

The Psychophysiology of 'Yes, And' vs. 'Yes, But': The Effect of Acceptance, Rejection and Repetition during Improvised Dialogue

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Highlights

- First psychophysiological study of the *Yes, And* principle of theatre improvisation
- Improvised dialogues generated robust heart rate orienting responses
- Preparatory physiological responses for rejection were observed before it occurred
- Smiling muscle responses differentiated improvised acceptance and rejection
- Smiling muscle, HR, and subjective stress responses habituated with repetition
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Abstract

This study examined how acceptance, rejection, and repetition of social feedback shape implicit physiological responses and subjective stress evaluations in a naturalistic, fictional setting. Thirty-nine student teachers performed dyadic “Yes, And” (acceptance) and “Yes, But” (rejection) theatre improvisation exercises while heart rate (HR), electrodermal activity (EDA), skin conductance responses (SCR), facial muscle activity (zygomaticus major and corrugator supercilii), and electrocortical activity indexed by frontal alpha asymmetry (FAAS), as well as self-reported stress were recorded. Across all improvised dialogue exercises, transient HR deceleration indicated a robust orienting response, while rejection elicited anticipatory HR slowing before stimulus onset, suggesting threat-related preparation. Zygomaticus major activity was higher in acceptance than rejection. Zygomaticus major activity, pre-stimulus HR, and self-reported stress decreased with repeated exercise. Together, the findings of this psychophysiological investigation of the “Yes, And” principle of theatre improvisation demonstrated that fictional social interactions evoke psychophysiological responses, and that repeated exposure of improvisation exercises can partially attenuate them. These findings contribute to improvisation pedagogy and experimental paradigms in social neuroscience, and may also be applied to therapeutic applications by mapping how social encounters modulate embodied responses and self-reported stress in a fictional, psychologically safe context.

Keywords: Theatre improvisation, Yes, And principle, Psychophysiology, Repetition, Social acceptance and rejection, Transient heart rate deceleration

1. Introduction

Improvisation is not exclusive to theatre stage or the expertise of trained actors—it is a fundamental aspect of spontaneous human communication. It unfolds in classrooms, meetings, and everyday conversations—whenever we respond to the unexpected. Whether delivering a presentation after misplacing your notes or navigating a surprising turn in dialogue, flexibility and creative thinking are required. In theatre, this adaptive process has been developed into a collaborative art form that can be taught and learned, theatre improvisation (DeMarco, 2012). Theatre improvisation (Johnstone, 1989; Spolin, 1999) refers to the spontaneous creation of dialogue and action in a fictional setting without a predetermined script, guided by principles of acceptance, responsiveness, and co-creation. This interplay of structure and spontaneity provides an apt setting for exploring social dynamics and related psychophysiological processes.

Improvisation is grounded in the principle of unconditional acceptance, whereby any verbal or nonverbal interpersonal contribution is embraced and expanded upon. This foundational rule, known as *"Yes, And"* encourages participants to accept their partner's input ("yes") and build upon it with a spontaneous addition ("and"). For example, in response to a partner's suggestion—*"Wouldn't it be wonderful to have a New Year's party at home this year?"*—an accepting reply might be, *"Yes, that is a great idea, **and** a themed party would be great fun!"* This unconditional support diminishes risk of failure and promotes spontaneity, interpersonal cohesion, and psychological safety (Drisko, 2013; Permann-Graham et al., 2022). In contrast, rejection—whether total *"No"* or more subtle rejection *"Yes, But"*—represents a breakdown in this collaborative flow. Subtle rejection may still begin with an affirmative "yes," but is followed by a negating continuation, such as *"Yes, that is a great idea, **but** it would be too much work to organize"*. Rejections—such as those conveyed through "Yes, But" responses—are discouraged in improvisational practice, as they tend to disrupt the co-creative process.¹ These contrasting modes of social interaction—acceptance versus rejection—mirror real-life social dynamics and provide an ecological framework for simulating social interaction in a safe, fictional space.

Thus far, the psychophysiological effects of fictional social acceptance remain poorly known. DeMichele and Kuenneke (2021) piloted the use of electroencephalography (EEG) following short-form improvisation games including "Yes, And" principle in adolescents with complex developmental trauma and their results indicated preliminary evidence supporting improvisation as an intervention capable of affecting changes in brain connectivity. The present study extends previous psychophysiological research on improvised social interaction (Seppänen et al., 2021), which focused on rejection exercises, by introducing two positive acceptance exercises: an initial and a repeated positive acceptance exercise ("Yes, And"). Comparing these two with the previously reported rejection exercise (Seppänen et al., 2021), the design enables investigation of how acceptance, rejection and repetition of fictional social stimuli influence physiological and subjective responses.

¹ Improvisers are trained to identify and avoid even the subtlest forms of rejection, as within fictional scenes, accepting any offer poses no real-world risk or consequence. This makes rejection unnecessary and counterproductive to the collaborative goals of improvisation.

This study delivers the first psychophysiological evidence on how the foundational “Yes, And” principle of theatre improvisation modulates autonomic, somatic, and subjective responses.

1.1 Emotional quality and physiological reactivity in fictional context

Experimental studies have shown that exposure to fictional stimuli induces changes in psychophysiological reactivity akin to corresponding real-life stimuli (Barnes, 2018; Jääskeläinen et al., 2021; Savard et al., 2024; Seppänen et al., 2021). Engagement with fiction has been proposed to generate emotional investment (Barnes, 2018), directing both cognitive focus and affective resources toward the imagined world. In audiovisual context, film clips—whether fictional or based on real events—evoked equivalent self-reported levels of sadness and anxiety (Goldstein, 2009). A scoping review by Savard et al. (2024) found that spoken emotional narratives elicit autonomic nervous system (ANS) responses such as changes in heart rate (HR) and skin conductance, even when the content is fictional. Previously, we have shown that fictional face-to-face social rejections in improvised dialogues elicit relatively similar psychophysiological reactivity as genuine rejections (Seppänen et al., 2021). However, the psychophysiological effects of fictional social acceptance remain largely unexamined. To address this, the present study investigated improvised dialogues simulating both accepting (“Yes, And”) and rejecting (“Yes, But”) interactions, enabling a direct comparison of their emotional impact.

1.2 Repetition and habituation

Physiological habituation refers to a reduction in reactivity following repeated exposure to stimuli (Barthel et al., 2025; Codispoti et al., 2006). Repeated exposure to emotional stimuli typically results in attenuated autonomic and affective responses, reflecting increased familiarity and reduced novelty (Codispoti et al., 2006). For instance, Finn et al. (2009) examined the effect of exposure therapy on speaking anxiety and found habituation in anxiety scores for the treatment group versus control group. However, findings are mixed when it comes to autonomic responses. Boesch et al. (2014) reported affective habituation without corresponding autonomic changes during repeated social stress tasks. Similarly, Barthel et al. (2025) concluded in their review that ANS responses to repeated stressors are variable and context-dependent.

While research on habituation to negative stimuli, such as social stress, has dominated the literature, the dynamics of repetition within fictional, positive contexts—where content is self-generated and continuously novel—remain less well understood. In the present study, the “Yes, And” exercise was repeated to examine whether positive fictional interactions would elicit signs of habituation in physiological and subjective domains. By maintaining the structural consistency of the task while allowing spontaneous content generation, the design allows investigating whether familiarity with the task format alone could lead to reduced psychophysiological reactivity. Understanding these dynamics has implications for domains such as learning, therapeutic interventions, and the development of social and emotional skills through improvisation-based interventions.

1.3 Multimodal measures of social interaction

Psychophysiological methods offer a multidimensional approach to capturing central (neural) and peripheral (autonomic and somatic) reactivity mirroring the impact of fictional, improvised encounters. When individuals engage in emotionally salient or demanding situations, the autonomic nervous system exhibits coordinated shifts in the balance of sympathetic and parasympathetic activity, the two branches of ANS (Kreibig, 2010; Savard et al., 2024; Ulrich-Lai & Herman, 2009). Heart rate (HR) reflects the balance between sympathetic excitation, which accelerates HR, and parasympathetic (vagal) inhibition, which decelerates HR. Electrodermal activity (EDA), measured as skin conductance, is considered as a robust and widely applied measure of emotional arousal. It mirrors changes in the electrical properties of the skin that result from autonomic nervous system functions, specifically the activation of sweat glands controlled by the sympathetic nervous system (Cacioppo et al., 2007; Cowley et al., 2016; Kelly et al., 2012; Levenson, 1992). EDA includes both tonic and phasic components, with the latter typically assessed through skin conductance responses (SCR), which reflect rapid, stimulus-related changes in arousal.

