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Influence of anger on the evaluation of emotional congruence between scenes and facial expressions

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Título: Influencia de la ira en la valoración de la congruencia emocional entre escenas y expresiones faciales.
Resumen: Las personas con altos niveles de ira muestran problemas en atención ejecutiva y en la capacidad para inhibir una respuesta dominante y/o activar una respuesta subdominante, que podrían influir en la valoración de la congruencia emocional. El objetivo de esta investigación fue analizar la relación entre los niveles de ira asociada a la agresividad y la valoración de la congruencia emocional (escenas y expresiones faciales). Se utilizó el *International Affective Picture System* para seleccionar las escenas de contenido emocional (Positivas, Violentas, Repulsivas, Neutras), y el *NimStim Face Stimulus Set* para seleccionar las expresiones faciales emocionales (Alegría, Ira, Miedo, Asco, Neutra). Además, se utilizó el cuestionario de agresividad de Buss y Perry (1992) para determinar los niveles de ira (menor, medio, mayor). Los sujetos con mayores niveles de ira (vs. menores) mostraron tiempos de respuesta más amplios en la valoración de la congruencia emocional entre imágenes y expresiones faciales. El tamaño del efecto fue grande y mayor en las congruencias negativas (r > .50) que en la positiva (r = .33). Estos resultados podrían explicarse por las dificultades en el control atencional de los sujetos del grupo con mayores niveles de ira, especialmente cuando la información que se procesa es negativa.
Palabras clave: Emoción. Esfuerzo controlado. Hostilidad. Miedo. Violencia.

Abstract: Individuals with high levels of anger exhibit difficulties in executive attention and in inhibiting dominant responses and/or activating subdominant ones, which may influence their appraisal of emotional congruence. This study aimed to analyze the relationship between anger levels associated with aggression and the evaluation of emotional congruence between scenes and facial expressions. The International Affective Picture System (IAPS) was used to select emotional scenes (Positive, Violent, Repulsive, Neutral), and the NimStim Face Stimulus Set was used to select emotional facial expressions (happiness, anger, fear, disgust, neutral). Additionally, the Buss and Perry (1992) Aggression Questionnaire was used to assess anger levels (lower, middle, upper). Participants with higher anger levels (compared to those with lower levels) showed longer response times when rating emotional congruence between scenes and facial expressions. The effect size was large, with stronger effects for negative congruence (r > .50) than for positive congruence (r = .33). These findings may be explained by difficulties in attentional control among participants with higher anger levels, particularly when processing negative information.
Keywords: Emotion. Cognitive control. Hostility. Fear. Violence.

Introduction

Aggressiveness constitutes an adaptive response elicited in situations involving the perception of imminent threat (Lorenz, 1965), and has been shaped through the process of natural selection. It is considered a response with an instinctive component, whose expression is modulated by a complex interplay of hormonal systems, environmental factors, neuroanatomical and neurochemical substrates, and genetic and molecular influences (Moya-Albiol, 2004). Its manifestation is associated with the activity of various brain structures, including the prefrontal cortex, insula, amygdala, basal ganglia, and hippocampus (Cupaioli et al., 2021). The adaptive value of aggression becomes evident in the development of specific skills that enhance its execution in particular situations, especially when the potential benefits outweigh the costs (Buss & Duntley, 2006). A clear example can be found in species that experience intense mating competition, where males evolve greater body size and develop skills for creating and using tools to increase the effectiveness of aggression against rivals (Lindenfors & Tullberg, 2011). Thus, aggression can be understood as a strategy for solving specific social problems (Buss & Shackelford, 1997).

Aggressiveness is a behavioral response that characterizes individuals and is aimed at causing harm to others. It can be expressed physically or verbally and is typically accompanied by two emotions: hostility and anger. Hostility is understood as a feeling of suspicion and perceived injustice toward others, representing the cognitive component of aggression, while anger reflects the emotional component, emerging after the perception of harm and involving psychological arousal and preparation for aggressive action (Buss & Perry, 1992). Several theoretical models have been proposed to explain the mechanisms underlying aggressive behavior. Among them, the General Aggression Model (GAM; Anderson & Bushman, 2002) offers the most integrative perspective, incorporating the interaction of personal, situational, and cognitive factors in the explanation of aggression. According to this model, aggression results from the interplay of various inputs (personal and situational factors) and the cognitive, affective, and arousal-related processes that shape the individual's current internal state. This internal state, in turn, guides the evaluation and decision-making processes that determine whether aggressive behavior occurs. Within this theoretical framework, anger promotes the occurrence of aggression through three main pathways: (1) by providing justification for aggressive behavior by disrupting rational judgment; (2) by optimizing cognitive resources toward ag-

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gression through cognitive biases; and (3) by facilitating the mobilization of aggressive behavior through increased physiological arousal (Sanz et al., 2006).

