



Implicit measures of environmental attitudes: a comparative study

Medidas implícitas de actitudes ambientales: un estudio comparativo



Research

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ABSTRACT

The present investigation aims to inquire about the capacity of three implicit instruments to measure the attitude toward natural and urban environments. One hundred and three students from a Mexican public university participated in the investigation. The implicit instruments used were the affective priming technique, the implicit association test, and the affect misattribution procedure. Further, an explicit scale was used for comparison. The results showed that all instruments converge in the same way; the nature images were viewed as more pleasant compared to the city images. Also, most results indicated good effect size values, observed power, and reliability, with the exception of the affective priming technique, which established low values. In addition, all instruments indicated weak correlations between each other. The results were discussed in terms of the capacity of the instruments to measure environmental attitudes, and also possible theoretical and methodological implications.

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RESUMEN

Se presenta una investigación en la que se realizaron tres estudios con mediciones implícitas con la finalidad de determinar la capacidad de los instrumentos para medir la actitud de los participantes hacia los ambientes naturales y urbanos. Participaron 103 estudiantes de una universidad pública mexicana. Los instrumentos utilizados fueron la técnica de facilitación afectiva, la prueba de asociación implícita y el procedimiento de falsas atribuciones afectivas, además se utilizó una escala explícita como comparación. Los resultados indicaron que todos los instrumentos convergieron en el mismo sentido: valorar las imágenes de naturaleza como más positivas que las de ciudad. Además, mostraron valores aceptables de confiabilidad, tamaño de efecto y potencia, con excepción de la técnica de facilitación afectiva que manifestó valores bajos. Adicionalmente todos presentaron bajas correlaciones entre ellos. Se discuten los resultados en términos de la capacidad de los instrumentos para medir las actitudes ambientales, así como posibles implicaciones teóricas y metodológicas de los mismos.

Palabras clave:

Medidas implícitas, medidas explícitas, actitudes, ambientes naturales, ambientes urbanos.

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1. INTRODUCTION

Implicit measures are instruments of evaluation that have gained a significant role in the study of social knowledge acquisition, and that may be sensitive to social pressures. Although these instruments are often used in the field of social cognition, they are not the most diffused tools in the field of psychology. Instead, explicit measures, which assess feelings, thoughts, and behaviors consistently and directly, are the most commonly used (Gawronski & De Houwer, 2014). An increasing interest in the usage of implicit measures have led to the development of a significant number of instruments that allow the spontaneous and automatic assessment of psychological attributes.

One of the concerns researchers encounter is to determine which implicit measure is the most suitable to use; either because it has a greater internal consistency, sensitivity and measurability, or because of the difficulty of the design. Another important factor to consider is the relation between implicit tests and explicit measures, which for the most part are the correlation between implicit measures and self-reports (Fazio, Jackson, Dunton, & Williams, 1995; Greenwald, McGhee, & Schwartz, 1998; Payne, Burkley, & Stokes, 2008; Spruyt et al., 2015). Although there are a variety of studies testing the validity of these measures, we will focus on the most cited ones: the affective priming technique, the implicit association test, and the affect misattribution procedure (Nosek, Hawkins, & Frazier, 2011). These have been applied across different areas of study, but more specifically domains exploring attitudes, stereotypes, and prejudice (Greenwald, Banaji, & Nosek, 2015; March & Graham, 2015).

Nevertheless, there is limited research in the field of environmental psychology where these tests are compared. In contrast to explicit measures, these types of tests are often used because they are able to predict intentional or willful behavior (Gawronski & De Houwer, 2014; Payne, Cheng, Govorun, & Stewart, 2005).

1.1 Implicit measures definition

One way to study a phenomenon within the field of psychology is by using implicit measures. These measures are considered implicit because psychological attributes are assessed automatically. In other words, subjects are able to deliver a response that is not intentional nor controlled (De Houwer & Moors, 2010; Gawronski & De Houwer, 2014).

