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SUSTAINABILITY: THE USE OF THE IMPLICIT ASSOCIATION TEST (IAT) TO IDENTIFY AND MEASURE IMPLICIT ATTITUDES

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ABSTRACT

Over the years, sustainability has been a major theme discussed by the leading environmental organizations around the world. Excessive consumption is one of the factors that is directly connected to environmental issues, interfering with the sustainability capacity of the Earth. Attitudes and behavior are influenced by both conscious (explicit) or unconscious (implicit) associations that subjects have in their memory. In order to identify unconscious associations, specific implicit memory tests are required, such as the Implicit Association Test (IAT), which is widely used to measure implicit associations towards several themes. This work aims to present the results from a pretest using the IAT to identify and measure the implicit associations of a group of environmental specialists regarding consumption and sustainability. By using the FreeIAT software, the IAT was customized for this research. The pretest with environmental specialists was conducted to check the consistency of the customized IAT. The Cronbach´s alpha was applied to measure the reliability of the test and showed *good internal consistency. Since the results from the pretest with the specialists demonstrated that the customized IAT is* reliable and consistent, this test can be applied to other groups of subjects to identify the implicit associations towards consumption and sustainability. The data obtained from the administration of the customized IAT will contribute to many research fields related to the environment, consumption, sustainability, energy and development.

1. INTRODUCTION

Energy is essential for the socio-economic development and planning of a country. Over the years, sustainability has been an important theme discussed by the leading environmental organizations around the world.

The economic growth of a country is closely tied to the availability of inputs for the production process such as land, labor, capital, and energy. For the sustainable development, it is necessary to plan how these resources will be provided in the long term to avoid excesses or faults [1].

Excessive consumption is one of the factors directly related to environmental issues, interfering with the sustainability capacity [2]. There is a close relationship among the economic activities, the environment and the sustainability of the planet [3]. Concerning sustainability, the extraction of natural resources, the industrialization process, the waste from both industry and post-consumption must be considered. The consumption patterns of the society influence the degree of exploitation of natural resources and the waste production [4].

In the modern economic system, a linear process of the extract-produce-discard type has taken place. With economic growth both the extraction of environmental resources and the amount of waste increase and recycling is minimal [5]. This Extraction-production-discarding model is shown in Figure 1.

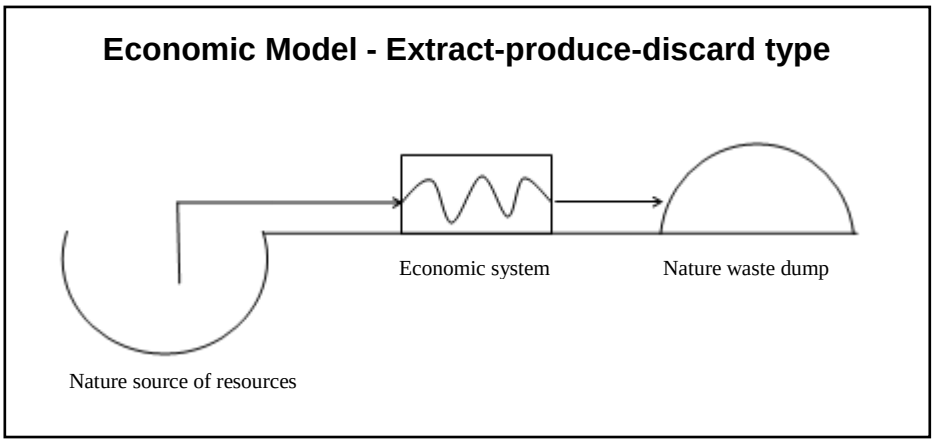

Figure 1: Extraction-production-discarding model

Based on a capitalist system, modern society consumes more and more and is faced with the imposition of new consumption needs [6]. This unbridled consumption causes not only the depletion of the natural resources available on the planet, but also the deterioration of the quality of life of people, especially the poorest ones [7]. All those factors are closely connected to the energy issue due to the fact that for the production of consumer goods a large amount of energy is used throughout the industrial process.