In addition to HR acceleration (Iffland et al., 2014; Massey-Abernathy et al., 2015; Williamson et al., 2018), transient HR deceleration has been linked to situations demanding heightened attention to salient stimuli for the facilitation of adaptive behavior and survival (Skora et al., 2022). This transient decelerative response may be threat-related (Livermore et al., 2021; Roelofs & Dayan, 2022; Vila et al., 2007), anticipation-related (Dekkers et al., 2015; Jennings & van der Molen, 2005) or error-related (Crone et al., 2003; van der Veen et al., 2004). HR deceleration has also been linked to expectancy violation (Van der Veen & Sahibdin, 2011), social pain (Eisenberger et al., 2003; Gunther Moor et al., 2010; van der Veen et al., 2019) as well as feedback processing and detection of incongruence in social cues (Dekkers et al., 2015). The prolonged variation of HR deceleration has been likened to a threat-induced freezing response—a passive defensive reaction marked by increased muscle tonus and behavioral immobility (Hagenaars et al., 2014; Noordewier et al., 2020; Roelofs et al., 2010).

While HR and skin conductance primarily index autonomic arousal, emotional dimension (positive vs. negative) is captured by physiological indicators such as facial electromyography (facial EMG) and frontal alpha asymmetry (FAAS), measured using EEG. Facial EMG recordings of zygomaticus major muscle activation, reflecting smiling and positive affect and of corrugator supercilii activation, reflecting frowning and negative affect, provides insight into affective processing of social stimuli (Cacioppo, 2004; Cacioppo et al., 1986; Wiggert et al., 2015). FAAS is commonly measured as the difference in electrical activity between the left and right frontal regions. FAAS is linked to emotional and motivational processes, such as approach/withdrawal motivation: relatively greater left frontal activity is linked to approach-related motivation, while relatively greater right frontal activity is linked to withdrawal-related motivation (Allen et al., 2004; Davidson, 1993; Davidson et al., 2000).

Complementing these physiological indices, self-reports capture participants' conscious emotional appraisals—insights that central and peripheral measures alone can miss. For example, if HR and skin conductance (EDA and SCR) remain unchanged yet self-reported stress steadily declines across repeated trials, it reveals a psychological adaptation process that would go unnoticed without

participants' subjective feedback. Together, these multimodal measures—implicit physiological signals and explicit subjective evaluations—offer a comprehensive view of emotional processes related to social interaction (McRae, 2016).

1.4 Aim and hypotheses

The aim of this study was to explore whether acceptance, rejection and repetition of improvised social exercises would be reflected differentially in implicit psychophysiological reactivity and explicit self-reported stress. Two “Yes, And” exercises conveyed positive acceptance and one “Yes, But” exercise negative rejection, each comprising multiple trials. To assess repetition effects, the positive acceptance exercise was delivered in two separate blocks of trials.

We hypothesized that physiological responses and self-reported stress would differ across positive, negative and repeated exercises. Specifically, HR, corrugator supercilii activity, skin conductance (EDA and SCR), and self-reported stress were expected to be lower, transient HR deceleration to be less pronounced, and relative left-hemisphere FAAS to be higher in the initial positive exercise compared to the negative one, and in the repeated positive exercise compared to the initial positive one. Zygomaticus major activity was expected to be higher in the positive relative to the negative exercise but decrease with repetition.

2. Materials and methods

This study implemented an experimental design utilizing theatre improvisation as a method for creating social interaction exercises with fictional content. The data used for this study were collected as part of a larger research project (Seppänen, 2022; Seppänen et al., 2021). “Yes, But” results have been published 2021 (Seppänen et al., 2021).

2.1 Participants

Participants included 39 undergraduate student teachers at the University of Helsinki in Finland. The participants (33 women, 5 men and 1 other) ranged in age from 20 to 40 years ($M = 27.1$, $SD = 6.5$). They were all right-handed, non-smoking and healthy, with no participants reporting past or present neurological disorders, present illnesses or use of psychiatric medication. Participants self-registered for the improvisation course that was part of the study via an automated system, receiving course credits for participating in the course and the study. The participants' prior experience with improvisation was either nonexistent or negligible². Five participants were excluded from the ECG analysis due to poor signal quality or missing data, and one participant was excluded as an outlier (z -value < -3).

² Three participants had minor prior exposure to drama activities, such as school drama classes or university workshops where improvisation played a minor role. These experiences occurred at least five years before the intervention or involved only a small proportion of improvisation and were therefore considered negligible for the purposes of inclusion.

Participants were informed about the study procedure, and they provided written consent to participate in the study. The University of Helsinki Ethical Review Board for the Humanities and Social and Behavioral Sciences provided ethical approval for the study (statement 25/2017).

2.2 Design and procedure

Before the experiment, each participant completed an online demographic survey. Experimental sessions, lasting about 2.5 hours, started between 14:00 and 16:00 to control circadian rhythms in physiological measures. Participants were asked to avoid caffeinated drinks for 2 hours and strenuous exercise for 3 hours before the session. Upon arrival at the lab, they were introduced to the facilities, briefed on the study, and asked to sign a consent form. Electrodes were then attached, and the experiment began with recording two baseline conditions, the Trier Social Stress Test (TSST) condition (Kirschbaum et al., 1993) and an interview condition. These conditions have been reported elsewhere (Seppänen et al., 2020, 2021).

The improvisation session lasted for approximately 25 min. The session began with a warm-up exercise (Word-by-Word), followed by acceptance ('Yes, And'), total rejection ('No'), and three types of subtle rejection exercises in a randomized order (one of which was 'Yes, But'). The session concluded with repeated 'Yes, And' exercise. Here, we report two positive acceptance exercises (the initial and repeated 'Yes, And' exercises) and one negative rejection exercise ('Yes, But'). These exercises were chosen due to their similar structure, which allows for comparative analysis. The 'Yes, But' exercise has been previously included in a study comparing fictional and real-life subtle rejections (Seppänen et al., 2021).

In the positive acceptance exercise, the experimenter first acknowledged the participant's spontaneous idea with a 'yes' and then expanded on it by adding related input with 'and...'. In the negative rejection exercise, the experimenter also began affirmatively with 'yes' but followed it with a rejecting input using 'but...'. Each response from the experimenter constituted a trial, defined as the moment when the stimulus occurred—that is, when the experimenter introduced new content to the conversation after the initial affirmative part ("yes"), typically starting with "and" or "but."

All exercises were demonstrated before the beginning of the exercise, so the participants were aware of the positive or negative nature of the upcoming exercise. The specific content of the improvised conversations fluctuated because the topics emerged spontaneously during the improvisation exercises. In other words, the conversations were unscripted to keep them as natural as possible. Table 1 summarizes the frequencies of the trials in each exercise.

Table 1
Number of Trials per Exercise and Participant

Exercise	Trials	Min / Participant	Max / Participant
Positive acceptance, initial (POS1)	152	2	6
Negative rejection (NEG)	128	2	5
Positive acceptance, repeated (POS2)	136	2	6

The exercises were recorded with a high-resolution video camera (Logitech® Webcam Pro 9000, Logitech International S.A., Lausanne, Switzerland. A 30-second waiting period preceded each exercise, during which video documentation and physiological measurements were already in progress. Synchronization between physiological and video data was achieved by playing a short sine-wave sound after each waiting period, accompanied by a simultaneous digital pulse sent to the data acquisition device controlled with Presentation® software (Neurobehavioral Systems, Inc., Albany, CA, USA).