The tendency to experience anger is associated with systematic cognitive biases in information processing (Anderson & Bushman, 2002; Wilkowski & Robinson, 2008). Specifically, these biases have been linked to attentional prioritization of violent information (e.g., faster detection and response to violent stimuli such as words or images), a pattern observed in individuals with high levels of anger (Blaine & Boyer, 2018; Bushman, 2006; Davis & McLeod, 2003; Ibarra & Maestripieri, 2017; Koster et al., 2004; Stewart et al., 2010; Wilkowski & Robinson, 2008). These individuals also tend to be more efficient at detecting contextual cues related to violence, such as an angry face in a social setting (Mellentin et al., 2015) or a violent reaction in a social interaction (Al-Moghrabi et al., 2022). Additionally, people with high levels of anger are more likely to interpret neutral or ambiguous expressions as threatening (e.g., Smeijers et al., 2017; Rohrberck et al., 2023). However, some studies have found no relationship between trait anger and the tendency to interpret facial stimuli as anger-related (e.g., Maoz et al., 2017). This inconsistency in the findings may be attributable to the use of modified real faces in research, which often fail to account for other influential factors such as cultural differences, gender, or the attractiveness of the model displaying the facial expression, variables that can affect evaluative processes (Hess et al., 2000; Golle et al., 2014).

High levels of anger have also been linked to difficulties in effortful control (EC), particularly in anger-relevant situations (Wilkowski & Robinson, 2010). EC has been defined as the efficiency of executive attention. This includes the ability to inhibit a dominant response and/or activate a subdominant one, as well as to plan and detect errors (Rothbart & Bates, 2006). EC can be understood as attentional regulation, which involves the ability to consciously focus attention in response to environmental demands, deliberately inhibit behaviors, and initiate goal-directed behaviors even when they are not spontaneously desired (Mira & Vera-Nuñez, 2017; Spinrad et al., 2007).

Effortful control consists of several subcomponents, including inhibitory control, which enables the suppression of automatic and impulsive behaviors, and performance monitoring, which allows for the active real-time evaluation of one's actions, thoughts, and outcomes (Lievaart et al., 2016). Individuals with high levels of trait anger tend to make more errors in inhibiting their responses when viewing angry faces, but not when viewing happy faces (Denny & Siemer, 2012). Effortful control is not associated with response facilitation, but rather with an increased ability to make goal-directed decisions when faced with contradictory information (Ossola et al., 2021). This process is crucial for understanding how individuals who frequently experience anger process information. In this context, it is particularly important to explore how they integrate contextual information, where effective attentional regulation is required.

Regarding the integration of visual scenes and facial expressions, studies in the general population have shown that attention to faces decreases when they are embedded in violent social interactions. Moreover, part of the attention diverted from faces is redirected toward contact points within the interaction (Scrivner et al., 2019). The interest in this research topic has extended to the computational domain, where recent studies have focused on developing video surveillance systems capable of detecting violent situations by analyzing both scenes and facial expressions (e.g., Wang et al., 2021). The joint analysis of visual scenes and facial expressions is crucial because it enables a better understanding of how emotional information is integrated. In these interactions, the integration of information serves to analyze actions and infer the intentions of others (Blakemore & Decety, 2001; Huang et al., 2015). Generally, visual contexts (scenes) enhance the detection and recognition of facial expressions when they are emotionally congruent (Hietanen & Astikainen, 2013; Righart & de Gelder, 2008).

