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Implicit measures of affect for the study of daily stress

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For seekers of the underlying mechanism of the mind

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Abstract

Implicit measures are considered to be automatic (associative) rather than reflective (conceptual) and can provide additional value to explicit (i.e. self-report) measures, particularly in daily stress field. Daily stress involves challenges of day-to-day living (e.g., commuting from work, paying bills, etc.). Research shows that these stressors have strong implications for our health and psychological well-being (Almeida et al., 2009), even if these stressors tends to be ignored or pushed down in order to try being efficient in life. Thus, capturing information that is processed at a pre-reflective (i.e., implicit) level is paramount to understand the relation between daily stress and health. The present thesis contributes to this research area in three ways. First, by adapting an implicit measure of positive and negative affect (IPANAT) for Spanish population (IPANAT-SPAIN). Results from Study 1 (*N*=446, 225 males), provide evidence for the validity of the Spanish adaptation, via Confirmatory Factor Analysis (CFI = 1; TLI = 1; RMSEA = .00; SRMR = .02) and reliability (implicit positive affect, α = .94; implicit negative affect, α = .88). Second, by creating a brief version of the IPANAT (IPANAT-18), for use on daily diary designs. Results from Study 2 (*N*=242, 111 males) indicate that the psychometric properties of the IPANAT-18 are similar to the ones of the full-length measure (CFI = 1; TLI = 1; RMSEA = .00; SRMR = .03, reliability: implicit positive affect, α = .86; implicit negative affect, α = .77). Hence, the shorter measure will serve research requiring less time for administration than the original test. Third, by proposing a multilevel design of daily diaries (5 days) for deepening our understanding of implicit affect and daily stress. Specifically, Study 3 (*N*=7, 3 males) was a pilot study in a highly stress population (i.e., surgeons). This pilot study examined implicit and explicit affect, stress appraisals, fatigue, and emotion regulation. Results indicate that the IPANAT-18 is appropriate for ecological momentary assessment designs, that self-reported fatigue could represent an indirect

measure of stress, and that implicit measures of affect may provide a fruitful method to examine the daily stress phenomenon.

Keywords: implicit measures, positive and negative affect, daily stress.

Content

Papers that integrate this thesis

Hernández, G. P., Rovira, T., Quirin, M., & Edo, S. (2020). A Spanish adaptation of the implicit positive and negative affect test (IPANAT). *Psicothema*, *32*(2), 268-274. http://doi.org//10.7334/psicothema2019.297

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General introduction

Self-report measures are among the most widely used tools to assess different psychological constructs, it is also one of the most criticized (Haeffel & Howard, 2010). For example, research in cognitive and social psychology has provided evidence that self-report assessments could be affected by several bias, for example, social desirability (Morey & Lanier, 1998), repression (Derakshan et al., 2007) , or self-deception (Paulhus & Vazire, 2007). Therefore, it is important to develop measures to assess psychological constructs that do not rely solely on self-report (Bartoszek & Cervone, 2017). Several indirect measures have been developed in the last years, they intend to assess psychological constructs that individuals may not be willing to report or of which they may themselves be unaware. Such measures include projective procedures, like the Thematic Apperception Test (TAT, Murray, 1943), as well as response time paradigms used in lexical decision or pronunciation tasks. These measures are commonly referred to as implicit measures and their hallmark is that respondents are not aware of the psychological construct that is being assessed. These measures are often referred as objective, indirect or implicit measures. Since any measurement strategy entails limitations, it is made clear that different measures are needed to substantiate research findings (Haeffel & Howard, 2010).

As an attempt to overcome the limitations associated with self-report measures, health psychologists have been recently exploring the relation between psychological constructs and health behaviors. Endrighi et al. (2016) found that both self-reported and implicit cognitions were useful to identify cancer survivors at risk of failing to follow physical activity recommendations. Davies et al. (2017) showed that implicit alcohol attitudes contributes to the prediction of risky drinking. In addition, Ellis et al. (2016) found that only implicit feelings about condoms predicted condom use among participants who had gotten lost in the heat of the moment and who had low

self-efficacy, whereas, only explicit feelings predicted condom use among participants without history of getting lost in the heat of the moment and with high self-efficacy.

A system processing approach provides a rational for implicit measures. For example, according to dual-process theories behavior is influenced by two different processing systems (Banting et al., 2009). A reflective, analytic (i.e., explicit) system, and an impulsive, intuitive (i.e., implicit) system (Kahneman, 2011). Consequently, self-report measures need to be supplemented with implicit measures that can assess impulsive, automatic, or intuitive processing to properly explore the mechanisms underlaying behavior. Therefore, the use of indirect measures can be particularly useful in stress research. Mainly, because physiological or endocrine reactions related to stress are partially automatic processes (van der Ploeg, et al., 2016), that can ultimately affect the individual's health even if the person is not aware of the stress levels experienced.

Daily stress

Implicit measures can be particularly useful in research dealing with daily stress. Daily stressors involve challenges of day-to-day living, and are comprised of predictable challenges, such as taking an school exam or commuting between school and home, as well as unexpected events, such as a sudden work deadline, or if at the last minute the nanny is unable to take care of your children (Piazza et al., 2013). Research shows that the way we respond to daily stressors has strong implications for our physical health, effects of emotions that linger after a stressor occurs are associated with greater numbers of chronic conditions 10 years later (Leger, 2018). In addition, it has been found that these daily stressors pose risks to mental health (Almeida et al., 2009), even if these stressors tend to be ignored or push down. Thus, to capture the information that is processed at an implicit level (e.g., repressed or denied via self- deception) is paramount to understand adjustments to stress. For example, Bolger et al. (2000) found that often social support transactions

received were not self-reported by participants, however these "invisible" support transactions promoted adjustment to a major stressor. In addition, it has been found that unconscious prolonged stress plays an important role in stress recovery (Brosschot, 2010; Brosschot et al., 2014; van der Ploeg et al., 2016), and therefore in handling stressful situations, even if people are not aware of them. In this line, a daily stress study found that rejection of daily stress (as a coping strategy) was frequent in participants with high primary appraisal (i.e., interpretation of the stressors), low secondary appraisal (i.e., analysis of the available resources) and low neuroticism (as personality trait) (Ferrer-Rodríguez, 2019). Thus, implicit measures could provide information about internal states from which individuals are not yet fully consciously aware.

Particularly, implicit measures of the affective state can be of great help to understand the daily stress phenomena, since one of the aspects that characterize a stressed person is the inability to identify and manage emotions effectively. Daily diary designs are increasingly recommended for studying dynamic psychological processes such as emotional states (Bolger et al., 2003). In diary studies, people provide frequent reports on the events and experiences of their daily lives, therefore, some important aspects need to be considered by instruments intended to be used in daily dairy designs. In recent years, more measures have been developed based on ecological methodologies of experience catching up them up at real-time, allowing idiopathic and idiographic analysis from the intra-subject variability. Because historically, the measures in these studies were originally developed for studying between-person differences, and their sensitivity to within-person changes is usually unknown (Cranford et al., 2006). In addition, the demanding nature of diary protocols has to be considered while creating and adapting new affect measures, since it might have negative effects on compliance (Gable, et al., 2000). Due to these demands, it is critical for diary measures to be as brief as possible.

Tests for the assessment of the implicit affective phenomena within stress research

Some instruments to measure implicit affect in the stress context have been developed. For example, the Implicit Association Test Anxiety (Egloff & Schmukle, 2002), the Implicit Association Test Anger (Schnabel et al., 2006), the Affect Misattribution Procedure (AMP; Payne et al., 2005), the Emotional Facial Action Coding System (EMFACS-7, Friesen & Ekman, 1984), EmoVoice for emotion recognition from speech (Vogt et al., 2008), and the Implicit Positive and Negative Affect Test (IPANAT) (Quirin et al., 2009a). The use of these methodologies has produced findings that support the incremental validity of implicit affect measures (for an overview of research findings using the IPANAT see Quirin & Bode, 2014). Regarding the stress phenomena, implicit affect assessed by the IPANAT has been found to be a useful tool. The test aims to assess "the automatic activation of cognitive representations of affective experiences" (Quirin et al., 2009a, p. 501). Which is in line with the theory that unconscious stress plays an important role on health (Brosschot et al., 2014). Therefore, to obtain an overview of empirical evidence of the relationship between the implicit the IPANAT and stress, we conducted a review of research exploring implicit affect (assessed by the IPANAT) and automatic psychophysiological stress responses (see Weil et al., 2019). Our focus was on implicit affect and autonomous nervous system reactions, since affective processes can occur spontaneously and typically go along with an automatic activation of action tendencies and physiological responses. Results show that the IPANAT was associated with autonomous nervous system functioning (such as stress-related cardiovascular activity and cortisol secretion) beyond explicit measures. Therefore, the IPANAT represents a promising research tool that may help to broaden our knowledge of stress and health processes.

The Implicit Positive and Negative Affect Test (IPANAT)

Theoretical background

Adopting an information processing approach of affect (e.g., Schwarz & Clore, 2003), implicit affect has been conceptualized as the automatic activation of cognitive representations of affective experiences (Quirin et al., 2009a). As such, implicit affect is considered to be processed in a associative rather than reflective, conceptual format (Strack & Deutsch, 2004; Leventhal & Scherer, 1987), and the stimulation of one associative representation is considered to automatically spread and activate associated representations (Gyurak et al., 2011). Within appraisal theories, this associative mechanism is viewed as an automatic activation of learned associations between stimulus representations and previously stored appraisal outputs (Moors, 2013).

The question of whether these automatic processes are conscious or nonconscious has arisen (Moors, 2010). According to Lieberman (2019) appraisal processes are automatic, but also conscious since there are at least two types of conscious processes. That is, reflective and pre-reflective appraisals, together they constitute the basis of our conscious experience. However, pre-reflective processes share the computational features of automatic processes. Then, the affective experience would initiate as a pre-reflective process with several automatic appraisal processes giving rise to not-yet-reflected-upon experience (Weil et al., 2019).

The IPANAT´s underlying mechanism

The IPANAT relates to the pre-reflective dimension of affect, using affect priming as a method to assess implicit affect. That is, the test draws on the principle of "affect infusion", according to which affect exerts an effect on evaluative processes influencing judgments of unrelated objects. Forgas (1992) showed that judgments of ambiguous objects (such as artificial words) require a constructive cognitive process that capitalizes on currently accessible information.

The more ambiguous and the less predefined a stimulus is for an individual, the smaller amount of available knowledge related to the stimulus, giving more space for affective states to automatically influence judgments of the stimulus (Bower, 1981). Thus, the IPANAT aim is to capture the pre-reflective affective process conveyed in participants' biased judgments of artificial words. According to the creator of the test, the fact that participants are not asked to reveal their affective states, adds to the implicitness criterion of the test.

The IPANAT presents trials of pairs of an artificial (non-sense) word with an affective adjective (e.g., SUKOV – happy) and asks participants to rate how much each artificial word sounds like each of the affective adjectives on a 4-point Likert scale, ranging from *doesn't fit at all* to *fits very well*. Based on the rationale of affect priming (e.g., Bower, 1981; see also Forgas, 1995), it is considered that an affective stimulus evokes a corresponding affective response in the individual that activates semantic concepts related to this emotion in working memory (e.g., "happy" or "helpless"). Accordingly, if a specific affective state is elicited, adjectives related to this state should be more strongly activated than unrelated adjectives, and individuals should thus tend to rate artificial words higher on activated than on non-activated semantic-affective representations, thereby automatically revealing their pre-reflective affective state, that is relatively independent of what they explicitly report (see Lieberman, 2019).

The IPANAT within stress research

Results of research using the IPANAT showed that implicit affect was associated with stress-related physiological responses beyond explicit measures. For example, it was found that after participants were exposed to a stressor, just implicit negative affect (and none of the explicit measures) significantly predicted the cortisol release, an endocrine marker of chronic stress (Quirin et al., 2009b). In addition, van der Ploeg et al. (2016) found that implicit affect was related to

cardiovascular (CV) activity during and after stressful tasks, whereas none of the explicit measures were related to CV activity. In addition, a higher level of implicit negative affect was associated with a lower systolic blood pressure (BP) and diastolic BP during the induction of unconscious stress (i.e., subliminal priming), while self-reported affect and implicit positive affect were not related to CV activity (van der Ploeg et al., 2020). These results provide support to the assumption that participants with high implicit negative affect show stronger psychophysiological stress reactions.

Therefore, the IPANAT seems to represent a promising research tool to broaden our knowledge of daily stressors and health. However, as described above, the field of daily stress requires specific considerations on the instruments to be used, because of the demanding nature of diary protocols, that may have negative effects on compliance. Since several assessments are needed within daily stress research, developing short instruments to aid our understanding of this phenomena is paramount. Thus, the importance of the adaptation of the IPANAT to be effectively used within daily stress research. In sum, integrating different methodologies as implicit measures and ecological momentary assessment offers the possibility of a highly sensitive and dynamic approach to the study of emotions, stress, and health.

Goals of the thesis

The aim of this thesis are: (1) to adapt the Implicit Positive and Negative Affect Test (IPANAT) to Spanish population, (2) to create and evaluate a brief version of the IPANAT (for the valid and economical use in stress research using ecological momentary assessment); and (3) to test a study design to assess implicit measures of affect and stress within daily diary methodology. Accordingly, three studies were conducted.

Study 1: A Spanish adaptation of the implicit positive and negative affect test (IPANAT)

Introduction

Self-report or 'explicit' measures of psychological constructs can be affected by several biasing factors such as repression (Derakshan et al., 2007), social desirability (Morey & Lanier, 1998), limitations or impairments in introspection, or self-deception (Paulhus & Vazire, 2007). This challenges the validity of self-report measures, self-reported affect included (see Meier et al., 2004). Therefore, the usage of indirect measures of affect, which circumvent asking individuals about their affective states and traits, can be considered helpful. In order to fill this gap, Quirin et al. (2009a) developed the Implicit Positive and Negative Affect Test (IPANAT), which asks about the degree to which artificial words sound like positive and negative affect words. The present work describes the adaptation and validation of a Spanish version of the IPANAT.

Implicit affect can be conceived as the automatic activation of semantic representation of affective (including emotional and mood-related) states and processes (Quirin et al., 2009a). Contemporary appraisal theories define affects as processes (Moors, 2013), in which affects are adaptive responses that reflect appraisals of characteristics of the environment that are important for the survival of the organism. According to Lieberman (2019), these appraisals are composed by a pre-reflective (i.e., automatic) and a reflective (i.e., rational) process. In this so-called dual-systems approach, where an analytic ('explicit') system, and an impulsive ('implicit') system is differentiated (e.g., Kahneman, 2011; Strack & Deutsch, 2004). Therefore, implicit measures of affect are of great interest to properly understand how affect is elicited or constructed, and how affective states may relate to the development of psychological and psychosomatic disease (Weil et al., 2019), for example, when individuals struggle with experiencing and regulating affect, or during stressful situations.

The IPANAT was developed for the assessment of implicit affect, conceptualized as the automatic and pre-reflective component of the affective experience. The test has been widely used to measure implicit affect and is assumed to operate according to the principle of affect infusion (Forgas, 1995), which means that affect exerts an influence on judgments of objects (including artificial words) that show no relation to the affective experience at hand. According to the authors, the IPANAT measures the automatic activation of cognitive representations of affective experiences.

There is empirical evidence showing that the IPANAT is an important addition to explicit affect measures. For example, it was found that implicit affect predicts the cortisol response to acute stress over and above a corresponding explicit affect measure (Quirin et al, 2009a). A different study found that implicit NA showed a negative association with attachment anxiety and with affective recovery in response to an upsetting memory recall. This effect was incremental to effects of the corresponding explicit affect measures (Selcuk et al., 2012). In addition, implicit PA was associated with faster physiological stress recovery, while explicit NA had no effect on recovery (Brosschot et al., 2014). Also, it was found that IPANAT measures change after emotion induction independently of explicit measures, and that implicit PA and implicit NA was related to cardiovascular activity during and after stressful tasks (when none of the explicit measures were related to cardiovascular activity) (van der Ploeg et al., 2014). In summary, implicit affect as assessed via the IPANAT appears to strongly contribute to explain physiological and behavioral reactions, and thus finally to a more thorough understanding of affective phenomena. Developing different language versions makes this instrument broadly accessible and enables a comparison of affective phenomena between languages and cultures.

During the test, participants are instructed to provide ratings on the degree to which six artificial words (SAFME, VIKES, TUNBA, TALEP, BELNI, and SUKOV) sound like six mood adjectives (happy, cheerful, energetic, helpless, tense, and inhibited). The resulting 36 items are scored on a 4-point Likert scale ranging from *doesn't fit at all* to *fits very well*.

Scores are computed in two steps. First, scores for single mood adjectives are computed by averaging across ratings of the combination of the mood word at hand with the six artificial words. Then, scores for positive affect (PA) are calculated by averaging scores from judgments concerning the mood adjectives happy, cheerful, and energetic, whereas scores for negative affect (NA) are derived by averaging scores from judgments concerning helpless, tense, and inhibited. The IPANAT has been validated for several countries such as Germany (Quirin et al., 2009a), Austria, USA, China, Italy, Mexico, the Netherlands, Poland, Russia, Switzerland, Uzbekistan (Quirin et al., 2018), Japan (Shimoda et al., 2014), and Macedonia (Sulejmanov & Spasovski, 2017), and is currently the instrument mostly used to assess implicit affect.

Here, we explore (1) the neutrality of the IPANAT´s artificial words in the Spanish population, and (2) the construct validity of the IPANAT-SPAIN. For this end, (2a) a model on the latent structure of the test based on Quirin et al. (2009s) was investigated for the IPANAT-SPAIN using Confirmatory Factor Analysis (CFA), and (2b) correlational analysis between explicit measures of affect and the IPANAT-SPAIN were conducted.

Method

Two phases were involved in the adaptation of the IPANAT's artificial words to the Spanish population. First, participants were asked to evaluate the neutrality of the words used in the original study (conducted in German population). Second, different participants were asked to judge the neutrality of a new set of artificial words, in order to determine the more neutral words

for Spanish population. In addition, a third sample was collected to explore construct validity of Spanish version of the IPANAT.

Participants

Phase A. For the first phase of the adaptation of the IPANAT´s neutral words to the Spanish population, a group of 20 participants (12 males, M_{age} = 31.95, *SD* = 10.78) were recruited online (using social networks, i.e., Facebook) to participate in a linguistics study, participants were required to be above 18 years and residents of Spain. Participants received no compensation for their participation in the study. All participants reported being born in Spain. Sample size was similar to the one of previous studies (see Quirin et al., 2009a; Sulejmanov & Spasovski, 2017)

Phase B. For the second phase of the adaptation of the IPANAT´s neutral words to the Spanish population, a new group of 12 participants (5 males, M_{age} = 24.58, *SD* = 7.99) were recruited online (as described on phase A) to participate in the evaluation of ten new artificial words (created during the original protocol for the IPANAT, but not selected for the original test in German). Participants received no compensation for their participation in the study. All participants reported being born in a Spanish province.

Phase C. Construct validity of the Spanish version of the IPANAT was assessed on a third phase of the present research. The sample included 468 (225 males) participants. Participants' age after classification into age groups of 18–24, 25–34, 35–44, 45-54, and 55-65 was distributed as follows: 14%, 19%, 28%, 22% and 17%. The corresponding percentage for each age group in the general adult population of Spain was 11, 18, 25, 24 and 22% respectively (Instituto Nacional de Estadística, 2018). Participants were recruited online by a Spanish market research firm (CERES), they received 12 euros as a compensation for their participation. Participants were required to be above 18 years and residents of Spain. More than 92% (i.e., 432) of participants reported to be

born in Spain. Regarding the education level, the majority of participants reported to have a university degree or above (53%). Otherwise, 38% reported a high school degree, 8% reported a secondary school degree, 1% reported not to have studied.

Instruments and Procedure

Phase A. The original artificial words from the IPANAT (i.e., SAFME, VIKES, TUNBA, TALEP, BELNI and SUKOV; see Quirin et al., 2009a) were presented to the participants, they were asked to evaluate the words (by a dichotomy question) with respect to the following criteria: pleasantness, familiarity, and meaning (i.e., Do you find the word SAFME pleasant? yes/no). In addition, the criterium of associative value was evaluated by asking participants to provide a list of words associated to the stimuli.

