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The role of anxiety and anxiety-related goals in influencing evaluative conditioning: Does the person-situation fit matter?

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ABSTRACT

Recent research showed that personality traits, specifically Neuroticism and Anxiety, moderate Evaluative Conditioning (EC) effects – the change in the evaluation of a stimulus (conditioned stimulus) due to its previous pairings with a positively- or negatively-valenced stimulus (unconditioned stimulus). Whereas past research is only correlational and focused on anxiety as a trait, the present research aimed at manipulating anxiety. In two studies, we manipulated participants' anxiety-related goals (e.g., avoiding feeling uncomfortable) before taking part in an EC procedure. We also measured anxiety as a trait, as a state, and as chronic and momentary anxiety-related goals. Multilevel analyses revealed that the fit (i.e., the compatibility) between state anxiety (measured) and the state-relevant contextual conditions (manipulated) – that is, the person-situation fit – has a crucial role in EC. More specifically, highly anxious and highly relaxed (low anxious) people have larger EC effects in, respectively, anxious and relaxed conditions.

1. Introduction

Personality traits are conceived as relatively stable constructs grouping specific patterns of thoughts, feelings, and actions (Costa & McCrae, 1990; McCrae & Costa, 1997), differentiating individuals (Allport, 1961). According to the Big Five model, five personality traits – Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism – can be identified (Costa & McCrae, 1990; McCrae & Costa, 1997). The HEXACO model, in turn, proposes six traits: Honesty-Humility, Emotionality, eXtraversion, Agreeableness, Conscientiousness, and Openness (Ashton et al., 2004; Lee & Ashton, 2004). Recent research has highlighted the role of personality traits in evaluative learning, a type of learning focused on acquisition and changes in evaluative behavior linked to likes and dislikes (De Houwer et al., 2013, 2023). In particular, empirical work on personality individual differences has mainly focused on *Evaluative Conditioning* (EC), one of the most extensively studied forms of evaluative learning (Huzoaica et al., 2025; Ingendahl & Vogel, 2023; Vogel et al., 2019). EC is defined as the change in the evaluation of a stimulus (Conditioned Stimulus, CS) due to its previous pairing with another positively- or negatively-valenced stimulus (Unconditioned Stimulus, US; De Houwer, 2007). Typically, CSs are evaluated more positively when paired with positive USs, and more negatively when paired with negative USs (De Houwer, 2007). Evidence has specifically shown that Neuroticism and, in particular its Anxiety facet, moderate the EC effects (Vogel et al., 2019). The present research expands on previous findings by experimentally examining anxiety as a state, along with anxiety-related goals.

Neuroticism, that reflects a general tendency toward negative emotions (John & Srivastava, 1999; Kalokerinos et al., 2020), has been found to amplify the EC effect (Bunghez et al., 2023; Casini et al., 2023; Vogel et al., 2019). Neurotic people, given their increased sensitivity to stimuli, tend to pay more attention and react more strongly to valence characteristics, including the valence of USs, which would result in stronger EC effects (Gast & Rothermund, 2011). In line with these results, the Emotionality factor of the HEXACO model, a rotational variant of Neuroticism (Ashton et al., 2004; Lee & Ashton, 2004), was also found to increase the EC effect (Casini et al., 2023). The moderation effect of EC was found especially for Anxiety (Casini et al., 2023; Vogel et al., 2019), a facet of both Neuroticism and Emotionality, involving tendencies to vigilance, to more threatening perceptions of situations (Elwood et al., 2011) and generally to more sensitivity to valence characteristics (Barrett, 1998). All these interconnected characteristics

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may help explain the impact of individual differences in anxiety on EC effects. However, the literature on this topic remains limited. Existing studies are primarily correlational, often yield conflicting results regarding the effects of neuroticism and anxiety on EC (Bunghez et al., 2024; Ingendahl & Vogel, 2023; Lazar et al., 2025), and focus exclusively on anxiety as a personality trait.

As mentioned earlier, anxiety's influence on EC may not be limited to its trait aspect. While personality traits are relatively stable, there is individual variability in their behavioral expressions, reflecting the degree of coherent thoughts, feelings and behaviors at a given moment (Baumert et al., 2017; Fleeson & Law, 2015). This variability can be attributed to transient properties, namely personality states, which represent momentary expressions of traits (Columbus & Strandsbjerg, 2025). For example, a person with a generally high level of anxiety trait may feel relatively calm at a particular moment if he/she does not perceive threats, whereas someone with a low anxiety trait may experience increased anxiety in specific situations, such as public speaking. According to the recent dynamic conception of personality traits, as developed by the Density distribution model, traits can be understood as the distributions of frequency of state levels manifested over time, different from person to person (Fleeson, 2001; Fleeson & Gallagher, 2009). Whole trait theory further proposes that these trait manifestations (states) are functional to achieving goals (Fleeson, 2012; McCabe & Fleeson, 2012, 2016). For instance, being anxious may manifest when faced with uncomfortable situations or to prevent negative outcomes (Dickson & MacLeod, 2004). Therefore, some goals (e.g., anxiety-related goals) would be more connected to some personality traits and states (e.g., anxiety trait and state). For example, the anxiety trait has been found to be related to goals like avoiding social judgements or preventing harm (Costantini et al., 2025). Like traits and states, goals have both stable and transient components, such that the pursuit of a momentary anxiety-related goal in a specific context would activate the anxiety state content, whereas chronic goal pursuit would elicit anxiety trait content. Initial correlational evidence on the role of anxiety-related goals on EC came from a recent study showing that the anxiety-related goal of Avoiding feeling uncomfortable moderated the EC effect, with an amplified effect for people who considered the goal to be important (Zago et al., 2024). This effect occurred only under contingency memory (i.e., when participants had memory of which stimuli were systematically paired), consistent with most EC literature showing larger EC effects in the case of contingency memory (Hofmann et al., 2010; Moran et al., 2023).

Although the relationship between anxiety and EC has been examined in a few recent correlational studies, the use of an experimental manipulation inducing anxiety would allow for causal inferences about this relation. A highly effective anxiety-inducing manipulation, showing a large meta-analytical effect of $d = 1.50$ (Joseph et al., 2020), is autobiographical recall. In this procedure, participants are instructed to vividly recall an episodic memory associated with certain emotions, combined with the writing of those emerged memories. In the context of activating states, additionally manipulating momentary anxiety-related goals could increase the behavioral response resulting from the state manipulation. For instance, activating the goal of avoiding feeling uncomfortable could promote state anxiety change through a spreading flow: increasing the salience of the goal would lead to state anxiety as a response (Di Sarno et al., 2023; Fleeson & Jayawickreme, 2015).