In light of this, tasks that require effortful control for successful performance, such as the assessment of emotional congruence (i.e., determining whether a visual context and a facial expression share emotional content), may be more sensitive to variations in anger response levels (frequency). To our knowledge, no task has been developed to measure emotional congruence in this context. Therefore, the primary aim of this research is to examine the relationship between the assessment of emotional congruence and anger, which could be interpreted through the lens of effortful control. First (Specific objective 1), we will present a task that assesses emotional congruence between scenes (positive, violent, repulsive, neutral) and facial expressions (happiness, fear, anger, disgust, neutral). This task will help analyze how participants process information that must be integrated into emotional categories to evaluate congruence (Experiment 1). Next (Specific objective 2), we will evaluate the task's sensitivity to levels of trait anger associated with aggression in the general population (Experiment 2). Based on these objectives, the following hypotheses are proposed:

Hypothesis 1 (Objective 1, Experiment 1): The task will demonstrate sensitivity to different experimental conditions, meaning that response times will vary depending on the type of congruence between images and facial expressions. These results would allow for the validation of the instrument used to analyze the relationship between emotional congruence and anger.

Hypothesis 2 (Objective 2, Experiment 2): Participants with higher levels of anger (compared to those with lower levels) will spend more time assessing emotional congruence between visual scenes and facial expressions, particularly when the information is negative. This could be explained by poorer performance in attentional regulation processes (effortful control).

Experiment 1

Method

Participants

The sample included 30 participants (80% female), aged 18 to 29 years (M = 19.93, SD = 2.07), all of whom were students at the University of Salamanca (Spain). Participants provided their consent to take part in the study in exchange for an increase of 0.25 points out of 10 in the grade of a subject, and they signed an informed consent form prior to beginning the task. All procedures conducted in this research involving human participants adhered to institutional and/or national research ethics standards, as well as the principles set forth in the 1964 Declaration of Helsinki and its subsequent amendments, or comparable ethical standards. This study was approved by the Research Ethics Committee of the University of Salamanca (code 1212).

Instruments

International Affective Picture System (IAPS; Lang et al., 1997): Forty scenes with emotional content were selected from the Spanish adaptation by Moltó et al. (1999). The scenes were categorized as follows: 10 positive, 10 violent negative, 10 repulsive negative, and 10 neutral (see Appendix).

NimStim Face Stimulus Set database (Tottenham et al., 2009): Fifty prototypical facial expressions were used, including 10 expressions each of happiness, anger, fear, disgust, and neutrality. These expressions were obtained from 10 models (five women and five men": 01F, 02F, 06F, 08F, 09F, 21M, 22M, 27M, 29M, 36M).

Procedure

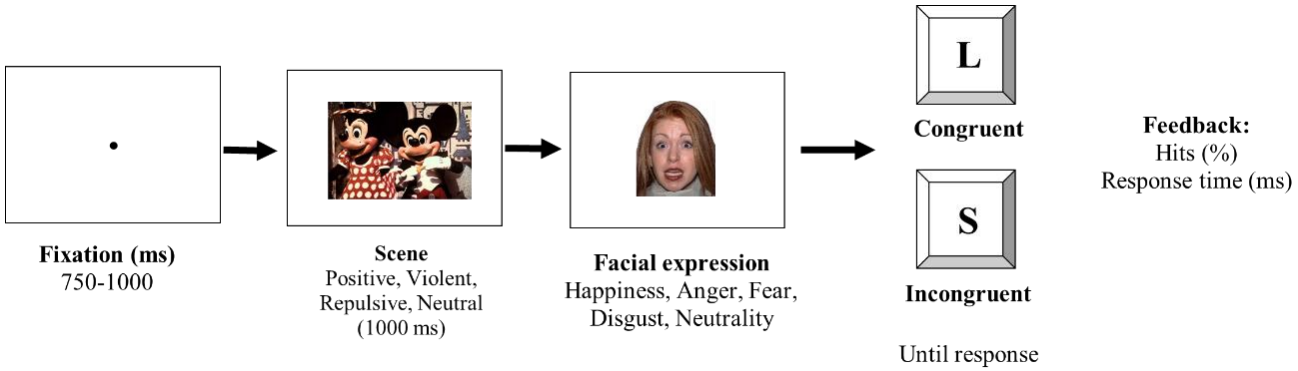
All participants first provided written informed consent. They then completed a task designed to assess emotional congruence between visual scenes and facial expressions.

Emotional congruence assessment task

The task was developed using E-Prime 2.0 software (Schneider et al., 2002) and consisted of two phases: a training phase with 20 trials, followed by an experimental phase with 200 trials, comprising 10 trials for each experimental condition (see Figure 1). The stimuli included 10 positive images, 10 negative images with violent content, 10 negative images with repulsive content, and 10 neutral images (see Appendix).

