



Contents lists available at ScienceDirect

Journal of Research in Personality

journal homepage: www.elsevier.com/locate/jrp

Full Length Article

A contextualized emotion perception assessment relates to personal and social well-being

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ARTICLE INFO

Keywords:

Emotion perception
Well-being
Interpersonal interaction
Multilevel analysis

ABSTRACT

Emotion Recognition Accuracy (ERA) is vital for social functioning and social relationships, yet empirical support for a positive link with well-being has been sparse. In three studies, we show that the Assessment of Contextualized Emotions (ACE) which distinguishes between accurately perceiving intended emotions and bias due to perceiving additional, secondary emotions, consistently predicted personal and social well-being. Across thirteen world cultures, accuracy was associated with higher well-being and life satisfaction, and bias linked to loneliness. A social interaction study in Czech Republic found accuracy (bias) was positively (negatively) associated with social well-being. The effects of accuracy and bias on well-being were partially mediated by social interaction quality in a third study. These findings further our understanding of ERA's social functions.

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<https://doi.org/10.1016/j.jrp.2024.104556>

Received 1 September 2024; Received in revised form 18 November 2024; Accepted 2 December 2024

Available online 9 December 2024

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The emotional expressions of others are a rich source of social information, conveying cues to others' affective and mental states (Darwin, 1872/1965; Matsumoto et al., 2008). Therefore, Emotion Recognition Accuracy (ERA), the accurate assessment of others' emotion expressions, is crucial for the regulation of relationships and for social functioning more generally (Adolphs, 2002; Fischer & Manstead, 2008). ERA can help to streamline and synchronize interpersonal communication as it underpins emotional interactions among people (Feldman et al., 1991; Niedenthal & Brauer, 2012). One key assumption by proponents of the emotional intelligence (EI) construct which incorporates ERA (Salovey & Mayer, 1990), is that higher EI promotes more constructive and harmonious relationships with others, and hence it can enable increased levels of well-being and happiness (Zeidner et al., 2012). As such, higher ERA skills are expected to predict higher well-being (Palese & Schmid Mast, 2020; Schmid Mast & Hall, 2018).

Yet, even though there is evidence for a link between well-being and both general emotional competencies (Lanciano & Gurci, 2015; Sánchez-Álvarez et al., 2016) and interpersonal sensitivity (Hall et al., 2009) – which both encompass ERA conceptually – empirical evidence concerning a specific positive link between higher ERA and well-being is sparse. We argue that this is explained by the way that ERA has been assessed in much of this research. Specifically, existing research has assessed ERA based on contextless facial information thereby rendering what is essentially a social perception task into a cognitive pattern matching task (Hess & Kafetsios, 2021; Kafetsios & Hess, 2022; 2023). We present evidence from three studies which involve different cultural groups and different indicators of well-being. The findings suggest that infusing context into emotion perception renders ERA a key predictor of social and personal well-being and point to social interaction quality as a mediator of this association.

1. The particularly thin evidence that link ERA with personal and social well-being

Carton et al. (1999) was one of the first to provide some evidence for the relationship between ERA (using the Diagnostic Analysis of Nonverbal Accuracy [DANVA] faces) and social well-being (reports of positive relations with others). Since that study, however, only very limited empirical evidence replicating that initial finding and extending it to social and personal well-being has emerged. In what follows, we briefly review this evidence.

First, the Mayer Salovey Caruso Emotional Intelligence Test-Faces (MSCEIT-Faces as part of the EI abilities set) was found to be practically unrelated with well-being related indices such as anxiety and positive well-being (Lanciano & Gurci, 2015). In the same vein, even though the MSCEIT-Faces performance test was associated with less anxious thoughts (Bastian et al., 2005) and lower dysfunctional rumination (Lanciano et al., 2012), it was not significantly related with subjective well-being (Bastian et al., 2005). In another study (van Beek & Dubas, 2008), inaccuracy in decoding facial expressions of emotions in drawings by early adolescents was not associated with depressive symptoms. Instead, the attributions adolescents made of the expressions predicted depression levels. More recently, using the Geneva Emotion Recognition Test, a performance test where participants watch actors portraying 14 different emotions, Schlegel (2020) found no significant associations with well-being, life satisfaction, or health indicators across 17 different samples. This lack of evidence was further reinforced, by a more comprehensive study (Sommer & Schlegel, 2024) that failed to find relationships between scores on the Geneva Emotion Recognition Test and either personal or social well-being indicators, including daily measures of well-being, and a generic evaluation of peoples' daily social interaction. However, in another study using the same ERA method (Schlegel et al., 2021) some evidence for an inverse relationship between ERA and negative (but not positive) affect emerged.

The absence of strong evidence for a relationship between ERA and personal and social well-being is puzzling given the arguments for a

connection between general EI skills and social competence (Brackett et al., 2006; Lopes et al., 2004). Indeed, a meta-analysis that examined the relationship between EI and subjective well-being (SWB, Sánchez-Álvarez et al., 2016) found a positive relationship with performance-based ability EI instruments (mainly the MSCEIT) and SWB.¹ Another meta-analysis has also returned consistent and meaningful relationships between the related, but more general, notion of interpersonal sensitivity, the “accurate judgment or recall of others' behavior or appearance” (p. 149, Hall et al., 2009) and social and personal well-being.

2. A Consideration of traditional ERA models

Hess and Kafetsios have argued (Hess & Kafetsios, 2021; Kafetsios & Hess, 2023) and shown evidence (Hess et al., 2016; Kafetsios & Hess, 2022) for the notion that the inability to find meaningful relationships between ERA and various predicted outcomes (such as prosocial personality styles, relational quality, social well-being) can be traced back to the use of a limited model and method when assessing ERA. Existing ERA models and methods² adopt a cognitive pattern matching, approach that essentially changes a social perception task into a cognitive task, by stripping out the social context within which social perception takes place and introducing a discrimination, instead of recognition, task (Hess & Kafetsios, 2021). When ERA models and methods include context, then socio-cognitive capabilities (perspective taking, mental attribution) are also engaged (North et al., 2010; Zaki and Ochsner, 2011). It is in those instances that ERA derived from contextual models and methods can predict prosocial personality traits (Kafetsios & Hess, 2022), social interaction quality (Hess et al., 2016), cultural orientations (Hess et al., 2016), and perspective taking (Antypa et al., 2024).