Beyond the usefulness of anxiety-inducing manipulation for causal inferences, this type of manipulation also allows us to study the effect of the person-situation fits on evaluative learning. According to an interactionist approach, personality traits and states can match with situational characteristics of the environments, determining sizable and stable configurations called *person-situation fit* (Rauthmann, 2021; Rauthmann & Sherman, 2023). For example, a generally extroverted person (trait) who finds her−/himself in easy-going and pleasant social interactions (situation) would experience trait-situation fit that amplifies pleasant affect and coherent extroverted social behaviors (consequence), which describes the compatibility between personality traits and trait-relevant situational cues. The state-situation fit, instead, refers to the compatibility between situational cues and the activated personality states; it can be experienced, for example, by a person who, being in a highly competitive and evaluative environment (situation) that affords anxiety (state), may experience greater anxiety than usual (consequence). Since person-situation fits represent another means of personality influence like trait or state anxiety, the fit between how anxious a person is per se and how much anxiety a situation induces could impact the EC effect. By manipulating anxiety, the role of the fit between trait anxiety and the anxious (or relaxed) situation induced by the manipulation (trait-situation fit) can be explored, as well as the role of the fit between state anxiety and the anxious (or relaxed) situation induced (state-situation fit). This framework, therefore, allows for the exploration of multiple anxiety-related influences on EC, including anxiety trait, state, and goals. More specifically, it makes it possible to investigate the role of individual differences in anxiety, the state-relevant contextual situations (experimental effect), and the joint effect between these two. Their joint impact can influence EC in different ways, given that individuals may react differently to the same situation depending on their levels of state or trait anxiety.

To summarize, individual differences in anxiety can be conceived in terms of traits and goals with momentary (state) and chronic (trait) components. Examining anxiety-related personality components not in isolation, but as part of an integrated pattern (Wilt et al., 2011), can shed light on how these components and their fit with the (anxious or not-anxious) situation can influence the EC effect.

2. Aims

We report two studies examining the role of anxiety as a trait and as a state, and of chronic and momentary anxiety-related goals, in EC. As far as we know, the current research represents the first study in the literature to experimentally explore the influence of anxiety on EC and to expand the focus to momentary individual differences (i.e., momentary states and goals). The aim is to investigate the extent to which stable and momentary individual differences in the anxious aspects of personality may be relevant moderating variables of EC. More specifically, after having ascertained the presence of an EC effect, the moderation effects on EC of both the situational context induced by the manipulation and anxiety individual differences will be investigated. Furthermore, the joint effect of anxiety individual differences and the experimental effect (anxiety-inducing manipulation) on EC will be explored. The current contribution consists of two studies whose data have also been aggregated for combined analyses. The first study was designed to examine the presence of the EC effect and to investigate whether individual differences in anxiety influenced this effect, as well as to explore the role of the fit between anxiety individual differences and the situational context induced by the manipulation. The second study was primarily aimed at replicating a key result of the first study. Specifically, in the first study, we expected person-situation effects, but we did not predict a priori the specific one that emerged. We therefore conducted the second study with the explicit aim of testing and replicating this specific effect, which is an important step for establishing credible evidence (Nosek & Errington, 2020).

3. Method

3.1. Participants

The studies were preregistered on AsPredicted.org (Identifiers #130048[1] and #143251[2]) and were conducted in English. Deviations

[1] https://aspredicted.org/vcdv-44t3.pdf.
[2] https://aspredicted.org/7fmp-s5sy.pdf.

from the pre-registrations are reported in the Supplementary Materials (SM) Section 1. Both studies were conducted under the same protocol approved by the local ethical commission (protocol RM-2023-626). Participants were recruited on Prolific Academic[3] and, after providing informed consent, completed the procedure and received monetary compensation for their participation.

The sample of Study 1 was determined through a power sensitivity analysis (Perugini et al., 2018), showing that for an $\alpha = 0.05$, power of 0.80, and a unidirectional hypothesis, a sample of at least 300 subjects allowed us to detect a moderating effect of anxiety of Cohen's $d_z \geq 0.28$ (equivalent to $r \geq 0.14$). According to available resources, 348 participants were recruited. After data collection, we excluded participants who did not complete the survey ($N = 40$), who declared that their data should not have been included in the analyses ($N = 2$; Self-Reported Single Item Careless Responding Indicator, see Measures), and who assessed all the CSs equally ($N = 42$). Thus, data from 264 participants (121 in the experimental condition and 143 in the control condition) were included in the analysis (see Table 1). This sample size allowed for sufficiently stable results to be detected (Schönbrodt & Perugini, 2013).

The number of participants in Study 2 mirrored the sample size of Study 1, slightly increasing it to account for potential exclusions: 397 participants were recruited. Following the exclusion of 109 participants, among whom 59 did not complete the survey, two declared that their data should be excluded, and 47 assessed all the CSs equally, data from 289 participants (145 in the experimental condition and 144 in the control condition) were analyzed (see Table 1). A simulation sensitivity power analysis (Brysbaert & Stevens, 2018; DeBruine & Barr, 2021; Kumle et al., 2021) showed that, based on the parameters and the effect size of the effect of interest, namely the person-situation interaction effect for state anxiety, obtained in Study 1 ($b = 0.0188$; $\beta = 0.05$; $N = 264$), the expected power to detect the same-direction effect in a unidirectional hypothesis at $\alpha = 0.05$ with a sample size of $N = 289$ in the second study was adequate (0.84; see SM Section 2, Tables S1–S2), confirming the adequacy of the final sample size of Study 2 to detect the effect of interest.

The total sample obtained by aggregating the final dataset of the two studies included 553 participants (266 in the experimental condition and 287 in the control condition). This combined sample, together with the two individual study samples, was sensitive enough to detect effects limited in size but not trivial, and reasonable based on the existing literature (Casini et al., 2023).

Table 1
Participant demographic data.