General characteristics of a number of implicit tests include: 1) the attributes of a stimulus determine

the type of assessment; these can be attributed either to attitude, stereotype, prejudice, self-esteem, etc., 2) the process is automatic, there is no control or awareness underlying the subject's response, 3) the evaluated attribution is caused by the nature of the cognitive processes that involved.

In this regard, the diffusion activation and response competition is one explanation that has been proposed. Similarly, there are some debates that consider the generation of dual attitudes, that is, one when working with explicit instruments and another one when working with implicit measures. Based on this premise, results the Fazio's (1990) Motivation and Opportunity as Determinates (MODE) model. Here, attitudes can be triggered by two different processes, either spontaneously without evaluating the stimulus; or deliberately, where planning and an analysis of costs and benefits is performed based on the motives or opportunities to complete a specific evaluation (Fazio & Olson, 2003; Fazio & Roskos-Ewoldsen, 1994).

On the other hand, the associative and propositional processes model in the evaluation argues that, depending on the preexisting structure, implicit measures create associations in long-term memory while propositional processes elicit value judgments based on inferences that generate relevant propositions (Gawronski & Bodenhausen, 2006).

Implicit measures employ different priming techniques. These presentations can be displayed as sequential priming or parallel priming. When using sequential priming, stimuli are exposed consecutively (e.g. semantic and affective priming, affect misattribution procedure, etc.). And when utilizing parallel priming (e.g. implicit association test), stimuli are presented simultaneously. These procedures allow us to understand the representations that participants create about a particular topic (Cameron, Brown-Iannuzzi, & Payne, 2012).

1.2 Affective priming

One of the first emotional implicit measures based on sequential priming techniques was the affective priming (AP) proposed by Fazio et al. (1995). This measure was created in attempts to learn about the implicit attitude that is triggered when evaluating an object indirectly. It is based on the priming paradigm, which states that the information, whether semantic or affective, is stored in associative networks in long-term memory. Depending on the levels of association made between different elements of a network, these are activated by stimuli that are presented during a short period of time (Fazio, 2001; Hermans, Baeyens, &

Eleen, 1998). Associations tend to change based on the experiences that individual is exposed to, causing a variation of associations (Fazio & Olson, 2003; Oskamp & Schultz, 2005).

This technique is based on the presentation of three stimuli. The first one is a point of fixation, followed by the stimulus that serves as the facilitator (priming). Finally, the purpose of the third stimulus is to assess the attitude that was triggered by the facilitator (Fazio, 2001). It is thought that the facilitators and the target stimulus are congruent when both have the same emotional value, or they can be incongruent when both display different values.

A variety of research studies have implemented these techniques in order to investigate the relationship between affective priming and self-report measures across a range of domains. However, it is common to find weak correlations between explicit measures (Cameron et al., 2012; Eves, Scott, Hoppé, & French, 2007; Fazio et al., 1995; Gawronski, Bodenhausen, & Becker, 2007). Greenwald and Nosek (2009) attributed said results to social desirability.

In relation to environmental based research, there are studies that have investigated the assessment toward different contexts, including natural and urban environments. Findings suggest a positive evaluation toward natural contexts (Hietanen, Klemettilä, Kettunen, & Korpela, 2007; Hietanen & Korpela, 2004; Korpela, Klemettilä, & Hietanen, 2002; Sánchez & De la Garza, 2015a; Sánchez, De la Garza, & Rangel, 2013). However, they have not been correlated to explicit reports.