2.1. The present studies

For the present studies we utilized the Assessment of Contextualized Emotion (ACE) model – an ERA model and method that conceptualizes Emotion Decoding Accuracy as a social perception task rather than a cognitive task (Hess & Kafetsios, 2022). The ACE model (Hess et al., 2016) involves social context when assessing emotion decoding accuracy. By embedding the expresser together with others, the ACE includes the most generic social context (other people) in the emotion decoding process. ACE distinguishes between emotion decoding accuracy (the signal, the accurate perception of intended emotions, e.g., sadness for a sad expresser), and emotion decoding bias (noise, the perception of other, secondary, emotions that may or may not be actually shown but are perceived, such as anger for a sad expresser).³ In line with the Truth and Bias model of social perception (West & Kenny, 2011; see also Funder, 1995; Zaki, 2013) ACE accuracy and bias are fundamentally separate processes, with bias being distinguishable from mere error (see Hess & Kafetsios, 2021). By embedding ERA within a social context and allowing decoders to assess, simultaneously, accuracy and bias, the Assessment of Contextualized Emotion allows to tap participants'

¹ Sánchez-Álvarez et al. (2016) study also considers the relation between self-report mixed EI instruments, and self-report ability EI instruments and SWB. As in our study we focus only on ability EI (i.e., emotion perception) we do not consider previous research using self-report measures (for trait EI relation with well-being, see also Austin, 2005).

² These include: The Diagnostic Analysis of Non-verbal Accuracy scale (DANVA; Nowicki & Duke, 2001), the Geneva Emotional Competence Test (GEC); Schlegel & Mortillaro, 2019), Ekman Faces Test /Pictures of Facial Affect (Young et al., 2002), Multimodal Emotion Recognition Test (MERT; Bänziger et al., 2009) among others.

³ In order to properly assess the influence of social knowledge on Emotion Decoding Accuracy (EDA), it is insufficient to merely evaluate secondary emotions. Secondary emotions are more likely to be perceived when observers engage in perspective-taking to understand others, but this process is contingent on the availability of a social context during the perception process.

perspective taking capabilities. Indeed, supporting this idea, recent neuroimaging evidence suggests that an ACE-type emotion task activates brain regions involved in theory of mind, unlike tasks that simply require labelling an emotion expression without context (Antypa et al., 2024).

In everyday social exchanges – which by definition take place in the context of other people, interaction partners draw on their emotional knowledge and engage in perspective-taking to understand others' emotional states, relying on more than just facial muscle movements. In line with this notion, ACE accuracy and bias have distinct, measurable, and significant impacts on social interaction. In three event sampling (diary) studies conducted in Greece and in Germany, ACE accuracy and bias emerged as unique, meaningful predictors of social interaction quality (Hess et al., 2016). In a diary study (Kafetsios & Hess, 2019), ACE bias mediated the link between the Difficulty in Identifying Feelings dimension of alexithymia and social interaction outcomes leading the authors to argue that bias as measured in the ACE can tap the lack of attunement in dyadic social interactions observed in people with alexithymia (Foran and O'Leary, 2012). In contrast, and consistently, neither a standard emotion perception task, the Mayer, Salovey, and Caruso Emotional Intelligence Test (MSCEIT) faces part (Mayer et al., 2003), nor a traditional hit rates approach to measuring accuracy by associating one (correct) label to a given emotion expression, were found to have the same predictive power (Hess et al., 2016; Kafetsios & Hess, 2022).⁴

However, direct evidence for links between ACE accuracy and bias and a wider range of personal and social well-being indicators is, still lacking. The present studies aimed to test the hypothesis that a contextualized assessment of ERA will be a significant predictor of personal and social well-being. We utilized different measures of personal and social well-being and employed diverse samples across different cultural groups. A central question within the scope of these studies was whether a traditional hit rates approach or a typical non-contextualized performance test could provide information similar to the accuracy and bias approach using the ACE.

Study 1 aimed to test the association of accuracy and bias with personal well-being across several world cultures. Study 2 tested the relationship of accuracy and bias with social well-being in the context of daily social interactions in a community sample from the Czech Republic. Study 3 combined the designs of the first two studies by assessing both the personal and social indicators of well-being in a daily social interaction study in Germany. Following the theoretical premise regarding the relation between emotion competencies and well-being (Elfenbein et al., 2007; Schmidt-Mast & Hall, 2018) we postulated that perceptions of day-to-day interaction quality would mediate the relation between emotion perception and well-being.

3. Study 1

Study 1 provided a first test of the hypothesis that higher personal well-being would be associated with higher ERA (in terms of higher ACE accuracy and lower ACE bias) but not with traditional hit rates.

3.1. Method

3.1.1. Participants and procedure

The dataset originates from a cross-cultural study pre-registered to examine cultural variance in attachment styles and the perspective of self versus others (available at https://osf.io/452bq/?view_only=0a9c625682a942c1b177fe7cd10a08cf). The specific hypotheses of the current analysis were not included in the pre-registration. Initial questionnaires and instructions were created in English and subsequently

translated into the languages of the participating study sites using a collaborative translation method as recommended by Harkness et al. (2010). All non-English scales and tasks were first translated by native speakers, and then checked by a team member (fluent in both English and the local language) to ensure it was understandable, meaningful, familiar, and appropriate for the respective cultural context. The specific data presented here have not been previously published.

Participants from twelve countries—China, Germany, Greece, India, Ireland, Italy, Japan, Poland, Spain, Turkey, the UK, and the US— took part in a web-based survey focusing on social relationships and cognitive styles. The countries were selected with the aim to have a good mix of cultures from different parts of the world in terms of key cultural orientations, such as variation in individualism/collectivism (Hofstede, 2001) and honor/face/dignity (Vignoles et al., 2024).