2.3 Measurements

2.3.1. Psychophysiological data collection

Electrocortical activity, skin conductance, facial muscle activity, and electro cardiac signals were recorded with a 32-channel LiveAmp amplifier, actiCAP electrodes, and a Sensor Trigger Extension (Brain Products GmbH, Gilching, Germany). All signals were acquired with a sampling rate of 500 Hz. A standard 32-channel electrode cap (EASYCAP GmbH, Herrsching, Germany) was used for 26 EEG electrodes. The EEG channel locations, according to the International 10-20 system (Jasper, 1958) included the following left–right pairs: Fp1/Fp2, F3/F4, F7/F8, FT9/FT10, FC1/FC2, FC5/FC6, T7/T8, C3/C4, CP1/CP2, CP5/CP6, TP9/TP10; and midline electrodes: Fz, Cz, Pz, and Oz. The ground electrode was placed at location FPz and the reference electrode at FCz. Two electrodes were used for recording heart activity, placed at approximately 2 cm below the right and left collar bones. To record facial muscle activity of the corrugator supercilii and zygomaticus major, two pairs of electrodes were placed on the corresponding muscle areas on the left side of the participants' face (Fridlund & Cacioppo, 1986). The electrodes were prepared with conductive electrode gel (Signagel®, Parker Laboratories Inc., Fairfield, USA). Electrode-skin contact impedance below 25 kOhm was required. For skin conductance recording, two additional Ag/AgCl electrodes prepared with conductive cream (TD 246, Discount Disposables LLC, Florida, USA) were placed on the first phalanx of the index and middle fingers of the non-dominant hand, according to Boucsein et al. (2012).

2.3.2. Subjective data collection

Following each improvisation exercise, participants reported their self-rated stress during the exercise using a Likert scale from 0 to 5 (0 = not at all stressed to 5 = extremely stressed).

2.4 Offline data analysis

The inter-individual variation of facial EMG and HR was adjusted by computing the change towards an individual baseline value. The baseline segment was extracted from a baseline (30-second silence) preceding the experimental part. Due to the audible start signal, the first and last 10 seconds were excluded for HR analysis and the first and last 5 seconds were excluded for facial EMG analysis. The

onsets of the positive acceptance (yes, and) and negative rejection (yes, but) trials were manually marked in the video recordings using ELAN 5.1 software (The Language Archive, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands) at the point where expressions signaling approval and continuation (e.g., 'and') or rejection and contrast (e.g., 'but') were spoken. The physiological data processing was conducted using Matlab R2022b (Mathworks Inc., Natick, MA, USA) and EEGLAB 2025.0.0 (Delorme & Makeig, 2004) unless otherwise stated.

The electro cardiac signals were digitally filtered (from 1 Hz to 30 Hz). The Pan–Tompkins algorithm (Pan & Tompkins, 1985) was used to extract R peaks from the filtered signal. RR intervals were computed as the duration (in milliseconds) between consecutive R peaks. The RR intervals were visually inspected, and atypical transients were interpolated using the mean of valid artifact-preceding and following values. HR was computed from the RR interval vector, and for a comparative time accuracy, the HR vector was linearly interpolated, resulting in a time resolution of 1 msec. Then, HR vectors were segmented into 5-second epochs beginning at the onset of the accepting and rejective trials, where the trial-related HR was computed as a mean across the whole epoch. For the HR deceleration analysis, mean heart rate was computed across every 2-second window starting from 6 seconds before the trial onset and ending at 6 seconds after the onset, resulting in six HR values per trial.

Facial EMG signals were digitally filtered (from 30 Hz to 130 Hz) and visually inspected. To compute the muscle specific activity, the two signals recorded at each muscle area were subtracted from each other (lower location minus upper location for zygomaticus major, central location minus distal location for corrugator supercilii) and the signals were rectified. The final muscle specific variables were calculated by averaging across the sample amplitudes of a 5-second epoch beginning at the trial onset.

Skin conductance signals were digitally low-pass filtered at 15 Hz, segmented to 5-second epochs beginning at the onset of the positive acceptance and negative rejection trials. Epoched data were visually inspected for artefacts. Epochs with an amplitude change greater than 10 μ S/s or with an untypical pattern, e.g. due to movement, were interpolated using 3rd order polynomial fitting, which was conducted to 1.3 % of epochs. Here, a more local one-second baseline (from the trial onset to 1 sec after the trial onset) was used due to the global negative trend in skin conductance level over time. The final EDA variable was computed as a mean across the baseline-adjusted epoch's sample amplitudes starting from one second after the trial onset (seconds 1– 5). Additionally, maximum peak amplitude within the same 4-second time window was extracted as a skin conductance response (SCR).

EEG signals were digitally filtered (from 0.5 Hz, slope 6 dB/octave to 100 Hz, slope 24 dB/octave), corrected for eye blinks (using Principal Component Analysis) and visually inspected in BESA 7.0 (BESA GmbH, Gräfelfing, Germany). Continuous EEG signals were exported from BESA to Matlab for further processing. Signals were segmented to 5-second epochs beginning at the onset of the positive acceptance and negative rejection trials (see Table 1), and re-referenced to electrode Cz. Power spectral density at alpha band (8–12 Hz; Klimesch, 2012; Nuwer et al., 1999) was computed

using spectopo function of EEGLAB (window size 500 samples, overlap 50%, zero padding 1024 samples). Alpha asymmetry values were calculated by subtracting the log-transformed alpha power spectral density values at F4 and F3 (F4–F3) (J. Allen et al., 2004; Sutton & Davidson, 1997). The epoch mean and maximum peak amplitude of the alpha power spectral density were analyzed separately.

Finally, all computed trial-based variables were averaged across the exercise type for each subject.

2.5 Statistical approach

Statistical analyses were performed using JASP, version 0.19.3. The manipulation check relied on repeated-measures analysis of variance (RM ANOVA) with planned contrasts to test whether the stimulus responses differed from the baseline scores.

All subsequent statistical tests were conducted using the change scores (stimulus response – baseline), excluding FAAS scores. Each physiological parameter (HR, facial EMG, skin conductance, and FAAS) was analyzed separately. To identify extreme values, Z-scores were calculated, with $|z| > 3$ considered as an outlier and excluded from further analysis. In case of non-normal distribution of data, log-transformations were applied. If normality was still not achieved after transformation, non-parametric tests were used.

The primary research question regarding the effect of acceptance (first positive), rejection (negative) and repetition (repeated positive) on psychophysiological reactivity and self-reported stress was tested using RM ANOVA with EXERCISE (first positive: POS1; negative: NEG; and repeated positive: POS2) as a within-subject factor.

For transient HR deceleration analysis, six 2-second HR intervals surrounding the social feedback stimulus were selected: three pre-stimulus intervals (-3, -2 and -1) and three post-stimulus intervals (1, 2, and 3). Following previous studies using a similar paradigm (Crone et al., 2003; van der Veen et al., 2014, 2016, 2019), -3 interval served as the baseline, which showed no differences between exercises, as confirmed by a RM ANOVA ($F(2, 36) = 0.064$; $p = 0.938$; $\eta^2 = 0.002$). To derive a time-sensitive index for a phasic HR change, the HR value at interval -3 was subtracted from each subsequent interval (-2, -1, 1, 2, and 3). To determine the presence of transient HR deceleration and whether it varied across exercises a 5×3 RM ANOVA was performed for these interval mean values using TIME (five intervals) and EXERCISE (POS1, NEG, POS2) as within-subject factors.

Additionally, a slope analysis was conducted to validate the rate of change of HR deceleration by subtracting the pre-stimulus interval from its matching post-stimulus interval ($\text{slope}_1 = \text{HR}_1 - \text{HR}_{-1}$; $\text{slope}_2 = \text{HR}_2 - \text{HR}_{-2}$; $\text{slope}_3 = \text{HR}_3 - \text{HR}_{-3}$). A 3×3 RM ANOVA was conducted on these change scores using SLOPE (1, 2, 3) and EXERCISE (POS1, NEG, POS2) as within-subject factors. Paired samples t-tests with FDR correction were used as follow-up tests.

We set the alpha level to 0.05 for all statistical analyses. To counteract the increased probability of a Type 1 error (false-positive) in multiple comparisons, the false discovery rate (FDR) procedure was performed for all post hoc comparisons across the study. We determined an a priori threshold of $q <$

0.1 to retain the balance between false positives and missed findings (false-negatives, or Type II errors). In the case of a violation of the sphericity assumption, we used the Huynh–Feldt adjustment, but uncorrected degrees of freedom are reported. Estimates of the effect size are reported using the partial eta squared (η^2).