1.3 Implicit association test

Another commonly used implicit measure in the field of social cognition is the implicit association test (IAT) developed by Greenwald et al. (1998), in which ideas of facilitation are reconsidered with the intent to obtain an automatic response. The IAT consists in presenting the objects of attribution and attributes using a parallel method. In these types of test, compared to sequential measures, stimuli are presented simultaneously. The objects of attribution are exhibited at the center of the screen, while labels corresponding to the attitude of the object and the attributions of the domain being evaluated, are found at the inferior corners of the screen. These should be dichotomous since they can only be classified at one of the two labels that are presented, either to the attitude of the object (e.g. flowers or insects) or to the attribution (e.g. positive or negative). The IAT has been implemented in a variety of domains including: identity, stereotypes

(race) and attitudes (Dasgupta & Greenwald, 2001; Schnabel, Asendorpf, & Greenwald, 2008).

As for the study on the environment and its correlation to explicit attitude tests and implicit identity measures, low correlations and significant reliability have been reported (Bruni & Schultz, 2010; Olivos & Aragonés, 2013; Schultz, Shriver, Tabanico, & Khaznia, 2004; Schultz & Tabanico, 2007). Similarly, most research studies have found that participants display a positive attitude and an implicit identity toward natural environments (Sánchez, De la Garza, Contreras, López, & Hedlefs, 2011).

1.4 Affect misattribution procedure

Payne et al. (2005) proposed an implicit measure technique called affect misattribution procedure (AMP). The idea behind this procedure is based on the tendency of the individuals to make erroneous attributions of diverse phenomena. When presenting an ambiguous stimulus, the subject tends to confer attributes based on previously developed mental representations, which are not always an accurate reflection of reality (Gawronski & Ye, 2014). This phenomenon is well known across the field of psychology and has been used in projective tests for many years, but not until recently it was considered an alternative for measures that utilized reaction time as a method of evaluation. It is based on the procedure proposed by Murphy and Zajonc (1993), which consists in showing an emotional image followed by a Chinese character and assessing whether these stimuli are perceived as pleasant or unpleasant through a scale.

Participants are instructed to ignore the first image and evaluate the Chinese character. The idea is that the first stimulus will activate an attitude that will be reflected when assessing the pictograph. Research studies implementing this procedure have documented results with good reliability as well as low correlations with scales. For instance, when studying racism Payne et al. (2008) found correlations when using explicit measures, making the argument that these findings are due to the structural adjustment (similarity of the task) between the explicit and implicit measures.

Therefore, the following research aims to determine the ability to measure participants' attitude toward natural and urban environments through the implementation of three implicit measures, and to contrast the results using an explicit instrument. Also, the measurement capability and the interrelation of the instruments will be compared. Thus we hypothesize that the implicit instruments have the capacity to

measure the attitudes toward natural and urban environments.

2. METHOD

The current investigation was conducted using three quasi-experimental design studies and an explicit instrument for comparison.

2.1 Study 1 – Affective priming technique

2.1.1 Participants

A non-random and convenience sample was used. A total of 103 psychology students from a Mexican public university participated in the study. Ages ranged from 18 to 20 years, with a mean of 18.5 years ($SD = .5$). There were 71% females and 29% males.

The following exclusion criteria were applied: participants whose reaction time in any experimental condition was greater than two standard deviations, as well as those who made more than 20% of errors in the study were excluded. In total, 10 participants were excepted.

2.1.2 Instruments

The test was administered using a computer program implemented in portable computers. The images represented natural, constructed, and neutral (geometric figures) environments. The words displayed emotional and neutral (table 1) content. These were primes presented in previous studies (Sánchez & De la Garza, 2015a; Sánchez et al., 2013).

Table 1. Target words used in the study

Positive (P)	Negative (N)	Neutral (NU)
LOVE	SCARED	CROSS
SERENITY	SADNESS	STAR
OPTIMISM	HATE	TRIANGLE
ACCOMPLISHMENT	FEAR	CIRCLE
HAPPINESS	DISGUST	SQUARE
BEAUTY	DEAD	RHOMBUS

Three different primes were presented in the study; the first one was a point of fixation where participants maintained their attention for 500 milliseconds (ms), then a prime image would appear for 250 ms, followed by a blank screen for 50 ms, and finally the target word would appear (figure 1). This word remained on the screen until a response was delivered. One hundred and eight pairs of primes were presented in six blocks, keeping each type proportionate.