In the absence of previous studies on the topic, to ascertain power, we followed previous multisite cross-cultural research that included variables similar to the cognitive predictors we employed (e.g., Rudnev et al., 2024). An a-priori power analysis (Faul et al., 2009) assuming a small to medium effect size of $f^2 = 0.07$, targeting power of 0.80 and an alpha level of 0.05, suggested a sample size of 141. All of the sites well exceeded that number (See Table S2 for a breakdown of the data collection process and sample demographics.) The final data set included 2440 participants (1653 women, 775 men, and 12 non-binary individuals) with an average age of 24.4 (SD 7.81) years. After data collection we conducted a multilevel power analysis using the *simr* package in R (Green & MacLeod, 2016) which indicated the resulting sample size is sufficient to detect medium Level 1 effects with a statistical power of 86.10 %, 95 % CI [83.80 %, 88.19 %].⁵

The survey was administered through Qualtrics for participants in the US and the UK, and Lime Survey for those from all other countries. All participants were university students over the age of 18. On average, the survey took about 35.6 min to complete (SD 15.5 min). To ensure data quality, we excluded participants who completed the survey in under 10 min and those who failed attention checks. This led to a reduction in the sample size from 2618 to 2440 participants. The ethics research committees of University XXX and of those partner institutions where additional ethics approval was required, approved the study.

3.2. Instruments

3.2.1. Emotion Recognition accuracy

We used a brief version of the Assessment of Contextualized Emotions (modelled after ACE-brief, Kafetsios & Hess, 2022) to assess ERA. Participants saw a series of 20 images showing four emotions (sad, happy, angry, disgust) expressed by a man and a woman, who were depicted either alone or surrounded by two other individuals of the same gender who showed either the same (congruent) or a neutral expression (incongruent). There are 18 different pictures (9 men) depicting emotion in context (9 incongruent) and 2 pictures (1 man, 1 woman) depicting a single person showing a happy expression. Stimuli were selected from the ACE-full (Hess et al., 2016) based on their high test-retest reliability as assessed in previous research (see Kafetsios & Hess, 2022, study 7).

The ACE-Faces stimuli (see Fig. S1 for an example) were produced from a set of *spontaneous* facial expressions that were filmed during a social interaction in which groups of three friends talked about a shared emotion eliciting event. Participants' task was to rate, on a seven-point scale, the central person's emotion expression in terms of the perceived intensity of seven emotions: calm, fear, anger, surprise, disgust, sad, happy. The major scoring dimensions of the ACE are *accuracy* (the

⁴ The MSCEIT faces part is consistently found to have strong inverse correlation with ACE bias (Hess et al., 2016; Kafetsios & Hess, 2022).

⁵ But see Nezlek (2010) for considerations regarding multilevel power in cross-cultural research.

intensity rated for the target emotion scale, i.e., anger intensity on the anger scale for an angry expression of both congruent and incongruent variations) and *bias* (the mean of ratings on all non-target scales for both congruent and incongruent variations) which have been shown to constitute two distinct facets of emotion decoding. As shown by Hess et al. (1997) and discussed by Hess & Kleck (1994) decoding the intensity of emotions is not only a valid indicator of ERA but also a meaningful one, as it captures the nuanced variations in emotional expressions that are essential for accurate interpretation. Hess et al. (1997) showed that as expressions become more intense, they are more accurately identified. This approach provides a more detailed understanding of emotional recognition in real-world interactions where intensity often varies and affects perception.

Accuracy, bias scores and hit rates were calculated separately for each emotion and later combined. In line with the truth and bias model of social perception (West & Kenny, 2011) ACE accuracy and bias are two dimensions which – even though theoretically independent – are typically correlated (see Kafetsios & Hess, 2022; average $\gamma_{01} = 0.551$, $t = 13.913$, $p < 0.001$ in the present samples); therefore, when predicting ACE accuracy or bias, it is imperative to account for the respective other variable.

Hit rates were calculated on the same ratings such that 1 was scored when the target scale (i.e., anger for an anger expression) was rated higher than any other scale and 0 when this was not the case.

Psychological Well-being. The Psychological Well-being Scale is a scale developed by Diener et al. (2009) to assess an individual's subjective well-being or happiness. It is a short 8-item summary survey of the person's self-perceived functioning in important areas such as relationships, self-esteem, purpose and meaning, and optimism.

A single-item measure – *How satisfied are you with your life?* – is widely used to assess an individual's overall life satisfaction or subjective well-being (Diener et al., 1985; Pavot & Diener, 1993).

Loneliness. The 3-item Loneliness Scale is a brief tool developed by Hughes et al. (2004) to assess feelings of loneliness in individuals and the extent to which a person feels socially connected to others: *How often do you feel that you lack companionship? How often do you feel left out? How often do you feel isolated from others?* Each question is answered on a 3-point scale ranging from 1 (hardly ever) to 3 (often).

Subjective Social Status was assessed with the use of the MacArthur Scale of Subjective Socioeconomic Status (Adler et al., 2000) a measure that depicts a ladder with 10 rungs which participants use to indicate one's relative standing in society.

3.3. Results

Descriptive statistics, Cronbach's alpha, and zero-order correlations of the variables used are shown in Table 1.

3.3.1. Data structure and analysis

The data from the present study had a nested structure, with ratings nested within individuals within countries. We conceptualized the data as a two-level hierarchical structure within countries and analyzed those using HLM software (Raudenbush et al., 2013), following the guidelines by Nezlek (2010). Initially, unconditional models (without predictors at any level) were calculated to estimate the means and variances (both within- and between-persons) of the measures of ACE accuracy and inaccuracy (see Table S1). The inspection of the means indicates that participants were generally more accurate than biased in ERA, and a significant portion of the measures' variance was within countries. Residuals versus predicted values plots of ACE accuracy and bias (see Fig. S2) suggested the model was homoscedastic and that residuals versus predicted values relationships were not systemically invariant.