Phase B. Once again, Spanish participants were asked to make evaluations of the words with respect of the following criteria: familiarity, pleasantness, and meaning. The familiarity criterion was evaluated by dichotomous questions, the pleasantness criterion was evaluated by a scale ranging from -4 (very unpleasant) to 4 (very pleasant), while the meaning criterion was evaluated by the number of times that participants described the possible meaning of each stimuli words.

Phase C

IPANAT-SPAIN. The Spanish version of the Implicit Positive and Negative Affect Test was used. All testing took place online via Qualtrics (Qualtrics Provo, 2013). In total, the study took approximately 10 minutes to complete. A computerized version of the IPANAT-SPAIN presented one item each per screen, after the presentation of the instruction (i.e., cover story) of the IPANAT. Then, participants were asked to provide judgments of artificial words. For each of the artificial words (*SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS*) participants indicated

on a 4-point Likert scale (1 = *doesn't fit at all*, 2 = *fits somewhat*, 3 = *fits quite well*, and 4 = *fits very well*) to what extent does the sound of the artificial word convey each of the following moods: happy, helpless, energetic, tense, cheerful, and inhibited (in Spanish: feliz, desamparado, activo, tenso, alegre, inhibido). The artificial words were randomly presented (to avoid order effects), each adjective within the same artificial word was also randomized, and the six items belonging to each artificial word were presented subsequently. Global scores for implicit positive and implicit negative affect were calculated by averaging the three adjective scores with positive valence and the three adjectives with negative valence, respectively (following Quirin et al., 2009a).

Explicit affect scales. After answering the IPANAT-SPAIN participants were presented with a series of affect questionnaires used to examine construct validity of the IPANAT. Explicit PA and NA were assessed with two instruments. First, we used the broadly applied Positive and Negative Affect Schedule (PANAS, Watson et al., 1988; Spanish version: López et al., 2015). Second, explicit affect was also assessed by asking participants for explicit mood judgments of the same mood adjectives included in the IPANAT (i.e., asking individuals to report the extent to which they felt happy, cheerful, energetic, helpless, tense, and inhibited at the moment) on a rating scale from 0 (not at all) to 10 (absolutely) (following Quirin et al., 2009a). Analogously to the original IPANAT, we composed a PA and an NA scale computing average scores for happy, cheerful, and energetic, versus helpless, tense, and inhibited, respectively.

Data analysis

Phase A. Overall scores for each of the stimuli words (on the first three criteria mentioned above) were calculated by the number of times the words were judged affirmatively to each of the dichotomous questions. Results showed that SAFME was judged to be familiar, pleasant and with a meaning 25% of the times, VIKES 40%, TUNBA 47.5%, TALEP 25%, BELNI 31% and

SUKOV 28.75%. In addition, the associative value criterion was scored by calculating the number of words listed by participants. Results showed that particularly two of the original artificial words of the IPANAT evoked more associative words among Spanish sample. Specifically, the word TUNBA was frequently associated with the Spanish word for grave/tomb (i.e., TUMBA); similarly, the word VIKES was frequently associated with BIKES, an informal English word for bicycle (which is well known in Spain). Thus, taking the results from the four criteria evaluated, the words TUNBA and VIKES were discarded from the Spanish version of the IPANAT. In addition, following the normativity for test adaptations proposed by Muñiz et al. (2013), we used expert judgments to examine the level of understanding of the Spanish translations of the six mood adjectives and the instructions of the IPANAT. Three different judges (two psychologists and one linguist) 100% agreed that the adjectives and instructions were a good adaptation.

Phase B. The neutrality of the new set of words was calculated considering the stimuli words than on average were close to 0 in the pleasantness criterion (mean scores: MALBI 1.75, BOREK -0.41, LONTA -0.75, MONUF -0.83, REMAL -0.91, FAMPO -0.89, GOLIP 0.33, KERUS 0.25, HIMAT 0.66 and PORAS -.50), and at the same time showed the lowest average scores on the familiarity and meaning criterion. Next, familiarity score was calculated by the number of affirmative responses, results showed that MALBI was found familiar 25% of the times, BOREK 16%, LONTA 25%, MONUF 16%, REMAL 66%, FAMPO 16%, GOLIP 16%, KERUS 16%, HIMAT 41% and PORAS 50%.

Meaning criterion scores were calculated by the number of times that participants were able to describe the possible meaning of the stimulus word. Results showed that only the words MALBI, BOREK and REMAL evoked a possible meaning on 16% of the participants for each of the three words. Then, from the new set of artificial words evaluated, the more neutral words for the Spanish

population were found to be GOLIP and KERUS. Therefore, the IPANAT-SPAIN uses these two words to replace the words VIKES and TUNBA from the original IPANAT.

Phase C

Basic statistical analyses were conducted using IBM SPSS Statistics 22.0. In addition, Confirmatory Factor Analysis (CFA) were performed using R 3.6 and RStudio 1.2. To evaluate the psychometric properties of the IPANAT-SPAIN, the construct and criterion-based validity were explored. Specifically, we performed a descriptive analysis of the items, CFA based on the model proposed by authors of the original test and previous findings with the IPANAT, reliability analyses of the scales (Cronbach´s alpha coefficients), and correlations with explicit measures of affect.

Confirmatory factor analysis. CFA is a confirmatory technique where the analysis is guided by hypothesized relationships among the observed and unobserved variables. In this model-driven approach, a hypothesized model to estimate a population covariance matrix is used that is compared with the covariance matrix of the sample (Schreiber et al., 2006). The goal is to have minimal differences between the two matrices. Based on the expected two factorial solution for the IPANAT (Quirin et al., 2009a) we tested two models:

-Model 1 is a parsimonious model, therefore it is an unrestricted model that allowed all of the items to load on a unique factor. Testing for the most appropriate dimensionality of the measure is important in case the data are compatible with a solution in which there is a strong and dominant factor running through all the test items (see Garrido et al., 2019).

-Model 2 hypothesizes that the IPANAT measures two factors, Implicit NA and Implicit PA. The latter model 2 tested the conception of bi-dimensionality of the test, in which 18 PA items were indicators of an implicit PA factor and that 18 NA items were indicators of the implicit NA

factor. Scores for each one of the six mood adjectives assessed (i.e., 3 for PA and 3 for NA) were computed by averaging across ratings of the combination of the mood adjective with the six artificial words, then the corresponding 3 adjectives were expected to load to its presumed factor. The model allowed each of the items to only load on the respective predicted factor. Since previous cross-cultural validations of the IPANAT found that a correlation between the two underlying factors can occur (see Quirin et al., 2018) in our study these two factors were set to be non-orthogonal, to better explore this possibility. According with Izquierdo et al. (2014), to allow the covariance of the latent factors of the model is the better way to corroborate its possible orthogonality.

Both models included error variances for each item and were set to load with a coefficient of 1. Factor loadings were estimated via an estimator of diagonally weighted least squares (DWLS), which is specifically designed for ordinal data (Cheng-Hsien, 2016). The fit of the CFA models was assessed using Chi-squared values and degrees of freedom for each model, as well as Comparative Fit Index (CFI; Bentler, 1990), the TLI (Tucker-Lewis index), the Root-Mean-Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) as an example of a commonly used absolute measure of fit (Browne & Cudeck, 1992; Jackson et al., 2009; Steiger & Lind, 1980).

Correlational analysis. Correlational analysis between the IPANAT-SPAIN and explicit affect instruments were also conducted. In line with previous research on the relationship between implicit attitudes and explicit attitudes (Hofmann et al., 2005), we expected a moderate strength of the relationships between implicit measures and explicit measures of the same affect type. In general, we expected that implicit PA to be more strongly correlated with explicit PA measures than with explicit NA measures. We also expect the opposite for implicit NA.

Results

After participants completed the test, they were asked to respond a question about the presumed underlying aim of the IPANAT-SPAIN. Twenty-two individuals suggested that the test might assess affective states and were excluded from the initial sample of 468 participants (4.70% of the sample), there were no missing data. The sample size used in the present study is adequate for the stability of the parameter estimates, since 10 participants per estimated parameter are considered adequate (Schreiber et al., 2006). In our CFA we specified 6 regressions, one covariance, and 6 variances, that is 13 parameters in total that need to be estimated. Because we have a final sample size of 446, we have an acceptable ratio of 34.3 participants to one estimated parameter. Descriptive statistics (mean scores, standard deviations, skewness, and kurtosis) can be found in Table 1. We identified that the assumption of multivariate normality was slightly violated in our sample, therefore we used the diagonally weighted least squares (DWLS) estimator, since this method provides more accurate parameter estimates (Mîndrilă, 2010). Table 1 shows that the mean scores for PA are higher than the mean score for implicit NA, the latter is consistent with previous findings on the IPANAT (Quirin et al., 2009a; Quirin et al., 2018). Additionally, Cronbach's alphas were .94 for implicit PA and .88 for implicit NA.

Table 1

Descriptive statistics of the Implicit Positive and Negative Affect Test – Spanish version

Mood adjective score	M	*SD*	SK	K
Happy (Feliz)	1.83	0.58	0.33	-0.56
Energetic (Activo)	1.88	0.63	0.27	-0.73
Cheerful (Alegre)	1.82	0.57	0.35	-0.56
IPA	**1.84**	**0.56**	**0.23**	**-0.65**
Helpless (Desamparado)	1.57	0.51	0.99	0.67
Tense (Tenso)	1.75	0.54	0.48	-0.19
Inhibited (Inhibido)	1.59	0.53	0.85	0.30
INA	**1.64**	**0.48**	**0.70**	**0.36**

Note. Mood adjective score from mean score of the 6 items belonging to each adjectives on the IPANAT-SPAIN. *N* = 446. SK = skewness, K = kurtosis.

Confirmatory Factor Analysis

As shown in Table 2, model 2 obtained a χ^2/df (CMIN) of .48, with a CFI (comparative fit index) of .99, the TLI (Tucker-Lewis index) of .99, the RMSEA (root mean square error of approximation) was .00, and the SRMS (standardized root mean square residual) was .02. According to Hu and Bentler (1999) those values indicate a good fit between the model and the observed data (see also Schreiber, 2006). Standardized parameter estimates are provided in Figure 1; unstandardized estimates are shown in Table 3.

Thus, it can be concluded that for the IPANAT-SPAIN, the model fit for the two factorial solution proposed by the developers of the original test is acceptable (see Figure 1). The two factors were found to be non-orthogonal in our sample. No post-hoc modifications were indicated from the analysis because of the good-fit indices, the residual analysis did not indicate any problems, and the modification indices did not suggest significative discrepancies between the proposed and estimated model.

Table 2

Fit Indices of Models Tested in Confirmatory Factor Analysis (N = 446)

Model	χ^2 *(df)*	χ^2 */df*	CFI	TLI	RMSEA	SRMR
1	55.87(9)	6.20	.97	.96	.11	.09
2	3.82(8)	0.47	1	1	.00	.02

Note. 1 = unrestricted one-factor parsimonious model, 2 = restricted bi-factorial model (Positive/Negative affect), not allowing for cross loadings between factors; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

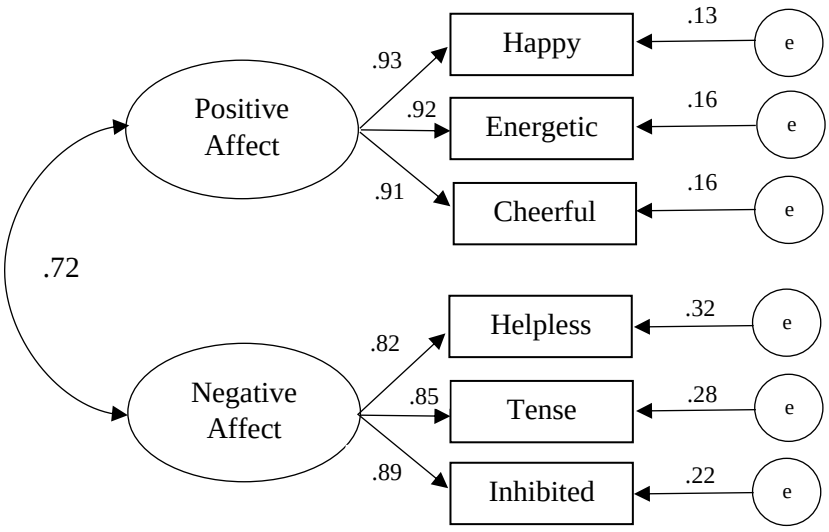
Table 3

Standardized and Unstandardized Coefficients for CFA Model 2 (N = 446)

Observed variable	Latent construct	β	*B*	*SE*
Happy (Feliz)	PA	0.93	1	
Energetic (Activo)	PA	0.92	1.06	0.06
Cheerful (Alegre)	PA	0.91	0.96	0.05
Helpless (Desamparado)	NA	0.82	1.0	
Tense (Tenso)	NA	0.85	1.09	0.07
Inhibited (Inhibido)	NA	0.89	1.11	0.07

Figure 1

Results from Confirmatory Factor Analysis (model 2) for IPANAT-SPAIN (N = 446).



Correlational Analysis

As shown in Table 4, the relationships between implicit and explicit measures of the same affect type turned out to be of moderate strength. The latter finding is consistent with results reported for the original IPANAT. Specifically, Quirin et al. (2009a) reported correlations of .20 for implicit and explicit PA and .22 for implicit and explicit NA. In addition, we also found that implicit NA was more strongly correlated with explicit NA measures than with explicit PA measures. The opposite was also found for implicit PA, with the exception of the correlation between implicit PA and the PANAS NA, however, the PANAS NA measure was more strongly correlated with implicit NA that with implicit PA.

Table 4

Pearson correlations among Implicit Affect, Explicit affect (PANAS), and Explicit scale (same adjectives than on IPANAT)

Measure	IPANAT PA	IPANAT NA
PANAS PA	**.20*****	.11**
Explicit scale PA (same adjectives)	**.18*****	.09**
PANAS NA	.28***	**.38*****
Explicit scale NA (same adjectives)	.12***	**.28*****

*Note. N = 446 **p < .05 ***p< .01*

In general, participants reported significantly higher mean levels of Implicit PA (M = 1.84, SD = .56) than Implicit NA (M = 1.64, SD = .48), t (445) = 9.93, p < .01; which suggested that on average they tended to judge the artificial words as carrying a more positive than negative connotation. The latter is consistent with previous findings with the IPANAT (see Quirin et al., 2018). This pattern was also observed in our sample by the explicit scales. We found that explicit PA assessed with the PANAS (M = 3.02, SD = .71) showed a significantly higher mean than explicit NA (M = 1.80, SD = .68), t (445) = 27.13, p < .01. In addition, explicit PA assessed with

the Scale Same Adjectives used by the IPANAT also showed a significantly higher mean of explicit PA (M = 6.13, SD = 1.84) than explicit NA (M = 2.68, SD = 1.99), t (445) = 25.55, $p < .01$.

Implicit PA and implicit NA were positively correlated, $r = .65$, $p < .01$, most of the IPANAT validations conducted in different countries reported no positive correlation between the two factors, except for the cases of China, Italy, the Netherlands, the USA, and Uzbekistan (see Quirin et al., 2018).

Discussion

The present work attempted to create and validate a Spanish version of the IPANAT, a measure for the indirect assessment of affect. Based on the results from two pre-tests, we exchanged artificial words from the original IPANAT to have a next to neutral artificial-words version for the Spanish language. We ended up using the following words: *SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS*. We explored the goodness of fit of IPANAT-SPAIN via CFA technique and found that the best fitting model supports a two-factor structure of the test, corresponding to implicit PA and implicit NA, which is in line with the factor structure found in the original IPANAT (see Quirin et al., 2009a). As mentioned in the results section, chi-square and fit indices indicated a good fit of the proposed model. In addition, the sample size used in the present study was adequate to produce relative stability of the parameter estimates. Internal consistency analyses showed a good reliability for both scales, and the CFA goodness of fit was comparable to findings from previous validations of explicit affect instruments (López, et al., 2015). Not least, convergent and discriminant validity of the IPANAT-SPAIN was supported by valence-congruent findings of correlations with explicit affect scales.

In our study, the two dimensions were found to be non-orthogonal. Moreover, a strong positive correlation between mean values of implicit PA and implicit NA was found. The latter is

consistent with previous cross-cultural studies on the IPANAT. According to Quirin et al. (2018), positive correlations between positive and negative affect could be due the fact that different cultures attribute slightly different meaning to mood adjectives, as found by for some adjectives referring to personality (Nye, et al., 2008) . For example, when validating the short form of the PANAS in the Australian sample, it was found that the item excited significantly correlated with both positive and negative affect (Mackinnon et al., 1999). This suggests that in some cultures certain mood adjectives (especially those associated with activation or arousal) may carry ambiguous meanings (see also Thompson, 2007). Additionally, previous cross-cultural studies on the IPANAT showed that correlations between positive and negative affect could often be attributed to positive correlations between mood adjectives *energetic* and *tense* (Quirin et al., 2009a). Therefore, in order to clearly assess positive and negative affect, further research should explore the use of adjectives that do not share valence or arousal levels, in order to substitute adjectives like *energetic* or *tense* for equivalent ones. Another possible explanation for the high correlation between the two factors of the IPANAT could be that in some languages the mood adjectives provide a smaller variability on the responses range. Therefore, future studies in these languages should explore this hypothesis in a sample with a strong emotional context or under emotional priming. Nonetheless, a factor structure with a positive correlation between factors might be the better model fit (see Brown, 2007), particularly if the factor loadings are strong, and the fit indices are better that the one-factor model. Therefore, the original bi-factorial structure for the IPANAT is replicated in our sample.

In addition, the relationships between implicit and explicit affect were found to be of moderate strength. The moderate correlations between implicit and explicit measures are consistent with results previously reported for the original IPANAT, as well as for other implicit measures

like the Implicit Association Test (Greenwald et al., 2003) or the Affect Misattribution Procedure (Payne et al., 2005) (see Echebarria-Echabe, 2013; Hofmann et al., 2005). Arguably, these low correlations between implicit and explicit measures can be due to different aspects, for example, motivational biases in the explicit measure, reduced introspective abilities, or even complete independence of the underlying constructs (Hofmann et al., 2005). For example, it has been found that correlations between implicit and explicit measures systematically increased as a function of increasing spontaneity of self-reports (Quirin et al., 2009a). Thus, researchers of attitudes have theorized that both: implicit and explicit measures tap into different underlying constructs.

The Associative-Propositional Evaluation model (APE, Gawronski & Bodenhausen, 2006) for example postulates the existence of two independent constructs, implicit versus explicit attitudes. While implicit attitudes are considered affective automatic reactions aroused by encounters with an object, explicit attitudes are considered conscious evaluations of the attitude's object. The fundamental mechanism that contributes to the formation and change of the attitudes is the processing of available information about the object. The proposed underlying mechanism for implicit attitudes is evaluative conditioning, seen as a change in the valence of a stimulus that is due to the pairing of that stimulus with another positive or negative stimulus (Hofmann et al., 2010). In contrast, explicit attitudes are considered to be based on syllogistic inferences about propositional information that is relevant for a judgment (Gawronski & Bodenhausen, 2006). The later could explain why the correlation between both measures increases as a function of spontaneity of the explicit measure.

In conclusion, the present research provides evidence for the validity and reliability of a Spanish adaptation of the IPANAT. Future studies that use the IPANAT-SPAIN in

complementation with indirect measures of health, attitudes, and personality traits may provide further evidence for criterion-based validity of the test.

Study 2: A Brief Version of the Implicit Positive and Negative Affect Test (IPANAT-18)

Introduction

Traditionally, psychological assessment of affective states relies on the individual's own report of their feelings. However, it has been found that people do not always identify and report emotions accurately (Quirin et al., 2009a). The latter may partly be attributed to the complexity of affective experiences, as they are comprised of different components such as situation appraisal, subjective feelings, expressive behavior, physiological responses, and action preparation (Scherer & Moors, 2019). It has been argued that these different processes occur at a pre-reflective (i.e., automatic) and a reflective (i.e., rational) level (Lieberman, 2019). Therefore, self-report methods may not fully reflect an individual's affective experience. Hence, the importance of studying implicit (i.e., automatic) affective processes.

Implicit affective processes are in line with a dual-process view of appraisal theories of affect (Clore & Ortony, 2000). According to this view, information can be processed with reflective propositions and rules (which convey one or more appraisal values) but alternatively (or additionally) be processed in an associative way (automatically activating learned associations between representations of the stimuli and previously stored appraisal outputs) (Moors, 2013). Accordingly, the affective experience would initially start with a pre-reflective process with several simultaneous automatic processes giving rise to experience that has not (yet) been reflected on. In line with this approach of affect as information processing, implicit affect is conceptualized as the automatic activation of cognitive representations of affective experiences (Quirin et al., 2009a).

