAll" comparison, highlighting the relative magnitude of change between the onset of eating and the entire eating interval.

it, the analysis was able to isolate the underlying frequency effects. Post-hoc analysis of the frequency interaction revealed that this effect was driven by a significant slowing of gut frequency (bradygastria) in the Real group but not the Sham group. This slowing was not present at baseline but became most pronounced during two specific epochs: upset (p{FDR adjusted} = 0.040, Cohen's d = -0.965) and the full eating period (p{FDR adjusted} = 0.0374, Cohen's d = -1.080).

These physiological responses are key to the proper interpretation of the results. A slowing of the Receiver's EGG frequency during these epochs cannot be interpreted as a simple parasympathetic "rest and digest" stabilization, but rather as an index of altered autonomic balance. Bradygastria has been described in the literature under conditions of heightened sympathetic influence that inhibit digestion, yet it can also arise from shifts in parasympathetic (vagal) modulation of gastric pacemaker activity. Thus, the pattern observed here is most parsimoniously understood as a complex, non-mimicking interaction between the Sender and Receiver, rather than a straightforward mirror of classic "rest and digest" or "fight or flight" states. For example, during the upset epoch, the Receiver's gut appeared to resonate with the Sender's sympathetic arousal state, initiating its own sympathetic gut "shut-down" response, whereupon EGG frequency declined. This would be compatible with a "resonance" hypothesis whereby the Receiver "felt" the Sender's emotion as one of threat or alarm, expressed as a shift in autonomic input to the stomach. Of greater interest, however, was the cumulative effect observed in the Receiver while the Sender was eating. Gastric frequency slowed during the initial 2-minute eating period (Cohen's d = -0.410), and when measured across the entire eating period, the effect size more than doubled to a large Cohen's d = -1.080 and became significant. This suggests the effect of the Real eating stimulation was not merely a brief, transient reaction, but a persistent, cumulative "signal" from the Sender strong enough to modify the Receiver's gastric pacing over the full epoch.

The significant frequency-based changes observed in this study, without significant corresponding amplitude changes (after FDR adjustment), overall suggest that parasympathetic (vagal) modulation played a primary role, possibly with superimposed sympathetic influences in certain conditions. The vagus nerve's role as the primary conduit of parasympathetic control of the gut and a central component of gut-brain communication supports this interpretation. A vagally mediated slowing of gastric frequency aligns with our findings, as external vagal nerve stimulation reduces frequency (Teckentrup et al., 2020). Given the well-established physiological sensitivity of EGG frequency to autonomic and enteric modulation, including decreases in dominant frequency during stress (Riezzo et al., 1996), the current findings support the interpretation that the experimental intervention selectively influenced the pacing of gastric myoelectrical activity rather than induced a nonspecific enhancement of signal amplitude. This outcome is notable because EGG amplitude can be influenced by various non-specific factors, including electrode contact, skin conductance, and body motion; thus, its interpretive specificity is lower than that of frequency. Observing a significant frequency shift, especially when amplitude effects were statistically controlled as in this analysis, suggests a relatively direct modulation of enteric neural or myoelectrical control mechanisms. The balance of evidence favors predominantly parasympathetic mediation rather than a purely sympathetic response.

This outcome aligns with prior psychophysiological research indicating that EGG frequency shifts are more reliable indicators of changes in gastric neural control than amplitude shifts under influences such as attention, arousal, intention, or stress. For instance, Parkman et al. (2003), in their consensus guidelines on EGG methodology, emphasize that amplitude is highly sensitive to confounding factors like body movement and posture, making it difficult to interpret unless tightly controlled. In contrast, frequency is relatively stable and thus more suitable for meaningful comparisons. Similarly, Riezzo et al. (1996) found that different stressors (e.g., cold pressor, Stroop test, and mental arithmetic) consistently decreased dominant frequency and increased its variability, while amplitude rose in only one task and varied widely between individuals. Such findings led those authors to recommend frequency-based metrics in psychophysiological research involving EGG. Gianaros et al. (2001) made the same recommendation after showing that stressors, such as public speaking and mental arithmetic, significantly reduced time spent in normogastria (2–4 cycles per minute), while amplitude-based indices showed no consistent pattern. Wolpert et al. (2020) echoed these findings in an extensive normative study, concluding that amplitude is highly susceptible to external variables (e.g., body fat, electrode placement, breathing), but frequency metrics offer more robust markers for affective state comparisons.

In the present study, the observed decrease in dominant EGG frequency in the Real condition, relative to the Sham condition, may plausibly reflect physiological stress induced by being hungry while intuitively sensing that one's distant partner was enjoying a meal. As noted above, such a response may be mediated by external vagal stimulation, which is known to decrease EGG frequency, potentially induced in the present case via extrasensory communication. Such a decrease is also consistent with stress-related or motivational arousal responses. From an evolutionary perspective, it is conceivable that early humans may have communicated vital information, such as the location of food, through nonlocal physiological or perceptual mechanisms. In such a scenario, the Receiver's physiological response might serve as a mobilizing signal, prompting distant group members to sense that a tribe member had found food and to move toward the food source. Moreover, because the Sender could see a live video of the Receiver during Real trials, subtle scopaesthesia-related arousal cannot be ruled out as a contributing factor. Mild sympathetic activation associated with being observed could theoretically influence Receiver physiology through nonlocal channels. This further underscores the need for a cautious interpretation of autonomic responses.