2.1.3 Procedures

Students were invited to participate in the study voluntarily. They were provided with detailed information about the study and assurance of their confidentiality was also given. Those who accepted to participate were taken to an isolated room where a computer was assigned.

The procedures to follow were explained thoroughly. When proving an answer participants pressed the letter M on the keyboard if there was

emotional content or Z for lack thereof. The time taken to give a response was measured. Participants were presented with 10 practice paired primes.

2.2 Study 2 – Implicit association test

2.2.1 Participants

The sample consisted of the same participants from study 1. The following exclusion criteria were applied: participants whose response time was greater than two standard deviations from the average of the test were excluded. A total of 98 subjects remained.

2.2.2 Instruments

A computer program was implemented to administer the test. Participants used the same computers from Study 1. The instrument consisted in presenting a series of stimuli, both images and words which were classified in four categories. The same images and words from Study 1 were applied,

excluding neutral stimuli. The test was presented in five blocks; blocks one, two, and four were for practice, and blocks three and five corresponded to the test. A total of 24 stimuli were presented at random in the test blocks. The categories used were: nature, city, good,

and bad (table 2). Two versions of the test were presented where the initial display of the categorized images is inverted (blocks three and five), with the intention of counterbalancing the study. Both versions were applied equivalently.

Figure 1. Screens sequence of the AP technique.