When analyzing the awareness involved in consumption, not only information and knowledge must be considered but also attitudes, behaviors, decision making and practical actions. Consumption decisions can be made consciously or unconsciously. The consumer´s

attitudes, as well as perceptions, memories of experiences, judgments, and actions are influenced by both conscious and unconscious factors. Both the thought and the behavior of an individual can be influenced by implicit psychological processes, which are connected to the implicit memory [8].

The memory system consists of explicit and implicit memories. Both are memories of long duration. However, the explicit memory stores and retrieves information in a conscious way and implicit memory involves information that has been stored unconsciously. Implicit memory comprises contents that cannot be expressed by words; but by performance. Although unconscious, the implicit memory interferes with behavior, choices, and responses, being that many decision-making processes are guided by unconscious and automatic processes [9].

In order to identify and assess the implicit memory associations, specific implicit memory tests are required [10-11]. Among those tests, the Implicit Association Test (IAT), proposed by [12] has shown to be an effective and widely used tool to measure implicit associations in several areas of knowledge [13-19].
Regarding sustainability, attitudes and behaviors are also influenced by implicit associations. Thus, positive implicit associations towards sustainability will generate more sustainable attitudes and choices.

This paper aims to present the results of the pretest to identify and measure the implicit associations towards sustainability by using the Implicit Association Test (TAI).

2. RESEARCH DEVELOPMENT

The first step of this research consisted of choosing a reliable tool for assessing implicit associations. The literature reports that the Implicit Association Test (IAT) has been administered worldwide effectively assessing a great variety of themes [20-21-22].
The IAT is a computer-based method that uses reaction time as an indicator of attitude strength. It is a chronometric procedure that quantifies the strength of conceptual associations by considering the latency with which respondents can employ two response keys when each has been assigned a dual meaning. It is based on the assumption that it is easier to make the same behavioral response (a key press) to concepts that are strongly associated than to concepts that are weakly associated [12].

One of the advantageous features of the IAT is its ability to produce large effects from relatively small samples, such as 20 participants [12].
The successful results have demonstrated IAT to be a reliable implicit measurement tool [21].
The customization and administration of the IAT require the use of a specific software. The *Free*IAT is a free and highly customizable software used to administer the Implicit Association Test [23].

2.1 The customization of the IAT

By following the steps provided by the FreeIAT, a customized IAT was designed to compare implicit associations towards sustainability. The IAT requires categorization of items representing four different categories, being two attributes (good and bad) and two concepts (sustainable and unsustainable) The positive attributes (good) were: *well-being, joy, peace, happy, pleasure.* The negative attributes (bad) were: *terrible, horrible, harmful, terrible, bad.* For the concept category "sustainable", the words were: *recycling, sustainability, environmental protection, renewable, clean energy, fauna, ecosystem, flora*. The words for the concept category "unsustainable" were: *consumerism, waste, global warming, deforestation, pollution, hunting, contamination, garbage.*

The IAT procedure has five steps, with steps 3 and 5 providing critical data. Typically, there are 40 trials within each critical block. The participants see the stimuli (words) that are presented sequentially in the center of the computer screen and are asked to respond as fast as possible by pressing the "E" key if the word belongs to the category on the left and the" I" key if the word belongs to the category on the right. Participants perform this categorization task until all stimuli have been presented several times.

When a respondent presses the wrong key in response to a stimulus item, the task presents a red X and waits for the correct response to be made. Error responses also provide useful information for measuring the intended construct [12].

Two output files are created: the 'AllData.txt', containing raw data from all trials and the 'ScoresOnly.txt', containing the most relevant "final" scores. The IAT effect is calculated by using latency data from steps 3 and 5.

Regarding the strength of the associations, the interpretation of the IAT effect consists of the following values: lower or equal to 0.15 (= neutral); between 0.16 and 0.35 (= slight); between 0.36 and 0.65 (= moderate); greater than 0.65 (= strong). Those values are valid for both positive and negative values [24]

In order to demonstrate the steps of the IAT designed for this study, an example of possible associations of the tests will be shown in Figures 1 to 4.