Previous research has demonstrated that affective processes, even if not fully recognized, can impact human behavior (e.g., Winkielman et al., 2005), and is related to brain processes (Lane,

2008; Pessoa, 2013), and health (e.g., Quirin & Bode, 2014; Lane, 2008; Weil et al., 2019). A number of procedures have been developed for taping affective processes indirectly, such as the Implicit Association Test (IAT; Greenwald et al., 2003; see also IAT-Anxiety, Egloff, & Schmukle, 2002), the Affect Misattribution Procedure (AMP; Payne et al., 2005). However, these measures have been developed to assess individuals' attitudes (or self-concepts) rather than affect itself, which has been led to the development of the IPANAT.

The IPANAT aim is to assess a pre-reflective (i.e., automatic) dimension of affect, and draws on the principle of affect infusion as a method to assess implicit affect. According to this principle, affect exerts an impact on evaluative processes influencing the judgments of unrelated objects presented simultaneously or in proximity. Thus, the goal of the test is to capture the automatic affective process expressed in the participants' biased judgments. Accordingly, the IPANAT uses participants' ratings of the degree to which six nonsense words (i.e., SAFME, VIKES, TUNBA, TALEP, BELNI, and SUKOV) sound like six mood adjectives (i.e., happy, cheerful, energetic, helpless, tense, and inhibited). Thus, the test is composed of 36-items, which are scored on a 4-point Likert scale, ranging from doesn't fit at all to fits very well.

The IPANAT showed good psychometric properties and construct validation (Quirin et al., 2009a; Quirin et al., 2018). In addition, criterion-based validity was found by research showing relationships between implicit NA and low implicit PA with slow blood pressure recovery after harassment (Brosschot et al., 2014; van der Ploeg et al., 2014), and under unconscious stress induction (van der Ploeg et al., 2020). As well as with both stress-contingent and circadian saliva cortisol, which did not occur for explicit affect (Mossink et al., 2015; Quirin et al., 2009b). An fMRI study demonstrated that implicit (IPANAT) but not explicit negative affect predicted accuracy of recognizing briefly presented anger gestures as well as concomitant neural correlates

in the fear network of the brain (Suslow et al., 2015; see also Quirin & Lane, 2012, for the necessity of considering implicit affect in neurosciences).

Bodenschatz et al. (2018) used eye-tracking in a healthy population to demonstrate that implicit NA predicts attention towards sad faces over and above self-reported depressive symptoms. Kazén et al. (2015), found that implicit NA predicted local processing, whereas implicit PA predicted global processing in individuals with low versus high emotion regulation abilities, respectively, effects that were not found for explicit affect. Additional studies demonstrated validity of the IPANAT as an affect measure that is incremental to explicit affect (e.g., Dekker & Johnson, 2018; Quirin et al., 2011; Remmers et al., 2016). Hence, implicit affect assessed via the IPANAT appears to contribute the understanding of affective phenomena.

In addition, the IPANAT has been adapted to many languages, displaying good psychometric properties (e.g., Hernández et al., 2020b; Shimoda et al., 2014; Sulejmanov & Spasovski, 2017). Results from ten different countries showed that the best-fitting model consisted of two factors corresponding to positive affect and negative affect (on average, $\chi^2/df = 2.53$, CFI = .96, TLI = .91). Both factors showed a good reliability coefficient, on average, implicit PA, α = .81; implicit NA, α = .78 (Quirin et al., 2018).

Investigations on affect and health often require economical assessments. For example, because affective processes are fleeting after experimental affect induction (see Hermans et al, 2001), because sometimes participants respond to the IPANAT in multiple assessments (like in ecological momentary assessment studies), or simply because it is administered in conjunction with other time consuming measures. Therefore, the purpose of this study was to create and evaluate a brief version of the original test (called IPANAT-18 in the remainder of this article). A validated brief version of the test could also improve the reliability on some experimental designs

(e.g., if there is need of repeated measures of affect), as well as avoid extra burden or boredom to participants. A brief version would improve the instrument's utility without sacrificing its psychometric properties.

Method

Participants

The sample included 242 Spanish adults (111 males). Participants' age after classification into age groups of 18–24, 25–34, 35–44, 45-54, and 55-65 was distributed as follows: 18%, 18%, 26.8%, 18.9% and 18.4%. Participants were recruited online by a Spanish market research firm (CERES), they received 12 euros as compensation for their participation. The only requirement for participation was to be above 18 years. Participants first saw a full description of the experiment, which served simultaneously as the informed consent form. Participants who provided consent were then given a URL directing them to the experiment. More than 90% (i.e., 218) of participants reported to have been born in Spain. Regarding the education level, the majority of participants self-reported to have a university degree or above (52%). Otherwise, 37% reported a high school degree, and 11% reported a secondary school degree.

Materials

IPANAT. A Spanish version of the IPANAT was used (see Hernández et al., 2020b). All testing took place online via Qualtrics (Qualtrics Provo, 2013). In total, the experiment took approximately 10 minutes to complete. A computerized version of the IPANAT presented one item each per screen, after the presentation of the instruction (i.e., cover story) of the IPANAT. Then, participants were asked to provide judgments of six artificial words across six mood adjectives. For each of the artificial words (*SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS*) participants indicated on a 4-point Likert scale (1 = *doesn't fit at all*, 2 = *fits somewhat*, 3 = *fits*

quite well, and 4 = *fits very well*) to what extent does the sound of the artificial word convey each of the following moods: happy, helpless, energetic, tense, cheerful, and inhibited. Thus, the test consisted of 36-items. The artificial words were randomly presented to avoid order effects, each adjective within the same artificial word was also randomized, and the six mood adjectives belonging to each artificial word were presented subsequently. Global scores for implicit PA and implicit NA were computed by averaging the three adjective scores with positive valence and the three adjectives with negative valence, respectively (following Quirin et al., 2009a).

Explicit affect scales. After answering the IPANAT participants were presented with a series of personality and affect questionnaires used to examine construct validity of the IPANAT. Explicit PA and NA were assessed with two instruments. First, we used the broadly applied Positive and Negative Affect Schedule (PANAS, Watson et al., 1988; Spanish version: López et al., 2015). Second, explicit affect was also assessed by asking participants for explicit mood judgments of the same mood adjectives included in the IPANAT (i.e., asking individuals to report the extent to which they feel happy, cheerful, energetic, helpless, tense, and inhibited at the moment) on a rating scale from 0 (not at all) to 10 (absolutely) (following Quirin et al., 2009a). Analogously to the original IPANAT, we composed a PA and an NA scale computing average scores for happy, cheerful, and energetic, versus helpless, tense, and inhibited, respectively.

Statistical Analyses

The goal of the present study was to create and evaluate a brief version of the IPANAT. As other projective tests, the IPANAT uses judgments of artificial words to track changes on responses to ambiguous stimuli with the objective of revealing pre-reflective emotions. As detailed before, the instrument items are composed of six mood adjectives that are assessed several times, then the 36 items are in fact six truly different items asked repeatedly to capture biased responses. Thus,

for the brief version of the IPANAT it is paramount to identify the number of repetitions of the items and not which particular items are needed to keep (since they are redundant), thus a random selection of the right number of items should yield similar psychometric properties that the full test. As suggested by Taber (2018), high levels of Cronbach´s alpha indicate that items in a scale elicit the same pattern of responses (which implies they are redundant), even though a higher number of items in a scale improve the reliability, additional items measuring the same thing as the existing items leads to redundancy that is inefficient, because almost no additional useful information is obtained, nonetheless the instrument takes longer to administer.

Since we aimed to improve the usefulness (and not the structure) of the test, in our study reliability analysis for different number of items were tested via Cronbach´s alpha coefficient, to determine the best ratio between the length of the test and good internal consistency. This item reduction analysis based on classical test theory was found to be a reliable item reduction method (Erhart et al., 2010) in comparison with other methods like Rasch item-fit analysis. As suggested by Erhart et al. (2010), our study accompanied this item reduction method by additional analysis (i.e., confirmatory factor analysis) to corroborate the psychometric properties of the instrument. Once Cronbach´s alpha coefficient provided a notion of the least number of items required to keep the psychometric properties of the original IPANAT, item reductive procedure consisted of a random selection of the words used as stimuli in the IPANAT. Then, the newly stablished set of items were extracted for the original 36-items. Then, the descriptive statistics, reliability coefficient, and latent structure of the full IPANAT were compared with the brief version.

As mentioned above, the latent structure of the IPANAT-18 was evaluated using Confirmatory Factor Analysis (CFA). The CFA model tested was based on the model proposed by authors of the original test and previous findings with the IPANAT, (see Quirin et al., 2018). The

CFA model expressed the hypothesis that the IPANAT measures two factors, implicit NA and implicit PA. Scores for each one of the six mood adjectives assessed (i.e., 3 for PA and 3 for NA) were calculated by averaging across ratings of the combination of the mood adjective and the three artificial words, then the corresponding 3 adjectives were expected to load to its presumed factor. It was a restricted model, which allowed each of the items to load on the respective predicted factor only. Finally, based on previous findings and on procedures followed for the IPANAT, a correlation between the two underlying factors could occur (see Quirin et al., 2018). Thus, in our study the two factors were set to be non-orthogonal, to better explore this possibility. According to Izquierdo et al. (2014), to allow the covariance of the latent factors of the model is the better way to corroborate its possible orthogonality.

The CFA models included error variances for each item and were set to load with a coefficient of 1. We estimated factor loadings via diagonally weighted least squares (DWLS) estimator, which has specifically been designed for ordinal data (Cheng-Hsien, 2016). We used Chi-squared values and degrees of freedom for each model to assess the fit of the CFA models. As well as Comparative Fit Index (CFI; Bentler, 1990), the TLI (Tucker-Lewis index), the Root-Mean-Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), as they are commonly recommended to assess absolute measures of fit (Browne & Cudeck, 1992; Jackson et al., 2009; Steiger & Lind, 1980). Following guidelines for Hopper et al. (2008), the present study used the next thresholds for determining model fit: Chi-squared (CMIN/df) less than 3, CFI $\geq$0.95, TLI $\geq$0.95 , RMSEA$\leq$0.05 and SRMR $\leq$0.08.

Finally, we used correlational analysis and Z-test to determine the relationships between the brief and the full version of the IPANAT, and with explicit measures of affect. Basic statistical

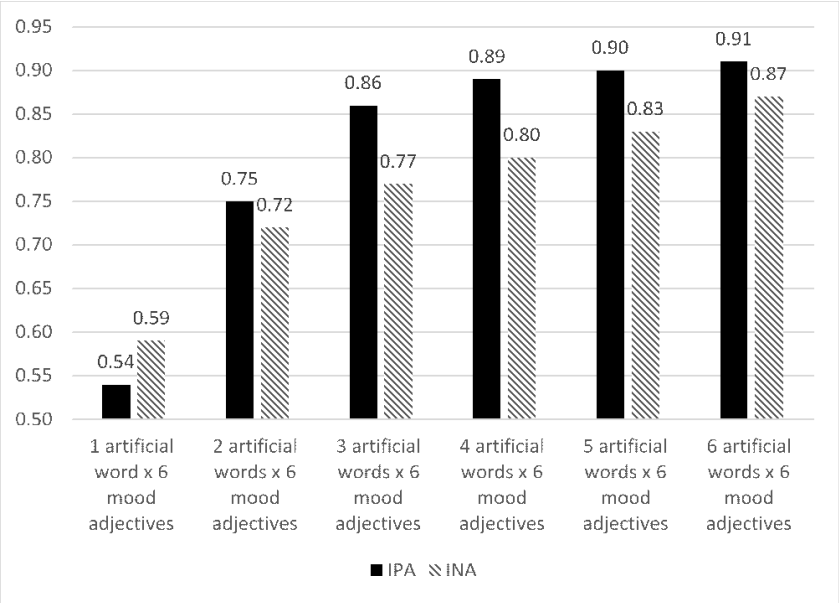
analyses were conducted using IBM SPSS Statistics 22.0. In addition, Confirmatory Factor Analysis (CFA) were performed using R 3.6 and RStudio 1.2.

Results

An analysis of the internal consistency of the IPANAT´S scales, while performing item´s reduction (see Figure 1), determined that the best ratio between number of items and an acceptable level of alpha coefficient were three artificial words (i.e., 18 items). Since the alpha coefficients for 18 items corresponded to the least number of items with similar reliability coefficient to the ones reported for the different versions of the full IPANAT (see Quirin et al., 2018). Therefore, for the IPANAT-18 three artificial words were randomly selected (i.e., SAFME, TALEP and BELNI) from the stimuli words used in the IPANAT-S.

Figure 1

Reliability of IPANAT´s scales shown by items reduction



After having completed the test, participants responded to a question about the presumed underlying aim of the IPANAT. Twelve individuals suggested that the test might assess affective states and were excluded from the initial sample of 242 participants (4.95% of the sample). Descriptive statistics (mean scores, standard deviations, skewness, and kurtosis) for the brief and the full version of the IPANAT can be found in Table 1. There were no missing data. After evaluating the assumptions of multivariate normality and linearity, we identified that the assumption of multivariate normality was slightly violated in our sample. Therefore, we used the diagonally weighted least squares (DWLS) estimator, since this method provides more accurate parameter estimates (Mîndrilă, 2010). Regarding sample size, it was determined that the size we used in the present study is adequate for the stability of the parameter estimates, since 10 participants per estimated parameter appears to be the general consensus (see Schreiber et al., 2006). In the CFA model we specify 6 regressions, 1 covariance, and 6 variances, totalling 13 parameters that need to be estimated. Since we have a final sample size of 230, we have an acceptable ratio of 17.69 participants to 1 parameter estimated.

As Table 1 shows, the mean scores for PA are higher than the mean score for implicit NA. The latter is consistent with previous findings with the IPANAT (Quirin et al., 2018). Table 1 also shows that the internal consistency estimates for the IPANAT-18 scales reached an acceptable level, implicit PA obtained an alpha coefficient of .86, while implicit NA was .77. Moreover, the alpha coefficients are comparable to the ones reported by the original version of the test (Quirin et al., 2009a).

Table 1

Descriptive statistics and reliability coefficient of the brief and full version of the Implicit Positive and Negative Affect Test

	M	*SD*	*SK*	*K*	*α*
Implicit PA (Full version)	1.82	0.58	0.20	-0.89	0.91
Implicit NA (Full version)	1.59	0.44	0.60	-0.41	0.87
Implicit PA (IPANAT-18)	1.82	0.61	0.19	-1.00	0.86
Implicit NA (IPANAT-18)	1.57	0.46	0.78	0.42	0.77

Note. *N* = 230. SK = skewness, K = kurtosis.

Factor Analysis

The model tested for the brief version of the IPANAT-18 obtained a χ^2 of 3.93, 8 degrees of freedom, a χ^2/df (CMIN) of 0.49, with a CFI of 1, the TLI was also 1, the RMSEA was 0.00, while the SRMR was 0.02. According to Hu and Bentler (1999), those values indicate a good fit between the model and the observed data (see also Schreiber et al., 2006). Table 2 depicts the χ^2 and fit indices of the full and brief version of the test, and Table 3 depicts standardized and unstandardized coefficients of the CFA Models. Along with Figure 2, the results suggest an acceptable model fit for a two-factorial solution of the IPANAT-18. Moreover, the fit indices obtained by the brief version (18-items) are slightly lower, yet comparable to fit indices found for the full version on this sample, and to the ones reported for ten different versions of the full test (see Quirin et al., 2018).

Table 2

Fit Indices of Models Tested in Confirmatory Factor Analysis (N = 230)

Model	χ^2 *(df)*	χ^2 */df*	CFI	TLI	RMSEA	SRMR
1. IPANAT	3.23(8)	0.40	1	1	0.00	0.02
2. IPANAT-18	3.93(8)	0.49	1	1	0.00	0.03

Note. 1 = Full-IPANAT (36 items), restricted bi-factorial model (Implicit Positive/Negative affect), not allowing for cross loadings between factors; 2 = IPANAT-18 (18 items), same structure than model 1; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Figure 2

Results from Confirmatory Factor Analysis (model 2) for IPANAT-18i (N = 230)

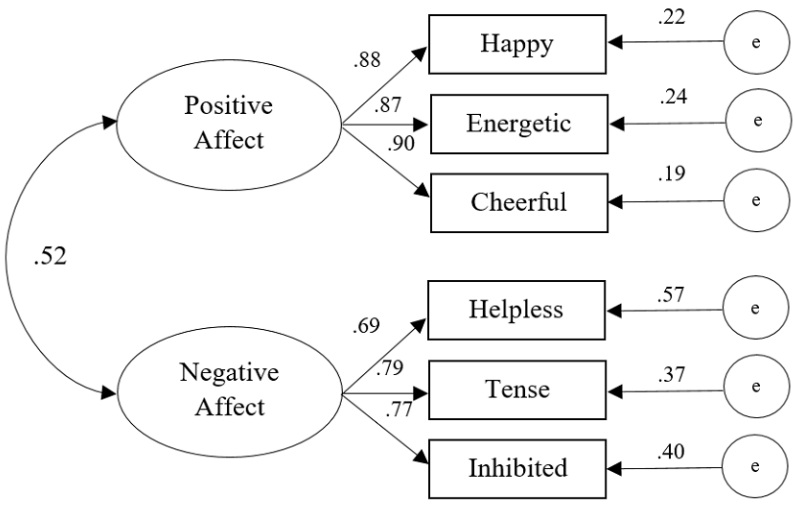


Table 3

Standardized and Unstandardized Coefficients for CFA Model 1(IPANAT) and Model 2(IPANAT-18) (N = 230)

		IPANAT			IPANAT-18		
Observed variable	Latent construct	β	*B*	*SE*	β	*B*	*SE*
Happy (Feliz)	PA	0.94	1.00		0.88	1.00	
Energetic (Activo)	PA	0.92	1.03	0.07	0.87	0.94	0.08
Cheerful (Alegre)	PA	0.89	0.97	0.07	0.90	0.99	0.09
Helpless (Desamparado)	NA	0.75	1.00		0.68	1.00	
Tense (Tenso)	NA	0.83	1.23	0.11	0.79	1.24	0.16
Inhibited (Inhibido)	NA	0.85	1.26	0.11	0.77	1.22	0.16

Relationships between scales of the brief and full versions of the IPANAT

The differences between the mean scores of implicit affect assessed with 18 items or 36 items were statistically non-significant. For example, differences for implicit PA brief and full version was $t(229) = -.35$, $p > .05$, and for implicit NA $t(229) = 1.22$, $p > .05$. In addition, implicit affect mean scores assessed with the 18-items and 36-items versions showed strong correlations (PA, r = .92; NA, r = .88).

Relationships between IPANAT-18 and explicit scales of affect

As shown in Table 4, the correlations between the IPANAT-18 and explicit affect measures are of moderate strength. In addition, Z-tests were run to compare the correlations between implicit and explicit scales of affect. For implicit negative affect, the results show that the correlation with explicit negative affect (assessed by PANAS) is significantly higher than the correlation with explicit positive affect, $z = 2.441$, $p < .01$. Inversely, it was found that implicit positive affect (assessed by Same Adjectives Scale), was more strongly correlated to explicit positive affect than to explicit negative affect.

Table 4

Pearson correlations among Implicit Affect (IPANAT-18), Explicit affect (PANAS), and Explicit scale (Same Adjectives than on IPANAT)

Measure	IPANAT-18 Implicit PA	IPANAT-18 Implicit NA
PANAS PA	**0.15***	0.07 *ns*
Explicit scale PA (Same Adjectives)	**0.26****	0.08 *ns*
PANAS NA	0.15*	**0.29****
Explicit scale NA (Same Adjectives)	-0.05 *ns*	**0.15*****

*Note. N =230 **p < .05 ***p< .01 ns = non-significant*

Different versions of the IPANAT-18

Statistical analysis were also performed on the non-selected stimuli words of the IPANAT (i.e., SUKOV, GOLIP and KERUS). Results indicated that this set of three artificial words also showed good psychometric properties. The fit indices of the CFA model of this brief version were CMIN 0.52, CFI 0.99, TLI 0.99, RMSEA 0.01, and SRMR 0.04.