The main hypotheses involved relationships between ACE accuracy and bias (country-level centered) and the three well-being indicators at

the individual level with no predictors at the culture level, see (1).⁶ All predictors were group/culture-mean centred and modelled as randomly varying across countries. These analyses also controlled for gender (uncentered) and age (see Table 2).

$$(1) \text{ Level 1: } y_{ij} = b_{0j} + b_{1j} * \text{Accuracy} + b_{2j} * \text{Bias} + b_{3j} * \text{Gender} + b_{4j} * \text{Age} + r_{ij}$$

$$\text{Level 2: } b_{0j} = g_{00} + u_{0j}$$

$$b_{1j} = g_{10} + u_{1j}$$

$$b_{2j} = \gamma_{20} + u_{2j}$$

$$b_{3j} = \gamma_{30} + u_{3j}$$

$$b_{4j} = \gamma_{40} + u_{4j}$$

As depicted in Table 2, ACE accuracy was positively associated with subjective well-being and life satisfaction whereas ACE bias was positively associated with loneliness. We calculated the effect size for the full model compared to a null model in three cases (Peugh, 2010) to be around $f^2 = 0.025$. A separate set of analyses including gender and age but this time with hit rates as the predictor of the three well-being outcomes did not reveal a significant relationship between hit rates and any of the three well-being indicators ($\gamma_{01} = 1.547$, $t = 1.141$, $p = 0.203$). Hit rates were significantly associated with gender (women had higher hit rate accuracy $\gamma_{02} = 0.026$, $t = 2.613$, $p = 0.024$) and age (older persons had lower hit rate accuracy $\gamma_{03} = -0.001$, $t = -4.055$, $p < 0.001$).

Given known relationships between social status and ERA (Kraus et al., 2010) and ACE in particular (Kafetsios et al., 2024) and social status and well-being (Yu & Blader, 2020), we exploratorily tested effects of subjective social status (Adler et al., 2000) in the above relationships between ACE accuracy and bias and the three well-being indicators. Entering Subjective Social Status (SSS) in equation (1) ($\gamma_{05} = 0.423$, $t = 15.842$, $p < 0.001$) rendered the relationship between ACE accuracy and life satisfaction non-significant ($\gamma_{04} = 0.119$, $t = 1.690$, $p = 0.119$). There was no evidence for SSS affecting the relationships between ACE accuracy and psychological well-being or ACE bias and loneliness and SSS maintained significant associations with psychological well-being⁷ ($\gamma_{05} = 1.606$, $t = 14.875$, $p < 0.001$) and loneliness ($\gamma_{05} = -0.237$, $t = -10.091$, $p < 0.001$).

In sum, findings from Study 1 showed that, as predicted, ACE accuracy was positively associated with subjective well-being and life satisfaction, and ACE bias negatively associated with loneliness. By contrast, a hit rates assessment of accuracy did not predict either of the three indicators of well-being.

4. Study 2

Study 2 examined how the ACE relates to social well-being conceptualized as emotion experience and perceptions regarding the self and others in everyday social interactions. People tend to spend much of their active day time (45 % according to U.S. Bureau of Labor Statistics, 2016) in the presence of another person. Everyday social encounters are

⁶ Given that some of the samples were collected after the onset of the SARS-CoV-2 pandemic, we included the time elapsed since the start of COVID-19 as a control variable in the main analyses (see Table S17) to account for potential COVID-related behavioral effects. However, there were no significant or meaningful differences in the results when this variable was included compared to the reported analyses.

⁷ We also run exploratory analyses that also included independent and interdependent self-construal as predictors of well-being. Whereas Independence and interdependence had significant, positive relationships with psychological well-being ($\gamma_{05} = 5.084$, $t = 17.866$, $p < 0.001$, $\gamma_{06} = 1.684$, $t = 12.049$, $p < 0.001$), the positive relationships with accuracy remained significant ($\gamma_{03} = 1.149$, $t = 3.297$, $p < 0.01$) and the negative relationship with bias approximated significant levels ($\gamma_{04} = -0.945$, $t = -1.980$, $p = 0.07$).

Table 1
Study 1 Descriptive statistics, Cronbach's alpha and zero-order correlations of the study variables.

	1	2	3	4	5	6	7	8
1. ACE accuracy	0.64 – 0.74							
2. ACE bias	0.334**	0.83 – 0.95						
3. Hit rates	0.283**	–0.572**	0.60–0.70					
4. Well-being	0.138**	–0.038	0.064**	0.86 – 0.91				
5. Loneliness	0.024	0.022	0.015	–0.427**	0.63 – 0.83			
6. Life satisfaction	0.050*	0.031	–0.013	0.619**	–0.460**	–		
7. Gender	0.092**	–0.142**	0.116**	0.061**	0.021	0.023	–	
8. Age	–0.007	0.013	–0.035	0.186**	–0.127**	0.120**	–0.104**	–
Mean	3.35	1.82	0.40	41.71	5.31	6.70		24.41
SD	0.57	0.41	0.18	7.97	1.73	1.93		7.81

Note. N = 2440. Cronbach alpha variation within the 12 samples in the diagonal. The correlations are presented to facilitate comparisons with results from previous research. Such correlations confound between- and within-group variability (Nezlek, 2010), and therefore provide potentially inaccurate descriptions of relationships. * $p < 0.05$. *** $p < 0.001$.

Table 2
Study 1 Multilevel model of relationships between ACE accuracy and Bias and three Well-being indicators.

	Well-being			Life satisfaction			Loneliness		
	Coef.	SE	t-value	Coef.	SE	t-value	Coef.	SE	t-value
Intercept γ_{00}	40.360	1.072	37.620***	6.504	0.205	31.689***	5.292	0.141	37.480***
ACE Accuracy γ_{10}	1.175	0.347	5.034***	0.198	0.074	2.683*	–0.089	0.085	–1.049
ACE Bias γ_{20}	–0.903	0.621	–1.454	–0.058	0.122	–0.483	0.354	0.074	4.734***
Gender γ_{30}	0.794	0.387	2.050	0.120	0.086	1.382	0.007	0.095	0.076
Age γ_{40}	0.117	0.03	3.787**	0.020	0.006	3.254***	–0.032	0.095	0.076

Note: Coefficients in bold are described in the results section. Gender coded –1 = males, 1 = females * $p < 0.05$ ** $p < 0.01$, *** $p < 0.001$.

important for psychological well-being (Gable & Reis, 2010) and decoding emotion expressions is an important skill for successful social interactions (Calvo et al., 2014).

4.1. Participants and procedure

Determination of the sample size was based on previous social interaction event sampling research using the ACE (Hess et al., 2016). The present study included 279 participants⁸ (193 women) aged 18 to 35 years ($M = 23.13$, $SD = 4.85$) reporting 5,331 social interactions ($M = 19.11$, $SD = 12.741$, range 1 to 85 social interactions). A power analysis conducted using the *simr* package (Green & MacLeod, 2016) indicated that a sample size of approximately 280 individuals provides sufficient statistical power (91.50 %, 95 % CI [89.60 %, 93.15 %]) to detect medium L2 effects.