Our failure to replicate the amplitude-based EGG effects reported by Radin and Schlitz (2005) may be due to specific methodological differences, particularly in role assignment. In the present study, researchers determined Sender and Receiver roles based on optimizing EGG signal quality, which may have conflicted with participants' intuitive inclinations. Indeed, several participants reported feeling they would have performed better in the opposite role, suggesting that allowing self-selection may be important for assessing these effects.

The study also had general limitations that warrant consideration. All participants endorsed a belief in telepathy, which may have enhanced sensitivity to the subtle impacts but limits the generalizability of the results to broader populations. Additionally, while EGG offers a focused view of gastrointestinal rhythms, it does not capture broader autonomic or cortical processes that may also contribute to distant physiological coupling. This is relevant in light of a recent study by Silberstein and Bigelow (2024), who used steady-state visual evoked potentials with event-related phase coherence (SSVEP-ERPC) and observed notable changes in brain connectivity in monozygotic twins, with a Cohen's *d* of 0.85. This more substantial effect may reflect the greater sensitivity of their neurophysiological measures, the unique closeness of monozygotic twins, or both. Another limitation is that "sad" images, while validated for strong affective and autonomic impact, may not evoke uniform responses across participants; for example, some may experience graveyard scenes as neutral or aesthetically pleasing. Improved sensitivity may be achieved by pre-rating and tailoring emotional stimuli to individual differences in emotional reactivity.

Future studies could refine the present protocol in several ways. Allowing participants to self-select into Sender and Receiver roles may better align with their intuitive strengths and potentially increase effect sizes. In the present study, the skewed role distribution likely contributed to participants' impressions that they might have performed better in the opposite role. In heterosexual participant pairs, all men served as Senders and all women as Receivers, which may have created misalignment with some participants' intuitive or interpersonal strengths. Allowing self-selection in future studies could reduce role–sex mismatch and enable more systematic examination of potential sex-related effects. Adding a semi-structured qualitative debrief would also be valuable, as participants may engage in spontaneous imagery, emotional inferences, or internally generated strategies that could clarify how subtle interpersonal effects unfold. Incorporating such debriefs in future replications would help contextualize physiological findings and illuminate subjective correlates of any observed coupling. Moreover, examining correlations between the Sender and Receiver regarding EGG amplitude and frequency may yield valuable insights. Finally, a key limitation of the current study design is that EGG alone does not permit definitive attribution of gastric frequency shifts to sympathetic or parasympathetic activity. Future studies should incorporate additional autonomic measures (e.g., such as heart rate variability, skin conductance responses, respiration, electroencephalography, and pupillometry) to derive a clearer profile of the underlying mechanism.

If replicated, these findings suggest that gut physiology may be uniquely sensitive to subtle, nonlocal interpersonal influences, particularly within emotionally bonded pairs. However, this interpretation remains tentative, given the study's exploratory design and analysis, as well as the limited sample size.

In conclusion, the observed decrease in EGG frequency during the Sender's upset and eating experiences indicates that gastric rhythm may be sensitive to subtle interpersonal influences under controlled conditions. However, because both sympathetic and parasympathetic pathways can produce frequency slowing, and because only EGG was collected, the underlying autonomic mechanism cannot be determined at this stage. These results nonetheless contribute to ongoing efforts to map the physiological substrates of nonlocal interpersonal connection.

IMPLICATIONS AND APPLICATIONS

This double-blind, sham-controlled EGG paradigm offers a generalizable template for probing subtle interpersonal coupling across disciplines, using autonomic physiology as an objective bridge between subjective experience and putative nonlocal influence. The condition-specific slowing of the Receiver's gastric frequency during the Sender's sadness and especially during eating suggests that physiological synchrony may emerge most strongly in richly embodied, enteroceptive states, motivating applications in affective neuroscience, social psychophysiology, and studies of interpersonal attunement. Methodologically, the linear mixed effects approach to epoch-by-condition interactions can be extended to other peripheral signals, including ECG-derived vagal indices, respiration, skin conductance, and pupilometry, to triangulate mechanisms and test whether vagal pathways mediate the observed effects. Clinically, the findings motivate interdisciplinary work on gut-brain communication, co-regulation in close relationships, and anomalous information transfer claims, while emphasizing the need for multimodal autonomic measurement to distinguish between parasympathetic and sympathetic contributions.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ETHICS STANDARDS STATEMENT

All study activities were approved and overseen by the Institutional Review Board at the Institute of Noetic Sciences (IORG#0003743), and the study design was pre-registered with the Koestler Parapsychology Unit (#1095).

AUTHOR CONTRIBUTIONS (CREDIT)

GY: Conceptualization, Funding acquisition, Investigation, Project administration, Writing – original draft; AD: Methodology, Software, Writing – Reviewing and Editing; HW: Project administration, Writing – review and editing; JHL: Investigation, Writing – review and editing; ST: Investigation, Writing – review and editing; MK: Formal analysis; SA: Writing – original draft; RT: Investigation, Writing – review and editing; DR: Conceptualization, Formal analysis, Methodology, Writing – original draft.

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