Discussion

The present study aimed to create and validate a brief version of the IPANAT, a measure for the indirect assessment of affect. Based on the results from the items reduction procedure, three

artificial words (i.e., SAFME, TALEP and BELNI) were randomly selected from the six stimuli words used in the IPANAT. Therefore, the brief version of the IPANAT is composed of 18 items. We explored the goodness of fit of IPANAT-18 via CFA technique and found that the best fitting model supports a two-factor structure of the test, corresponding to implicit PA and implicit NA, which is in line with the factor structure found in the original IPANAT (see Quirin et al., 2009a). As mentioned in the results section, chi-square and fit indices indicated a good fit of the proposed model. In addition, the sample size used in the present study was adequate to produce relative stability of the parameter estimates. Internal consistency analyses showed a good reliability for both scales, and the CFA goodness of fit was comparable to findings from previous validations of explicit affect instruments (López et al., 2015).

In our study, PA and NA dimensions were non-orthogonal, as reflected in a positive correlation between mean values of implicit PA and implicit NA. This is consistent with previous findings from cross-cultural studies with the IPANAT (see Hernández et al., 2020b; Quirin et al., 2018). The authors argued that positive correlations between positive and negative affect could be due the fact that different cultures attribute slightly different meaning to mood adjectives. The latter is also consistent with findings of adjectives referring to personality (Nye et al., 2008). In concordance, previous cross-cultural studies with the IPANAT showed that high correlations between positive and negative affect was mostly due to a positive correlation between the mood adjectives *energetic* and *tense* (Quirin et al., 2018). In addition, it has been argued that in some languages the mood adjectives provide a smaller variability on the responses range. Therefore, future studies exploring this hypothesis should use a sample with a strong emotional context or under emotional priming. Nonetheless, according to Brown (2006), a factor structure with a positive correlation between factors might be the better model fit, particularly if the factor loadings

are strong, and the fit indices are better that the one-factor model, as previously found in the IPANAT´s CFAs (see Hernández et al., 2020b).

Not least, convergent and discriminant validity of the IPANAT-18 was supported by valence-congruent findings of correlations with explicit affect scales. For example, results showed that correlations between the IPANAT-18 and explicit affect measures are significant and of moderate strength. These moderate correlations are consistent with results reported for the original IPANAT, since Quirin et al. (2009a) reported significant correlations of .20 for implicit and explicit PA and .22 for implicit and explicit NA. The moderate correlations between implicit and explicit measures is consistent with results previously reported for the original IPANAT, as well as for other implicit measures like: the Implicit Association Test (Greenwald et al., 2003), or the Affect Misattribution Procedure (Payne et al., 2005) (See Echebarria-Echabe, 2013). According to some authors, these low correlations between implicit and explicit measures can be due to different aspects, as motivational biases in the explicit measure, lack of introspective access of the participants, or even complete independence of the underlying constructs (Hofmann et al., 2005). In addition, evidence of discriminant validity of the IPANAT-18 can be obtain for our results, since Z-tests showed that implicit NA was more strongly correlated with explicit NA measures than with explicit PA measures, the opposite was found for implicit PA.

Finally, a different set of the artificial words (i.e., SUKOV, GOLIP and KERUS) can be used as a different version of the IPANAT-18. Since results showed that the random selection of items (i.e., three artificial words by 6 mood adjectives) yield similar psychometric properties than the full test. The latter is useful for researchers of the affective phenomena, particularly in experimental settings were repeated measures of the test are needed, since having different version of the test could reduce anchoring effects on participant’s responses.

In conclusion, the present study suggests that the psychometric properties of the IPANAT-18 version are almost as good as those of the full-length measure. Hence, it appears that the shorter measure will serve research requiring less time for administration than the original test. The latter is especially important for research where affective processes are experimentally induced, since it has been determined that the induced affect is often fleeting (Hermans et al., 2001), so a brief version is useful to tap the processes. Likewise, research using repeated assessment, as daily-diaries studies, can also benefit by an economical multiple assessment, since a shorter version of instruments will help not to frustrate participants.

Non-essential part of the thesis

Study 3: Testing a study design for the assessment of implicit and explicit measures of affect and stress within daily diary methodology

Introduction

Daily stressors consist in everyday challenges, such as taking care of your responsibilities at home or at work. It has been found that daily stressors influence physical and mental health when measured at the daily level (DeLongis, et al., 1988). Exploring implicit measures of affect may provide a new method to examine the relationship between stress and health (van der Ploeg et al., 2020). Since automatic (i.e., implicit) processing of stress-related stimuli can influence health, for example by causing repetitive increases in physiological parameters, such as blood pressure. In fact, research shows that implicit affect is related to stress-related physiological markers more and above explicit affect, examples include circadian saliva cortisol (Mossink et al., 2015; Quirin et al., 2009b), and slow blood pressure recovery after harassment (Brosschot et al., 2014). Therefore, implicit measures can be used to better understand how the appraisal of the situation and affective processes are on the basis of adjustment to daily stressors. For example, it has been found that increases in negative affect and decreases in positive affect on days stressors occur are related to poorer mental and physical health years later (Leger et al., 2016). In addition, to examine implicit (i.e., automatic) affect within the Transactional Model of Stress and Coping can be advantageous, since one of the aspects that characterize a stressed person is the inability to identify and manage emotions effectively. According to this view, the appraisal of a situation rather than the situation itself determines the degree of its stressfulness (Lazarus, 1990).

Evidence for the important role of implicit affect in stress physiology has been found in experimental settings (e.g., Brosschot et al., 2014; Mossink et al., 2015; Quirin et al., 2009b). However, there is a lack of knowledge about how implicit affect works on an ecological context. In addition, some research with implicit measures of affect and stress were unable to corroborate

the hypothesis due to the selection of the stress task and its degree of effectiveness for the experiment (e.g., Quirin et al., 2009b, Schmukle & Egloff, 2004; Verkuil et al., 2014). According to Gunnar et al., (2009). For example, Sato and Kawahara (2012) explicitly stated the importance of choosing the adequate stress task for the study goals, they found that participants with high implicit anxiety after the stressor had an overall enhanced heart rate and larger stressor-induced decreases in heart rate variability. Therefore, conducting field research in a population that is widely known to be under a lot of stress is a good way to better understand the interaction among variables relevant for the study of stress, since the stress is in fact present.

In addition, some empirical evidence suggests that implicit constructs (e.g., attitudes or affect) as automatic processes are not fully reflecting its explicit counterparts (Hofmann et al., 2005). Therefore, we consider important to assess the relationship among direct and indirect measures of stress and affectivity. On this line, fatigue could account for an indirect measure of stress. As stress and fatigue are considerate to be different facets of the same adaptive process, because fatigue can be understood as changes follow by a sustained attempt to maintain task goals under threat from environmental stressors (Hockey, 2013). Examining the interactions of implicit and explicit affect and fatigue can provide further knowledge of the daily stress process. For example, a daily diary study conducted in health professionals found that mood and fatigue do not depend on a single factor, such as workload, but rather on distribution of tasks, as well as on the stress during a shift and how it is handled (Martínez-Zaragoza et al., 2020).

Therefore, taking into consideration the arguments of the present introduction. A methodological design to explore implicit affect and daily stress should have the following characteristics. (A) To explore the differential role of explicit and implicit measures of affect (e.g., via the PANAS and the IPANAT) on daily stress appraisals (e.g., via the Daily Inventory of

Stressful Events, Almeida et al., 2002), as well as the influence of emotion regulation (e.g., via the Difficulties in Emotion Regulation Scale, Guzmán-González et al., 2014) on stress adjustment. (B) To be a longitudinal field research, with at least 5 days of sampling to properly conduct multilevel analysis (see Ferrer-Rodríguez, 2019). (C) Participants should represent a well-known highly stressed population, to better observed possible relationship among the variables. (D) To examine explicit stress (via self-report of stressors) and implicit stress (e.g., via the assessment of fatigue), to better determine the interactions among the different aspects of the stress phenomena.

The present study examines the applicability and usefulness of a methodological design as described above. For that end, we conducted the present study on a population with high levels of stress. Thus, the aim of the present research is to test a study design to assess implicit measures of affect and stress within daily diary methodology. Specifically, our goal is to evaluate its pertinence and to make modifications for its application on a larger sample.

Method

Here we describe in detail the methodology used for a pilot study conducted to evaluate feasibility, adverse events, as well as to improve upon the study design prior to performance of a full-scale study. The study was planned to have an initial stage (i.e., baseline questionnaires) followed by 5 consecutive days of sampling.

Participants

The sample included 7 surgeons (3 males) working at the hospital "Centro Médico Nacional 20 de Noviembre", in Mexico city. Participants' age was on average 30.57 years. Participants were recruited in the hospital (by the administrative personal that was collaborating with the present research), they received no compensation for their participation. The only requirement for participation was job description (i.e., working as surgeons). Participants first saw a full description

of the experiment, which served simultaneously as the informed consent form. Participants who provided consent were then re-directed to the experiment (baseline stage). All participants reported to have been born in Mexico.

Materials

Baseline Stage

Participants were asked to complete the Perceived Stress Scale (PSS), followed by the Difficulties in Emotion Regulation Scale (DERS-E), and finally they completed a short demographics questionnaire.

Perceived Stress Scale (PSS, Remor, 2006). The PSS is a self-report instrument to assess the level of perceived stress during the last month. It is a measure of the degree to which situations in one's life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale is composed of 14 items in a 5-point Likert scale ranging from *never* to *very often*. Total score is calculated to determine the stress category (i.e., low stress, moderate stress and high perceived stress). Internal consistency of the Spanish version of the scale is .81 (Cronbach alpha coefficient).

The Difficulties in Emotion Regulation Scale Spanish version (DERS-E, Guzmán-González et al., 2014). The Difficulties in Emotion Regulation Scale is an instrument designed to assess emotional dysregulation. It is a self-report instrument that measures difficulties in emotion regulation in adults. The scale consists of 28 items in a 5-point Likert scale ranging from *never* to *very often*. Average scores are calculated for each of the 5 factors of the scale (i.e., emotional rejection, emotional interference, emotional lack of attention, loss of control and emotional confusion). Internal consistency (i.e., Cronbach alpha coefficient) for each of the factors were .89, .89, .74, .88 and .71, respectively.

Demographics. Sociodemographic variables included age, gender, education, medical specialization, and working hours per day.

Daily diary Stage

Participants completed the first daily diary on the same day as the baseline questionnaire. An interval-contingent method was employed, so participants were asked to complete the diary after 6 p.m. of each day for 5 consecutive days. Participants were asked to respond to the following instruments.

The Implicit Positive and Negative Affect Test brief version (IPANAT-18, Hernández et al., 2020a). The IPANAT is based on the principle of affect infusion. This principle indicates that affect exerts an influence on evaluative processes, which affects judgments of unrelated objects (see Quirin et al., 2009a). Thus, in the test, participants are instructed to provide ratings concerning the degree to which three artificial words (e.g., SAFME, VIKES), sound like six mood adjectives (i.e., happy, cheerful, energetic, helpless, tense, and inhibited). The 18 items are scored on a 4-point Likert scale ranging from *doesn't fit at all* to *fits very well*. Scores are computed in two steps. First, scores for single mood adjectives are computed by averaging across ratings of the combination of the mood word at hand with the six artificial words. Then, scores for positive affect (PA) are calculated by averaging scores from judgments concerning the mood adjectives happy, cheerful, and energetic, whereas scores for negative affect (NA) are derived by averaging scores from judgments concerning helpless, tense, and inhibited. Reliability of the scale is α = .86 for implicit positive affect, and α = .77 for implicit negative affect.

The Positive and Negative Affect Schedule (PANAS, Spanish version: López et al., 2015). To assess explicit affect, we will use the broadly applied PANAS. The test consists of two 10-item mood scales that comprise the Positive and Negative Affect schedule. The instrument uses

a 5-point Likert scale ranging from *nothing* to *very much*. Total score is calculated for positive affect (PA) by averaging scores from judgments concerning the positive mood adjectives, whereas scores for negative affect (NA) are derived by averaging scores from negative mood adjectives. Cronbach´s alpha for the scale is .92 for positive affect subscale, and .88 for negative affect subscale.

One Item Fatigue Screen (OIFS, Temel et al., 2006). The one item fatigue assessment consists in asking participants to rate their level of fatigue at the moment on a 10-point Likert scale varying from (1) *no fatigue* to (10) *worst possible fatigue*. The scale shows good test-retest reliability ($r = 0.88$), and was highly correlated with the Fatigue Symptom Inventory severity scale ($r = 0.87$).

The Daily Inventory of Stressful Events (DISE, Almeida et al., 2002). The DISE asks participants about the occurrence of seven different types of daily stressors within various life domains and captures a variety of interpersonal stressors, work stressors, and network stressors (see Almeida et al., 2002 for a detailed description of the DISE). This measure comprised seven stem questions that asked if the following stressors had occurred in the last 24 hr (e.g., an argument with someone; almost having an argument, etc.). Primary appraisals of the stressing situation reported by participants is also be assess by the DISE.

Primary appraisal: Stressor-severity. The DISE integrates a question to assess stressor severity (i.e., by asking participants: How stressful was this for you – on a 7-point scale ranging from *not at all* to *very much*).

Primary appraisal: Stressor-influence. The DISE integrates seven questions to assess stressor influence (i.e., by asking participants: How much do they feel at risk on the seven interpersonal areas – ranging from *not at all* to *a lot*).

Secondary appraisal: Stressor-control. To assess stressor control, participants were asked how much control they had over each stressor on a 4-point scale ranging from *no control at all* to *a lot of control* (following Leger, 2016).

Procedure

All testing took place online via Qualtrics (Qualtrics, Provo, UT). Qualtrics is web-based and was used to present the experimental instructions, administer the measures, and collect the data. The platform allows to take the survey on a desktop computer or in your cell phone, which is important for the ecological momentary assessment of participants that work long hours. The first task that participants completed was the baseline questionnaire. Then, participants were asked to complete the daily diary during 5 consecutive days. Participants received the on-line link every day at 6 p.m., and they were allowed to complete their daily diaries until 2 a.m. of the following day. Since the IPANAT requires that the goal of the test remain unknown to participants, a cover story was added at the beginning of every day register (i.e., To start today´s register, let's make a small mental exercise to help you take perspective from the rush of the day. For this exercise, please try to evaluate the perception of the sounds of the following words). To test the effectivity of the cover story, participants were asked about the presumed underlying aim of the IPANAT on day 1 and 5 of the registries. Once the IPANAT is completed, the instruction to begin with the study will be given, followed by the other instruments of the daily dairy.

Data analysis

First, means scores of the scales administered at baseline were calculated to determine levels of perceived stress and difficulties in emotion regulation. Then, descriptive statistics and multilevel graphs were performed for the variables *implicit and explicit affect, fatigue* and *stressor severity*. The latter to evaluate if data collected in 5 consecutive days will display inter and intra

subject variability. Next, visual examination of the relationship of *implicit* and *explicit affect* measures was performed using spaghetti plots, to better explore multilevel data (see Bolger & Laurenceau, 2013). Also, daily scores of indirect (i.e., *fatigue*) and direct (i.e., *stressor severity*) stress measures were examined using spaghetti plots. Finally, the daily stressors reported by participants will be described.

Results

Results from this pilot study are presented to evaluate the feasibility of the proposed methodology, as well as the quality of the data collection to be apply on in a larger sample. The seven participants completed the baseline stage, not all participants completed the 5 days register: two of them completed the 5 days, two more completed 4 days and three completed 3 days (making a total of 27 registers). Table 1 shows the mean scores of the scales administered at baseline, the Perceived Stress Scale (PSS) and the Difficulties with Emotion Regulation (DER-S).

Table 1

Mean scores of baseline scales PSS and DERS-E for participant.

	PSS	*DERS-E*				
		Emotional rejection	*Emotional loss of control*	*Emotional interference*	*Emotional lack of attention*	*Emotional confusion*
Participant 1	39	3.62	3.26	3.31	3.00	3.00
Participant 2	30	1.46	1.74	1.23	3.00	2.80
Participant 3	36	1.38	1.87	1.38	3.22	2.80
Participant 4	38	1.77	2.09	1.77	3.11	2.80
Participant 5	33	1.08	1.57	1.08	3.11	2.60
Participant 6	33	1.08	1.52	1.00	2.89	2.20
Participant 7	48	4.00	3.13	3.46	2.22	2.00

Note. PSS maximum score of 70 correspond to highest level of perceived stress. DERS-E scores range from 1 *never* to 5 *very often*.

Table 2 shows the descriptive statistics for *implicit* and *explicit affect*, *fatigue*, and stress*or severity*. A visual inspection of multilevel graphs shows that the data collected for the present study displays data variability. For example, Figure 1 shows the *implicit and explicit affect* daily reported by participants, there we can observe within subject variation and between subject variation of the measure. The same can be observed for *fatigue* (Figure 2), and *stressor severity* (Figure 3). However, affect measures were more stable, since they displayed less variability among them, while other variables such as *fatigue* and *stressor severity* showed more variation, this can be also corroborated by the standard deviations of the variables shown in Table 2. Thus, we can observe similar patters between *implicit* and *explicit affect*, as well between *positive* and *negative affect* (assessed by the IPANAT and the PANAS).

Table 2

Descriptive statistics of implicit and explicit affect, fatigue, and stressor severity

	Scale Range	*N*	*Scale Range*	*Min*	*Max*	*M*	*SD*
Implicit NA (IPANAT-18)	1-4	27	1-4	1.00	2.35	1.57	.43
Implicit PA (IPANAT-18)	1-4	27	1-4	1.00	2.25	1.56	.40
Explicit NA (PANAS)	1-5	27	1-5	1.00	2.94	2.07	.50
Explicit PA (PANAS)	1-5	27	1-5	1.00	3.10	2.17	.56
Fatigue	1-10	27	1-10	1.00	9.00	5.22	2.57
Stressor severity	0-6	27	0-6	2.04	0.00	5.00	1.45

Figure 1

Multilevel graphs of implicit negative affect (top left), implicit positive affect (top right), explicit negative affect (bottom left), and explicit positive affect (bottom right) per day and participant.

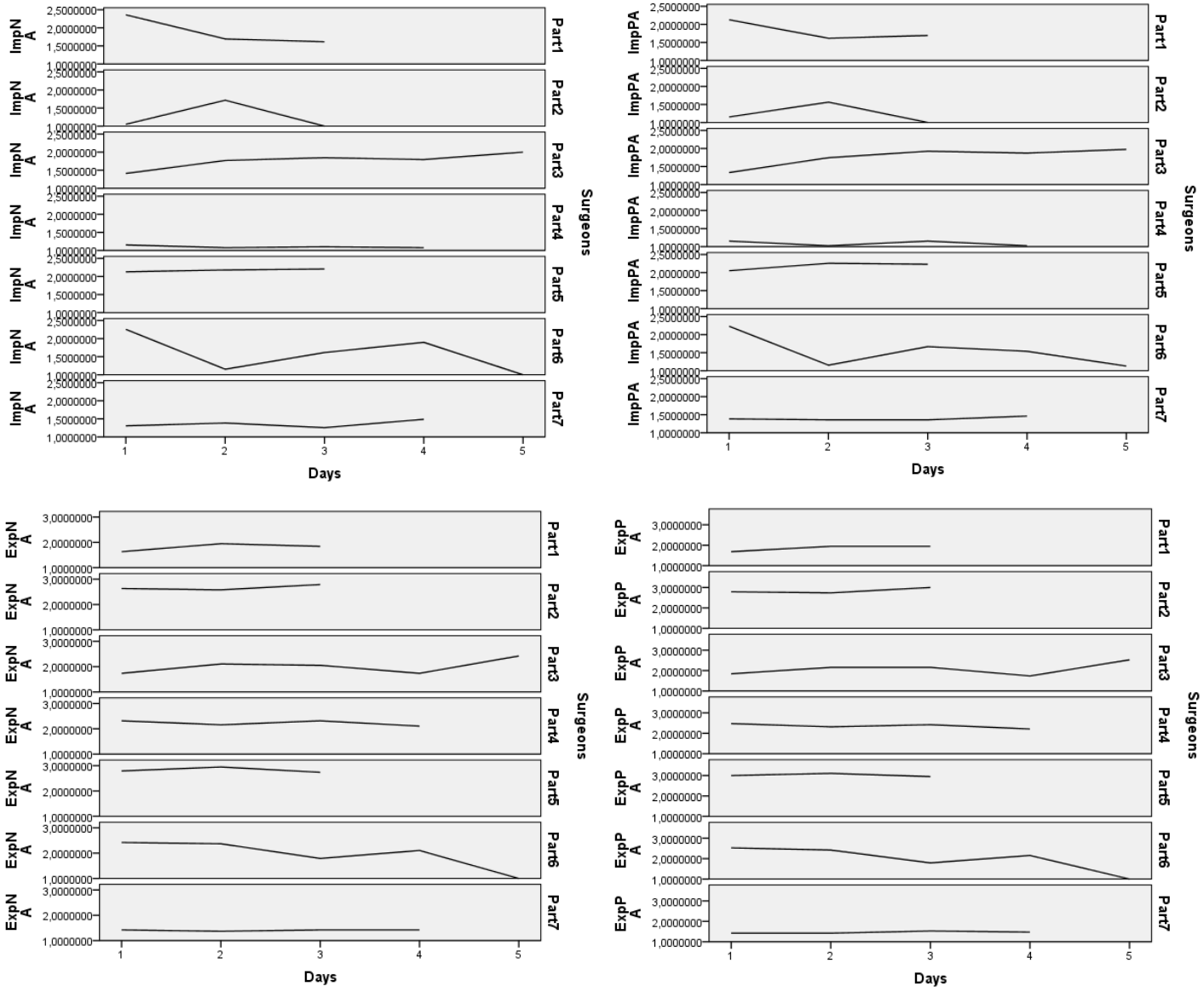


Figure 2

Multilevel graph of fatigue assessment per day and participant.