Participants were recruited via non-probability sampling methods from the community in the Czech Republic through social media advertisements, local newspaper announcements, and posters in public spaces. The data collection procedure encompassed several phases, both online and in laboratory settings, as detailed in the [supplementary file](#). The present analysis focuses on the diary study part. This dataset forms part of a larger pre-registered project (https://osf.io/pu56h/?view_only=3fbcf8042fa34383b68dc436ae404dd9) which received approval from the University [Blinded for review] research ethics committee. The specific data reported here have not been published elsewhere.

4.2. Instruments

Emotion Recognition Accuracy. We used a brief version of the Assessment of Contextualized Emotions (see Kafetsios & Hess, 2022) to assess ERA. Participants saw a series of 24 images showing four emotions (sad, happy, angry, disgust) expressed by one man and one woman,

⁸ Initially, 338 (238 women) participants aged between 18 and 35 years ($M = 23.24$, $SD = 4.92$) completed the first, questionnaire, phase. Of those, 59 participants were excluded for failing to complete one of the other study phases.

who was shown either alone or surrounded by two other individuals of the same gender who showed either the same or a neutral expression. Similar to the version used for Study 1, 16 different pictures (8 men, 8 women) depicted emotion expressions in context. Further 8 different pictures depicted emotion expressions shown by single individuals. Stimuli were selected from the ACE-full (Hess et al., 2016) based on their high test–retest reliability as assessed in previous research (see Kafetsios & Hess, 2022, study 7). Accuracy, bias scores and hit rates were calculated separately (as for Study 1) for each emotion and later combined. ACE accuracy and bias were correlated (average $r(279) = 0.501$ in the present sample.).

The Faces subtest of the Mayer, Salovey, Caruso EI Test (MSCEIT, Mayer et al., 2003) includes photographs of four subtly emotional faces. For each face, participants were asked to rate the degree to which each of five emotions (happiness, fear, surprise, disgust, excitement) are present, using a 5-point scale anchored with 1–not at all present and 5 – very much present. Different emotion terms were used for different faces. The criteria for scoring responses as correct or incorrect were established based on the consensus of a separate large sample of observers who collectively determined the emotional expressions depicted by the facial stimuli (Mayer et al., 2003).

4.3. Diary study

After completing the ACE and the other measures, participants completed the Rochester Interaction Record (RIR; Nezlek, 2010) on ten consecutive days to rate each interaction (lasting at least 10 min) they had during each day (5,331 social interactions 1–85 interactions, average 1.91 interactions per day). They rated the interaction on seven-point scales measuring the quality and emotion experienced and perception of that interaction in terms of: own positive (joy, calm, enthusiasm, alertness, security) and negative emotion (regret, anger, anxiety, pressure, shame, rejected), perceived expression of positive and negative emotion by the interaction partner, as well as perceived emotional support, support satisfaction, and avoiding expressing emotion to the other.

4.4. Results

4.4.1. Data structure and analysis

We used a series of multilevel random coefficient models to analyze this multi-level dataset using HLM software (Raudenbush et al., 2013). Initially, unconditional models were calculated to estimate the means and within- and between-persons variances of the measures of ACE accuracy and inaccuracy. A significant portion of the measures' variance was within persons (see Table S3.) The inspection of the means indicates that participants were generally more accurate than biased in ERA (Accuracy $M = 5.206$, $SD = 0.763$, Bias $M = 2.31$, $SD = 0.568$).

As shown in Table 3, ACE accuracy positively predicted own positive affect and positive affect shown by the interaction partner during the interaction as well as perceived social support and support satisfaction. By contrast, ACE bias positively predicted own negative affect and negative affect shown by the interaction partner during the interaction as well as having avoided showing emotions during the interaction. Interestingly, ACE bias also predicted own positive affect.

5. Discussion

In a community sample from the Czech Republic, higher ACE accuracy was associated with higher own positive emotions during everyday social interactions as well as perceiving others expressing more positive emotion, being more emotionally supportive and feeling satisfied by their support. Conversely, and independently of accuracy, ACE bias was associated with higher own negative emotion, avoidance to express own emotion and perceiving others expressing more negative emotion. Interestingly, ACE bias also predicted own positive affect. This may be because ACE bias may also reflect hypersensitivity to emotion and given that most reported interactions were likely at least somewhat positive and in fact just being in social interactions is often positive (Berry & Hansen, 1996), this hypersensitivity then predicts positive affect as well.

Overall, these results replicate and extend previous research using the full ACE method in student samples (Hess et al., 2016) and suggest that ACE accuracy (bias) is associated with higher (lower) quality social interactions, that increase (diminish) rapport and attunement in social interactions (see also Kafetsios & Hess, 2019). In Study 3 we directly tested the conjecture that ACE accuracy and bias effects on individual-level well-being are mediated by gains and deficits in social interaction.

6. Study 3

Studies 1 and 2 provided evidence that ACE Accuracy and Bias are meaningfully related to aspects of personal (Study 1) and social (Study 2) well-being. Building on these findings, Study 3 utilized the same personal well-being indicators as Study 1 and incorporated an event-sampling (diary study) design, as employed in Study 2. This approach aimed to test whether the perceived quality of daily interactions mediated the relationship between ACE accuracy, bias, and personal well-being.

6.1. Method

6.1.1. Participants

One hundred and thirty-two participants (46 men) with a mean age of 26.23 ($SD = 5.08$, range 18 to 42 years) took part in the study recruited from a major state university in Germany. As compensation, participants were given small gifts (spa products, chocolates, etc.). The study is reported in Hess et al. (2016, Study 3).⁹ The well-being data reported here and their relation to ACE accuracy and bias as well as to social interaction quality have not been reported elsewhere. The sample

⁹ The study 3 by Hess et al. (2016) had a narrower focus, namely on the relation between emotion perception and social interaction quality.

Table 3
Study 2 Multilevel analyses.