Measure	Study 1	Study 2
	N	*N*
Age		
M	42.13	43.72
SD	13.87	13.15
Gender		
Woman	157	159
Man	105	122
Other	1	6
I prefer not to say	1	2
Educational level		
Bachelor's degree or more	174	203
High school diploma	88	83
Middle school diploma	1	2
Primary school diploma	1	1

3.2. General procedure

The procedure was the same for both studies and therefore it is described only once. Participants completed several tasks during an online session that lasted approximately 20 min. After completing the questionnaires assessing chronic anxiety-related measures, they were randomly assigned to an anxiety (experimental condition) or a relaxation group (control condition). They were exposed to the experimental manipulation, after which they filled out momentary anxiety-related and affective state measures and completed the EC procedure. Subsequently, participants underwent a phase aimed at restoring (experimental group) or maintaining (control group) their emotional state, followed by the assessment of their current affective state to establish its effectiveness. Finally, participants provided demographic information and answered questions related to demand awareness. The detailed experimental procedure is available on the OSF website.[4]

3.3. Anxiety-inducing manipulation

The anxiety-inducing procedure was adapted from previous studies, mirroring well-established paradigms used in affect and mood studies, with a variation to ensure the sustained activation of the anxiety-related goal to avoid feeling uncomfortable (Joseph et al., 2020). First, participants had five minutes to recall an autobiographical event and write it down. In the anxiety group, participants had to recall an uncomfortable situation in their life, whereas in the relaxation group, a comfortable situation. Second, to keep the goal salient, participants were informed that at the end of the experiment, they would have a second task in which they would be asked to think about how that situation could take place in their life in the present and to write it down. In fact, they performed instead the restoration task. The exact instructions for both conditions are reported in SM Section 3.

3.4. EC paradigm

The EC paradigm, adapted from previous studies (Vogel et al., 2019), included three phases.

3.4.1. Conditioning phase

Eight CSs were randomly selected and paired with eight USs. The CSs, taken from a standardized database, were computer-generated pictures of greyscale fractals rated as neutral in valence in validation studies (Ovalle-Fresa et al., 2022). The USs were pictures characterized by a high level of arousal and a similar level of either positive (four USs) or negative valence (four USs), taken from the Open Affective Standardized Image Set (OASIS; Kurdi et al., 2017), depicting people, animals, or scenes. Each CS was paired with a specific valenced US, determining eight CS-US pairs. Pairings were fixed randomly such that, for each participant, a particular CS was always paired with the same US. The order of pairs was randomized. The conditioning phase consisted of eight cycles. In one cycle, all eight CS-US pairs were presented once, totaling 64 conditioning trials. In each trial, the CS and the US were displayed randomly for 3000 ms on the left or right side of the screen, with a 1000 ms inter-trial interval.

3.4.2. Post-conditioning phase

Participants rated the valence of each CS presented individually in a random order, selecting a value from −10 = *completely negative* to +10 = *completely positive*, with zero as "*neutral*".

3.4.3. Contingency memory task

Each CS was displayed with four USs, two negative and two positive, with the correct US always included. Participants were asked to click on

[3] https://www.prolific.com.

[4] https://osf.io/pw8sd/overview

the US picture they thought had been paired with the specific CS (correct response). Contingency memory was computed at the level of the CS-US pairs (Pleyers et al., 2007; Stahl et al., 2009) so that if the pair was accurately remembered, it was scored as 1, otherwise as 0.

3.5. Restoring phase

We sought to leave participants in a positive state, without the potential leftover effects of the anxiety-inducing manipulation. Participants were asked to think for three minutes about a situation in their life in which they felt comfortable and had a moment of happiness, and to write it down. The instructions are reported in SM Section 3.

3.6. Measures

3.6.1. HEXACO Personality Inventory (PI) – Emotionality

The 32 Emotionality items of the complete version of the HEXACO-PI (Ashton & Lee, 2009; Lee & Ashton, 2004) assess Emotionality and its four facets: Fearfulness, Anxiety, Dependence, and Sentimentality. The dimension of interest is Anxiety (see Table 2 for measures descriptions and α_s).

3.6.2. State-Trait Anxiety Inventory (STAI)

The 20-item questionnaire of the STAI Y1 form (Spielberger et al., 1983) was used to measure state anxiety, whereas the 20-item questionnaire of the STAI Y2 form (Spielberger et al., 1983) was used to measure trait anxiety.

3.6.3. Chronic and momentary anxiety-related goal measure

An eight-item questionnaire adapted from Costantini et al. (2025) was used to assess the importance generally given to the Avoid feeling uncomfortable goal (chronic measure), with the following items: Avoid feeling uncomfortable, Avoiding feeling unease, Avoid uncomfortable situations, Trying to feel at ease, Looking for situations where I find myself at ease, Looking for comfortable situations, Trying to feel comfortable, Trying to keep away from annoying situations. The same items, framed in reference to the specific moment in time (momentary measure), were used to assess the importance given to the goal in the present.

Table 2
Measures description and reliability by study.

Measure	Item example	Response scale	α	
			Study 1	Study 2
HEXACO-PI Emotionality	I sometimes can't help worrying about little things	1 = *strongly disagree*, 5 = *strongly agree*	0.91	0.90
Anxiety facet	I get very anxious when waiting to hear about an important decision		0.87	0.87
State-Trait Anxiety Inventory Y1 form	I am tense	1 = *not at all*, 4 = *very much so*	0.96	0.97
State-Trait Anxiety Inventory Y2 form	I feel nervous and restless	1 = *almost never*, 4 = *almost always*	0.96	0.96
Chronic Anxiety-related Goal Measure	Avoid feeling uncomfortable	1 = *not important to me at all*, 5 = *highly important to me*	0.87	0.90
Momentary Anxiety-related Goal Measure	Avoid feeling uncomfortable		0.92	0.93
Positive affective states (PANAS)	Interested	1 = *very slightly or not at all*, 5 = *extremely*	0.92	0.92
Negative affective states (PANAS)	Distressed		0.92	0.95

3.6.4. Positive And Negative Affective State (PANAS)

The 20-item questionnaire of the PANAS (Watson et al., 1988) was used to measure the general positive and negative affective states.

3.6.5. Demand awareness

Participants rated from 1 = *not at all* to 7 = *completely* to what extent their responses were based on what they thought at that moment (internal reasons), trying to comply with the researchers' goals or hypothesis (demand compliance; Sawyer, 1975), and trying to go against them (reactance; Brehm, 1966; Steindl et al., 2015). SM Section 8 includes analyses of demand awareness measures, which did not affect the main results.