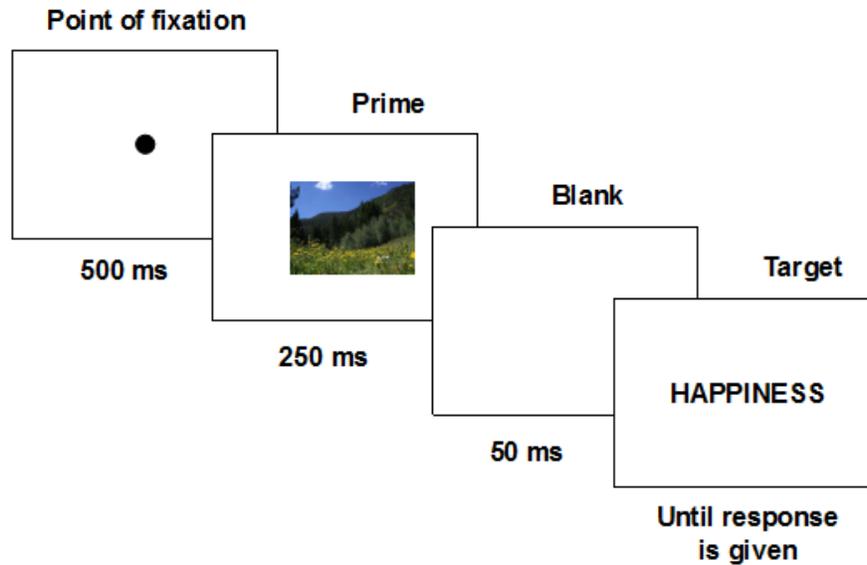


Table 2. Blocks of content for the IAT

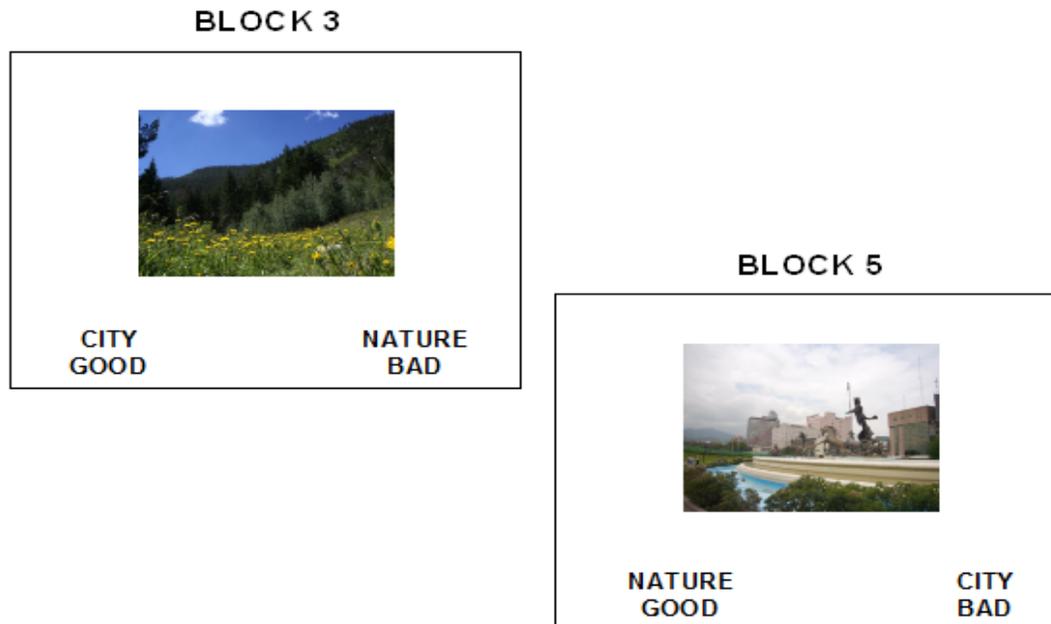
Block	Function	Left category (Z)	Right Category (M)
1	Practice	Nature Images	City Images
2	Practice	Positive Words	Negative Words
3	Test	Nature Images + Positive Words	City Images + Negative Words
4	Practice	City Images	Nature Images
5	Test	City Images + Positive Words	Nature Images + Negative Words

2.2.3 Procedures

Once in front of the computer, participants received a detailed explanation of the procedures. They were asked to respond using Z and M on the keyboard to classify the stimuli in their corresponding category; either to the right or to the left. The time taken

to respond was registered. If they made a mistake, a label was shown at the top of the screen indicating the failure and showing the participant to press the other key (figure 2). When errors occurred, the response time was replaced by the average of the block, and a 600 ms penalization was applied (Greenwald et al., 1998).

Figure 2. Screens for the IAT.



2.3 Study 3 - Affect misattribution procedure

2.3.1 Participants

The sample consisted of the same participants from Study 1. This time they were asked if they knew Chinese. No one confirmed having knowledge of the language.

2.3.2 Instruments

A computer program was implemented to administer the test. Participants used the same computers from Study 1. The same city and nature images from Study 1 were presented, as well as a gray square used as the neutral prime, and 18 Chinese characters.

The test consisted of presenting three stimuli. First, a point of fixation was displayed for 750 ms followed by an image that was either a nature, urban, or neutral environment; this image was presented for 100 ms. The screen then remained blank for 100 ms. Immediately a Chinese character was showed for 100 ms. Consequently, a screen with gray "noise" appeared along with a 4-point Likert scale ranging from

-2 to +2 (Payne et al., 2008), labeled unpleasant to the left and pleasant to the right (figure 3). A total of 18 pairs of stimuli were presented randomly (i.e. 6 designated to nature, 6 to city, and 6 to neutral).

2.3.3 Procedures

Participants were given a detail explanation of the procedures. Emphasis was made on evaluating their perception of the Chinese character and not the proceeded image. There were no time limitations to deliver a response. Two primes were presented for practice.