Test IAT – "Sustainable and Unsustainable"

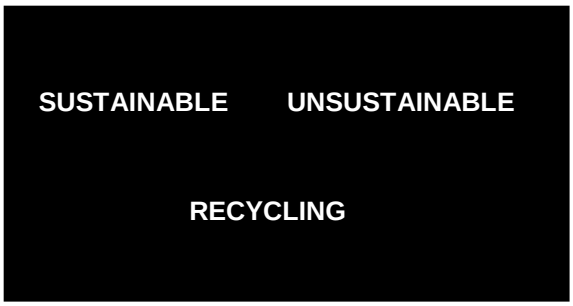

Figure 1. The concept dimension

Figure 2. The attribute dimension

Figure 3. The concept-attribute pairing

Figure 4. The categories are combined in opposite way

2.2 Pretest with Specialists

After customizing the IAT for the study, a pretest with specialists was administered. According to Hair [23], when items of a measurement instrument are developed specifically for a study, a pretest should be taken before the main experiment is carried out [25]

To measure the strength of implicit associations towards sustainability, a pretest using the customized IAT was first administered to 24 specialists from the *Centro de Engenharia Nuclear* (CEN) at the *Instituto de Pesquisas Energéticas e Nucleares* (IPEN).
The pretest aimed to check the comprehension and consistency of the customized IAT.

3. RESULTS AND DISCUSSION

Of the 24 specialists, (13 males and 11 females), 100% demonstrated positive automatic associations towards sustainability, as shown in Figure 5. This high percentage of positive associations was an expected result since the subjects have deep knowledge about sustainability and environment.

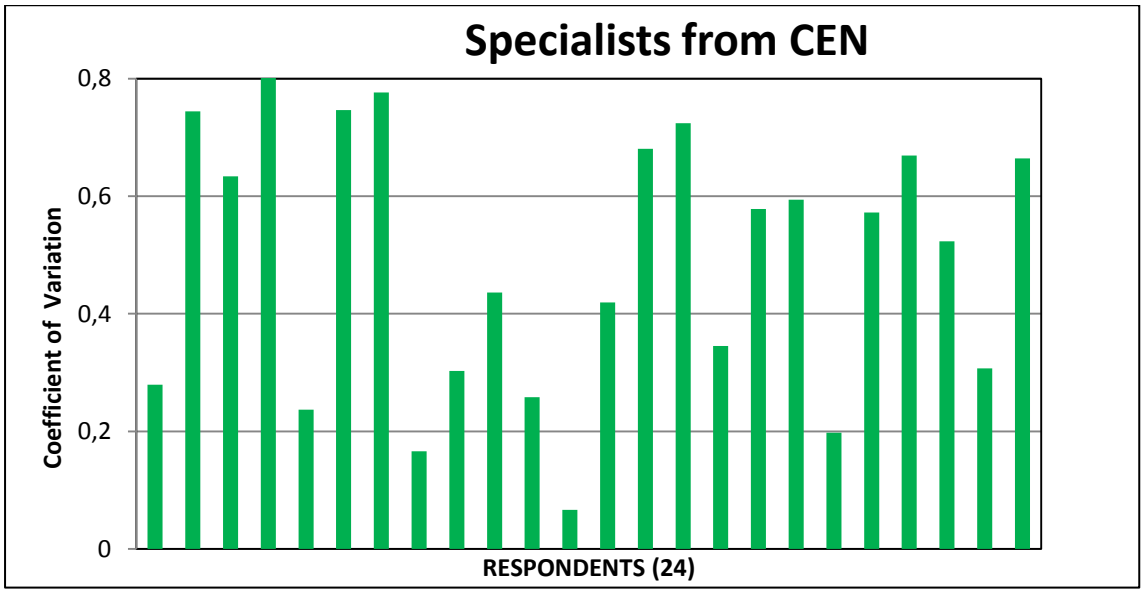

Figure 5: Positive implicit associations of specialists towards sustainability

Regarding the strength of the positive implicit associations of the 24 specialists, 4,2% had neutral values, 33,3 demonstrated slight positive association, 29,2% demonstrated moderate positive association and 33,3% demonstrated strong positive association towards sustainability, as shown in Figure 6.