3. Results

3.1. Manipulation check

To confirm the effectiveness of the experimental manipulation, an RM ANOVA with planned contrasts for EXERCISE (baseline, POS1, NEG and POS2) was performed for HR, facial EMG, mean EDA, and SCR to assess whether psychophysiological responses elicited by the stimuli differed from baseline. For mean EDA and SCR, local baseline (the first second following the onset of a stimulus) was used. Baseline values and stimulus responses appear in Table 2a and Table 2b.

Table 2a

Baseline Values and Stimulus Responses (HR, Facial EMG, FAAS)

	Heart rate (HR)		<i>Zygomaticus major</i>		<i>Corrugator supercilii</i>		FAAS, mean		FAAS, peak	
	M	SD	M	SD	M	SD	M	SD	M	SD
Baseline	83.90	14.12	6.32	4.56	5.63	2.94	-0.07	2.84	-0.02	3.52
First positive (POS1)	79.97	8.66	17.99	12.71	6.63	3.87	-0.60	2.59	-0.26	2.80
Negative (NEG)	75.09	8.23	10.06	6.25	6.70	3.90	-0.64	2.45	-0.33	2.72
Repeated positive (POS2)	79.92	8.37	14.03	11.63	7.09	4.30	-1.30	2.59	-1.08	2.95

Note: FAAS, frontal alpha asymmetry.

Table 2b

Baseline Values and Stimulus Responses (EDA, SCR)

	Mean EDA baseline (1 s)		Mean EDA response (2–5 s)		SCR baseline (1 s)		SCR (2–5 s)	
	M	SD	M	SD	M	SD	M	SD
First positive (POS1)	21.02	8.03	21.02	8.11	21.14	8.11	21.26	8.24
Negative (NEG)	20.52	7.06	20.43	7.03	20.62	7.09	20.66	7.08
Repeated positive (POS2)	20.43	7.08	20.37	7.03	20.53	7.11	20.60	7.11

Note: EDA, electrodermal activation; SCR, skin conductance response.

There was a significant main effect of EXERCISE for heart rate (HR) ($F(3, 36) = 15.170$, $p < 0.001$, $\eta^2 = 0.296$), zygomaticus major activity ($F(3, 34) = 17.089$, $p < 0.001$, $\eta^2 = 0.335$), and corrugator

supercilii activity ($F(3, 35) = 3.127$, $p = 0.029$, $\eta_p^2 = 0.082$). In contrast, there was no main effect of EXERCISE for mean EDA or SCR.

Planned comparisons indicated that HR decelerated significantly relative to baseline in all exercises (all $ps \leq 0.001$, $FDR < 0.1$). Zygomaticus major activity was significantly elevated in all exercises compared with baseline (POS1 and POS2: $p < 0.001$, $FDR < 0.1$; NEG: $p = 0.002$, $FDR < 0.1$), as well as corrugator supercilii activity (all $ps < 0.05$, $FDR < 0.1$).

3.2. Physiological reactivity related to acceptance, rejection and repetition

Figures 1–3 present mean change scores (stimulus response – baseline) for heart rate (HR; Fig. 1), facial EMG (zygomaticus major, Fig. 2a; corrugator supercilii, Fig. 2b), and electrodermal activity (EDA mean, Fig. 3a) with skin conductance responses (SCR, Fig. 3b), across positive acceptance (POS1), negative rejection (NEG), and repeated positive acceptance (POS2) exercises. Figure 4 presents raw frontal alpha asymmetry (FAAS) values (mean, Fig. 4a; peak, Fig. 4b).

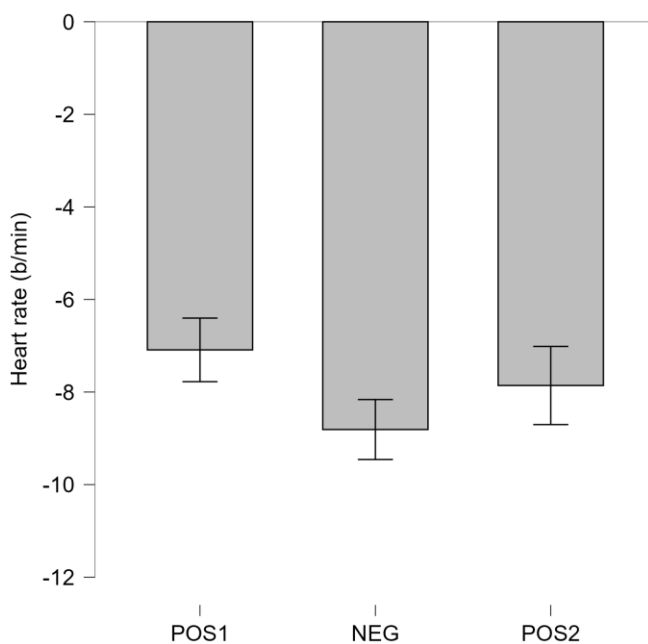


Figure 1. Heart rate change (b/min) during positive (POS1), negative (NEG), and repeated positive (POS2) social stimuli. Values represent the change scores (baseline subtracted). Error bars: ± 1 SE

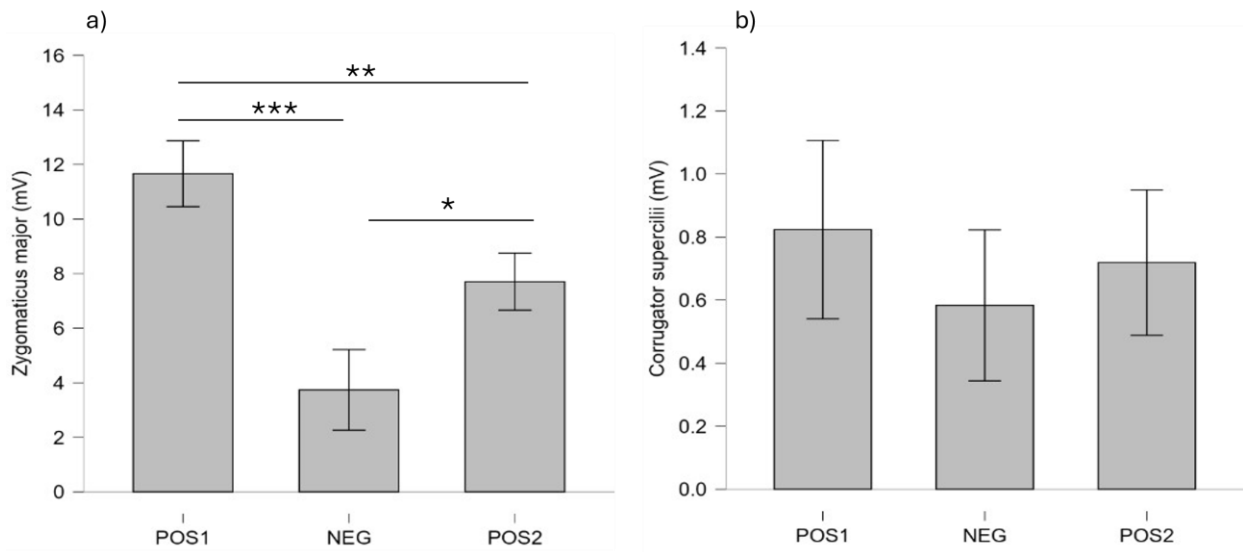


Figure 2. **(a)** Zygomaticus major and **(b)** corrugator supercilii activity during positive (POS1), negative (NEG), and repeated positive (POS2) social stimuli. Values represent the change scores (baseline subtracted). Error bars: ± 1 SE (* $p < 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, FDR < 0.1).