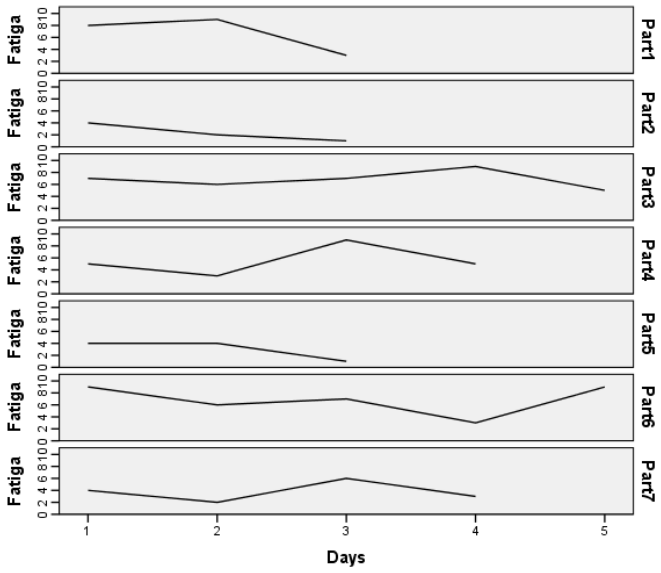
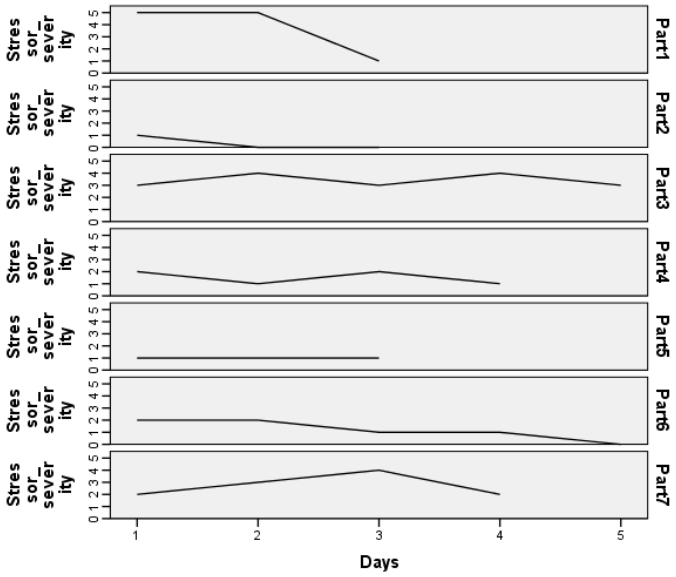


Figure 3

Multilevel graph of stressor severity per day and participant

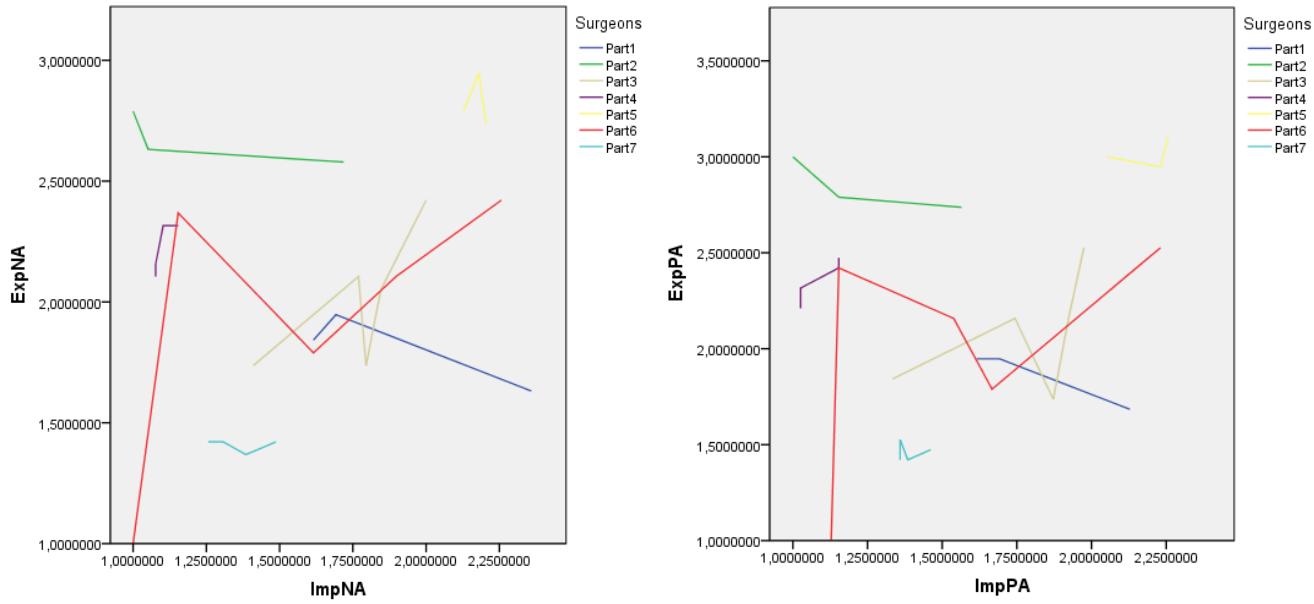


Implicit and explicit affect measures

A visual inspection of spaghetti plots displaying daily reported *implicit* and *explicit affect* shows similar patterns for five of the seven participants, as shown via ascending lines on participants 3, 4, 5, 6, and 7 (see Figure 4). It can also be observed a similar pattern between *negative* and *positive affect*.

Figure 4

Spaghetti plot of implicit and explicit negative affect (left) and implicit and explicit positive (right) for all participants.

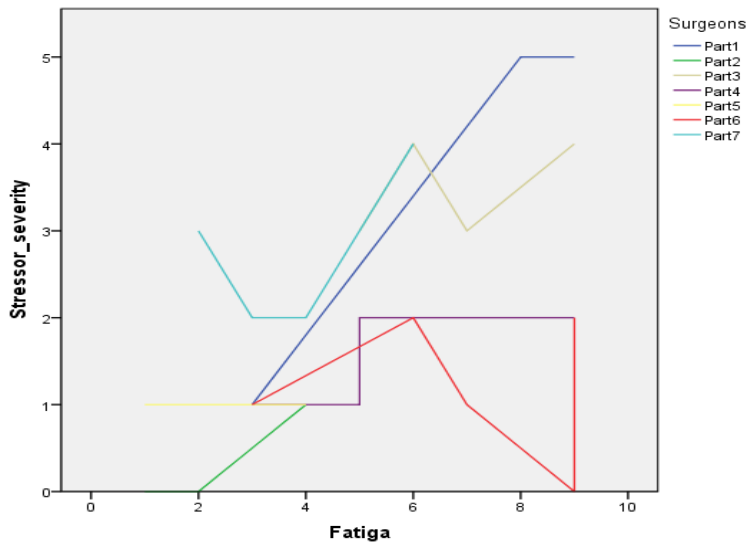


Direct and indirect stress measures

A visual inspection of a spaghetti plot of the variables *fatigue*, and primary appraisal (i.e., *stressor severity*) indicate similar patterns for four of the seven participants (i.e., participants 1, 2, 3, and 7) (see Figure 5).

Figure 5

Spaghetti plot of Fatigue and primary appraisal (i.e., stressor severity) for all participants.



Daily stressors reported by participants

The Daily Inventory of Stressful Events (DISE) captures the occurrence of seven different types of daily stressors within various life domains. Table 3 shows the frequency reported by participant on each of the categories of the scale.

Table 3

Frequency of type of daily stressors reported by participants

Type of stressor	*Frequency of response*
Something happened that is not in the previous categories	11
Something happened at work or school that most people would consider stressing	5
Having a discussion or disagreement with someone	4
Feeling the need to defend themselves but not doing it to avoid disagreement	4
Something happened at their home that most people would consider stressing	2
Be affected by something that happened to a family member or a close friend	1
Feeling discriminated for their physical appearance, age or gender	0

Discussion

The goal of the present study was to test a proposed methodological design to assess implicit measures of affect and stress within daily diary methodology. We focused on the examination of indirect and direct assessment of affect and stress in a highly stressed sample (i.e., surgeons). Results from this pilot study allow to draw some conclusions regarding the daily diary design.

First, the fact that all participants reported moderate to high level of perceived stress confirms that the population for the study (i.e., surgeons) was adequately selected. Six participants reported a moderate level of perceived stress, while one participant reported high perceived stress. Results also show that the two participants with the highest scores on perceived stress (i.e., participant 1 and 7) were also the ones with highest scores on the DER-S, particularly in scales of emotional rejection, emotional loss of control and emotional interference. Those participants scored more than 3 points on the named dimensions of the scale (ranging from 1 to 5), while all other participants scored on average 1.46 points.

Results also show that no data was lost within the register day, and that minimum and maximum values are congruent with the range of responses on each scale. This indicates that online surveys performed on a desktop computer or a cell phone are a good option for daily diary studies. In addition, the data collection approach seems to be effective since the data displays within and between subject variability.

Regarding the relationship between affect measures, a visual examination of the data shows some congruency among implicit and explicit measures, also between *negative* and *positive affect*. This is in line with previous findings with the IPANAT (see Hernández et al., 2020b, Quirin et al., 2018). Implicit and explicit affect measures seem to be more stable than other variables like *fatigue*

and *stressor severity*, since they displayed low variation on the range of response. This is also congruent with previous findings of affect measures (see Quirin et al., 2018; López et al., 2015). This low variation of affect measures might be due to the effect of emotion regulation. However, it is important to notice that initially, a low variation of implicit affect could have implied a measurement error by the implicit measure. Therefore, the decision of assessing explicit affect was adequate to observe that the same effect was captured by the self-report measure.

In fact, even if our sample is small, some individual patters seem to indicate that the implicit affect measure is actually more responsive to fluctuations of the emotional state than the explicit measure. For example, our results show that *implicit positive affect* moderately displays divergent patters to direct and indirect stress measures (i.e., higher levels of stress encompass lower levels of *implicit positive affect* and vice versa), while these patterns are less clear for the explicit affect measure. Also, the added value of implicit affect measures, the adequate data collection, and the pertinence of the methodological design could be supported by data analysis of one of the most extreme participants. Participant seven reported the highest levels of perceived stress at baseline. He also reported the highest levels of emotional rejection, emotional loss of control and emotional interference. In addition, his levels of implicit and explicit affect were in the lowest range of the scales, and were the ones displaying less variation. In this participant, only implicit affect showed small variations, while his daily report of direct and indirect stress showed variation that is comparable to other participants. Thus, the implicit measure was able to capture some changes in his affective state, for example, on day four he reported less direct and indirect stress, while displaying an increase of implicit affect.

Another finding of our study was that the variables *fatigue* and *stressor severity* were showing similar patters among participants. This is a sign that the fatigue level can be assessed

with a single item, as showed by Temel et al. (2006), and that fatigue, as suggested by Hockey (2013) is a good indirect indicator of stress. In addition, the present research showed that average scores and standard deviations displayed by the IPANAT-18 are in line with findings of previous research with the full IPANAT (see Hernández et al., 2020b; Quirin et al., 2018). Finally, only one participant suggested that the test might assess affective states, which is also in line with previous findings with the test (see Quirin et al., 2009a). Thus, the new cover story for the IPANAT, designed to keep the implicitness criterion of the test while using it on consecutive days, seems to be adequate.

The present research identified situations that need to be considered in future longitudinal research. Namely, that it is important to remunerate participants, since longitudinal studies imply big-time compromise. Thus, motivating participants will help not to lose data as the daily registers advance. In addition, results to the question *Type of Stressor* of the DISE scale showed a large misclassification by participants. For example, the most reported dimension (i.e., eleven occasions) was the option where "something happened that is not in the previous categories". Examples of the daily stressors reported by these surgeons are: "going to therapy", "health problems", and "tiredness". However, the following stressors were also reported in the same category: "medical evaluation of a very sick patient (a child)", "having to do a presentation at last minute" and "a work college was ignoring me", all of which can be included on the category "something happened at work or school that most people would consider stressing". The same applies for the reported stressor "my mom had an accident and had to go to a hospital", which can be included on the category "something happened at their home that most people would consider stressing". The latter indicates that participants should be trained in the categories of the DISE before the beginning of the daily study.

Conclusion

The proposed methodological design for the study of implicit and explicit measures of affect and daily stress is pertinent and feasible, and the IPANAT-18 represents an economical tool for the assessment of implicit affect to be used in daily dairy research. The new cover story for the IPANAT design to be used on consecutive days seems to be adequate, which indicates that IPANAT can be used on multiple occasions. Thus, the brief version of the IPANAT is working as expected on ecological momentary assessment designs. Our research found that online surveys performed on a desktop computer or a cell phone are a good option for daily diary studies. In addition, it was found that levels of self-reported fatigue exhibit similar patters to self-reported stressors. Therefore, it can represent an indirect measure of stress that can be economically assessed by one item. Finally, our study found that future research should properly train participants in the categories of the DISE before its use on a daily study.

General discussion

The goals of this thesis were (1) to adapt the Implicit Positive and Negative Affect Test (IPANAT) to Spanish population, (2) to create and evaluate a brief version of the IPANAT (for the valid and economical use in stress research using ecological momentary assessment), and (3) to test a study design to assess implicit measures of affect and stress within daily diary methodology.

In the pursue of scientific rigor, the studies for the adaptation, creation and validation of new versions of the IPANAT were conducted in the following manner. First, we exhaustively reviewed research literature involving the IPANAT and stress related behaviors (see Weil et al., 2019). Second, we used preliminary studies, including expert judges and focus groups to corroborate the proper functioning of the items. Third, we built competing models of the latent structure of the tests. Forth, we tested congruent and discriminant validity of the new versions of the IPANAT using explicit measures.

To achieve the first goal of this thesis we conducted Study 1, consisting in the adaptation of the IPANAT to Spanish population (IPANAT-SPAIN). First, results from two pretest studies indicate that some of the artificial words used in the original IPANAT were not neutral for Spanish population (e.g., the word TUNBA was too similar to the word TUMBA, that in Spanish means grave, and was reported with strong negative associations). Thus, different words from the original set of the 32 artificial words created for the IPANAT were tested. Results showed that more neutral stimuli words for Spanish population were: SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS. Second, the IPANAT-SPAIN was administered to a representative sample of N = 468 adults from Spain (225 men). Then, we explored the goodness of fit of IPANAT-SPAIN via CFA technique and found that the best fitting model supports a two-factor structure of the test. It

corresponds to implicit PA and implicit NA, which is in line with the factor structure found in the original IPANAT (see Quirin et al., 2009). Chi-square and fit indices indicated a good fit of the model. Also, the CFA goodness of fit was comparable to findings from previous validations of affect scales (López, et al., 2015). Internal consistency analyses showed a good reliability for both scales (α = .94 for PA, and α = .88 for NA). Lastly, convergent and discriminant validity of the IPANAT-SPAIN was supported by valence-congruent findings of correlations with explicit affect scales. The pattern of relationships between the IPANAT-SPAIN and explicit affect measures were consistent with previous findings (see Quirin et al., 2018). Thus, the results indicate that the Spanish adaptation of the IPANAT has satisfactory psychometric properties, which is in line with the first goal of this thesis. Once we achieved this task, we proceeded with the validation of a short version of the IPANAT to be used on longitudinal field stress research.

To achieve the second goal of this thesis we proceeded with Study 2, which details the validation of a brief version of the IPANAT (IPANAT-18). First, we conducted an item reductive procedure based on Cronbach´s alpha coefficient to determine the best ratio between the length of the test and good internal consistency. It was shown that results from a random selection of three of the stimuli words used in the IPANAT were similar to those of the full version. Second, psychometric properties of the IPANAT-18 were evaluated via Confirmatory Factor Analysis. In addition, correlational analyses were used to determine the relationship between the brief and the full version of the IPANAT, and with explicit measures of affect. We replicated a two-factors structure of positive affect versus negative affect and found a good fit for the IPANAT-18 model (CFI = 1; TLI = 1; RMSEA = .00; SRMR = .03). Reliability was adequate (implicit PA, α = .86; implicit NA, α = .77) and the pattern of relationships with explicit affect measures were congruent and consistent with previous findings (see Quirin et al., 2018). Differences between the mean

scores of implicit affect assessed with 18 items or 36 items were statistically non-significant, and showed strong correlations (PA, $r = .92$, $p < .01$; NA, $r = .88$, $p < .01$). In sum, the IPANAT-18 showed satisfactory psychometric properties and constitutes a useful tool for economically measuring affective processes in experimental and field research, such as in economical multiple assessment (e.g., daily diary) settings. The latter is in line with the accomplishment of the second goal of this thesis.

In our studies 1 and 2, implicit PA and NA dimensions were non-orthogonal, as also reflected in a positive correlation between mean values of implicit PA and implicit NA. This is consistent with previous findings from cross-cultural studies with the IPANAT (see Hernández et al., 2020b; Quirin et al., 2018). The authors argued that positive correlations between positive and negative affect could be due to the fact that different cultures attribute slightly different meaning to mood adjectives. According to Nye et al. (2008) the latter is also consistent with findings of adjectives referring to personality. In addition, it has been argued that in some languages the mood adjectives provide a smaller variability on the responses range. Therefore, future studies exploring this hypothesis should use a sample with a strong emotional context or under emotional priming. The latter finding guided the methodological design for our third study.

To achieve the third goal of this thesis we conducted Study 3, which consisted in a pilot study to evaluate the pertinence of a methodological design using implicit measures of affect and stress within daily diary setting. The fact that Study 3 is a pilot study is the main reason why it is integrated as a non-essential part of the thesis. The methodological design of Study 3 includes our validated short version of the IPANAT (for reliable and economical assessment on daily diary studies). In addition, Study 3 is considering that implicit and explicit measures may address different psychological constructs. Thus, direct and indirect measures of stress (i.e., fatigue) are

included. Another important part of the design was to have participants from a highly stressed population (i.e., surgeons), since previous studies exploring implicit affect were conducted on laboratory settings, where the effectivity of the stress task was not guaranteed. Therefore, the proposed methodological design has the potential to overcome some difficulties in the use of implicit affect for the prediction of stress related behaviors.

Seven surgeons (3 males) from Mexico City participated in Study 3. Results show that online data collection seems to be effective for daily diary settings, since the data displays adequate within and between-participant variability, and no data were lost during collection. Regarding implicit and explicit measures of affect, the measures seem to display similar patterns, which is congruent to previous findings. However*, implicit positive affect* moderately displays expected patters to direct and indirect *stress measures* (i.e., higher levels of stress encompass lower levels of *implicit positive affect* and vice versa), while these patterns are less clear for the explicit affect measure. The variables *fatigue* and primary appraisal (i.e., *stressor severity)* display similar patters among participants, which suggests that fatigue is a good indirect indicator of stress, as mentioned by Hockey (2013). Our study also found a large misclassification on the question *Type of Stressor* of the DISE scale, similar to previous findings with the DISE (see Ferrer-Rodríguez, 2019). The latter indicates that participants should be trained in the categories of the DISE before the beginning of the daily study.