2.4 Study 4 – Environmental attitude scale

2.4.1 Participants

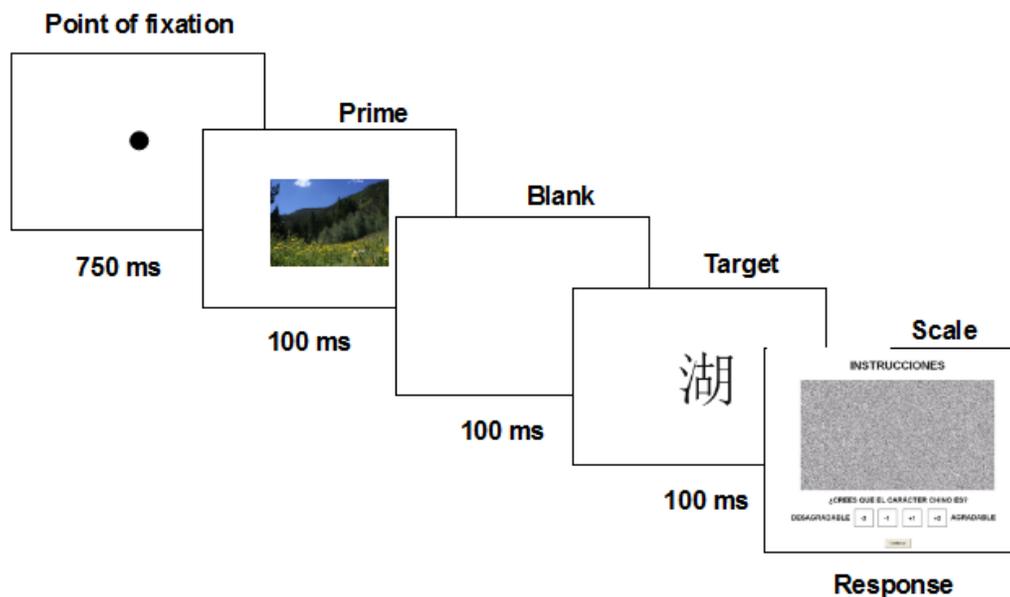
The sample consisted of the same participants from Study 1.

2.4.2 Instruments

The environmental attitude scale (EAS) was developed electronically using the Google Forms platform. The 12 images from Study 3 were presented.

The aim was to implement the same stimuli and methods of evaluation presented in this study.

Figure 3. Screens sequence of the AMP.



2.4.3 Procedures

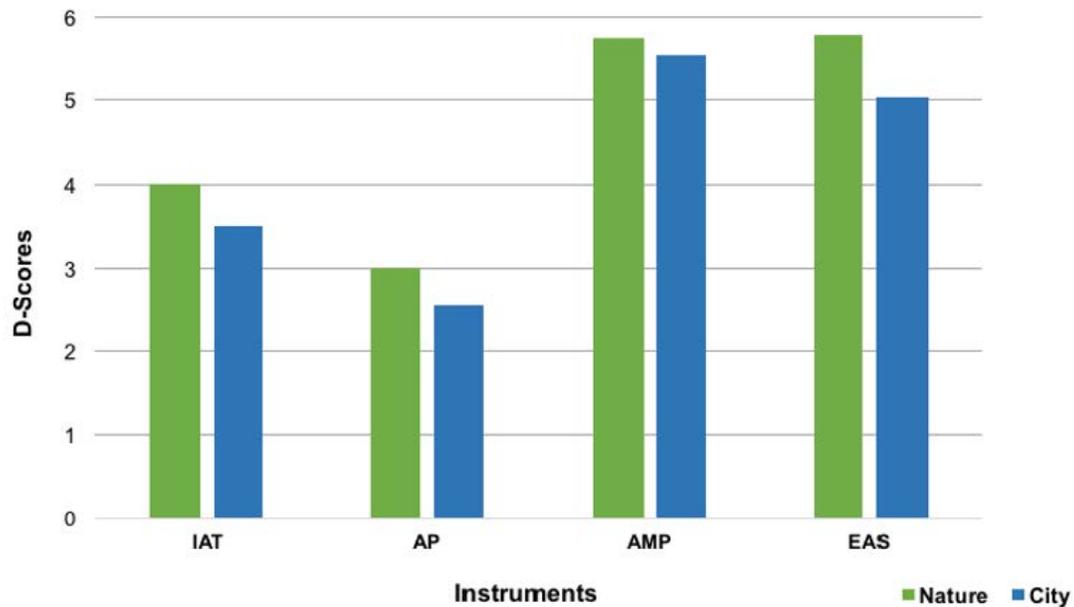
Participants were directed to enter a website to answer the scale. Here, they were asked to imagine that they were in the place portrayed in the picture. They were inquired about their perception of the place and to answer based on a 4-point Likert scale, where -2 was unpleasant and +2 was pleasant.