3.6.6. Self-Reported Single Item Careless Responding Indicator (SRSI)

Participants were asked whether their data should be used in the analyses, being assured that they were in any case fully compensated for the study, to detect participants who did not pay adequate attention during the study (Meade & Craig, 2012).

3.7. Data analysis

A similar analytical approach to that employed in previous studies on Neuroticism, Anxiety, and EC was adopted (e.g., Bunghez et al., 2023). For each effect, we first briefly report the results in the two individual studies (Study 1 and Study 2). We then rely on the integrative analysis of the full dataset to derive the most precise parameter estimates and for the detailed interpretation of the effects (McShane & Böckenholt, 2017, 2025). As a first step, we tested for heterogeneity by including Study as a factor and examining whether it moderated the critical person-situation interaction effect. This term was not significant ($p = .87$, see analysis in SM Section 4, Table S15), indicating that the effect was consistent across the two studies and therefore justifying our focus on the full dataset as the primary analysis. Full results for all individual models are provided in SM Sections 5–6, while the main findings are briefly summarized in the Results section. For a concise reading of the results, readers may focus on the analyses based on the full dataset, which provide the most reliable and precise estimates of the effects.

Given the high correlation between the Anxiety of the HEXACO-PI and anxiety of the STAI Y2 (Study 1: $r = 0.71$; Study 2: $r = 0.73$; total sample: $r = 0.72$; all p's < 0.001) and considering that both measures assess anxiety, we used a composite score of the two measures, denominated Trait anxiety (separate analyses for individual measures are reported in SM Section 7 and yielded results similar to those obtained for the composite score).

3.7.1. Effect of the manipulation and the restoring phase

To assess the effect of the experimental manipulation, we ran three *t*-tests through the general linear model on the momentary goal measure, the anxiety state form, and the PANAS questionnaire, with Group (anxiety vs. relaxation condition, between-subjects) as independent variable. Then, to check the effectiveness of the restoring phase, we ran a *t*-test on the PANAS measures through the same model as above.

3.7.2. EC effect

To establish the presence of the EC effect, we performed a linear mixed analysis with CSs evaluation as the dependent variable and US valence (positive vs. negative, within-subjects) as a predictor. We also investigated the role of contingency memory on the EC effect by including it and its interaction with US valence into the model.

3.7.3. Individual effects of personality or situational anxiety on EC

To test whether the EC effect was affected by both contingency memory and the experimental manipulation, we performed the same mixed analysis as above, adding Group and its interactions with US valence and Contingency memory as independent variables. Moreover, we tested mixed models about the moderation of the EC effect by our constructs of interest, namely, individual differences in anxiety, in conjunction with contingency memory. For this purpose, we conducted the same mixed model analyses as above, with Group replaced respectively by State anxiety, Momentary anxiety-related goal, Trait anxiety, and Chronic anxiety-related goal.

3.7.4. Joint effect of personality and situational anxiety on EC

Finally, we tested the influence of chronic and momentary individual differences in anxiety on the experimental effect. For each construct, we performed a mixed model with US valence, Contingency memory, Group, the specific anxiety measure, and their interactions as predictors of CSs evaluation. In particular, this interaction term reflects the joint effect of the situational context (the experimental manipulation) and individual differences in reacting to the context (person-situation effect).

3.7.5. Specification of mixed-effects models

Mixed-model analyses were conducted in R using the lme4 (Bates et al., 2015) and the lmerTest (Kuznetsova et al., 2017) packages. Fixed effects included the intercept and the predictors as specified in each model. Participant-level variability was modelled via random intercepts (Judd et al., 2012, 2017). Random slopes for Contingency memory and for its interaction with US valence were not included because the former explained zero variance, and the latter led to model non-convergence. Regarding the random slope for US valence, empirical and conceptual reasons supported the choice of a more parsimonious model without random slopes. Empirically, the model without random slopes performed better than the random-slopes model. The latter showed worse fit (i.e., lower predictive accuracy), suggesting that the slope was capturing noise or redundant variance and reducing the explanatory power of personality individual differences. Conceptually, the random-intercept-only model aligned better with the data-generating process, given that variations in the effect of US valence on CS evaluation should be attributed primarily to measured individual differences. For transparency and in line with best-practice recommendations (Meteyard & Davies, 2020), we report in the SM Section 9 the full results of the random intercept and slope model of the critical effects, along with details on the model selection and comparison of the two types of models.

4. Results

Descriptive analyses and correlations between the measures are reported in the SM (Tables S3, S17, S27) together with detailed tables of all the subsequent analyses (Section 4 for the total sample and Sections 5 and 6 for Study 1 and Study 2, respectively).

4.1. Effect of the manipulation and the restoring phase

In Study 1, participants in the anxiety group exhibited higher levels of anxiety ($p < .001$, $d = 0.48$) and negative emotions ($p = .002$, $d = 0.39$), while those in the relaxation group reported higher positive emotions ($p = .01$, $d = 0.34$). No significant differences emerged between groups in the levels of the momentary anxiety-related goal ($p = .46$, $d = 0.09$).

In Study 2, these patterns were replicated ($d_{anxiety} = 0.75$, $p < .001$; $d_{negative\ emotions} = 0.37$, $p < .001$; $d_{positive\ emotions} = 0.32$, $p = .01$). Similarly, the manipulation did not significantly affect the momentary anxiety-related goal ($p = .88$, $d = 0.03$).

Analyses of the full dataset as well showed higher anxiety and negative emotions in the anxiety group, and enhanced positive emotions in the relaxation group (all p's < 0.001), whereas the levels of the momentary anxiety-related goal did not significantly change between the groups ($p = .55$, $d = 0.05$). Overall, these findings indicate that the manipulation did not influence directly the goals, but it significantly affected anxiety, inducing different state-relevant situational contexts, with a larger specific effect on anxiety ($d = 0.65$) compared to the overall mood ($d_{positive\ affect} = 0.33$, $d_{negative\ affect} = 0.55$, $d_{positive-negative} = 0.52$). The restoring phase proved effective in re-establishing participants' affective state balance between the groups in the total sample ($p = .10$, $d = 0.14$), as well as in both individual studies.