In addition, results from this study indicate that the IPANAT-18 produces comparable results to the full version of the test (see Hernández et al., 2020b; Quirin et al., 2018), and that the new cover story for the IPANAT design to be used on consecutive days seems to be adequate. Therefore, the brief version of the IPANAT is working as expected on ecological momentary assessment designs. In sum, future research on daily stress could benefit from the use of the

previously mentioned short instruments to assess indirect measures of affect and stress to better understand the interactions among implicit processing and stress related behaviors.

Challenges assessing implicit affectivity in the stress context

There is no doubt that advances regarding implicit measures of affectivity have been made. However, according to the normative analysis for implicit measures proposed by De Houwer et al. (2006), further research is needed in order to consolidate the validity of these implicit measures. For example, regarding the IPANAT and the implicitness criterion proposed by De Houwer et al. (2006), researchers have conducted experiments to evaluate in what sense the measure from the tests is implicit. For instance, the IPANAT authors explored the test implicitness in at least two different ways: by assessing whether participants suspected the actual purpose of the artificial words task, and by comparing correlations between implicit and explicit measures of affectivity when individuals spontaneously respond to affect rating scales instead of reflective responding. However, further research could examine the implicitness of the test in different ways. For instance, the IPANAT has not been tested under a faking condition (i.e., where participants are asked to make a good impression). In addition, to test for implicitness, research on implicit affect should explore the influence of processing resources on implicit measures. More specifically, it needs to be established if the process can operate when processing resources are scares. That is, adding a second task (that is cognitively demanding) to the study could provide additional evidence of the implicit nature of the test.

Moreover, future research should consider particularities of the stress phenomenon when validating implicit measures of affect. Specifically, according to Blanchette and Richards (2010), affect changes cognitive functions (i.e., attention, interpretation, recall, judgment, or decision making, etc.). Since affect and emotions are core themes in stress, implicit measures of affect

(based on indirectly assessing affect while performing other cognitive tasks) should consider a different pattern of response that can impact the instrument reliability and validity. For instance, attentional bias towards threatening stimulus related to negative affect could improve reliability of negative adjectives scales. In the same manner, neutrality of words used in semantic tasks could be put in doubt (as shown by findings of Study 1). The latter can add an effect on the implicit measures that use neutral word as stimuli (like the IPANAT), and therefore, change the content and structure of the instruments. Thus, throughly neutral stimuli should be explored for future research with the IPANAT.

Contributions of the present research

The stress experimented on the daily basis (i.e., bills, school, jobs, etc.) tends to be ignored or pushed down and left uncontrolled in order to be efficient in life. However, it affects peoples' health. At the same time, unconscious prolonged stress plays an important role on peoples' wellbeing, even if they are not aware of it. Therefore, implicit measures can be helpful for better understanding interactions between daily stress and health. The present thesis contributes to this area of research in three ways: (a) by advancing an implicit measure of affect (i.e., the IPANAT) to be economically used on longitudinal field stress research, (b) by proposing new methodologies that could help overcome previous issues investigating implicit affect and stress, and (c) by pointing out new validations needed to improve implicit instruments within stress research.

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Appendix A
Presentation on the STAR Conference Stress, Anxiety and Resilience. Lublin, Poland.

Hernández, G., Edo, S., & Rovira, T. *A review of instruments measuring implicit affectivity in the stress process* (2018, July). Presentation at the Stress and Anxiety Research Society Annual meeting. Lublin, Poland.

Background

Implicit measures of affectivity are a useful addition to self-report questionnaires typically used in stress research. Perhaps because physiological or endocrine reactions related to stress are automatic processes, that can ultimately affect the health of the individual, even if the person was not aware of the stress levels experienced. The aim of this paper is to provide a review of instruments measuring implicit affectivity in the stress process, and discuss psychometric strengths, and limitations.

Methods

A search strategy was developed for several electronic databases, using combinations of the key words: implicit, affect, mood, emotion, and stress. The quality of the found instruments was assessed by published psychometric data. In addition, a normative analysis for implicit measures was used to assess to what extent the implicit measures of affectivity meet the properties of an ideal implicit measure.

Results

Three instruments were found to assess implicit affectivity in the stress context: the Implicit Positive And Negative Affect Test, the IAT-Anxiety, and the IAT-Angriness. A description of each tool, including purpose, scoring, and psychometric support is provided.

Conclusions

Tests of implicit affectivity are scarce. The Implicit Positive and Negative Affect Test was found to be the most statistically sound instrument. Further research is needed to explore the automatic nature of the process involve on tests of implicit affectivity, as well as the nature of the process by which the attribute of interest causes the outcome of the test. Finally, the present review made evident that theoretically sound instruments are needed within stress research.

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Appendix B. Papers that integrate this thesis

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A Spanish adaptation of the implicit positive and negative affect test (IPANAT)

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Abstract

Background: Self-report measures of affective states (i.e., explicit measure) underlie a variety of cognitive biasing factors. Therefore, measures for the indirect assessment of affect (i.e., implicit) have previously been developed, such as the Implicit Positive and Negative Affect Test. The IPANAT asks participants to make judgments about the degree to which artificial non-sense words sound like affective states, and has demonstrated good reliability and validity. **Methods:** We created a Spanish version of this test (IPANAT-SPAIN). After adapting artificial words to Spanish language, based on preliminary studies, the IPANAT-SPAIN was administered to a representative sample of N = 468 adults from Spain (225 men). Competing models of its latent structure were evaluated using confirmatory factor analysis. To assess convergent validity, we correlated the IPANAT-SPAIN with explicit measures of affect. **Results:** The best-fitting model consisted of two factors corresponding to positive implicit affect (PA) and negative implicit affect (NA). Reliability of the IPANAT-SPAIN was a = .94 for PA, and a = .88 for NA. The pattern of relationships between the IPANAT-SPAIN and explicit affect measures were consistent with previous findings. **Conclusions:** The results indicate that the Spanish adaptation of the IPANAT has satisfactory psychometric properties.

Keywords: Implicit affect, IPANAT, psychometric properties.

Resumen

Adaptación para población española de la escala de afecto positivo y negativo implícitos (IPANAT). **Antecedentes:** el uso de cuestionarios autoinformados para medir estado afectivo (i.e., medición explícita) puede conllevar sesgos cognitivos. Por ello, se han desarrollado medidas indirectas (i.e., implícitas), como el Test de Afecto Implícito Positivo y Negativo. En el IPANAT las personas deben realizar valoraciones acerca del grado en que creen que palabras artificiales expresan distintos estados afectivos, y ha demostrado buena fiabilidad y validez. **Método:** para crear la versión española se realizaron estudios preliminares para adaptar las palabras artificiales. La nueva versión adaptada se administró a una muestra representativa de personas adultas residentes en España (N = 468, 225 hombres). Se realizaron análisis factoriales confirmatorios para corroborar la estructura del instrumento. Asimismo, se correlacionaron las medidas de afecto implícitas con medidas explícitas, para estudiar su validez de convergencia. **Resultados:** el mejor modelo corresponde a dos factores (PA:afecto implícito positivo y NA:afecto implícito negativo), con coeficientes de fiabilidad de a = .94 y a = .88, respectivamente. Las relaciones entre las medidas del IPANAT-España y las medidas de afecto explícito fueron consistentes con hallazgos previos. **Conclusiones:** los resultados indican que el IPANAT-España tiene propiedades psicométricas adecuadas.

Palabras clave: afecto implícito, IPANAT, propiedades psicométricas.

Self-report or "explicit" measures of psychological constructs can be affected by several biasing factors such as repression (Derakshan, Eysenck, & Myers, 2007), social desirability (Morey & Lanier, 1998), limitations or impairments in introspection, or self-deception (Paulhus & Vazire, 2007). This challenges the validity of self-report measures, self-reported affect included (see Meier, Robinson, & Clore, 2004; Quirin, Kazen, & Kuhl, 2009). Therefore, the usage of indirect measures of affect, which circumvent asking individuals about their affective states and traits, can be considered helpful. In order to fill this gap, Quirin, Kazén, and Kuhl (2009) developed the Implicit Positive and Negative Affect Test (IPANAT), which asks about the degree to which artificial words sound like positive and negative affect words. The present work describes the adaptation and validation of a Spanish version of the IPANAT.

Implicit affect can be conceived as the automatic activation of semantic representation of affective (including emotional and mood-related) states and processes (Quirin et al., 2009). Contemporary appraisal theories define affects as processes (Moors, 2013), in which affects are adaptive responses that reflect appraisals of characteristics of the environment that are important for the survival of the organism. According to Lieberman (2019), these appraisals are composed by a pre-reflective (i.e., automatic) and a reflective (i.e., rational) process. In this so-called dual-systems approach, where an analytic ("explicit") system, and an impulsive ("implicit") system is differentiated (e.g., Kahneman, 2011; Strack & Deutsch, 2004). Therefore, implicit measures of affect are of great interest to properly understand how affect is elicited or constructed, and how affective states may relate to

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the development of psychological and psychosomatic disease (Weil, Hernández, Suslow, & Quirin, 2019), for example, when individuals struggle with experiencing and regulating affect, or during stressing situations.

The IPANAT was developed for the assessment of implicit affect, conceptualized as the automatic and pre-reflective component of the affective experience. The test has been widely used to measure implicit affect and is assumed to operate according to the principle of affect infusion (Forgas, 1995), which means that affect exerts an influence on judgments of objects (including artificial words) that show no relation to the affective experience at hand. According to the authors, the IPANAT measures the automatic activation of cognitive representations of affective experiences.

There is empirical evidence showing that the IPANAT is an important addition to explicit affect measures. For example, it was found that implicit PA predicts total circadian cortisol over and above a corresponding explicit affect measure (Quirin, Kazén, Rohrmann, & Kuhl, 2009). A different study found that implicit NA showed a negative association with attachment anxiety and with affective recovery in response to an upsetting memory recall. This effect was incremental to effects of the corresponding explicit affect measures (Selcuk, Zayas, Günaydin, Hazan, & Kross, 2012). In addition, implicit PA was associated with faster physiological stress recovery, while explicit NA had no effect on recovery (Brosschot et al., 2014). Also, it was found that IPANAT measures change after emotion induction independently of explicit measures, and that implicit PA and implicit NA was related to cardiovascular activity during and after stressful tasks (when none of the explicit measures were related to cardiovascular activity) (van der Ploeg, Brosschot, & Verkuil, 2014). In summary, implicit affect as assessed via the IPANAT appears to strongly contribute to explain physiological and behavioral reactions, and thus finally to a more thorough understanding of affective phenomena. Developing different language versions makes this instrument broadly accessible and enables a comparison of affective phenomena between languages and cultures.

During the test, participants are instructed to provide ratings on the degree to which six artificial words (SAFME, VIKES, TUNBA, TALEP, BELNI, and SUKOV) sound like six mood adjectives (happy, cheerful, energetic, helpless, tense, and inhibited). The resulting 36 items are scored on a 4-point Likert scale ranging from *doesn't fit at all* to *fits very well*.

Scores are computed in two steps. First, scores for single mood adjectives are computed by averaging across ratings of the combination of the mood word at hand with the six artificial words. Then, scores for positive affect (PA) are calculated by averaging scores from judgments concerning the mood adjectives happy, cheerful, and energetic, whereas scores for negative affect (NA) are derived by averaging scores from judgments concerning helpless, tense, and inhibited. The IPANAT has been validated for several countries such as Germany (Quirin et al., 2009), USA, China, Italy, the Netherlands, Russia (Quirin et al., 2018), Japan (Shimoda, Okubo, Kobayashi, Sato, & Kitamura, 2014), and Macedonia (Sulejmanov & Spasovski, 2017), and is currently the instrument mostly used to assess implicit affect.

Here, we explore (1) the neutrality of the IPANAT's artificial words in the Spanish population, and (2) the construct validity of the IPANAT-SPAIN. For this end, (2a) a model on the latent structure of the test based on Quirin et al. (2009) was investigated for the IPANAT-SPAIN using Confirmatory Factor Analysis (CFA), and (2b) correlational analysis between explicit measures of affect and the IPANAT-SPAIN were conducted.

Method

Two phases were involved in the adaptation of the IPANAT's artificial words to the Spanish population. First, participants were asked to evaluate the neutrality of the words used in the original study (conducted in German population). Second, different participants were asked to judge the neutrality of a new set of artificial words, in order to determine the more neutral words for Spanish population. In addition, a third sample was collected to explore construct validity of Spanish version of the IPANAT.

Participants

Phase A. For the first phase of the adaptation of the IPANAT's neutral words to the Spanish population, a group of 20 subjects (12 males, M_{age} = 31.95, SD = 10.78) were recruited online (using social networks, i.e., Facebook) to participate in a linguistics study, participants were required to be above 18 years and residents of Spain. Participants received no compensation for their participation in the study. All participants reported being born in Spain. Sample size was similar to the one of previous studies (see Quirin et al., 2009; Sulejmanov & Spasovski, 2017)

Phase B. For the second phase of the adaptation of the IPANAT's neutral words to the Spanish population, a new group of 12 subjects (5 males, M_{age} = 24.58, SD = 7.99) were recruited online (as described on phase A) to participate in the evaluation of ten new artificial words (created during the original protocol for the IPANAT, but not selected for the original test in German). Participants received no compensation for their participation in the study. All participants reported being born in a Spanish province.

Phase C. Construct validity of the Spanish version of the IPANAT was assessed on a third phase of the present research. The sample included 468 (225 males) participants. Participants' age after classification into age bands of 18-24, 25-34, 35-44, 45-54, and 55-65 was distributed as follows: 14%, 19%, 28%, 22% and 17%. The corresponding percentage for each age band in the general adult population of Spain was 11, 18, 25, 24 and 22% respectively (Instituto Nacional de Estadística, 2018). Participants were recruited online by a Spanish market research firm (CERES), they received 12 euros as a compensation for their participation. Participants were required to be above 18 years and residents of Spain. More than 92% (i.e., 432) of participants reported to be born in Spain. Regarding the education level, the majority of participants reported to have a university degree or above (53%). Otherwise, 38% reported a high school degree, 8% reported a secondary school degree, 1% reported not to have studied.

Instruments and Procedure

Phase A. The original artificial words from the IPANAT (i.e., SAFME, VIKES, TUNBA, TALEP, BELNI and SUKOV; see Quirin, et al., 2009) were presented to the participants, they were asked to evaluate the words (by a dichotomy question) with respect to the following criteria: pleasantness, familiarity, and meaning (i.e., Do you find the word SAFME pleasant?). In addition, the criteria of associative value was evaluated by asking participants to provide a list of words associated to the stimuli.

Phase B. Once again, Spanish participants were asked to make evaluations of the words with respect of the following criteria: familiarity, pleasantness, and meaning. The familiarity criteria was evaluated by dichotomous questions, the pleasantness criteria was evaluated by a scale ranging from -4 (very unpleasant) to 4 (very pleasant), while the meaning criteria was evaluated by the number of times that participants describe the possible meaning of each stimuli words.

Phase C. *IPANAT-SPAIN*. The Spanish version of the Implicit Positive and Negative Affect Test was used. All testing took place online via Qualtrics (Qualtrics Provo, 2013). In total, the experiment took approximately 10 minutes to complete. A computerized version of the IPANAT-SPAIN presented one item each per screen, after the presentation of the instruction (i.e., cover story) of the IPANAT. Then, participants were asked to provide judgments of artificial words. For each of the artificial words (*SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS*) participants indicated on a four-point answer scale (1 = *doesn't fit at all*, 2 = *fits somewhat*, 3 = *fits quite well*, and 4 = *fits very well*) to what extend does the sound of the artificial word convey each of the following moods: happy, helpless, energetic, tense, cheerful, and inhibited (in spanish: feliz, desamparado, activo, tenso, alegre, inhibido). The artificial words were randomly presented (to avoid order effects), each adjective within the same artificial word was also randomized, and the six items belonging to each artificial word were presented subsequently. Global scores for implicit PA and implicit NA were computed by averaging adjective scores derived from positively valenced and negatively valenced adjectives (following Quirin et al., 2009).

Explicit affect scales. After answering the IPANAT-SPAIN participants were presented with a series of affect questionnaires used to examine construct validity of the IPANAT. Explicit PA and NA were assessed with two instruments. First, we used the broadly applied Positive and Negative Affect Schedule (PANAS, Watson, Clark, & Tellegen, 1988; Spanish version: López, Hervas, & Vázquez, 2015). Second, explicit affect was also assessed by asking participants for explicit mood judgments of the same mood adjectives included in the IPANAT (i.e., asking individuals to report the extent to which they feel happy, cheerful, energetic, helpless, tense, and inhibited at the moment) on a rating scale from 0 (not at all) to 10 (absolutely) (following Quirin et al., 2009). Analogously to the original IPANAT, we composed a PA and an NA scale computing average scores for happy, cheerful, and energetic, versus helpless, tense, and inhibited, respectively.

Data analysis

Phase A. Overall scores for each of the stimuli words (on the first three criteria mentioned above) were calculated by the number of times the words were judged affirmatively to each of the dichotomous questions. Results showed that SAFME was judged to be familiar, pleasant and with a meaning 25% of the times, VIKES 40%, TUNBA 47.5%, TALEP 25%, BELNI 31% and SUKOV 28.75%. In addition, the associative value criteria was score by calculating the number of words listed by participants. Results showed that particularly two of the original artificial words of the IPANAT evocated more associative words among Spanish population. Specifically, the word TUNBA was frequently associated with the Spanish word for grave/tomb (i.e., TUMBA); similarly, the word VIKES was frequently associated with BIKES, an informal English word for bicycle (which is well known in Spain). Thus, taking the results from the four criteria evaluated, the words TUNBA and VIKES were discarded from the Spanish version of the IPANAT. In addition, following the normativity for test adaptations proposed by Muñiz, Elosua, & Hambleton (2013) we used expert judgments to examine the level of understanding of the Spanish translations of the six mood adjectives and the instructions of the IPANAT. Three different judges (two psychologist and one linguist) 100% concur that the adjectives and instructions were a good adaptation.

Phase B. The neutrality of the new set of words was calculated considering the stimuli words than on average were closes to 0 in the pleasantness criteria (mean scores: MALBI 1.75, BOREK -0.41, LONTA -0.75, MONUF -0.83, REMAL -0.91, FAMPO -0.89, GOLIP 0.33, KERUS 0.25, HIMAT 0.66 and PORAS -.50), and at the same time showed the lowest average scores on the familiarity and meaning criteria. Next, familiarity score were calculated by the number of affirmative responses, results showed that MALBI was found familiar 25% of the times, BOREK 16%, LONTA 25%, MONUF 16%, REMAL 66%, FAMPO 16%, GOLIP 16%, KERUS 16%, HIMAT 41% and PORAS 50%.

Meaning criteria scores were calculated by the number of times that participants were able to describe the possible meaning of the stimuli word. Results showed that only the words MALBI, BOREK and REMAL evocated a possible meaning on 16% of the participants for each of the three words. Then, from the new set of artificial words evaluated, the more neutral words for the Spanish population were found to be GOLIP and KERUS. Therefore, the IPANAT-SPAIN uses these two words to replace the words VIKES and TUNBA from the original IPANAT.

Phase C. Basic statistical analyses were conducted using IBM SPSS Statistics 22.0. In addition, Confirmatory Factor Analysis (CFA) were performed using R 3.6 and RStudio 1.2. To evaluate the psychometric properties of the IPANAT-SPAIN, the construct and criterion-based validity were explored. Specifically, we performed a descriptive analysis of the items, CFA based on the model proposed by authors of the original test and previous findings with the IPANAT, reliability analyses of the scales (Cronbach's alpha coefficients), and correlations with explicit measures of affect.