Each trial followed a fixed sequence: it began with a blank screen featuring a central black dot, displayed for 750 to 1,000 milliseconds, to help focus the participant's attention. This was followed by the presentation of an emotionally valence scene (positive, violent, repulsive, or neutral), displayed for 1,000 ms. Next, a facial expression was presented, which could correspond to happiness, anger, fear, disgust, or neutrality. The expression remained on the screen until participants responded by pressing the "L" key if they perceived emotional congruence between the scene and the facial expression, or the "S" key if they perceived incongruence. The key-response mapping (i.e., which key indicated congruence or incongruence) was counterbalanced across participants to control for response biases. After each response, participants received immediate feedback indicating whether their answer was correct or incorrect. Additionally, they were shown their response time for that trial and their cumulative accuracy percentage (see Figure 1). The provision of feedback aimed to help participants learn the potential associations between the scenes and the facial expressions. This was especially important because violent scenes were considered congruent with both angry and fearful facial expressions. The training phase ensured that participants became familiar with these relationships, thereby reducing the likelihood of confusion during the experimental phase and enhancing the reliability of the results.

Figure 1
Experimental procedure depicting an incongruent trial, in which a positive scene is followed by a facial expression of fear



Data analysis

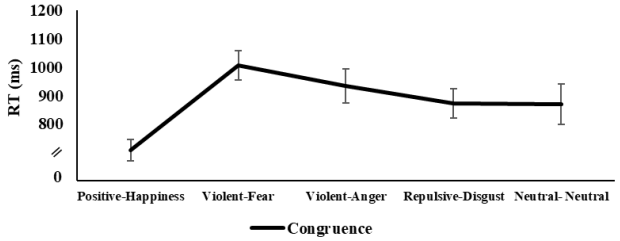
A repeated-measures ANOVA was conducted with congruency (Positive–happiness, Violent–Fear, Violent–Anger, Repulsive–Disgust, Neutral–Neutral) as the within-subjects independent variable. The dependent variable was the assessment of emotional congruency between scenes and facial expressions, measured in response times (ms). An initial inspection of the data distribution indicated deviations from normality; therefore, response times were normalized using a logarithmic transformation prior to analysis.

Results

The repeated-measures ANOVA revealed statistically significant effects of the congruence variable on the response times used to assess emotional congruence between the scenes and facial expressions ($F(4, 26) = 165$, $p < .001$, $\eta^2_p = .73$). Post-hoc analysis (Bonferroni) revealed that the Positive-Happiness congruency elicited significantly shorter response times than all other congruencies, including Violent-Fear ($M_{(i-j)} = -297.20$, $p < .001$, $r = 1.00$), Violent-Anger ($M_{(i-j)} = -225.10$, $p < .001$, $r = .90$), Repulsive-Disgust ($M_{(i-j)} = -162.67$, $p < .001$, $r = .81$), and Neutral-Neutral ($M_{(i-j)} = -160.42$, $p = .020$, $r = .63$). Furthermore, differences were observed between the Violent-Fear congruency and the Repulsive-Disgust ($M_{(i-j)} = -134.53$, $p = .007$, $r = .67$) and Neutral-Neutral ($M_{(i-j)} = 136.78$, $p = .018$, $r = .62$) congruency (see Figure 2).

Figure 2

Mean response times (RTs, in milliseconds) as a function of emotional congruency condition (Positive–Happiness, Violent–Fear, Violent–Anger, Repulsive–Disgust, Neutral–Neutral). Error bars represent standard errors of the mean



The results indicate that congruence between a positive scene and a happy facial expression is processed more rapidly than other congruency conditions. In contrast, the pairing of a violent scene with a fearful facial expression elicited the longest response times during the evaluation of emotional congruence. Based on these initial findings, and after confirming the task's sensitivity to variations in emotional congruence, we proceeded to carry out the task in a second experiment, this time accounting for individual levels of trait anxiety associated with aggressiveness. This approach allowed us to explore the potential influence of trait anxiety on the evaluation of emotional congruence between visual scenes and facial expressions.