4.2. EC effect

In Study 1, a significant interaction effect between US valence and Contingency memory was observed ($p < .001$). EC was present only when participants correctly remembered the contingencies between CSs and USs (i.e., 1444 out of 2112 pairs; $p < .001$, $d = 1.36$), while it was not observed for trials without contingency memory ($p = .78$, $d = -0.02$).

In Study 2, the interaction effect was significant as well ($p < .001$). In this study, however, EC was present both under correct (i.e., 1581 out of 2312 pairs; $p < .001$, $d = 1.36$) and, to a lesser degree, incorrect memory trials ($p = .05$, $d = 0.18$).

In the total sample, participants correctly remembered, on average, 68% of the CS-US pairs ($SD = 0.47$; i.e., 3025 out of 4424 pairs). Analyses showed a significant interaction effect between US valence and Contingency memory, $t(4076.19) = 23.65$, $p < .001$. Consistent with Study 1, simple effects confirmed that EC was observed only when participants correctly remembered the contingencies, $t(2652.99) = -39.44$, $p < .001$, $d = 1.36$, while it was not present for trials without contingency memory, $t(1127.85) = -1.24$, $p = .22$, $d = 0.09$. So, only for correctly remembered trials the pairing of valenced stimuli affected the evaluations of neutral stimuli.

4.3. Individual effects of personality or situational anxiety on EC

4.3.1. Trait anxiety and chronic anxiety-related goal

In Study 1, a significant three-way interaction between US valence, Contingency memory, and Trait anxiety was detected ($p = .04$, $\eta^2_p = 0.0022$). For the Chronic anxiety-related goal, the corresponding three-way interaction was not significant ($p = .91$, $\eta^2_p = 0.00001$).

In Study 2, no significant three-way interaction effect between US valence, Contingency memory, and Trait anxiety was observed ($p = .13$, $\eta^2_p = 0.0011$), nor for chronic anxiety-related goal ($p = .16$, $\eta^2_p = 0.0009$).

Analyses of the total sample confirmed the second pattern. Neither the three-way interactions for Trait anxiety, $t(4068.00) = -0.25$, $p = .80$, $\eta^2_p = 0.00002$, nor the one for the Chronic anxiety-related goal, $t(4060) = -0.90$, $p = .37$, $\eta^2_p = 0.0002$, reached significance (all $\eta^2_p < 0.001$). Therefore, trait anxiety seems to not have a simple moderation effect on EC given that participants with higher levels of anxiety did not have a different EC effect compared to the other people.

4.3.2. Situational anxiety induced by the experimental manipulation

In both Study 1 and Study 2, we did not observe a significant three-way interaction effect between US valence, Contingency memory, and Group (Study 1: $p = .25$, $\eta^2_p = 0.0007$; Study 2: $p = .53$, $\eta^2_p = 0.0002$).

Analyses on the full dataset confirmed this pattern: the three-way interaction for Group was not significant, $t(4071.29) = -1.33$, $p = .18$, $\eta^2_p = 0.0004$. Hence, we did not find evidence that the influence of US valence on CS evaluations, as moderated by contingency memory, differed between the two conditions.

4.3.3. State anxiety and momentary anxiety-related goal

No significant three-way interaction effect between US valence, Contingency memory, and State anxiety was found in either Study 1 (p

= .41, η_p^2 = 0.0003) or Study 2 (p = .59, η_p^2 = 0.0001). Similarly, no significant interaction emerged for the Momentary anxiety-related goal (Study 1: p = .88, η_p^2 = 0.00001; Study 2: p = .16, η_p^2 = 0.0010).

In the total sample, the three-way interaction effect remained not significant for both State anxiety, $t(4044) = -0.16$, p = .87, η_p^2 = 0.00001, and Momentary anxiety-related goal, $t(4053) = -1.11$, p = .27, η_p^2 = 0.0003.

4.4. Joint effect of personality and situational anxiety on EC

4.4.1. State anxiety and momentary anxiety-related goal

In Study 1, a significant four-way interaction between US valence, Contingency memory, Group, and State anxiety was observed (p = .01, η_p^2 = 0.0032). The same interaction effect was significant also in Study 2 (p = .03, η_p^2 = 0.0024).

Analyses conducted with the Momentary anxiety-related goal, instead, did not show a significant four-way interaction effect in either Study 1 (p = .88, η_p^2 = 0.00001) or Study 2 (p = .07, η_p^2 = 0.0016).

Analyses in the total sample confirmed these patterns. The four-way interaction between US valence, Contingency memory, Group, and State anxiety remained significant, $t(4040) = 3.29$, p = .001, η_p^2 = 0.0027. These results showed that, only for high contingency memory, the effect of the situational context induced by the experimental manipulation on EC differs as a function of different levels of state anxiety. In particular, larger EC effects seemed to emerge in fit conditions (characterized by high state anxious participants in the anxiety condition and low state anxious participants in the relaxation conditions) than misfit conditions (Fig. 1). Additional group-specific analyses on the full dataset showed that the three-way interaction between US valence, Contingency memory and State anxiety was significant for both the anxiety-inducing condition, $t(1930) = 2.33$, p = .02, η_p^2 = 0.0028, and the relaxation-inducing condition, $t(2108) = -2.33$, p = .02, η_p^2 = 0.0026, were those who were, respectively, more anxious or relaxed exhibited a larger EC effect, as confirmed by simple slope analyses (see Table 3). More specifically, in the anxiety-inducing condition, the difference in the evaluation of CS+ and CS− for correctly remembered trials corresponded to approximately 6.02 points for participants with lower state anxiety and 6.47 points for those with higher anxiety on a − 10 to +10 rating scale, indicating a stronger EC effect among more anxious participants. In contrast, in the relaxation-inducing condition, higher state anxiety was associated with a reduced EC effect (low anxiety: 7.94 points; high anxiety: 5.35 points). Therefore, when participants' internal states matched the situational context EC effects were significantly larger compared to conditions of misfit. Another way to decompose at the four-way interaction is by examining the three-way interaction between US valence, Group, and State anxiety for correct versus incorrect contingency memory trials. The three-way interaction effect was significant for trials in which participants correctly remembered the