Confirmatory factor analysis. CFA is a confirmatory technique where the analysis is guided by hypothesized relationships among the observed and unobserved variables. In this model-driven approach, a hypothesized model to estimate a population covariance matrix is used that is compared with the covariance matrix of the sample (Schreiber, Nora, Stage, Barlow, & King, 2006). The goal is to have minimal differences between the two matrices. Based on the expected two factorial solution for the IPANAT (Quirin et al., 2009) we tested two models:

- Model 1 is a parsimonious model, therefore it is an unrestricted model that allowed all of the items to load on a unique factor. Testing for the most appropriate dimensionality of the measure is important in case the data is compatible with a solution in which there is a strong and dominant factor running through all the test items (see Garrido, González, Seva, & Piera, 2019).
- Model 2 hypothesizes that the IPANAT measures two factors, Implicit NA and Implicit PA. The latter model 2 tested the conception of bi-dimensionality of the test, in which 18 PA items were indicators of an implicit PA factor and that 18 NA items were indicators of the implicit NA factor. Scores for

each one of the six mood adjectives assessed (i.e., 3 for PA and 3 for NA) were computed by averaging across ratings of the combination of the mood adjective with the six artificial words, then the corresponding 3 adjectives were loaded to its belonging factor. The model allowed each of the items to only load on the respective predicted factor. Since previous cross-cultural validations of the IPANAT found that a correlation between the two underlying factors can occur (see Quirin et al., 2018) in our study these two factors were set to be non-orthogonal, to better explore this possibility. According with Izquierdo, Olea y Abad (2014), to allow the covariance of the latent factors of the model is the better way to corroborate its possible orthogonality.

Both models included error variances for each item and were set to load with a coefficient of 1. Factor loadings were estimated via an estimator of diagonally weighted least squares (DWLS), which is specifically designed for ordinal data (Cheng-Hsien, 2016). The fit of the CFA models was assessed using Chi-squared values and degrees of freedom for each model, as well as Comparative Fit Index (CFI; Bentler, 1990), the TLI (Tucker-Lewis index), the Root-Mean-Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) as an example of a commonly used absolute measure of fit (Browne & Cudeck, 1992; Jackson, Gillaspy, & Purc-Stephenson 2009; Steiger & Lind, 1980).

Correlational analysis. Correlational analysis between the IPANAT-SPAIN and explicit affect instruments were also conducted. In line with previous research on the relationship between implicit attitudes and explicit attitudes (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005), we expected a moderate strength of the relationships between implicit measures and explicit measures of the same affect type. In general, we expected that implicit PA to be more strongly correlated with explicit PA measures than with explicit NA measures. We also expect the opposite for implicit NA.

Results

After participants completed the test, they were asked to respond a question about the presumed underlying aim of the IPANAT-SPAIN. Twenty-two individuals suggested that the test might assess affective states and were excluded from the initial sample of 468 subjects (4.70% of the sample), there were no missing data. The sample size used in the present study is adequate for the stability of the parameter estimates, since 10 participants per estimated parameter are considered adequate (Schreiber et al., 2006). In our CFA we specified 6 regressions, one covariance, and 6 variances, that is 13 parameters in total that need to be estimated. Because we have a final sample size of 446, we have an acceptable ratio of 34.3 participants to one estimated parameter. Descriptive statistics (mean scores, standard deviations, skewness, and kurtosis) can be found in Table 1. We identified that the assumption of multivariate normality is slightly violated in our sample, therefore we used the diagonally weighted least squares (DWLS) estimator, since this method provides more accurate parameter estimates (Mîndrilă, 2010). Table 1 shows that the mean scores for PA are higher than the mean score for implicit NA, the latter is consistent with previous findings on the IPANAT (Quirin et al., 2009; Quirin et al., 2018). Additionally, Cronbach's alphas were .94 for implicit PA and .88 for implicit NA.

Confirmatory Factor Analysis

As shown in Table 2, model 2 obtained a χ^2/df (CMIN) of .48, with a CFI (comparative fit index) of .99, the TLI (Tucker-Lewis index) of .99, the RMSEA (root mean square error of approximation) was .00, and the SRMS (standardized root mean square residual) was .02. According to Hu and Bentler (1999) those values indicate a good fit between the model and the observed data (see also Schreiber, 2006). Standardized parameter estimates are provided in Figure 1; unstandardized estimates are shown in Table 3.

Thus, it can be concluded that for the IPANAT-SPAIN, the model fit for the two factorial solution proposed by the developers of the original test is acceptable (see Figure 1). The two factors were found to be non-orthogonal in our sample. No post-hoc

Table 1
Descriptive statistics of the Implicit Positive and Negative Affect Test – Spanish version

Mood adjective score	M	SD	SK	K
Happy (Feliz)	1.83	0.58	0.33	-0.56
Energetic (Activo)	1.88	0.63	0.27	-0.73
Cheerful (Alegre)	1.82	0.57	0.35	-0.56
IPA	**1.84**	**0.56**	**0.23**	**-0.65**
Helpless (Desamparado)	1.57	0.51	0.99	0.67
Tense (Tenso)	1.75	0.54	0.48	-0.19
Inhibited (Inhibido)	1.59	0.53	0.85	0.30
INA	**1.64**	**0.48**	**0.70**	**0.36**

Note: Mood adjective score from mean score of the 6 items belonging to each adjectives on the IPANAT-SPAIN. n = 446

Table 2
Fit Indices of Models Tested in Confirmatory Factor Analysis (n = 446)

Model	χ^2 (df)	χ^2/df	CFI	TLI	RMSEA	SRMR
1	55.87(9)	6.20	.97	.96	.11	.09
2	3.82(8)	0.47	1	1	.00	.02

Note: 1 = unrestricted one-factor parsimonious model, 2 = restricted bi-factorial model (Positive/Negative affect), not allowing for cross loadings between factors; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual

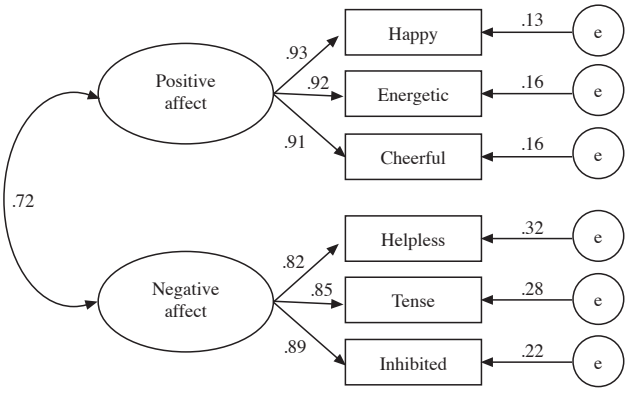

Figure 1. Results from Confirmatory Factor Analysis (model 2) for IPANAT-SPAIN (*n* = 446)

modifications were indicated from the analysis because of the good-fit indexes, the residual analysis did not indicate any problems, and the modification indices did not suggest significative discrepancies between the proposed and estimated model.

Table 3
Standardized and unstandardized coefficients for CFA Model 2 (n = 446)

Observed variable	Latent construct	β	B	SE
Happy (Feliz)	PA	0.93	1	
Energetic (Activo)	PA	0.92	1.06	0.06
Cheerful (Alegre)	PA	0.91	0.96	0.05
Helpless (Desamparado)	NA	0.82	1.0	
Tense (Tenso)	NA	0.85	1.09	0.07
Inhibited (Inhibido)	NA	0.89	1.11	0.07

Correlational analysis

As shown in Table 4, the relationships between implicit and explicit measures of the same affect type turned out to be of moderate strength. The latter finding is consistent with results reported for the original IPANAT. Specifically, Quirin et al. (2009) reported correlations of .20 for implicit and explicit PA and .22 for implicit and explicit NA. In addition, we also found that implicit NA was more strongly correlated with explicit NA measures than with explicit PA measures. The opposite was also found for implicit PA, with the exception of the correlation between implicit PA and the PANAS NA, however, the PANAS NA measure was more strongly correlated with implicit NA that with implicit PA.

In general, participant reported significantly higher mean levels of Implicit PA (M = 1.84, SD = .56) than Implicit NA (M = 1.64, SD = .48), t (445) = 9.93, p < .01; which suggested that on average they tended to judge the artificial words as carrying a more positive than negative connotation. The latter is consistent with previous findings with the IPANAT (see Quirin et al., 2018). This pattern was also observed in our sample by the explicit scales. We found that explicit PA assessed with the PANAS (M = 3.02, SD = .71) showed a significantly higher mean than explicit NA (M = 1.80, SD = .68), t (445) = 27.13, p < .01. In addition, explicit PA assessed with the Scale Same Adjectives used by the IPANAT also showed a significantly higher mean of explicit PA (M = 6.13, SD = 1.84) than explicit NA (M = 2.68, SD = 1.99), t (445) = 25.55, p < .01.

Implicit PA and implicit NA were positively correlated, r = .65, p < .01, most of the IPANAT validations conducted in different countries reported no positive correlation between the two factors, except for the cases of China, Italy, the Netherlands, the USA, and Uzbekistan (see Quirin et al., 2018).

Table 4
Pearson correlations among implicit affect, explicit affect (PANAS), and explicit scale (same adjectives than on IPANAT)

Measure	IPANAT PA	IPANAT NA
PANAS PA	**.20*****	.11**
Explicit scale PA (same adjectives)	**.18*****	.09**
PANAS NA	.28***	**.38*****
Explicit scale NA (same adjectives)	.12***	**.28*****

*Note: n = 446 **p < .05 ***p< .01*

Discussion

The present work attempted to create and validate a Spanish version of the IPANAT, a measure for the indirect assessment of affect. Based on the results from two pretests, we exchanged artificial words from the original IPANAT to have a next to neutral artificial-words version for the Spanish language. We ended up using the following words: *SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS*. We explored the goodness of fit of IPANAT-SPAIN via CFA technique and found that the best fitting model supports a two-factor structure of the test, corresponding to implicit PA and implicit NA, which is in line with the factor structure found in the original IPANAT (see Quirin et al., 2009). As mentioned in the results section, chi-square and fit indexes indicated a good fit of the proposed model. In addition, the sample size used in the present study was adequate to produce relative stability of the parameter estimates. Internal consistency analyses showed a good reliability for both scales, and the CFA goodness of fit was comparable to findings from previous validations of explicit affect instruments (López et al., 2015). Not least, concordant and discriminant validity of the IPANAT-SPAIN was supported by valence-congruent findings of correlations with explicit affect scales.

In our study, the two dimensions were found to be non-orthogonal. Moreover, a strong positive correlation between mean values of implicit PA and implicit NA was found. The latter is consistent with previous cross-cultural studies on the IPANAT. According to Quirin et al. (2018), positive correlations between positive and negative affect could be due the fact that different cultures attribute slightly different meaning to mood adjectives, as found by for some adjectives referring to personality (Nye, Roberts, Saucier, & Zhou, 2008) . For example, when validating the short form of the PANAS in the Australian sample, it was found that the item excited significantly correlated with both positive and negative affect (Mackinnon et al., 1999). This suggests that in some cultures certain mood adjectives (especially those associated with activation or arousal) may carry ambiguous meanings (see also Thompson, 2007). Additionally, previous cross-cultural studies on the IPANAT showed that correlations between positive and negative affect could often be attibuted to positive correlations between mood adjectives *energetic* and *tense* (Quirin et al., 2009). Therefore, in order to clearly assess positive and negative affect, further research should explore the use of adjectives that do not share valence or arousal levels, in order to substitute adjectives like *energetic* or *tense* for equivalent ones. Another possible explanation for the high correlation between the two factors of the IPANAT could be that in some languages the mood adjectives provide a smaller variability on the responses range. Therefore, future studies in these languages should explore this hypothesis in a sample with a strong emotional context or under emotional priming. Nonetheless, a factor structure with a positive correlation between factors might be the better model fit (see Brown, 2006), particularly if the factor loadings are strong, and the fit indices are better that the one-factor model. Therefore, the original bi-factorial structure for the IPANAT is replicated in our sample.

In addition, the relationships between implicit and explicit affect were found to be of moderate strength. The moderate correlations between implicit and explicit measures are consistent with results previously reported for the original IPANAT, as well as for other implicit measures like the Implicit Association Test (Greenwald et al., 2003) or the Affect Misattribution Procedure (Payne et al., 2005)

(see Echebarria-Echabe, 2013; Hofmann et al., 2005). Arguably, these low correlations between implicit and explicit measures can be due to different aspects, for example, motivational biases in the explicit measure, reduced introspective abilities, or even complete independence of the underlying constructs (Hofmann et al., 2005). For example, it has been found that correlations between implicit and explicit measures systematically increased as a function of increasing spontaneity of self-reports (Quirin et al., 2009). Thus, researchers of attitudes have theorized that both: implicit and explicit measures tap into different underlying constructs.

The Associative-Propositional Evaluation model (APE, Gawronski & Bodenhausen, 2006) for example postulates the existence of two independent constructs, implicit versus explicit attitudes. While implicit attitudes are considered affective automatic reactions aroused by encounters with an object, explicit attitudes are considered conscious evaluations of the attitude's object. The fundamental mechanism that contributes to the formation and change of the attitudes is the processing of available information about the object. The proposed underlying mechanism for implicit attitudes is evaluative conditioning, seen as a change in the valence of a stimulus that is due to the pairing of that stimulus with another positive or negative stimulus (Hofmann, De Houwer, Perugini, Baeyens, & Crombez, 2010). In contrast, explicit attitudes are considered to be based on syllogistic inferences about propositional information that is relevant for a judgment (Gawronski & Bodenhausen, 2006). The later could explain why the correlation between both measures increases as a function of spontaneity of the explicit measure.

In conclusion, the present research provides evidence for the validity and reliability of a Spanish adaptation of the IPANAT. Future studies that use the IPANAT-SPAIN in complementation with indirect measures of health, attitudes, and personality traits may provide further evidence for criterion-based validity of the test.

Acknowledgements

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RESEARCH ARTICLE

A Brief Version of the Implicit Positive and Negative Affect Test (IPANAT-18)

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As self-reports of affect are limited in several regards, an indirect measure of affect, the Implicit Positive and Negative Affect Test (IPANAT; Quirin, Kazén, & Kuhl, 2009) has previously been developed and adapted to more than 10 languages (Quirin et al., 2018), showing adequate reliability and validity. Based on a sample of 242 Spanish adults (111 males), we evaluate a trimmed 18 items version of the IPANAT (IPANAT-18). Item reductive procedures consisted in a random selection of the stimuli words used in the IPANAT. Psychometric properties of the IPANAT-18 were evaluated via Confirmatory Factor Analysis. In addition, correlational analyses were used to determine the relationship between the brief and the full version of the IPANAT, and with explicit measures of affect. We replicated a two-factors structure of positive affect versus negative affect and found a good fit for the IPANAT-18 model (CFI = 1; TLI = 1; RMSEA = .00; SRMR = .03). Reliability was adequate (implicit PA, α = .86; implicit NA, α = .77) and the pattern of relationships with explicit affect measures were congruent and consistent with previous findings. Differences between the mean scores of implicit affect assessed with 18 items or 36 items were statistically non-significant, and showed strong correlations (PA, r = .92, p < .01; NA, r = .88, p < .01). In sum, the IPANAT-18 showed satisfactory psychometric properties and constitutes a useful tool for economically measuring affective processes such as in experimental and economical multiple assessment (e.g., daily diary) settings.

Keywords: implicit affect; IPANAT; psychometric properties

Traditionally, psychological assessment of affective states usually relies on the individual's own report of their feelings. However, it has been found that people do not always identify and report emotions accurately (Quirin, Kazen, & Kuhl, 2009). The latter may partly be attributed to the complexity of affective experiences, as they are comprised of different components such as situation appraisal, subjective feelings, expressive behavior, physiological responses, and action preparation (Scherer & Moors, 2019). It has been argued that these different processes occur at a pre-reflective (i.e., automatic) and a reflective (i.e., rational) level (Lieberman,

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2019). Therefore, self-report methods may not fully reflect an individual's affective experience. Hence, the importance of studying implicit (i.e., automatic) affective processes.

Implicit affective processes are in line with a dual-process view of appraisal theories of affect (Clore & Ortony, 2000). According to this view, information can be processed with reflective propositions and rules (which convey one or more appraisal values) but alternatively (or additionally) be processed in an associative way (automatically activating learned associations between representations of the stimuli and previously stored appraisal outputs) (Moors, 2013). Accordingly, the affective experience would initiate with a pre-reflective process with several simultaneous automatic processes giving rise to experience that has not (yet) been reflected on. In line with this approach of affect as information processing, implicit affect is conceptualized as the automatic activation of cognitive representations of affective experiences (Quirin et al., 2009).

Previous research has demonstrated that affective processes, even if not fully recognized, can impact human behavior (e.g., Winkielman et al., 2005), and are related to brain processes (Lane, 2008; Pessoa, 2013), and health (e.g., Quirin & Bode, 2014; Lane, 2008; Weil et al., 2019). A number of procedures have been developed for taping affective processes indirectly, such as the Implicit Association Test (IAT; Greenwald et al., 2003; see also IAT-Anxiety, Egloff, & Schmukle, 2002), the Affect Misattribution Procedure (AMP; Payne et al., 2005). However, these measures have been developed to assess individuals' attitudes (or self-concepts) rather than affect itself, which has been led to the development of the IPANAT.

The IPANAT aim is to assess a pre-reflective (i.e., automatic) dimension of affect, and draws on the principle of affect infusion as a method to assess implicit affect. According to this principle, affect exerts an impact on evaluative processes influencing the judgments of unrelated objects. Thus, the goal of the test is to capture the automatic affective process expressed in the participants' biased judgments. Accordingly, the IPANAT uses participants' ratings of the degree to which six nonsense words (i.e., SAFME, VIKES, TUNBA, TALEP, BELNI, and SUKOV) sound like six mood adjectives (i.e., happy, cheerful, energetic, helpless, tense, and inhibited). Thus, the test is composed of 36-items, which are scored on a 4-point Likert scale, ranging from doesn't fit at all to fits very well.

The IPANAT showed good psychometric properties and construct validation (Quirin et al., 2009; Quirin et al., 2018). In addition, criterion-based validity was found by research showing relationships between implicit NA and low implicit PA with slow blood pressure recovery after harassment (Brosschot et al., 2014; van der Ploeg et al., 2014), and under unconscious stress induction (van der Ploeg et al., 2019). As well as with both stress-contingent and circadian saliva cortisol, which did not occur for explicit affect (Mossink et al., 2015; Quirin, Kazén, Rohrmann, & Kuhl, 2009). An fMRI study demonstrated that implicit (IPANAT) but not explicit negative affect predicted accuracy of recognizing briefly presented anger gestures, as well as concomitant neural correlates in the fear network of the brain (Suslow et al., 2015; see also Quirin & Lane, 2012, for the necessity of considering implicit affect in the neurosciences).

Bodenschatz et al. (2018) used eye-tracking in a healthy population to demonstrate that implicit NA predicts attention towards sad faces over and above self-reported depressive symptoms. Kazén et al. (2014) found that implicit NA predicted local processing, whereas implicit PA predicted global processing in individuals with low versus high emotion regulation abilities, respectively, these effects were not found for explicit affect. Additional studies demonstrated validity of the IPANAT as an affect measure that is incremental to explicit affect (e.g., Dekker & Johnson, 2018; Quirin et al, 2011; Remmers et al., 2016). Hence, implicit affect assessed via the IPANAT appears to contribute the understanding of affective phenomena.

In addition, the IPANAT has been adapted to many languages, displaying good psychometric properties (e.g., Hernández et al., 2020; Shimoda et al., 2014; Sulejmanov & Spasovski, 2017). Results from ten different countries showed that the best-fitting model consisted of two factors corresponding to positive affect and negative affect (on average, $\chi^2/df = 2.53$, CFI = .96, TLI = .91). Both factors showed a good reliability coefficient, on average, implicit PA, $\alpha = .81$; implicit NA, $\alpha = .78$ (Quirin et al., 2018).

Investigations on affect and health often require economical assessments. For example, due to the fact that affective processes are fleeting after experimental affect induction (see Hermans et al., 2001), because sometimes participants respond to the IPANAT in multiple assessments (like in ecological momentary assessment studies), or simply because it is administered in conjunction with time consuming other measures. Therefore, the purpose of this study was to create and evaluate a brief version of the original test (called IPANAT-18 in the remainder of this article). A validated brief version of the test could also improve the reliability on some experimental designs (e.g., if there is need of repeated measures of affect), as well as avoid extra burden or boredom to participants. Thus, a brief version would improve the instrument's utility without sacrificing its psychometric properties.