Experiment 2

Method

Participants

The sample consisted of 82 participants (85.4% female), aged between 18 and 22 years ($M = 19.12$, $SD = 0.64$), all of whom were undergraduate students at the University of Salamanca (Spain). Participants provided consent to participate in the study in exchange for an increase of 0.25 points out of 10 in the grade of a subject, and they signed an informed consent form prior to beginning the task. All procedures involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committees, and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical guidelines. The study was approved by the Research Ethics Committee of the University of Salamanca (code: 1212).

Instruments

The same task used in Experiment 1 was employed, including the adaptation of the Buss and Perry Aggression Questionnaire (AQ; Buss & Perry, 1992) for the Spanish population (Andreu et al., 2002). This version retains the 29 items of the original questionnaire, which refer to aggressive behaviors and feelings. Responses are coded using a five-point Likert-type scale (1 = completely false for me; 2 = quite false for me; 3 = neither true nor false for me; 4 = quite true for me; 5 = completely true for me). The questionnaire comprises four subscales: physical aggression (9 items), verbal aggression (5 items), anger (7 items), and hostility (8 items). In the present study, only the anger subscale was considered, with a Cronbach's alpha coefficient of 0.77. The reliability score obtained in this research was similar to that reported by Andreu et al. (2002), with a value of 0.70.

Procedure

The procedure was identical to that of Experiment 1. After completing the experimental task, participants filled out the anger subscale of the Buss and Perry Aggression Questionnaire (Buss & Perry, 1992).

Data analysis

A mixed-design ANOVA was conducted, using as the between-subjects independent variable the groups formed based on the levels (lower, middle, upper) of the anger subscale from the Aggression Questionnaire. Comparison groups were established according to participants' scores falling within the following percentiles: P0–P25 (lower-level group), P25–P75 (middle-level group), and P75–P100 (upper-level group). Scores on the anger subscale ranged from 7 to 35 points. The groups formed based on these percentiles

showed the following mean anger scores: lower-level group (M = 13.55, SD = 2.37), middle-level group (M = 18.62, SD = 1.36), and upper-level group (M = 25.22, SD = 2.44). According to the Spanish adaptation by Andreu et al. (2002), the mean score for the anger subscale was 20.11 (out of 35) (SD = 4.9) in a sample of 1,382 participants. Specifically, for women aged 19 to 20, the most representative age and gender group in the present study, the mean was 20.64 (SD = 4.97). These reference values support the appropriateness of labeling the groups as lower, middle and upper levels of anger, as they align with the normative data from the validation of the Spanish version of the questionnaire.

No statistically significant differences were found in age across the groups formed based on anger levels, $F(2, 79) = 0.26$, $p = .771$, $\eta^2_p = .01$. Likewise, there were no differences in the number of male and female participants within each group, $\chi^2 = 0.41$, $p = .817$. On the other hand, the within-subjects independent variable was emotional congruence, which included five levels (Positive – Happiness, Violent – Fear, Violent – Anger, Repulsive – Disgust, Neutral – Neutral). Finally, the dependent variable was the evaluation of emotional congruence, assessed through response times (ms). An analysis of the data distribution revealed that the data did not meet normality criteria; therefore, a logarithmic transformation was applied to normalize the values.

Results

Descriptive Analysis

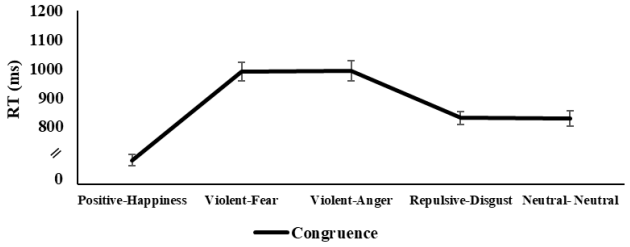
First, we present the descriptive statistics for the different experimental conditions (Table 1). The percentiles used to establish the comparison groups were: P_{25} = 16.00, P_{50} = 18.00, P_{75} = 21.00.