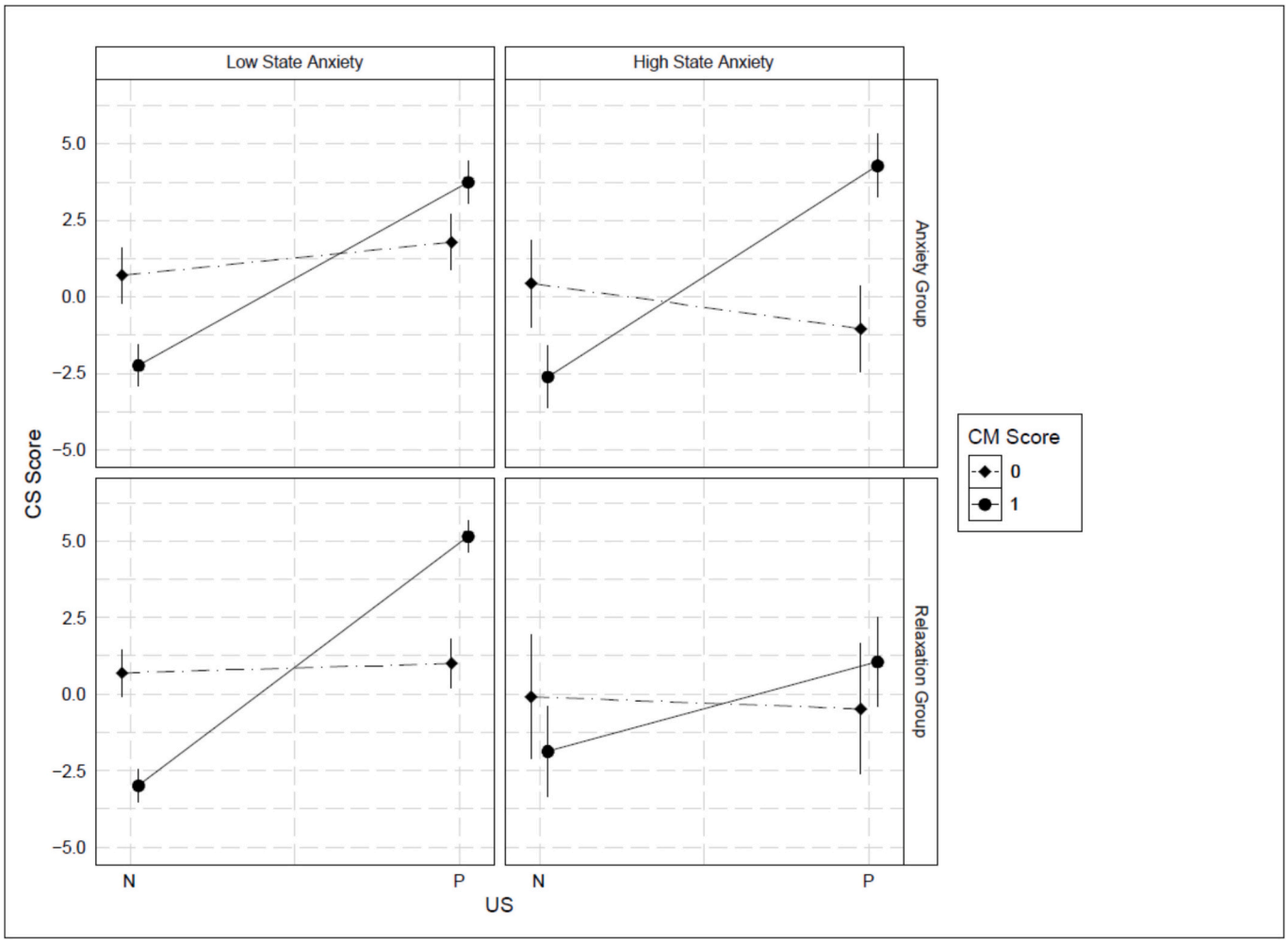

Fig. 1. Graphical representation of the interaction between US valence, contingency memory, group and state anxiety.
Note. N = negative, P = positive. CM Score = 0, pairs without correct contingency memory; CM Score = 1, pairs with correct contingency memory. Upper quadrants depict the anxiety condition; lower quadrants depict the relaxation condition. The left quadrants represent low state anxiety; the right quadrants represent high state anxiety. Error bars represent 95% confidence intervals.

Table 3
Simple slope analyses for three-way interaction models between US valence, contingency memory and state anxiety within each group.

a) Anxiety group

Moderator		Effect (US[c])	Estimate	95% CI	*SE*	*t*	*df*	*p*
State anxiety[a]	CM[b]							
−14.21	0	P − N	−0.49	[−0.98, 0.00]	0.25	−1.94	1912.08	.05
−14.21	1	P − N	−3.01	[−3.35, −2.68]	0.17	−17.50	1884.79	<.001***
0	0	P − N	−0.17	[−0.48, 0.15]	0.16	−1.06	1915.15	.29
0	1	P − N	−3.12	[−3.35, 2.90]	0.11	−27.46	1889.07	<.001***
14.21	0	P − N	0.15	[−0.22, 0.52]	0.19	0.78	1912.48	.45
14.21	1	P − N	−3.24	[−3.49, 2.99]	0.13	−25.44	1886.58	<.001***

b) Relaxation group

Moderator		Effect (US[c])	Estimate	95% CI	*SE*	*t*	*df*	*p*
State anxiety[a]	CM[b]							
−14.21	0	P − N	−0.15	[−0.58, 0.29]	0.22	−0.66	2090.10	.51
−14.21	1	P − N	−3.97	[−4.24, −3.70]	0.14	−28.76	2039.18	<.001***
0	0	P − N	−0.06	[−0.40, 0.28]	0.17	−0.35	2090.87	.73
0	1	P − N	−3.32	[−3.55, −3.10]	0.11	−29.13	2041.91	<.001***
14.21	0	P − N	0.03	[−0.57, 0.63]	0.31	0.09	2084.86	.93
14.21	1	P − N	−2.67	[−3.06, −2.28]	0.20	−13.52	2037.45	<.001***

Note. *SE* = standard error; US = unconditioned stimulus; CM = contingency memory.
[a] State anxiety was grand centered.
[b] −1 = pairs with correct contingency memory, 1 = pairs without correct contingency memory.
[c] −1 = positive, 1 = negative.
*** $p < .001$.

contingency between CSs and USs, $t(2613.34) = 4.41$, $p < 0.001$, $\eta_p^2 = 0.0074$, but not for those with incorrect contingency memory, $t(1123) = -1.24$, $p = .22$, $\eta_p^2 = 0.0014$.