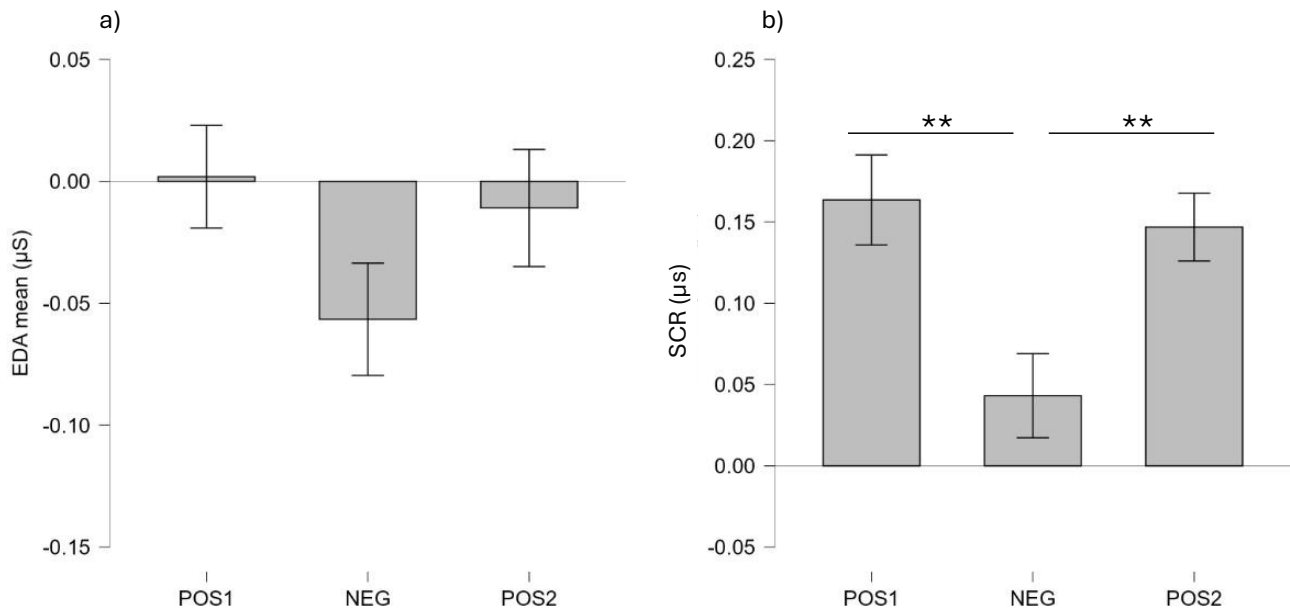


Figure 3. **(a)** EDA mean and **(b)** skin conductance response (SCR) during positive (POS1), negative (NEG), and repeated positive (POS2) social stimuli. Values represent the change scores (baseline subtracted). Error bars: ± 1 SE (* $p < 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, FDR < 0.1).

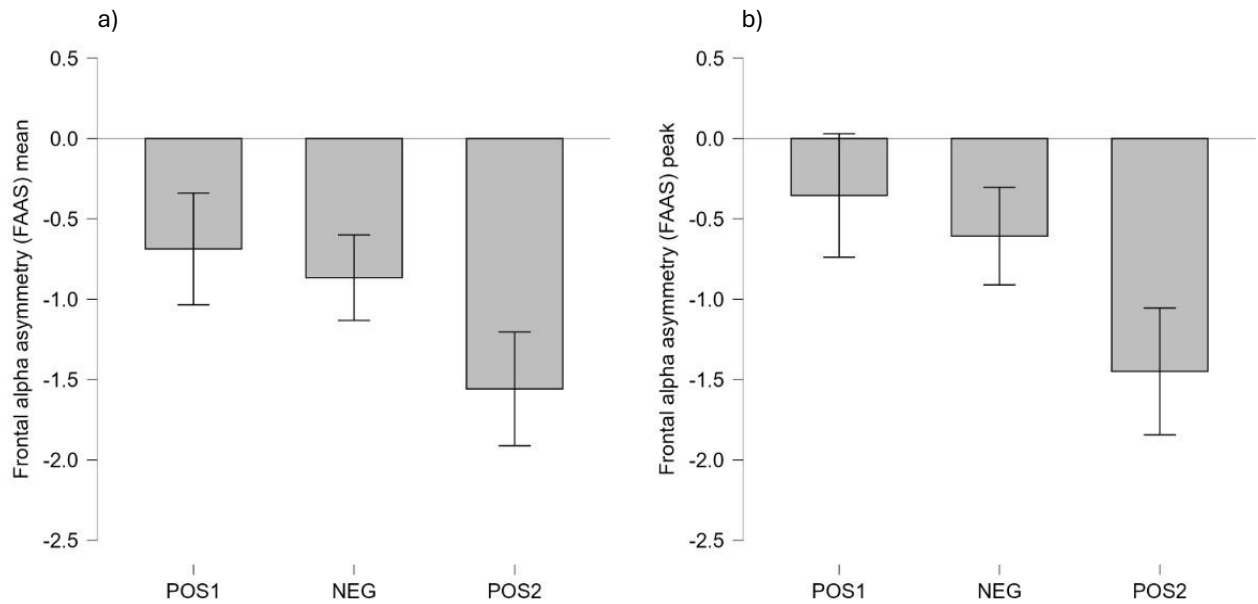


Figure 4. (a) Frontal alpha asymmetry (FAAS) mean and (b) Frontal alpha asymmetry (FAAS) peak during positive (POS1), negative (NEG), and repeated positive (POS2) social stimuli. Error bars: ± 1 SE.

To test whether psychophysiological reactivity differed between improvisation exercises, an RM ANOVA for EXERCISE (POS1, NEG and POS2) was performed for HR, facial EMG, mean EDA, SCR, and FAAS. The effect of EXERCISE was significant for *zygomaticus major* and SCR but not for HR, *corrugator supercilii*, mean EDA, or FAAS (Table 3)³. Paired-samples t-tests indicated that *zygomaticus major* activity was higher in POS1 than NEG, $t(35) = 4.121$, $p < .001$, $FDR < 0.1$, $d = 0.687$, and POS2 exercises, $t(34) = 2.837$, $p = 0.008$, $FDR < 0.1$, $d = 0.48$. In addition, activity in the POS2 exercise was higher than in NEG exercise, $t(34) = 2.154$, $p = 0.038$, $FDR < 0.1$, $d = 0.364$ (Figure 2a)⁴. SCR was higher in POS1 compared to NEG, $t(34) = 3.054$, $p = 0.004$, $FDR < 0.1$, $d = 0.516$, and also higher in POS2 compared to the NEG, $t(34) = 3.562$, $p = 0.001$, $FDR < 0.1$, $d = 0.602$ (Figure 4b). SCR showed no difference between positive exercises ($p > 0.05$, $FDR > 0.1$)⁵.

³ *Zygomaticus major* and *corrugator supercilii* activity values were log-transformed to improve normality, and SCR data were analyzed using non-parametric tests due to non-normal distributions. The log-transformed RM ANOVA results for *zygomaticus major* were ($F(2, 33) = 10.134$; $p < 0.001$; $\eta^2 = 0.235$), *corrugator supercilii* ($F(2, 33) = 0.359$; $p = 0.601$; $\eta^2 = 0.011$) and Friedman test results for SCR $\chi^2(2) = 15.941$, $p < 0.001$. As these supplementary analyses yielded results consistent with the parametric tests, only the parametric test results are reported in the main text. Figures also depict the original, untransformed values.

⁴ Corresponding Wilcoxon signed-rank tests: POS1 vs. NEG: $W = 541.00$, $z = 3.70$, $p < .001$, $FDR < 0.1$; POS1 vs. POS2: $W = 445.00$, $z = 2.129$, $p = 0.033$, $FDR < 0.1$; POS2 vs. NEG: $W = 179.00$, $z = -2.026$, $p = 0.043$, $FDR < 0.1$.

⁵ Corresponding Wilcoxon signed-rank tests indicated that SCR in NEG exercise was significantly lower than in the POS1 exercise, $W = 520.00$, $z = 3.36$, $p < .001$, $FDR < 0.1$, and POS2 exercise $W = 107.00$, $z = 3.41$, $p < .001$, $FDR < 0.1$. SCR showed no difference between positive exercises $W = 340.00$, $z = 0.73$, $p > 0.05$, $FDR > 0.1$.

Table 3
Effect of Condition (Positive, Negative, and Repeated Positive) on
Psychophysiological Reactivity

	N	df	F	<i>p</i>	ηp^2
Heart rate (HR)	37	(2,36)	1.389	0.256	0.037
<i>Zygomaticus major</i>	35	(2,34)	9.952	<0.001***	0.226
<i>Corrugator supercilii</i>	34	(2,33)	0.228	0.796	0.007
EDA mean	34	(2,33)	1.827	0.169	0.052
Skin conductance response (SCR)	34	(2,33)	6.827	0.002**	0.171
Frontal alpha asymmetry (FAAS), mean	37	(2,36)	2.003	0.145	0.053
Frontal alpha asymmetry (FAAS), peak	37	(2,36)	2.492	0.092	0.065

Note: *df*, degrees of freedom; ηp^2 , partial eta squared (effect size); EDA, electrodermal activity.