Table 1
Descriptive analysis of the results obtained under the different experimental conditions (N = 82)

	ANGER LEVELS (GROUPS)					
	G1: Lower level *n = 22*		G2: Middle level *n =42*		G3: Upper level *n =18*	
Scene-Expression	*M*	*SD*	*M*	*SD*	*M*	*SD*
Positive-Happiness	626.55	144.10	699.40	175.14	724.78	163.53
Violent-Fear	892.09	276.30	955.95	269.69	1122.67	278.90
Violent_Anger	843.59	219.63	1053.07	333.84	1077.56	278.30
Repulsive_Disgust	715.70	188.77	858.80	200.57	916.21	177.17
Neutral_Neutral	727.11	198.78	904.05	230.10	850.92	217.38

The mixed ANOVA revealed significant effects of the group variable (lower, middle, upper) on response times, $F(2, 79) = 6.12$, $p = .003$, $\eta^2_p = .13$. Post-hoc analysis (Bonferroni) indicated that participants in the lower anger group had significantly faster response times compared to both the middle (M(i-j) = -133.25, $p = .013$) and upper (M(i-j) = -177.42, $p = .006$) anger groups. On the other hand, the congruence variable also showed significant effects on response times, $F(4, 76) = 58.29$, $p < .0001$, $\eta^2_p = .76$. Post-hoc analysis (Bonferroni) revealed significant differences between all congruence levels (M(i-j) > 143, $p < .0001$, $r > .57$), except between the Violent-Fear and Violent-Anger conditions (M(i-j) = -1.17, $p = 1.00$, $r = .08$) (see Figure 3).

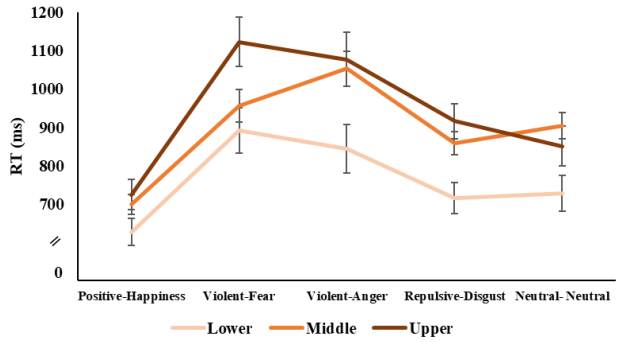
Figure 3
Mean response times (RT), considering the levels of the Congruence variable (Positive – Happiness, Violent – Fear, Violent – Anger, Repulsive – Disgust, Neutral – Neutral)



The interaction effects between the congruence and group variables were also statistically significant, $F(8, 154) = 2.76$, $p = .007$, $\eta^2_p = .77$. Post-hoc analysis (Bonferroni) revealed statistically significant differences in the Positive-Happiness congruence, with participants in the upper anger group showing slower response times compared to those in the lower anger group ($M_{(i-j)} = 98.23$, $p = .046$, $r = .33$). For the Violent-Fear congruence, response times were significantly longer in the upper anger group compared to both the middle ($M_{(i-j)} = 166.71$, $p = .026$, $r = .56$) and lower ($M_{(i-j)} = 230.58$, $p = .005$, $r = .40$) anger groups. In the Violent-Anger congruence, participants in the lower anger group responded significantly faster than those in both the middle ($M_{(i-j)} = -209.48$, $p = .005$, $r = .35$) and upper ($M_{(i-j)} = -233.97$, $p = .006$, $r = .49$) anger groups. On the other hand, in the Repulsive-Disgust congruence, the lower anger group exhibited significantly faster response times compared to the middle ($M_{(i-j)} = -143.10$, $p = .002$, $r = .51$) and upper ($M_{(i-j)} = -200.51$, $p < .001$, $r = .65$) anger groups. Finally, within the Neutral-Neutral congruence, the lower anger group showed faster response times compared to the middle anger group ($M_{(i-j)} = -176.94$, $p = .001$, $r = .47$) (see Figure 4).

Figure 4

Mean response times (RTs), across groups formed based on anger levels (lower, middle, upper) in the evaluation of different types of Scene–Facial Expression congruence (Positive–Happiness, Violent–Fear, Violent–Anger, Repulsive–Disgust, Neutral–Neutral)



Discusion and conclusions

The general objective of this research was to examine the relationship between participants' anger levels and their performance on a task assessing emotional congruence between scenes and facial expressions. First, the results of the first experiment (specific objective 1) showed that the task designed to measure congruence levels was sensitive, revealing statistically significant differences between all the levels of congruence analyzed, except between Violent-Fear and Violent-Anger. This lack of difference between these two levels could be due to the observer's perspective, that is, when faced with a violent scene, the evaluator may consider an angry expression as congruent if adopting the aggressor's perspective, while a fearful expression may be seen as congruent if adopting the victim's perspective. Regarding the second objective, participants with higher levels of anger showed longer response times when evaluating emotional congruence. The effect size of this relationship was considerably large in the Violent-Fear, Violent-Anger, and Repulsive-Disgust conditions, even exceeding the effect size found for the Positive-Happiness congruence.