The analysis conducted on the total sample with the momentary anxiety-related goal did not show a significant four-way interaction effect, similarly to Study 1 and Study 2, $t(4042) = -1.51$, $p = .13$, $\eta_p^2 = 0.0006$.

4.4.2. Trait anxiety and chronic anxiety-related goal

In Study 1, no significant four-way interactions were detected for either Trait anxiety ($p = .13$, $\eta_p^2 = 0.0012$) or the Chronic anxiety-related goal ($p = .71$, $\eta_p^2 = 0.00001$). Similarly, in Study 2 these four-way interactions were not significant (Trait anxiety: $p = .40$, $\eta_p^2 = 0.0003$; Chronic anxiety-related goal: $p = .09$, $\eta_p^2 = 0.0013$).

Analyses of the total sample agreed with these results: no significant four-way interaction was detected for Trait anxiety, $t(4059) = 0.72$, $p = .47$, $\eta_p^2 = 0.0001$, or for Chronic anxiety-related goal, $t(4054) = -1.16$, $p = .25$, $\eta_p^2 = 0.0003$.

5. General discussion

5.1. Main findings and implications

In this paper, we report the evidence coming from two studies. First, in line with previous results (Hofmann et al., 2010; Moran et al., 2023), the studies confirmed the presence, only under conditions of contingency memory, of a large EC effect ($d = 1.36$ for both studies and the total sample) such that CSs were evaluated more positively after being paired with positive USs compared to negative USs.

Second, the experimental manipulation was effective in inducing anxiety, determining individual differences in situational anxiety between the experimental and the control group. The anxiety-related situational context alone did not influence the EC effect. However, when the situational effect of the experimental manipulation was considered together with individual differences in anxiety, it was found to affect EC. The interaction between state anxiety and the situation significantly moderated the EC effect, such that, in the presence of contingency memory, larger EC effects were found in fit conditions (for anxious people in an anxiety-inducing context and for more relaxed and therefore less anxious people in a relaxation context). Crucially, this effect that was observed for state anxiety in the first study was replicated in the second study and was confirmed by the analyses in the total sample. This pattern of results reveals that evaluative learning is not only a matter of individual differences or situational context. Instead, what matters is the fit between individual state personality differences and the situational context, a concept known as state-situation fit (Rauthmann, 2021; Rauthmann & Sherman, 2023), which can make people more anxious or relaxed. In other words, faced with the same situational context (the manipulation), individuals tend to respond in different ways according to individual differences in anxiety, resulting in variability in evaluative learning.

The observed effect can be explained by different theoretical accounts. In line with the literature reviewed previously, the larger EC effect observed in anxiety state-situation fit conditions may result from increased sensitivity to evaluative information in individuals experiencing anxiety, which can be further enhanced in contexts where anxiety arises from both personality and situational sources (Barrett, 1998; Vogel et al., 2019). We can speculate about the theoretical explanations for the effect of relaxation state-situation fit, that could be attributable to a broadened attentional scope and greater receptivity to environmental cues in individuals experiencing relaxation (Fredrickson, 2001). This suggests that the underlying processes of the person-situation fit effects may be specific to the personality trait involved. However, while the mechanisms may relate to the characteristics of anxiety and relaxation states, another plausible explanation is that the observed effect is primarily driven by the conditions of fit. In this context, the ease with which information is processed can play a role. Specifically, when the situational context is coherent with individuals' current personality states, as in the case of anxiety or relaxation state-situation fit, people could experience fluency, that is, the subjective experience of ease with which incoming information is processed. Under such conditions, information may be encoded more easily, amplifying evaluative judgements and shifting evaluations in both positive and negative directions, coherently with the Fluency Amplification Model (Landwehr &

Eckmann, 2020). Conversely, in the presence of incompatibility and conditions of misfit, people may need to allocate more cognitive resources to process and interpret the situation to adapt to it, as their personality would provide less guidance for behavior. This would leave fewer resources available for evaluative learning, resulting in a smaller EC effect. Although experiencing fluency could theoretically account for the results, post-hoc analyses indicated that memory for US identity paired with specific CSs did not significantly differ between fit and misfit conditions (see SM Table S16), suggesting that fluency is unlikely to be a primary driver of the observed moderation. However, prior research shows that cognitive load, potentially imposed by the need to adapt in misfit conditions, can impair EC even when CS-US pairings are accurately remembered, as it impairs the encoding of CS-US relations that is necessary for EC to occur (Mierop et al., 2020). Therefore, fluency remains a possible contributing factor.

An alternative speculative explanation is offered by Trait Activation Theory, which emphasizes the ease with which individuals activate traits relevant to situational demands (Tett & Guterman, 2000). Participants in fit conditions may have been more sensitive to contextual cues, such as the experimental manipulation. Consequently, those whose affective state adapted more strongly to the situational manipulation may also have become more susceptible to valence-based learning, thereby enhancing EC. In contrast, individuals less prone to adjust to the situation, or lacking the skills required to respond appropriately, would exhibit a smaller sensitivity to external evaluative stimuli and therefore a smaller EC effect. Since this represents a novel finding, further dedicated studies will be necessary to better understand the specific mechanisms underlying this effect.

Regarding trait anxiety, we found that it moderated the EC effect in the first study. However, this effect was not replicated in the second study, nor did it emerge in the analyses with the full dataset. Overall, no significant moderation effects of trait anxiety, either individually or in combination with situational anxiety, emerged on EC. The lack of a clear moderation effect is partly in line with the mixed nature of the findings of previous research about the moderating effect of neuroticism and anxiety on EC (Bunghez et al., 2023; Casini et al., 2023; Ingendahl & Vogel, 2023; Lazar et al., 2025; Vogel et al., 2019; Zago et al., 2024). A possibility is that these effects have boundary conditions. For example, it has been shown that ambiguous USs (i.e., whose valence is not obvious) could facilitate the effect of personality differences (e.g., Neuroticism) in CSs evaluation (Bunghez et al., 2023), although the evidence remains mixed (Bunghez & Lupu, 2025).

Considering anxiety-related goal, no significant effects emerged for the goal “Avoid feeling uncomfortable” on EC, neither for its momentary nor for its chronic aspects, in contrast with previous correlational findings (Zago et al., 2024). Therefore, it seems that this dynamic aspect of anxiety does not influence the EC, at least in the present studies.