** $p < 0.01$; *** $p \leq 0.001$.

HR deceleration

To examine whether transient heart rate (HR) deceleration occurred and whether its pattern varied across different improvisation exercises, a RM ANOVA was conducted. The analysis used TIME (intervals -2 to 3) and EXERCISE as within-subject factors on HR change scores (Figure 5) and identified a main effect of TIME ($F(4, 32) = 51.936$; $p < 0.001$; $\eta p^2 = 0.619$) and a TIME* EXERCISE interaction ($F(8, 32) = 3.008$; $p = 0.012$; $\eta p^2 = 0.086$), indicating that HR varied across intervals and differed depending on the exercise.

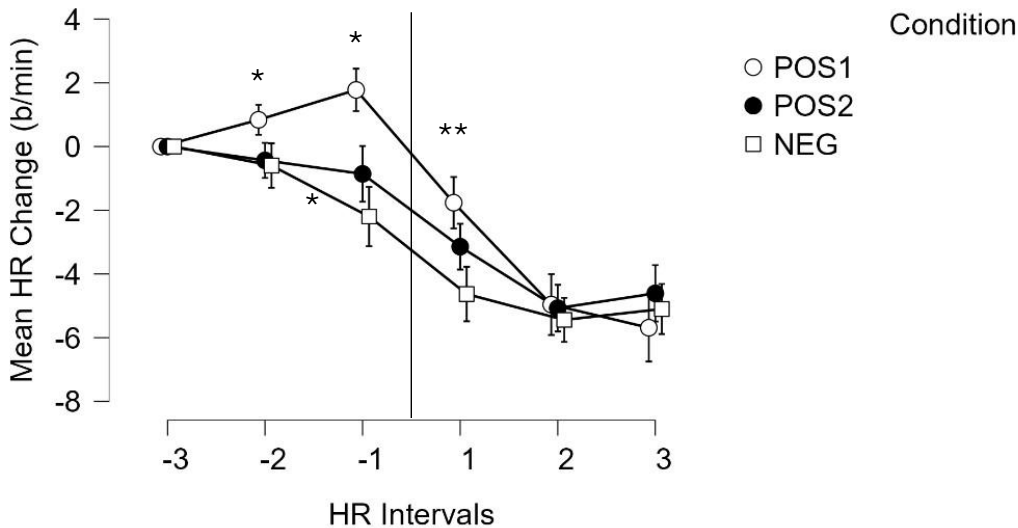


Figure 5. Transient heart rate responses to positive acceptance (POS1), negative rejection (NEG), and repeated positive acceptance (POS2) social stimuli. The onset of stimuli is presented as the vertical line at zero. The duration of HR intervals is 2 s, lasting from 6 s pre-stimulus (-3 , -2 , and -1) to 6 s post-stimulus (1 , 2 , and 3). HR change scores were computed by subtracting the HR value at interval -3 from each subsequent interval. Error bars: ± 1 SE (* $p < 0.05$, ** $p < 0.01$, FDR < 0.1).

The main effect of time was tested with paired-samples t-tests, which revealed that all post-stimulus intervals (1, 2, 3) differed from the pre-stimulus intervals (-1 and -2) in all exercises ($p < 0.005$ for all, $FDR < 0.1$), indicating an HR deceleration effect in all exercises. The pre-stimulus intervals -2 and -1 did not differ from each other ($p > 0.05$ for all, $FDR < 0.1$) in POS1 and POS2 exercises, indicating that HR deceleration did not begin before stimulus presentation. In the NEG exercise, intervals -2 and -1 differed ($t(36) = 2.07$; $p = 0.045$, $FDR < 0.1$), signifying the commencement of HR deceleration already before the actual stimulus.

When investigating differences between exercises at each interval, POS1 and POS2 differed significantly at pre-stimulus interval -2, $t(36) = 2.057$; $p = 0.047$, $FDR < 0.1$, indicating that HR was higher in the first positive exercise relative to the repeated positive exercise, but not for the negative exercise (POS1 vs NEG, $t(36) = 1.561$; $p = 0.127$, $FDR > 0.1$). At pre-stimulus interval -1, HR increased in POS1 relative to POS2 ($t(35) = 2.472$; $p = 0.018$, $FDR < 0.1$) and NEG exercises ($t(36) = 3.377$; $p = 0.002$, $FDR < 0.1$). At post-stimulus interval 1, the NEG exercise demonstrated greater HR deceleration than the POS1 exercise ($t(36) = -3.207$; $p = 0.003$, $FDR < 0.1$) but did not differ from the POS2 exercise (NEG vs POS2, $t(35) = 1.594$; $p = 0.120$, $FDR > 0.1$). POS1 and POS2 exercises showed no difference at post-stimulus interval 1 (POS1 vs POS2, $t(35) = 1.605$; $p = 0.117$, $FDR > 0.1$). No differences were found at intervals 2 and 3 ($p > 0.05$ for all, $FDR > 0.1$). Also, no differences were found between POS2 and NEG exercises at any intervals ($p > 0.05$ for all, $FDR > 0.1$).

Finally, a 3 (SLOPE: 1, 2, and 3) \times 3 (EXERCISE: POS1, POS2, NEG) RM ANOVA was conducted on the slope scores to test whether the rate of HR deceleration differed across time intervals and improvisation exercises, and whether there was an interaction between these factors. RM ANOVA results revealed a significant main effect of SLOPE, $F(2, 66) = 14.401$, $p < 0.001$, $\eta_p^2 = 0.304$, but no main effect of EXERCISE ($p > 0.05$) or SLOPE \times EXERCISE interaction ($p > 0.05$). Follow-up paired-samples t-tests showed that Slope 1 values were across all exercises less negative—i.e., the HR deceleration in the first post-stimulus interval was smaller—than both Slope 2 and Slope 3 values ($p < 0.01$ for all, $FDR < 0.1$), whereas Slopes 2 and 3 did not differ in any exercise ($p > 0.05$ for all, $FDR > 0.1$). Slope scores appear in Appendix 1.

3.3. Self-Reported Stress

To examine differences in self-reported stress associated with improvisation exercises, a RM ANOVA for EXERCISE (POS1, NEG and POS2) was conducted. The results revealed that self-reported stress differed between exercises ($F(2, 36) = 10.382$; $p < 0.001$; $\eta_p^2 = 0.224$)⁶. Pairwise comparisons showed that the repeated positive exercise was evaluated as less stressful than the first positive (POS1 vs POS2, $t(36) = 4.291$; $p < 0.001$, $FDR > 0.1$) and negative (POS2 vs NEG, $t(36) = 3.479$; $p = 0.001$, $FDR > 0.1$) exercises (Figure 7).

⁶ Due to non-normal distributions, a Friedman test with Wilcoxon post hoc tests (FDR-corrected) was conducted. The Friedman test indicated a significant difference in self-reported stress across the three exercises, $\chi^2(2) = 17.867$, $p < 0.001$. Corresponding Wilcoxon signed-rank tests: POS2 vs. POS1: $W = 235.00$, $z = 3.52$, $p < .001$, $FDR < 0.1$; NEG vs. POS2: $W = 219.00$, $z = 3.003$, $p = 0.002$, $FDR < 0.1$. As these supplementary analyses yielded results consistent with the parametric tests, the parametric test results are reported in the main text.