To appropriately interpret the results, it is essential to consider that participants were first required to recognize the type of emotional expression and subsequently compare this information with the valence of the visual scene they were instructed to retrieve from working memory. A plausible explanation for the observed findings involves deficits in attentional regulation (effortful control), which have been documented in individuals with elevated levels of anger. According to the emotional impairment hypothesis, emotional stimuli may disrupt attentional control and hinder the active maintenance of information in working memory (Garrison & Schmeichel, 2018; Ogilvie et al., 2011). Such deficits may be reflected in the response times associated with evaluating emotional congruence. This interpretation is supported by evidence indicating that response time measures are sensitive to individual differences in cognitive abilities (Vasques et al., 2018), particularly those related to executive functions and effortful control. Consistent with these findings are results from a study employing event-related potentials (ERP) to examine anger-related attentional bias toward negative stimuli during an emotion-word Stroop task. Higher levels of anger were associated with enhanced N200, P300, and N400 amplitudes in response to negative words. These findings suggest that individuals with heightened aggressiveness may exert greater effort to suppress attention to negative information (Stewart et al., 2010), potentially increasing the time required to respond in tasks that demand attentional control. In line with this, the data from the present research further support the idea that processes related to effortful control may play a significant role in anger reactivity (Wilkowski & Robinson, 2008).

The task employed in the present study demonstrates potential for adaptation in interventions aimed at reducing aggressive behavior through the modification of attentional biases (Attentional Bias Modification – ABM). In this regard, the methodology developed by Zhao et al. (2022) illustrates an approach intended to redirect attention away from hostile faces (associated with threatening connotations) and toward smiling faces (positively valence). In their visual search paradigm, participants were instructed to actively identify and respond to the smiling face within a matrix of hostile distractors. This procedure was designed to train attentional disengagement from threatening stimuli and to facilitate orientation toward positive cues, thereby reinforcing a more adaptive attentional focus. Repeated exposure to these trials aimed to diminish the automatic tendency to process hostility-related cues and to strengthen the tendency to detect and respond to positive signals, thereby contributing to a reduction in aggressive behavior. The findings reported by Zhao et al. (2022) demonstrated the effectiveness of this visual search task, in which smiling faces served as target stimuli and hostile faces as interfering stimuli, in reducing aggressiveness, particularly among participants who initially exhibited heightened attentional engagement with hostile stimuli or reduced attention to positive stimuli.

Applying these principles to the emotional congruence task used in the present study, a possible modification would involve instructing participants to prioritize responses to positive emotional congruence while actively inhibiting responses to negative congruence, particularly in the Violent-Anger and Violent-Fear congruence conditions. This adaptation could train participants to selectively disengage from stimuli that evoke violence, redirecting their attention toward positive cues. However, it is important to acknowledge that other variables may mediate the effectiveness of such modifications, including state anger levels and aggression-related cues present in social contexts. These factors highlight the possibility that the positive outcomes observed in controlled tasks may not necessarily be maintained in natural social interaction settings, where aggressive behaviors are more likely to emerge.

On the other hand, the results obtained in this study reveal high sensitivity in young adult populations, suggesting that the task could effectively discriminate individuals with

elevated levels of anger associated with various psychiatric disorders, although further research involving clinical samples would be necessary. Moreover, the type of stimuli used allows for the manipulation of the level of arousal induced in participants, either by adjusting the intensity of IAPS images or by modifying the degree of emotional expression in facial stimuli. This could be effective in eliciting anger states in individuals prone to experiencing such emotion, given that situations capable of provoking anger, such as violent scenes, are typically perceived as unpleasant, undesirable, and aversive (Carver & Harmon-Jones, 2009). This approach would enable the examination of the effects of state anger, in addition to trait anger, on the evaluation of emotional congruence.