	PA			NA			Othpos			Othneg			EMSUP			SSATISF			Avoid		
	Coef.	SE	t-ratio	Coef.	SE	t-ratio	Coef.	SE	t-ratio	Coef.	SE	t-ratio	Coef.	SE	t-ratio	Coef.	SE	t-ratio	Coef.	SE	t-ratio
Intcpt. ₋₁₀₀	4.261	0.04	112.002	1.767	0.031	56.038	5.61	0.044	128.042	1.677	0.031	53.190	4.905	0.057	85.476	5.199	0.055	93.683	2.454	0.059	41.453
Age ₇₁₀	-0.01	0.008	-1.736	0.012	0.007	1.726	-0.027**	0.010	-2.719	0.004	0.006	0.743	-0.023	0.012	-1.908	-0.017	0.011	-1.502	0.029*	0.014	2.050
Acc. ₇₂₀	0.156**	0.05	2.744	0.022	0.053	0.422	0.194**	0.073	2.666	-0.025	0.055	-0.453	0.296**	0.098	3.023	0.236**	0.087	2.715	-0.160	0.094	-1.696
Bias ₇₃₀	0.215*	0.082	2.605	0.249***	0.070	3.539	0.033	0.099	0.340	0.248***	0.071	3.458	0.022	0.133	0.170	-0.047	0.129	-0.370	0.463***	0.123	3.759

Note: PA = Positive affect, NA = Negative affect, EMSUP = emotional support, SSATISF = Satisfaction with support, Avoid = Avoided expressing emotion to the other, Othpos = Other expressed positive emotion, Othneg = Other expressed negative emotion, Acc. = ACE Accuracy, Bias = ACE Bias

size is sufficient to detect medium L2 effects with a power of 89.20 %, 95 % CI [87.11 %, 91.06 %] (Arend & Schäfer, 2019).

6.2. Procedure and measures

In a laboratory task, participants completed the full version of ACE-faces emotion perception task (see Hess et al., 2016). Hit rates were calculated as described for Study 1. Prior to the laboratory assessment, participants completed a standard questionnaire with various personality measures (see supplementary file). Following the laboratory task, participants received instructions for the event sampling diary task. Participants described 3,231 interactions (range from 1 to 87, median 23) using an adaptation of the Rochester Interaction Record (RIR; Nezlek, 2010) that included reports of Own Positive Affect, Own Negative Affect, Satisfaction with the Interaction, Feeling Understood, Expressed Emotions Openly, Felt Accepted, Felt Supported, Other Expressed Emotion Openly, Other Positive Emotions, Other Negative Emotions, and Other Well-meaning. Only participants with at least 1 record and no missing level 2 variables were included in the final sample which resulted in 115 participants (25 men, 90 women, $M_{age} = 25.817$, $SD = 5.098$) and 2,818 interaction records. One day after the last day of the diary task, participants completed again the same well-being indicators which were included in Study 1 and were fully debriefed. The Faces subtest of the Mayer, Salovey, Caruso EI Test (MSCEIT, Mayer et al., 2003) was also included in this study.

6.3. Open practices statement

The research was not preregistered. All data, syntaxes, and materials are openly available https://osf.io/kvj3a/?view_only=d73e05f743614797b76d18e605bf2b72.

6.4. Results

Descriptive statistics, Cronbach’s alpha, and zero-order correlations of the study variables at level 2 are presented in Table 4. ACE bias was negatively related to psychological well-being. In a series of multiple regressions, we regressed the three well-being indices on ACE accuracy and bias also entering MSCEIT faces scores. Including MSCEIT faces scores did not meaningfully alter the results presented in Table 4. In similar analyses controlling for hit rates, hit rates did not significantly predict any of the well-being indices over and above the two contextualized ERA indicators. However, controlling for hit rates strengthened the associations between ACE accuracy and bias reported in Table 4.

6.5. Multilevel structural equation modelling (MSEM) analysis

In this analysis, each individual represents a cluster (level 2 of the hierarchy) consisting of several diary entries (level 1). Using the notation proposed by Krull & MacKinnon (2001), the structure of the model

can be labeled as 2–1–2. because both the independent and dependent variables are constant within each individual. but the mediator variables vary among diary entries. More precisely, the model has a (2.2)–1–2 structure, as there are two correlated independent variables – ACE accuracy and ACE bias.

Preacher et al. (2010) showed extensive evidence that the multilevel structural equation modeling (MSEM) paradigm is adequate and the most powerful approach to investigate mediation effects in multilevel data. MSEM can effectively separate within and between subject variance and preserves statistical power while avoiding spuriously inflating power for the test. We employed this approach to test our hypothesis. As interaction quality was measured on level 1, we assume that there are two sources of the indicators’ variance: the variance stemming from the variability of everyday interactions and the variance associated with more stable psychological traits of study participants. The latter constitutes the latent mediator variable.

The analyses were performed in R (version 4.2.2, R Core Team, 2022) using lavaan package version 0.6–17 (Rosseel, 2012). Parameters were estimated using bootstrap resampling. Intraclass correlations of level 1 variables ranged from 0.22 to 0.40 (median 0.28) indicating a sufficient amount of variability between clusters.

Fig. 1 shows the structure of the model with standardized coefficients. All loadings in the Figure differ significantly from zero with the exception of the direct effects of ACE accuracy (0.13, CI95 = [-0.07, 0.33], $p = 0.194$) and ACE bias (-0.10, CI95 = [-0.31, 0.10], $p = 0.330$) on well-being. However, both indirect effects significantly differ from zero, with a positive sign for ACE accuracy (0.11, CI95 = [.02, 0.21], $p = 0.023$) and with a negative sign for ACE bias (-0.17, CI95 = [-0.28, -0.06], $p = 0.003$). In sum, the findings support the hypothesis that ERA mediates the effect of perceived interaction quality during a 10-day period on subsequently assessed well-being. Note that the observed effects have rather small to medium magnitudes. Considering both direct and indirect effects, well-being increases by 0.24 standard deviations when ACE accuracy increases by one standard deviation and -0.27 standard deviations for ACE bias. The model explains 23.9 % of the variance.