3. RESULTS

The results indicated that participants rated nature related images as more pleasant and/or more positive than city related images in each task (figure 4). In order to make this comparison and due to the different metric measures that are implemented (ms vs. Likert scale), a transformation of the data was made into D-scores (Greenwald, Nosek, & Banaji, 2003), which consists in dividing each recorded data into the corresponding standard deviation of each instrument. Also, the data was inverted in the IAT and AP measures since lower reaction time values mean a more positive valuation, contrary of Likert scale measures.

In order to corroborate whether there were significant differences between images, a t-test analysis was implemented in each study. In table 3, the first column indicates that, under each measure and in comparison with city images, participants assessed nature images with a positive attitude, while also presenting significant results.

To determine the instruments' ability to measure this attitude, the effect size (partial eta), observed power, and reliability (Cronbach's Alpha) was calculated for each measure (table 3). In regards to the effect size, an average value was observed when implementing the implicit tests. However, the AP test showed a weak value (multifactorial design). The explicit measure (EAS) presented a higher value. All instruments indicated high value of sensitivity to conduct the measures (observed power), with the exception of the AP test with a low and not acceptable value (Cárdenas & Martini, 2014). Lastly, in regards to the measures' internal consistency (Cronbach's Alpha) all instruments revealed acceptable values, with the exception of the AP test, which presented a low value.

Figure 4. Scores of the instruments for the nature and city images.

Note: IAT= implicit association test, AP= affective priming, AMP= affect misattribution procedure, EAS= environmental attitude scale.

Table 3. t-test, size effect, observed power, and reliability of the instruments

	t-test	Effect Size	Observed Power	Cronbach's Alpha
IAT	6.58*	.31	.99	.87
AP	6.63*	.04†	.72	.65
AMP	6.92*	.28	.99	.81
EAS	10.10*	.50	.98	.83

Note: IAT= implicit association test, AP= affective priming, AMP= affect misattribution procedure, EAS= environmental attitude scale. * $p < .01$. †= Multifactorial design.

To establish a relationship between the measures used in the study, a correlation between each of them was calculated. The D-scores previously established were implemented. As shown in table 4, there was only a weak correlation found between the implicit (AMP) and explicit (EAS) measures.

In addition, a t-test analysis was implemented in order to determine whether there were significant differences in the mean of the responses between the different measures. Only when effecting the IAT and the AP measures, as well as the AMP and the AP measures, no significant differences were found (table 5).

Table 4. Correlations between different instruments.

	IAT	AP	AMP	EAS
IAT	–			
AP	.04	–		
AMP	.03	.03	–	
EAS	.11	.10	.28*	–

Note: IAT= implicit association test, AP= affective priming, AMP= affect misattribution procedure, EAS= environmental attitude scale. * $p < .01$, – = Not applicable.

Table 5. t-test between instruments.

	IAT	AP	AMP	EAS
IAT	–			
AP	.21	–		
AMP	3.69*	.62	–	
EAS	2.72*	1.87*	5.27*	–

Note: IAT= implicit association test, AP= affective priming, AMP= affect misattribution procedure, EAS= environmental attitude scale. * $p < .01$, – = Not applicable.