On the other hand, given the sensitivity of this task to levels of anger, it could be used as a monitoring tool in the evaluation of interventions. In this regard, interventions aimed at reducing activation levels have been found to be more effective than those focused on venting anger through activities that increase individual arousal (Kjærvik & Bushman, 2024). This distinction between intervention strategies would likely be reflected in the task we present, as reducing activation levels (vs. increasing-venting) as an intervention strategy could be associated with a progressive reduction in the response times for evaluating emotional congruence between scenes and facial expressions. Conversely, the association of increased activation (anger-venting) in response to violent situations would likely have the opposite effect, prolonging response times for evaluating congruence between the scene and facial expression. However, it is important to consider that other factors, such as personality or motivation toward tasks that are more or less arousing, could be modulating the suitability of one intervention over the other.

Future research should explore this issue in longitudinal studies, where participants' performance in evaluating emotional congruence is tracked alongside their progress in interventions aimed at reducing anger levels and violent behaviors. As previously noted, the task demonstrates strong sensitivity to anger levels, even within a sample of young students, suggesting it would likely prove highly sensitive in clinical populations. Applying this task to samples with disorders characterized by elevated anger levels would be valuable, particularly if modifications are made to allow for the monitoring and modulation of changes associated with interventions targeting anger reduction. While much of the research has focused on attention bias modification, it would also be beneficial to apply this approach at a more advanced level of information processing, one that requires greater attentional control, such as evaluating emotional congruence between scenes and facial expressions.

The limitations of this study are related to the type of sample used, which consists of university students, predominantly women. This limits the generalizability and interpretation of the results. Additionally, the stimuli employed, specifically the selected scenes from the IAPS, are dimensionally classified, meaning they are categorized as either positive or negative with varying levels of arousal. While the selection of stimuli for this research was based on the thematic content of the scenes, as outlined in the instrument's guidelines (Anexo), it would be beneficial to further validate the stimuli used to more reliably establish the emotional categories of violence and repulsiveness defined in this study.

Based on the results obtained in this research, we can draw the following conclusions: 1) Anger is directly and significantly related to the response times used in evaluating emotional congruence between scenes and facial expressions; 2) The effect size of the relationship between anger and emotional congruence evaluation is large in the Violent-Fear, Violent-Anger, and Repulsive-Disgust conditions, and higher than in the Positive-Happiness condition; 3) The proposed task could serve as a useful tool for intervention and monitoring in the treatment of anger associated with various psychiatric disorders.

Complementary information

Conflict of Interest.- The authors of this article declare that there is no conflict of interest.
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Appendix

Valence and arousal values for the IAPS scenes used in this study.

Scene	Valence	Arousal	Content
		Positive	
3550	2.17	7.33	Bloody face
6312	2.13	6.90	Kidnapping
6313	1.94	7.26	Assault
6350	2.55	7.64	Knife
6360	2.59	7.03	Slap
6370	3.61	6.67	Ski mask
6530	2.52	7.06	Beaten woman
6540	1.95	7.84	Man with knife
6560	2.91	7.42	Gun aiming
6570	1.94	7.62	Gun aiming
		Violent	
3550	2.17	7.33	Bloody face
6312	2.13	6.90	Kidnapping
6313	1.94	7.26	Assault
6350	2.55	7.64	Knife
6360	2.59	7.03	Slap
6370	3.61	6.67	Ski mask
6530	2.52	7.06	Beaten woman
6540	1.95	7.84	Man with knife
6560	2.91	7.42	Gun aiming
6570	1.94	7.62	Gun aiming
		Repulsive	
2730	2.30	6.26	Child and cow
9008	3.56	4.80	Syringe
9140	2.54	6.23	Dead cow
9290	2.71	4.75	Trash
9300	2.54	5.24	Dirty toilet
9320	3.65	5.58	Vomit
9330	3.48	4.94	Trash
9373	2.94	5.34	Trash
9390	3.98	5.19	Dirty plates
9570	2.23	6.98	Rotten dog
		Neutral	
7060	4.78	3.35	Trash can
7090	5.56	3.38	Book
7100	5.42	3.15	Fire hydrant
7130	5.24	4.17	Truck
7150	4.87	3.25	Umbrella
7190	5.56	3.38	Book
7217	4.84	2.73	Hanger
7233	5.39	2.29	Plate
7234	4.01	3.41	Ironing board
7235	5.33	2.13	Chair