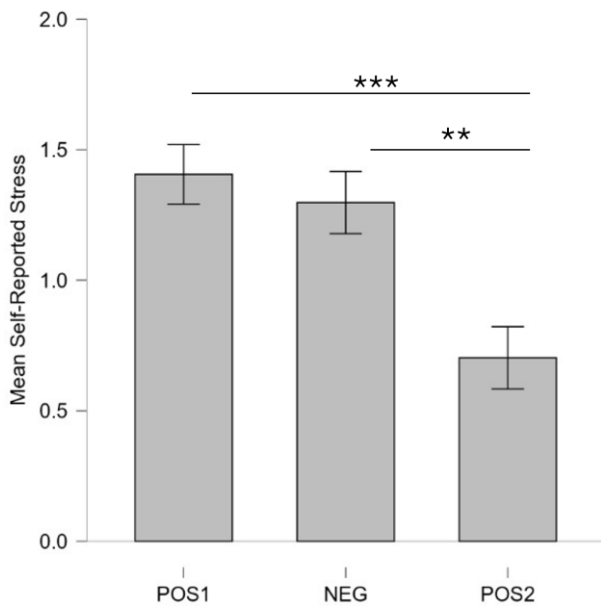


Figure 7. Self-reported stress during improvisation exercises. Scale 0 to 5 (0 = not stressed at all, 5 = extremely stressed). Error bars: ± 1 SE (** $p \leq 0.01$, *** $p \leq 0.001$, FDR < 0.1).

4. Discussion

This study investigated how acceptance, rejection and repetition of social stimuli shape both implicit physiological responses and explicit subjective evaluations within a naturalistic, fictional setting. Participants engaged in dyadic “Yes, And” (positive acceptance) and “Yes, But” (negative rejection) improvisation exercises designed to simulate social acceptance and rejection. We measured autonomic arousal (heart rate, skin conductance), facial muscle activity (zygomaticus major and corrugator supercilii), neural activity (FAAS), and self-reported stress to capture physiological reactivity and subjective experience during naturally unfolding face-to-face dialogues.

Improvisation exercises elicited reliable psychophysiological responses in HR and facial EMG measures. Decelerated heart rate⁷ and increased zygomaticus major and corrugator supercilii activity were consistently observed across all exercises compared to baseline, indicating successful experimental manipulation. In contrast, skin conductance (mean EDA and SCR) did not show significant changes, suggesting limited sympathetic responsiveness to the stimuli or methodological constraints in capturing subtle arousal-related effects. This should be taken into consideration when interpreting results.

⁷ Baseline heart rate, recorded during the silent waiting period immediately after the Trier Social Stress Test (TSST), was likely elevated due to incomplete recovery from the TSST (Seppänen et al., 2021). This inflated baseline caused subsequent HR changes to appear negative and should be considered when interpreting the results.

4.1. Effects related to acceptance and rejection

HR did not differentiate positive acceptance and negative rejection exercises, consistent with the view that HR primarily indexes autonomic arousal rather than emotional quality. In line with this, transient HR deceleration was observed across all exercises, indicating a robust orienting response regardless of acceptance or rejective content. This supports the evidence that social cues, even in fictional, improvised contexts, reliably engage autonomic processes (Seppänen et al., 2021). By activating a brief “vagal brake,” the socially salient stimuli optimize sensory intake and attentional engagement (Skora et al., 2022). At the same time, this deceleration primes to preparation for action (Jennings & van der Molen, 2005). In this study, the required action was another verbal utterance to continue the conversation. The observed transient HR deceleration could also be linked to general feedback processing (Dekkers et al., 2015) since the stimuli in this study always involved feedback – positive or negative – in response to the participant’s previous conversational input.

However, the negative rejection exercise elicited stronger transient HR deceleration than the initial positive acceptance exercise. At first glance, this aligns well with the established view that threatening or aversive stimuli provoke stronger HR deceleration than positive ones (Livermore et al., 2021; Roelofs & Dayan, 2022; van der Veen et al., 2019; Vila et al., 2007). Yet, HR deceleration in the repeated positive acceptance exercise did not differ from negative rejection exercise, complicating the interpretation. Also, slope analysis indicated that the rate of HR deceleration was the same across all exercises. This pattern suggests that while emotional dimension may influence transient HR deceleration, the effect is not straightforward and may be modulated by factors such as novelty or repetition. Thus, although HR deceleration reflects engagement with fictional stimuli, its sensitivity to emotional dimension remains inconclusive based on the data of this study.

Yet, an unexpected finding emerged in the pre-stimulus window. Specifically, HR decreased already between intervals -2 and -1 in negative exercise only, indicating that participants began to physiologically respond even before the actual stimulus starting with ‘but’ was presented. Given that participants were aware of the emotional quality of each upcoming exercise, this anticipatory deceleration might reflect a preparatory response to the expected negative social interaction (Heslegrave & Furedy, 1979; Jennings, 1982; Ribeiro & Castelo-Branco, 2019). Also, salient information might have been detectable in the tone of voice, facial expressions and body language of the experimenter, signaling rejection and possible salience even before the actual stimulus. The absence of similar anticipatory decelerations in both positive acceptance exercises suggests that negative social cues may engage threat-related processing (Livermore et al., 2021; Roelofs & Dayan, 2022; Vila et al., 2007) earlier than positive ones.

Facial EMG measures partially confirmed our hypotheses. As expected, zygomaticus major activity was higher in both positive acceptance exercises compared to the negative one, consistent with facial activation typically associated with positive affect expression (Cacioppo, 2004; Cacioppo et al., 1986). However, corrugator supercilii activity, associated with negative affect expression (Cacioppo, 2004; Cacioppo et al., 1986), did not differentiate acceptance and rejection. Because corrugator supercilii activity nonetheless was sensitive to the task manipulation, this null finding implies that it

may have indexed general engagement or cognitive effort rather than negative affect expression *per se* (Cowley et al., 2016; Devine et al., 2023; Ravaja et al., 2006). Both positive acceptance and negative rejection exercises required participants to react quickly and spontaneously during the dynamic flow of the dialogue, yielding attentional load. Also, Larsen et al. (2003) suggest that in social interaction – as opposed to experimental design where participant is alone exposed to emotional stimuli – emotional quality may prompt a stronger effect on zygomaticus major activity than in corrugator supercilii.

SCR was higher in both positive acceptance exercises compared to the negative one; however, this finding should be interpreted with caution because SCR did not pass the manipulation check, raising concerns about its robustness. If replicated, such a pattern might indicate that socially affirming interactions elicit stronger sympathetic activation than partially rejecting ones. Mean EDA did not differ between exercises or from baseline, suggesting limited sensitivity to the manipulation.

Contrary to our hypothesis, FAAS did not differ between exercises, indicating that frontal asymmetry was not sensitive to acceptance, rejection, or repetition in this context. However, it is interesting that FAAS values were uniformly negative across exercises. Negative values indicate relatively lower alpha power on the right—hence greater right-hemisphere activation—commonly associated with withdrawal-oriented states (Harmon-Jones & Gable, 2018; Poole & Gable, 2014). This pattern suggests that participants may have maintained a general withdrawal-oriented state throughout the session rather than exhibiting exercise-specific shifts. One plausible explanation for this null effect is that the very act of participating in laboratory-based social tasks was inherently aversive and maintained withdrawal orientation regardless of exercise type (Vecchio & De Pascalis, 2020). Furthermore, in their review, Firth et al. (2024) report studies that associate relative right-lateralized activation to conflict monitoring and response inhibition. Improvisation—whether in “Yes, And” or “Yes, But” exercises—share exactly those demands: participants must continuously monitor a partner’s evolving narrative, inhibit habitual or planned responses, and suppress any line of thought that would derail the scene. These processes may prompt relative right-lateralized asymmetry that persists across exercises and potentially masks any subtle differences between acceptance and rejection exercises.

Self-reported stress ratings showed that participants found the repeated positive acceptance exercise less stressful than the negative rejection exercise, partially confirming our hypothesis. However, there was no difference between the initial positive acceptance and negative rejection exercises. Given that the participants were naïve to improvisation training and the initial positive acceptance exercise was also the first improvisation exercise of the experiment, this lack of difference in stress is unsurprising. Standard improvisation training typically involves multiple warm-ups to build psychological safety, but our tightly scheduled 2.5-hour session—of which the exercises reported here comprised the final segment—allowed only one warm-up exercise. Consequently, the novelty and excitement of the very first exercise likely overrode hypothesized subjective stress differences, masking the anticipated contrast between the initial positive acceptance and negative rejection exercises.