4. DISCUSSION

Results indicated that the participants displayed a positive attitude toward nature images while using all measures, regardless of whether the instrument was implicit or explicit. These results can be added to other implicit based studies, such as the AP technique (Hietanen et al., 2004, 2007; Korpela et al., 2002; Sánchez et al., 2015a), the IAT test (Sánchez et al., 2011; Schultz & Tabanico, 2007), and those with explicit measures (Olivos & Aragonés, 2013; Sánchez, De la Garza, Lopez, & Morales, 2012; Schultz et al., 2004; Schultz & Tabanico, 2007).

On the other hand, implicit and explicit measures demonstrated an appropriate effect size, power value, and reliability; thus it can be said that they are suitable to measure the attitude toward the images that were presented, with the exception of the AP technique which presented low values. These last findings were previously reported in other research studies (Gawronski & De Houwer, 2014; Pérez, 2013). This could be an intrinsic quality of the measure, which would question its use compared to other alternatives.

The analysis also detected that the relationship between different instruments can vary. No significant correlations between measures were found, with the exception of the implicit AMP and the explicit EAS measures. Similarly, when examining whether there are differences between the responses of each measure, the AP technique demonstrated to be similar to the IAT and the AMP, even when the AMP does not use reaction time as a measure. This means that in average participants performed similar assessments, even though these were not correlated, previous research studies have reported similar findings (Bosson, Swann, & Pennebaker, 2000; Gawronski & Bodenhausen, 2006).

A possible explanation to the correlation found between the AMP and the EAS is that both measures are implemented using a Likert scale to see how the stimuli are evaluated, using the same structural adjustment (Payne et al., 2008). Another plausible explanation is that participants may fail to follow the instructions when asked not to consider the prime image and only to evaluate the Chinese character, placing in question its implicit characteristics (Nosek et

al., 2011). Other researchers have reported that this phenomenon may be due to the low value of reliability of other implicit measures (IAT and AP) (Cameron et al., 2012). Nevertheless, our study demonstrated that the IAT exhibited high levels of reliability and was not correlated with the explicit scale, which questions previously stated affirmation.

Another argument is that from the participants' evaluation of the stimuli derives different cognitive mechanisms, which are the results of low correlations. As proposed by dual models, it can be argued that these instrument different psychological constructs (Gawronski & Bodenhausen, 2006).

For this reason, when performing the evaluation, we propose the dual model of the associative and propositional processes as the most accurate way to explain the results obtained. It appears that positive associations with the natural environment are activated in the memory when nature images are presented, resulting in positive attitude.

During the explicit measure, this activation enables that the statement, along with the images, drive the participants to make positive judgments toward natural contexts, considering that the information and the images are always exposed until a response is provided. One of its implications is the elaboration of complex cognitive processes, as mentioned by Gawronski and Bodenhausen (2006); if high levels of complexity are observed in the explicit evaluation, lower levels of correlation will be identified with the implicit tests. It can't be denied that both, the associative and propositional processes theory and the structural adjustments, are plausible explanations, nevertheless, further investigation it's necessary.

One of the limitation of this study was the population; only psychology students were part of the sample. It is recommended that future research studies look at non-student populations. It would also be appropriate to implement different nature and city images. Finally, cognitive mechanisms based on the implicit phenomenon should be further explored. Likewise, it can be affirm that these instruments would be useful to assessing public spaces such as offices, schools, parks, etc.; as it is a method of evaluation to environmental education courses (Sánchez & De la Garza, 2015b).

As a significant contribution of the present research study, it can be concluded that implicit measures, such as IAT and AMP, revealed a good measure capability, in comparison with the AP test, which has the lower levels of reliability. Additionally, implicit measures converge in the same direction; nature is perceived as more pleasant than the city, no

matter what type of mechanism is used when the evaluation is being performed. The AMP, which is implemented for the first time in environmental matters, resulted to be a convenient alternative given its good reliability and ease of design.

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