To sum up, our research examined in a fine-grained manner the effects of anxiety on EC. Robust evidence of the effect of the fit between state anxiety and the situational context emerged. Indeed, although the specific interaction effect was not the primary focus before Study 1, its replication in Study 2 provides important evidence about its robustness (Miller, 2009). Crucially, replicating a structured and theoretically interpretable interaction is unlikely to occur if the pattern observed in Study 1 were due to noise, such as random measurement errors, situational fluctuations, or sampling variability (Abelson, 1995). Study 2 and the combined analyses also helped clarify the status of other potentially promising findings from Study 1, revealing that some of these effects were not replicated or did not reach statistical significance (i.e., the simple moderation for trait anxiety), allowing us to distinguish fragile from more robust patterns. The findings, therefore, represent a new result in the literature and the first experimental evidence on anxiety's role in the effects of an evaluative conditioning procedure. The results can provide a starting point for future studies on further investigations extending this finding and into the processes underlying the effects.

5.2. Limitations and future directions

The present study has some limitations that should be considered. First, the manipulation did work in inducing anxiety but it did not affect the anxiety-related goal. It could be that the recalling of autobiographical events is effective for mood and negative emotions, like anxiety (Joseph et al., 2020), but insufficiently specific or strong to influence momentary goals. Nevertheless, it is worth noting that the manipulation did affect anxiety, with a larger effect than that observed for a more general negative affect induction, reflecting the effectiveness of the procedure in inducing anxiety-related situations. Moreover, the reliance on autobiographical recall depends on participants' subjective interpretation of a situation that made them feel “uncomfortable and at unease”, which may have introduced variability. This was reflected in the heterogeneity of recalled events in terms of type, intensity, and perceived emotional impact, potentially limiting the manipulation's effect on the anxiety-related goal. Future research could therefore aim to further improve the experimental manipulation by employing alternative procedures that more directly target the anxiety-related goal while enhancing ecological validity.

Future studies could also examine with a more specific focus the mechanisms underlying the effects of the state-situation fit on EC, exploring both the anxiety and relaxation effects. These studies could shed light on whether these two effects can be explained by similar (e.g., the ease of processing) or different processes, such as the sensitivity to valence information for anxious people (Barrett, 1998; Vogel et al., 2019).

Moreover, further investigation is needed to explore the role of trait anxiety and whether the trait-situation fit also has an influence on EC. The investigation of the processes responsible for these effects would also help in clarifying whether the influence of the person-situation fit on EC is specific to anxiety and relaxation conditions or whether it would apply to any type of person-situation fit. According to the ease of processing explanation, every fit between situational and dispositional variables could produce similar results. However, it could be that this effect is specific to positive and negative poles of personality traits that per se influence EC, like anxiety. In this view, for example, similar person-situation fit effects could emerge for Agreeableness, given its moderation role on EC (Vogel et al., 2019). Furthermore, along with generalization to other person-situation fit, studies investigating the effect of person-situation fit on different EC procedures involving multiple USs per CS (one-to-many pairings) will help to clarify the generalization of its effect on stimulus-rich situations and boundary conditions (Reichmann & Hütter, 2024).

Finally, future research could further study the role of the person-situation fit with larger samples and recruited from different sources. Although the present study was adequately powered, larger sample sizes are always desirable to ensure that small interaction effects are not overlooked. At the same time, several elements indicate that the current design provided sufficient sensitivity to detect the observed effects. The main EC effect was large ($d = 1.36$), the mixed experimental design substantially increased statistical power (Sommet et al., 2023), and the moderation effects displayed a cross-over shape. Indeed, small-to-moderate four-way interactions (minimum detectable effect size $f^2 = 0.015$) were detectable with a conventional power above 0.80. In addition, the four-way interaction involving state anxiety was the only effect that replicated across both studies. The probability of observing the results of both Study 1 and Study 2 under the null hypothesis is $p = .0029$ (Fisher, 1948), providing strong evidence against a chance finding. In this respect, the consistency of this interaction effect across two independent samples is more informative than the individual-studies p-values, which naturally fluctuate with sample size and sampling variability (Cumming & Calin-Jageman, 2024). Accordingly, evaluating the combined evidence across studies offers a clearer and more reliable picture of the underlying effect. It should be noted that the p-value associated with the combined evidence fell below the most

stringent threshold of 0.005 proposed by Benjamin et al. (2018) for establishing robust significance of novel effects.

6. Conclusions

In conclusion, our work extends the literature on EC by experimentally investigating anxiety's influence in a comprehensive way, examining both chronic and momentary components, and enriches the knowledge of the relationship between personality and evaluative learning. The findings are particularly relevant in that they also show that momentary individual differences have a role in EC as well as personality traits. This evidence corroborates theoretical frameworks that emphasize the dynamic interconnection between personality states and traits (Fleeson, 2012; McCabe & Fleeson, 2012, 2016). Furthermore, the results highlight the relevance of the interplay between moderators at the personal level (e.g., state anxiety) and moderators at the situational level (i.e., the context) in a logic of person-situation fit. This fit affects how people are conditioned in their attitudes and preferences and could also influence other types of evaluative learning (De Houwer et al., 2023). The way individual process and learn from environmental regularities is shaped not only by stable dispositional aspects of personality, but also by complex combinations of transitory states and situational contexts at the moment of regularities processing. In this light, different configurations of person-situation fit, determined by the alignment of individual variables and situational characteristics, may serve as the mechanism through which personality shapes evaluative learning effects.

CRediT authorship contribution statement

Beatrice Zago: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Théo Besson:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Marine Rougier:** Writing – review & editing, Writing – original draft, Conceptualization. **Jan De Houwer:** Writing – review & editing, Writing – original draft, Conceptualization. **Marco Perugini:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization.

Author note

This study was registered with AsPredicted.org (Identifiers #130048 and #143251).

This study was approved by the Ethics Committee of the University of Milano-Bicocca, protocol RM-2023-626 and was conducted according to the principles expressed in the Declaration of Helsinki.

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

During the preparation of this work, the authors used ChatGPT to check for grammatical, lexical, and stylistic errors made by non-native speaking authors. After using this tool, the authors reviewed and edited the content as needed, and they take full responsibility for the content of this publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary materials

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2026.113798.

Data availability

All the materials, the participant data, and the analysis scripts can be found on the Open Science Framework website (https://osf.io/pw8sd/overview

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