7. General discussion

Emotion Recognition Accuracy (ERA), the accurate evaluation of others’ emotional expressions and feelings is a fundamental human skill essential for the regulation of interpersonal relationships and overall social functioning. Yet, existing evidence supporting this relationship has been scarce (Lanciano & Curci, 2015; Sommer & Schlegel, 2024). We predicted that much of this failure was due to the way ERA has been assessed in these studies. We proposed that the use of a contextualized assessment of ERA, which does justice to the social nature of this task, would allow to highlight the role of ERA for well-being. For this, we used the Assessment of Contextualized Emotion (ACE), which infuses social context by including a naturalistic group setting and distinguishes

Table 4
Study 3 descriptive statistics, zero-order and partial correlations of the study variables.

	1	2	3	4	5	6	7	8	9
1 ACE accuracy	0.871								
2 ACE bias	0.377***	0.963							
3 Well-being	0.184*	-0.192*	0.872						
4 Life satisfaction	0.204*	-0.194*	0.759***	-					
5 Loneliness	-0.133	0.270**	-0.637***	-0.534***	0.793				
6 MSCEIT faces	0.145	-0.492***	0.192*	0.136	-0.210*	0.864			
7 Hit rates	0.660***	-0.688***	0.094	0.128	-0.112	0.194*	0.816		
8 Gender	-0.174*	0.183*	-0.294***	-0.367***	0.204*	-0.188*	-0.228**	-	
9 Age	-0.217**	0.039	-0.264**	-0.319***	0.244**	-0.081	-0.172*	0.267***	-
Mean	5.099	2.321	5.363	3.784	1.692	54.413	0.525	0.293	26.227
SD	0.645	0.465	0.91	0.961	0.59	10.485	0.135	0.457	5.083

Note. With bold are results from partial correlations that control of the respective other ACE accuracy index (Bias for Accuracy and the inverse). Cronbach alphas in the diagonal. Gender: 1 Male, 0 Female * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

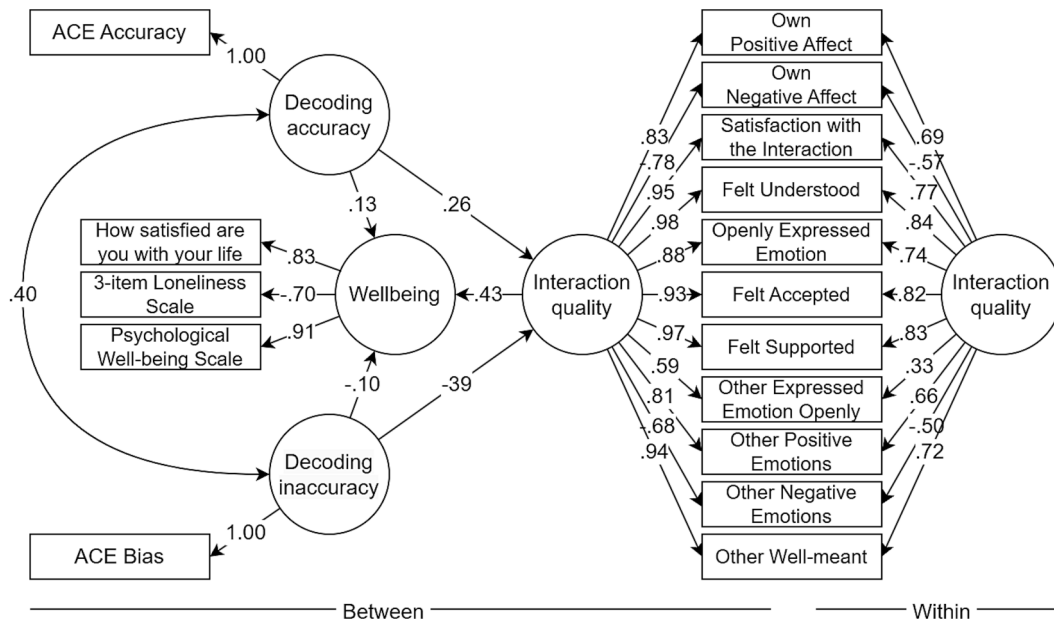


Fig. 1. Study 3 MSEM model with estimated standardized coefficients.

accuracy (the accurate assessment of the intended emotion) from bias (the perception of secondary emotions additional to the ones presented).

In three studies involving more than 2800 participants from 13 world cultures and more than 6000 social interactions in two of those cultures, we found consistent relationships between a contextualized assessment of ERA and personal and social well-being. Specifically, in Studies 1 and 3 ACE accuracy was associated with higher personal psychological well-being and life satisfaction whereas ACE bias was associated with higher loneliness. Moreover, in Study 3 ACE bias was negatively associated with psychological well-being and life satisfaction. These findings support the idea of a truth and bias model in emotion perception (West & Kenny, 2011) and pave the way for the identification of different likely processes that link ERA with well-being.

At a personal level, ACE accuracy involves agentic ways of perceiving others (Kafetsios et al., 2024; Magee & Galinsky, 2008) and this agentic nature of engaging with the social world can account for higher personal and social well-being. Conversely, bias involves more stereotypical, culturally shared, less accurate representations of the social world (Hess et al., 2016), and such biases have shown to increase loneliness (Wols et al., 2015) in line with a socio-cognitive skills theory of loneliness (Cacioppo & Hawley, 2009).

In all studies, neither a hit rates assessment of ERA as typically used in previous research nor a standard assessment of non-contextualized emotions (MSCEIT-Faces, Studies 2 & 3) were associated with social or personal well-being. We surmise that a significant factor contributing to weak or null findings on links between ERA and well-being to date has been the reliance on contextless facial information for the assessment of ERA. Hess and Kafetsios (Hess & Kafetsios, 2021; Kafetsios & Hess, 2023) have posited that the use of such materials renders the task non-social and engages different brain regions that are linked more to cognitive problem solving than a social perception task (see Antypa et al., 2024). As such, even though the use of such measures can assess one way of decoding emotions, namely through pattern matching as suggested by Buck (1984), it does not adequately capture what people do when they interact with others. In real life interactions people recruit their emotion knowledge to engage in perspective taking, allowing them to infer their interaction partners' emotional states based on a broader data base than the simple movement of facial muscles. In this vein, Antypa et al. (2024) found that using an ACE type emotion task does,

indeed, recruit brain areas associated with theory of mind, whereas the simple task of applying a label to a contextless emotion expression does not.