Method

Participants

The sample included 242 Spanish adults (111 males). Participants' age after classification into age bands of 18–24, 25–34, 35–44, 45–54, and 55–65 was distributed as follows: 18%, 18%, 26.8%, 18.9% and 18.3%. Participants were recruited online by a Spanish market research firm (CERES), they received 12 euros as compensation for their participation. The only requirement for participation was to be above 18 years. Participants first saw a full description of the experiment, which served simultaneously as the informed consent form. Participants who provided consent were then given a URL directing them to the experiment. More than 90% (i.e., 218) of participants reported to have been born in Spain. Regarding the education level, the majority of participants self-reported to have a university degree or above (52%). Otherwise, 37% reported a high school degree, and 11% reported a secondary school degree.

Materials

Implicit Affect scale

A Spanish version of the IPANAT was used (see Hernández et al., 2020). All testing took place online via Qualtrics (Qualtrics Provo, 2013). In total, the experiment took approximately 10 minutes to complete. A computerized version of the IPANAT presented one item each per screen, after the presentation of the instruction (i.e., cover story) of the IPANAT. Then, participants were asked to provide judgments of six artificial words across six mood adjectives. For each of the artificial words (*SAFME, TALEP, BELNI, SUKOV, GOLIP, and KERUS*) participants indicated on a four-point answer scale (1 = *doesn't fit at all*, 2 = *fits somewhat*, 3 = *fits quite well*, and 4 = *fits very well*) to what extend does the sound of the artificial word convey each of the following moods: happy, helpless, energetic, tense, cheerful, and inhibited. Thus, the test consisted of 36-items. The artificial words were randomly presented to avoid order effects, each adjective within the same artificial word was also randomized, and the six mood adjective belonging to each artificial word were presented subsequently. Global scores for implicit PA and implicit NA were computed by averaging the scores derived from positively valence, and negatively valence adjectives (following Quirin, et al., 2009).

Explicit affect scales

After answering the IPANAT participants were presented with a series of personality and affect questionnaires used to examine construct validity of the IPANAT. Explicit PA and NA were assessed with two

instruments. First, we used the broadly applied Positive and Negative Affect Schedule (PANAS, Watson et al., 1988; Spanish version: Lopez et al., 2015). Second, explicit affect was also assessed by asking participants for explicit mood judgments of the same mood adjectives included in the IPANAT (i.e., asking individuals to report the extent to which they feel happy, cheerful, energetic, helpless, tense, and inhibited at the moment) on a rating scale from 0 (not at all) to 10 (absolutely) (following Quirin et al., 2009). Analogously to the original IPANAT, we composed a PA and an NA scale computing average scores for happy, cheerful, and energetic, versus helpless, tense, and inhibited, respectively.

Statistical Analyses

The goal of the present study was to create and evaluate a brief version of the IPANAT. As other projective tests, the IPANAT uses judgments of artificial words to track changes on responses to ambiguous stimuli with the objective of revealing pre-reflective emotions. As detailed before, the instrument items are composed of six mood adjectives that are assessed several times, then the 36 items are in fact six truly different items asked repeatedly to capture biased responses. Thus, for the brief version of the IPANAT it is paramount to identify the number of repetitions of the items and not which particular items are needed to keep in a brief version (since they are redundant), thus a random selection of the right number of items should yield similar psychometric properties that the full test. As suggested by Taber (2018), high levels of Cronbach's alpha indicate that items in a scale elicit the same pattern of responses (which implies they are redundant), even though a higher number of items in a scale improve the reliability, additional items measuring the same thing as the existing items leads to redundancy that is inefficient, because almost no additional useful information is obtained, nonetheless the instrument takes longer to administer.

Since we aimed to improve the usefulness of the test, in our study reliability analysis for different number of items were tested via Cronbach's alpha coefficient, to determine the best ratio between the length of the test and good internal consistency. This item reduction analysis based on classical test theory was found to be a reliable item reduction method (Erhart et al., 2010) in comparison with other methods like Rasch item-fit analysis. As suggested by Erhart et al. (2010), our study accompanied this item reduction method by additional analysis (i.e., confirmatory factor analysis) to corroborate the psychometric properties of the instrument. Once Cronbach's alpha coefficient provided a notion of the least number of items required to keep the psychometric properties of the original IPANAT, item reductive procedure consisted of a random selection of the stimuli words used in the IPANAT. Then, the newly stablished set of items were extracted for the original 36-items. Finally, the descriptive statistics, reliability coefficient, and latent structure of the full IPANAT were compare with the brief version.

As mentioned above, the latent structure of the IPANAT-18 was evaluated using Confirmatory Factor Analysis (CFA). The CFA model tested was based on the model proposed by authors of the original test and previous findings with the IPANAT (see Quirin et al., 2018). The CFA model expressed the hypothesis that the IPANAT measures two factors, implicit NA and implicit PA. Scores for each one of the six mood adjectives assessed (i.e., 3 for PA and 3 for NA) were calculated by averaging across ratings of the combination of the mood adjective and the three artificial words, then the corresponding 3 adjectives were loaded to its belonging factor. It was a restricted model, which allowed each of the items to load on the respective predicted factor only. Previous findings indicate that a correlation between the two underlying factors could occur (see Quirin, et al., 2018). Thus, in our study the two factors were set to be non-orthogonal, to better explore this possibility. According to Izquierdo et al. (2014), to allow the covariance of the latent factors of the model is

the better way to corroborate its possible orthogonality.

The CFA models included error variances for each item and were set to load with a coefficient of 1. We estimated factor loadings via diagonally weighted least squares (DWLS) estimator, which has specifically been designed for ordinal data (Cheng-Hsien, 2016). We used Chi-squared values and degrees of freedom for each model to assess the fit of the CFA models. As well as Comparative Fit Index (CFI; Bentler, 1990), the TLI (Tucker-Lewis index), the Root-Mean-Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), as they are commonly recommended to assess absolute measures of fit (Browne & Cudeck, 1992; Jackson et al., 2009; Steiger & Lind, 1980). Following guidelines for Hopper et al. (2008), the present study used the next thresholds for determining model fit: Chi-squared (CMIN/df) less than 3, CFI $\geq$ 0.95, TLI $\geq$ 0.95, RMSEA $\leq$ 0.05 and SRMR $\leq$ 0.08.

Finally, we used correlational analysis and Z-tests to determine the relationships between the brief and the full version of the IPANAT, and with explicit measures of affect. Basic statistical analyses were conducted using IBM SPSS Statistics 22.0. In addition, Confirmatory Factor Analysis (CFA) were performed using R 3.6 and RStudio 1.2.

Results

An analysis of the internal consistency of the IPANAT's scales while performing item's reduction (see **Figure 1**), determined that the best ratio between number of items and an acceptable level of alpha coefficient were three artificial words (i.e., 18 items). Since the alpha coefficients for 18 items corresponded to the least number of items with similar reliability coefficient to the ones reported for the different versions of the full IPANAT (see Quirin et al., 2018). Therefore, for the IPANAT-18 three artificial words were randomly selected (i.e., SAFME, TALEP and BELNI) from the stimuli words used in the IPANAT-S.

After having completed the test, participants responded to a question about the

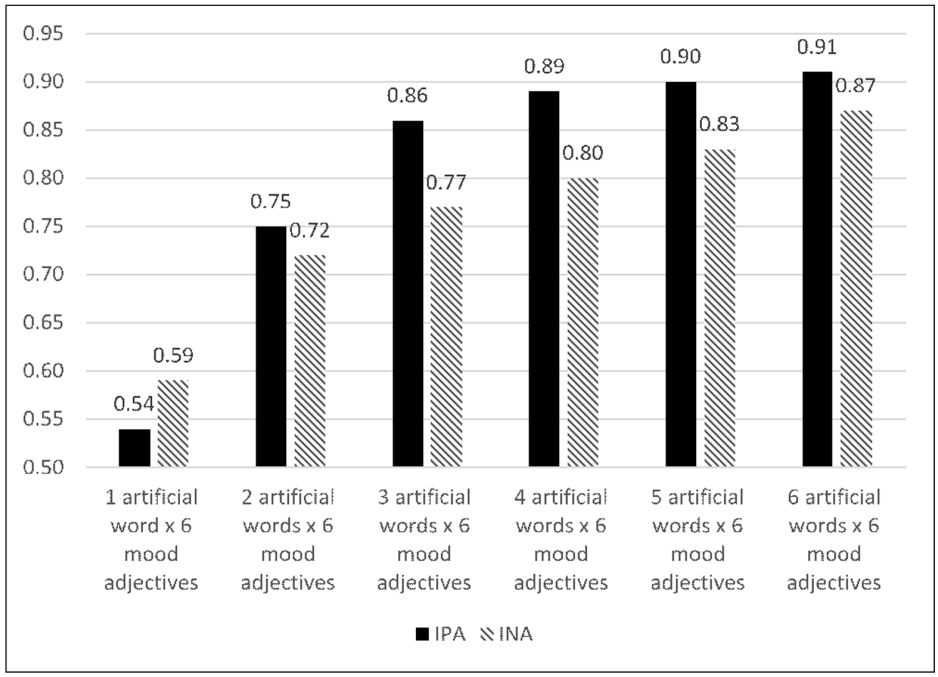

Figure 1: Reliability of the IPANAT's scales showed by items reduction.

presumed underlying aim of the IPANAT. Twelve individuals suggested that the test might assess affective states and were excluded from the initial sample of 242 participants (4.95% of the sample). Descriptive statistics (mean scores, standard deviations, skewness, and kurtosis) for the brief and the full version of the IPANAT can be found in **Table 1**. There were no missing data. After evaluating the assumptions of multivariate normality and linearity, we identified that the assumption of multivariate normality is slightly violated in our sample. Therefore, we used the diagonally weighted least squares (DWLS) estimator, since this method provides more accurate parameter estimates (Mîndrilă, 2010). Regarding sample size, it was determined that the size we used in the present study is adequate for the stability of the parameter estimates, since 10 participants per estimated parameter appears to be the general consensus (see Schreiber et al., 2006). In the CFA model we specify 6 regressions, 1 covariance, and 6 variances, totalling 13 parameters that need to be estimated. Since we have a final sample size of 230, we have an acceptable ratio of 17.69 participants to 1 parameter estimated.

As **Table 1** shows, the mean scores for PA are higher than the mean score for implicit NA. The latter is consistent with previous findings with the IPANAT (Quirin et al., 2018). **Table 1** also shows that the internal consistency estimates for the IPANAT-18 scales reached an acceptable level, implicit PA obtained an alpha coefficient of .86, while implicit NA was .77. Moreover, the alpha coefficients are comparable to the ones reported by the original version of the test (Quirin et al., 2009).

Factor Analysis

The model tested for the brief version of the IPANAT-18 obtained a χ^2 of 3.93, 8 degrees of freedom, a χ^2/df (CMIN) of 0.49, with a CFI of 1, the TLI was also 1, the RMSEA was 0.00, while the SRMR was 0.02. According to Hu and Bentler (1999), those values indicate a good fit between the model and the observed data (see also Schreiber et al., 2006). **Table 2** depicts the χ^2 and fit indices of the full and brief version of the test, and **Table 3** depicts standardized and unstandardized

Table 1: Descriptive statistics and reliability coefficient of the brief and full version of the Implicit Positive and Negative Affect Test.

	M	*SD*	*SK*	*K*	*α*
Implicit PA (Full version)	1.82	0.58	0.20	–0.89	0.91
Implicit NA (Full version)	1.59	0.44	0.60	–0.41	0.87
Implicit PA (IPANAT-18)	1.82	0.61	0.19	–1.00	0.86
Implicit NA (IPANAT-18)	1.57	0.46	0.78	0.42	0.77

Note: $n = 230$.

Table 2: Fit Indices of Models Tested in Confirmatory Factor Analysis ($n = 230$).

Model	χ^2 *(df)*	χ^2 */df*	CFI	TLI	RMSEA	SRMR
1. IPANAT	3.23(8)	0.40	1	1	0.00	0.02
2. IPANAT-18	3.93(8)	0.49	1	1	0.00	0.03

Note: 1 = Full-IPANAT (36 items), restricted bi-factorial model (Implicit Positive/Negative affect), not allowing for cross loadings between factors; 2 = IPANAT-18 (18 items), same structure than model 1; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

Table 3: Standardized and Unstandardized Coefficients for CFA Model 1(IPANAT) and Model 2(IPANAT-18) (n = 230).

Observed variable	Latent construct	IPANAT			IPANAT-18		
		β	*B*	*SE*	*β*	*B*	*SE*
Happy (Feliz)	PA	0.94	1.00		0.88	1.00	
Energetic (Activo)	PA	0.92	1.03	0.07	0.87	0.94	0.08
Cheerful (Alegre)	PA	0.89	0.97	0.07	0.90	0.99	0.09
Helpless (Desamparado)	NA	0.75	1.00		0.68	1.00	
Tense (Tenso)	NA	0.83	1.23	0.11	0.79	1.24	0.16
Inhibited (Inhibido)	NA	0.85	1.26	0.11	0.77	1.22	0.16

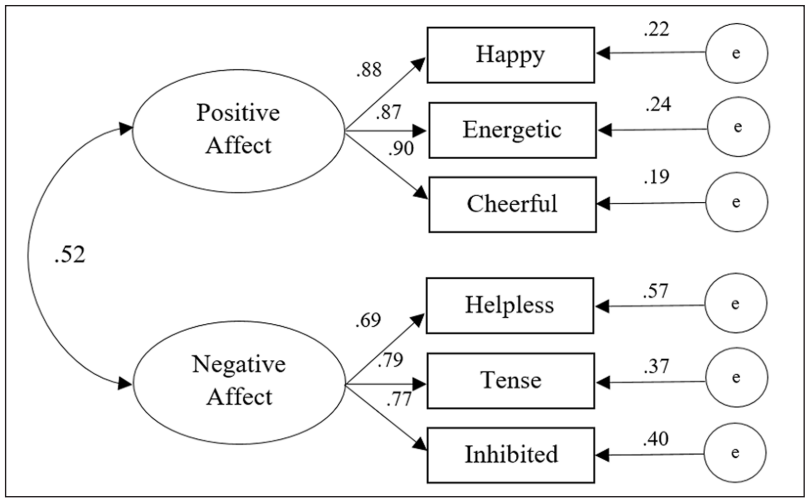

Figure 2: Results from Confirmatory Factor Analysis (model 2) for IPANAT-18 (n = 230).

coefficients of the CFA Models. Along with **Figure 2**, the results suggest an acceptable model fit for a two-factorial solution of the IPANAT-18. Moreover, the fit indices obtained by the brief version (18-items) are slightly lower, yet comparable to fit indices found for the full version on this sample, and to the ones reported for ten different versions of the full test (see Quirin et al., 2018).

Relationships between scales of the brief and full versions of the IPANAT

The differences between the mean scores of implicit affect assessed with 18 items or 36 items were statistically non-significant. For example, differences for implicit PA brief and full version was $t(229) = -.35$, $p > .05$, and for implicit NA $t(229) = 1.22$, $p > .05$. In addition, implicit affect mean scores assessed with the 18-items and 36-items versions showed strong correlations (implicit PA, r = .92; implicit NA, r = .88).

Relationships between IPANAT-18 and explicit scales of affect

As shown in **Table 4**, the correlations between the IPANAT-18 and explicit affect measures are of moderate strength. In addition, Z-tests were run to compare the correlations between implicit and explicit scales of affect. For implicit negative affect, the results show that the correlation

Table 4: Pearson correlations among Implicit Affect (IPANAT-18), Explicit affect (PANAS), and Explicit scale (Same Adjectives than on IPANAT).

Measure	IPANAT-18 Implicit PA	IPANAT-18 Implicit NA
PANAS PA	**0.15***	0.07 *ns*
Explicit scale PA (Same Adjectives)	**0.26****	0.08 *ns*
PANAS NA	0.15*	**0.29****
Explicit scale NA (Same Adjectives)	–0.05 *ns*	**0.15*****

Note: $n = 230$, ** $p < .05$, *** $p < .01$, ns = non-significant.

with explicit negative affect (assessed by PANAS) is significantly higher than the correlation with explicit positive affect, $z = 2.441$, $p < .01$. Inversely, it was found that implicit positive affect (assessed by Same Adjectives Scale), was more strongly correlated to explicit positive affect than to explicit negative affect, $z = 3.107$, $p < .01$.

Different versions of the IPANAT-18

Statistical analysis were also performed on the non-selected stimuli words of the IPANAT (i.e., SUKOV, GOLIP and KERUS). Results indicated that this set of three artificial words also shows good psychometric properties. The fit indices of the CFA model of this brief version were CMIN 0.52, CFI 0.99, TLI 0.99, RMSEA 0.01, and SRMR 0.04.

Discussion

The present study aimed to create and validate a brief version of the IPANAT, a measure for the indirect assessment of affect. Based on the results from the items reduction procedure, three artificial words (i.e., SAFME, TALEP and BELNI) were randomly selected from the six stimuli words used in the IPANAT. Therefore, the brief version of the IPANAT is composed of 18 items. We explored the goodness of fit of IPANAT-18 via CFA technique and found that the best fitting model supports a two-factor structure of the test, corresponding to implicit PA and implicit NA, which is in line with the factor structure found in the original IPANAT (see Quirin et al., 2009). As mentioned in the results section, chi-square and fit indexes indicated a good fit of the proposed model. In addition, the sample size used in the present study was adequate to produce relative stability of the parameter estimates. Internal consistency analyses showed a good reliability for both scales, and the CFA goodness of fit was comparable to findings from previous validations of explicit affect instruments (López et al., 2015).

In our study, PA and NA dimensions occurred to be non-orthogonal, as also reflected in a positive correlation between mean values of implicit PA and implicit NA. This is consistent with previous findings from cross-cultural studies with the IPANAT (see Hernández et al., 2020; Quirin et al., 2018). The authors argued that positive correlations between positive and negative affect could be due the fact that different cultures attribute slightly different meaning to mood adjectives. The latter is also consistent with findings of adjectives referring to personality (Nye et al., 2008). In concordance, previous cross-cultural studies with the IPANAT showed that high correlations between positive and negative affect was mostly due to a positive correlation between the mood adjectives *energetic* and *tense* (Quirin et al., 2018). In addition, it has been argued that in some languages the mood adjectives provide a smaller variability on the responses range. Therefore, future studies exploring this hypothesis should use a sample with a strong emotional context or under emotional priming. Nonetheless, according to Brown (2006)

a factor structure with a positive correlation between factors might be the better model fit, particularly if the factor loadings are strong, and the fit indices are better that the one-factor model, as previously found in the IPANAT's CFAs (see Hernández et al., 2020).

Not least, convergent and discriminant validity of the IPANAT-18 was supported by valence-congruent findings of correlations with explicit affect scales. For example, results showed that correlations between the IPANAT-18 and explicit affect measures are significant and of moderate strength. These moderate correlations are consistent with results reported for the original IPANAT, since Quirin et al. (2009) reported significant correlations of .20 for implicit and explicit PA and .22 for implicit and explicit NA. The moderate correlations between implicit and explicit measures are also consistent with findings of other implicit measures like: the Implicit Association Test (Greenwald et al., 2003), or the Affect Misattribution Procedure (Payne et al., 2005) (See Echebarria-Echabe, 2013). According to some authors, these low correlations between implicit and explicit measures can be due to different aspects, as motivational biases in the explicit measure, lack of introspective access of the participants, or even complete independence of the underlying constructs (Hofmann et al., 2005). In addition, evidence of discriminant validity of the IPANAT-18 can be obtain for our results, since Z-tests showed that implicit NA was more strongly correlated with explicit NA measures than with explicit PA measures, the opposite was found for implicit PA.

Finally, a different set of the artificial words (i.e., SUKOV, GOLIP and KERUS) can be used as a different version of the IPANAT-18. Since results showed that the random selection of items (i.e., three artificial words by 6 mood adjectives) yield similar psychometric properties than the full test. The latter is useful for researchers of the affective phenomena, particularly in experimental settings were repeated measures of the test are needed, since having different version of the test could reduce anchoring effects on participant's responses.

In conclusion, the present study suggests that the psychometric properties of the IPANAT-18 version are almost as good as those of the full-length measure. Hence, it appears that the shorter measure will serve studies requiring less time for administration than the original test. The latter is especially important for research where affective processes are experimentally induced, since it has been determined that the induced affect is often fleeting (Hermans et al., 2001), so a brief version is useful to better capture these processes. Likewise, research using repeated assessment, as daily-diaries studies, can also benefit by an economical multiple assessment, since a shorter version of instruments will help not to frustrate participants.

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Competing Interests

The authors have no competing interests to declare.

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