4.2 Repetition effects

Repetition of the positive acceptance exercise led to decreased zygomaticus major activity and self-reported stress, suggesting habituation to the positive improvisation exercise, as hypothesized. However, HR, corrugator supercilii activity, skin conductance, and FAAS indicated no habituation. Also, transient HR deceleration remained consistent across both positive acceptance exercises, indicating a stable orienting response regardless of repetition. This result is in line with Binder et al. (2005), who reported that, although repeated auditory presentations produced diminished SCR—indicating sympathetic habituation—HR deceleration remained consistent across trials, revealing no habituation of the parasympathetic orienting response. This appears plausible from the perspective of feedback processing: although the structure of the exercise was familiar, the content of each improvised dialogue was novel and self-generated, maintaining engagement. This variability of the improvised content might have contributed to the absence of SCR habituation; however, given that SCR did not pass the manipulation check, this explanation remains speculative. Unlike the identical auditory stimuli used in Binder et al. (2005), our design involved self-generated, dynamic content, which may have reduced stimulus consistency.

Interestingly, transient HR deceleration analysis revealed an unexpected higher HR in the pre-stimulus window of the initial versus repeated positive acceptance exercise. This may reflect anticipatory arousal or reward anticipation, as HR accelerations have been observed in anticipation of positive stimuli (Fowles et al., 1982; Schumacher et al., 2015; Ulrich-Lai & Herman, 2009). Thus, the absence of pre-stimulus HR acceleration in the repeated positive acceptance exercise may reflect habituation to the exercise format: participants no longer exhibited anticipatory arousal before the stimuli, even though their post-stimulus HR deceleration still indexed feedback processing of the stimulus itself. Alternatively, the drop in pre-stimulus HR on repetition may mirror the lower self-reported stress associated with the repeated positive acceptance exercise, despite equivalent mean HR across exercises.

4.3 Summary of findings and implications for applied improvisation

The present findings align with and extend prior research on emotional and social processing in naturalistic experimental designs. Prior work demonstrated that fictional rejections trigger comparable psychophysiological responses as real-world rejections (Seppänen et al., 2021). Building on this, the current study shows that participants not only react to negative social cues but also begin to physiologically prepare for them in advance. Moreover, the results indicate that positively framed fictional interactions also evoke robust transient HR deceleration, suggesting that emotionally engaging content—regardless of its emotional quality—can reliably elicit attentional and autonomic responses. The observed effects in zygomaticus major activity and SCR are consistent with established evidence that positive social cues elicit increased facial expressivity and autonomic arousal (Kreibig, 2010; Larsen et al., 2003) regardless of the fact that participants knew the fictionality of the context. Additionally, the inclusion of repeated positive acceptance exercise offers a novel contribution: while some signs of habituation were observed (reduced zygomaticus major activity, anticipatory HR, and self-reported stress), most physiological measures remained stable, suggesting

that the improvisation exercises maintained their salience over time. This supports the idea that dynamic, self-generated social content can sustain engagement and emotional responsiveness, even with repeated exposure.

These findings demonstrate that improvisational exercises elicit autonomic and somatic responses consistent with established psychophysiological literature. Participants experienced fictional exercises genuinely salient, with transient HR deceleration indicating orienting response and facial EMG changes tracking affective engagement. Given that authentic, hands-on experience drives learning (Ballon et al., 2007; Kolb, 1984; Preminger, 2012; Silvennoinen et al., 2022), improvisation training can cultivate social competences on par with real-life encounters, but within a controlled, psychologically safe setting that maintains unpredictability and immediate feedback while minimizing interpersonal risk (Perrmann-Graham et al., 2022; Seppänen et al., 2019). Translating these psychophysiological markers to inform applied improvisation can guide the development of more precise, adaptive, and evidence-based learning interventions across educational, organizational, and clinical domains (Barker, 2019; Chan et al., 2023; Dahn et al., 2021; Gao et al., 2018; Hodge & Ratten, 2015; Seppänen & Toivanen, 2023; Vera & Crossan, 2004).

4.4 Methodological considerations and limitations

While the study provides valuable insights into psychophysiological responses to improvised social exercises, several limitations should be acknowledged. First, the study's strength in ecological validity comes at the expense of experimental control. For example, typical HR recovery following stimulus-related deceleration could not be observed, because the post-stimulus recording interval was too brief to capture the rebound phase. Employing a naturally unfolding conversational paradigm prevented precise control over the duration of each speaking turn. Although extending the post-stimulus interval would have allowed assessment of recovery dynamics, doing so would have substantially reduced the number of analyzable trials in which participants remained silent after stimuli. Nonetheless, this approach preserved the ecological validity of dyadic interaction. Most other studies have used picture-based paradigms with no in-person, real-time interaction or a virtual game paradigm with no in-person interaction. We deem this compromise between experimental control and naturalistic stimuli acceptable, as dynamic, life-like stimuli of ecological validity elicit more robust and qualitatively different physiological activation than discrete, static presentations (Jääskeläinen et al., 2021; Risko et al., 2016).

Second, we acknowledge that our fixed exercise sequence may have introduced order effects. This progression was chosen for pedagogical and ethical reasons. As improvisation novices, participants first needed a neutral warm-up to orient themselves and feel at ease; next, an affirming “Yes, And” to introduce the core concept of improvisation; then exposure to rejections to contrast acceptance; and finally, ending on a positive note both to study habituation and to ensure participants left the session feeling supported rather than demoralized or misunderstanding the collaborative spirit of improvisation. Nonetheless, future research should employ counterbalanced or randomized task orders to avoid sequence-related confounds.

Third, the absence of habituation across repeated positive trials in skin conductance (EDA and SCR) and FAAS may reflect limited measurement sensitivity and insufficient statistical power rather than genuine physiological stability. Although heart rate and facial EMG reliably indexed stimulus manipulation, EDA and SCR failed manipulation checks—suggesting floor effects or low signal-to-noise ratios may have obscured subtle adaptive changes. Moreover, the study may have been underpowered to detect small-to-moderate effects in these indices. Future research should validate each measure’s responsiveness and conduct a priori power analyses tailored to each physiological index to ensure that true habituation and modest effects are not inadvertently overlooked.

Fourth, the lack of a neutral control exercise limits our ability to isolate acceptance vs. rejection specific responses from general effects of improvisational demand or social engagement. Incorporating an interactive baseline—neither accepting nor rejecting—would provide a clearer reference point for interpreting positive and negative quality effects. An ecologically valid improvised baseline might involve participants engaging in a neutral dialogue—taking turns simply describing the room or co-constructing a story by adding non-evaluative statements (“and then this happens...”)—thereby matching the interactive and creative demands.

Fifth, participants’ elevated zygomaticus major activation may have been driven in part by social mimicry (Dimberg et al., 2000; Duffy & Chartrand, 2015; Wessler & Hansen, 2021) of the experimenter’s positive, enthusiastic nonverbal cues. Because we did not record the experimenter’s facial behaviour, we cannot rule out this form of emotional contagion. Standardizing experimenter expressions or using prerecorded prompts would have ensured control but at the cost of the naturalistic design we sought to preserve.

5. Conclusions

This study demonstrates that fictional, improvised exercises elicit reliable psychophysiological responses which differentiate acceptance from rejection. Transient HR deceleration occurred in all exercises, confirming a robust orienting response to socially salient stimuli. Zygomaticus major activity was elevated during positive acceptance versus negative rejection exercises. Anticipatory HR deceleration in the rejection exercise suggested early engagement of threat-related processing even when participants knew the interaction was fictional. Repetition of the acceptance exercise produced partial habituation as zygomaticus major activity, anticipatory HR and self-reported stress responses decreased on the second exposure. Our findings highlight the promise of theatre improvisation exercises as ecologically valid tools for investigating emotional and interpersonal processes in real time.

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Conflicts of Interest

The authors declare no conflict of interest.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author S.S. used scite.ai to assist in finding relevant literature, and Microsoft Copilot to check the grammar. After using these tools, S.S. reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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APPENDIX 1

Descriptive Statistics for Heart Rate Slope Scores (N = 33)

Slope	Condition	Mean	SD
Slope 1	POS1	-3.541	3.07
	POS2	-2.285	3.088
	NEG	-2.433	4.134
Slope 2	POS1	-5.799	6.109
	POS2	-4.638	5.056
	NEG	-4.845	5.23
Slope 3	POS1	-5.689	6.094
	POS2	-4.609	5.08
	NEG	-5.101	4.512