A second important findings of the present research is the demonstration of a link between ERA and perceived social interaction quality. Specifically, how others are approached in social interactions, the emotional rapport one has (and perceives to have) with others in social interactions, are important facets of well-being as demonstrated in Study 2 and 3. This is in line with key theoretical views on the social significance of ERA for well-being (Hall et al., 2009; Palese & Schmid Mast, 2020). Yet, to date these theoretical models have seen little empirical support. In fact, to our knowledge, the present research is the first to present such evidence. Partially replicating previous research with student samples (Hess et al., 2016) Study 2 found that the quality of everyday social interactions in a community sample in the Czech Republic was higher (lower) for participants with higher ACE accuracy (bias). Higher quality of social interactions was reflected in higher reported own positive emotion, and importantly, more positive perceptions of others' positive emotions. Results from multilevel Structural Equation Model analyses in Study 3 revealed that a large proportion of the co-variation of ACE accuracy and bias and personal well-being is due to quality of social interaction.

As such, the present findings support a long-standing assumption that higher ERA can streamline and synchronize interpersonal communication and emotional interactions among people (Feldman et al., 1991; Niedenthal & Brauer, 2012). Schmid Mast and Hall (2018) have noted a "black box" between accurate inferences about others and social interaction outcomes, with limited evidence that (and how) ERA can improve these outcomes. Results from the present studies linking ACE accuracy (bias) with positive (negative) expectations about the interactants' emotional state and well-being outcomes, provide some insight into this black box and help explain how the accurate perception of others' emotional expressions can lead to correct inferences and adaption to others' behavior in line with the Behavioral Adaptability Model (Schmid Mast & Hall, 2018).

7.1. Limitations and future directions

A number of limitations require addressing. Firstly, causal paths

between ERA and personal and social well-being cannot be drawn on the basis of the present research alone. Secondly, the data were drawn from studies originally conducted with somewhat different research questions in mind. As such, only two traditional approaches to ERA (hit rates and the MSCEIT Faces) were included, limiting generalizability to other measures. Future research could directly address this limitation. Finally, in all studies we observed small to medium effects, not uncommon in research that combines cognitive with self-report methodology (Ahadi & Diener, 1989; Podsakoff et al., 2003); in some cases, the sample power to detect small effects was limited, if considering all the parameters of the multilevel study designs (Arend & Schäfer, 2019). Nevertheless, results replicate very well across different samples, cultures and using different variants of the ACE method. Study 3 replicated study 1 findings on relationships between Accuracy and Bias and personal well-being, whereas Study 2 replicated results from Hess et al. (2016) social interaction studies taken place with student samples in a different culture and using a different variant of the ACE measure.

The results from the present research pave a first step for the use of a contextualized approach to ERA to understand its effects for social interaction outcomes. Future research could also test the differential effects of ACE accuracy and bias for synchrony at individual and dyadic level (Macpherson & Miles, 2023), attunement and rapport (Palese & Schmid Mast, 2020; Reis et al., 2017) or active listening (Itzhakov et al., 2022) and for different populations likely to vary in their levels of ERA. At a broader level, and with an eye to informing well-being, further research could also test collective effects of contextualized ERA skills for social networks outcomes (to see how ERA skills differ across different see Hypsova et al., 2024 for promising early findings). Finally, a direct implication of the present research is to further understand the personality and social constituting factors of accuracy and bias (Kafetsios & Hess, 2022) and how changes in those constituting factors can affect changes in personal and social well-being (Joshani, 2024).

8. Conclusion

Despite strong theoretical predictions for a positive association between Emotion Recognition Accuracy (ERA) and well-being, to date, empirical support for this relationship has been very limited. Results from three studies provide for the first time evidence that a contextualized assessment of ERA is a unique, consistent, and meaningful predictor of personal and social well-being. These effects were partially mediated by social interaction quality in real-life social and personal relationships. The studies advance our understanding of ERA, and open up the possibility to pose and empirically test new questions about ERA's and social perceptions or social functions.

CRedit authorship contribution statement

Konstantinos Kafetsios: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ursula Hess:** Writing – review & editing, Data curation. **Daniel Dostal:** Writing – original draft, Formal analysis, Data curation. **Martin Seitzl:** Writing – review & editing, Funding acquisition, Data curation. **Petra Hypsova:** Writing – review & editing, Project administration, Data curation. **Shlomo Hareli:** Writing – review & editing, Data curation. **Itziar Alonso-Arbiol:** Writing – review & editing, Data curation. **Astrid Schütz:** Writing – review & editing, Data curation. **Dritjon Gruda:** Writing – review & editing, Data curation. **Kelly Campbell:** Writing – review & editing, Data curation. **Bin-Bin Chen:** Writing – review & editing, Data curation. **Marco J. Held:** . **Shanmukh Kamble:** Writing – review & editing, Data curation. **Takuma Kimura:** Writing – review & editing, Data curation. **Alexander Kirchner-Häusler:** Writing – review & editing, Data curation. **Stefano Livi:** Writing – review & editing, Data curation. **Eugenia Mandal:** Data curation. **Dominika Ochnik:** Data curation. **Ezgi Sakman:** Data

curation. **Nebi Sumer:** Writing – review & editing, Data curation. **Annalisa Theodorou:** Data curation. **Ayşe K. Uskul:** Writing – review & editing, Data curation.

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.

Funding and Acknowledgements

The research was supported by Research grant 22-15238S to K. Kafetsios by the Czech Science Foundation and partly supported by a research Grant by the Hellenic General Secretariat for Research and Development by a Grant (KA10413) awarded to K. Kafetsios and the University of Crete. Also, the study was partially funded by a grant from the Basque Government to Research Groups (Consolidated Group 'Culture, Cognition, and Emotion'; IT1598-22) and by a grant from the Spanish Ministry of Science and Innovation (PID2020-115738 GB-I00). A previous version of this research was presented at ISRE 2024, Queens University Belfast.

Author Contributions

KK developed the research concept, conducted analyses in the first and second study and drafted the MS. All authors contributed to translation of materials, conceptual feedback and data collection. DD conducted the analyses presented in the third study and power analyses in all studies. All authors contributed to translation of materials, conceptual feedback and data collection. All authors approved the final version of the manuscript for submission.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jrp.2024.104556>.

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