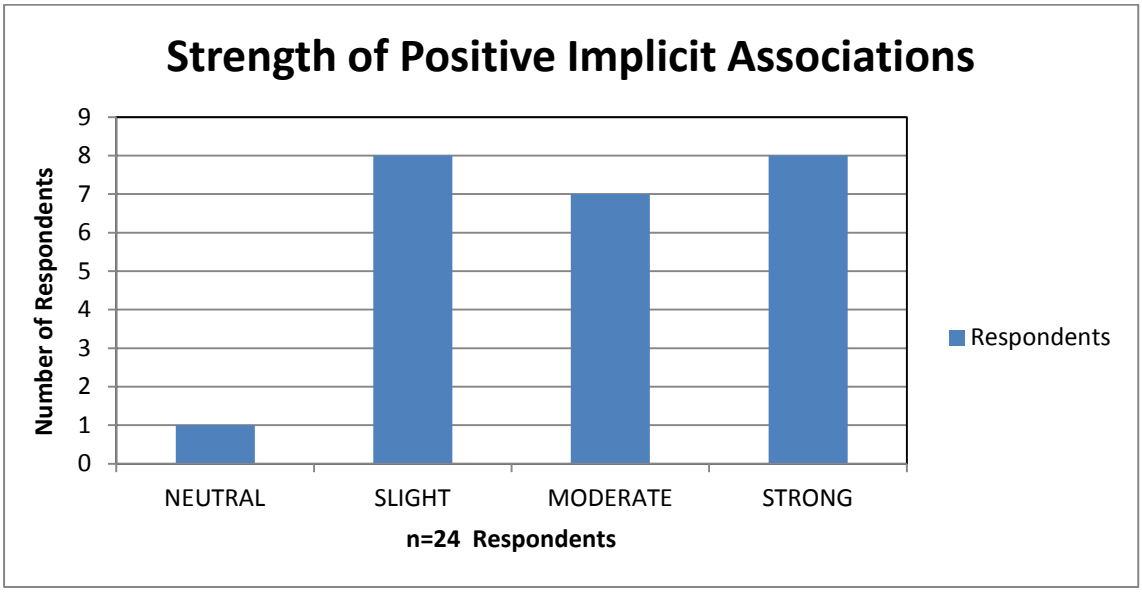

Figure 6: The strength values of the implicit associations towards sustainability

The strength values of the positive associations varied between males and females, as demonstrated in Table 1.

Table 1: Gender comparison of positive association strength towards sustainability

Participants	**Neutral**	**Slight**	**Moderate**	**Strong**
N=24	**%**	**%**	**%**	**%**
Male (n=13)	7,7	38,5	23,1	30,7
Female (n=11)	0	27,2	36,4	36,4

The pretest demonstrated that although specialists have positive implicit associations towards sustainability, these associations vary in strength intensity.

3.1 Statistical Treatment

Internal consistency must be determined before a test can be employed for research or examination purposes to ensure validity.

For this study, the Cronbach´s alpha was applied to measure the reliability of the pretest. The value of *alpha* ranges from zero (unreliable) to one (perfect reliability), with a value of .70 or greater considered acceptable for most purposes. Table 2 shows the rule for describing internal consistency using Cronbach's alpha provided by George and Mallery [17].

Table 2: Cronbach´s alpha reliability coefficients

Internal Consistency	Unacceptable	Poor	Questionable	Acceptable	Good	Excellent
Cronbach's alpha	$0.5 > \alpha$	$0.6 > \alpha \geq 0.5$	$0.7 > \alpha \geq 0.6$	$0.8 > \alpha \geq 0.7$	$0.9 > \alpha \geq 0.8$	$\alpha \geq 0.9$

The statistical software program SPSS was used in this study to run the Cronbach`s alpha test. The value of alpha was .771, suggesting that the items have acceptable internal consistency.

4. CONCLUSION

The IAT designed for this study was effective to identify and measure the implicit associations towards sustainability. The results from the pretest administered to specialists demonstrated the consistency and reliability of the customized IAT.

A future step in the development of this research will be to administer the customized IAT to other groups of subjects to identify and measure the implicit associations towards sustainability.

The data obtained from administration of the customized TAI for other groups will contribute to several fields of knowledge, such as the environment, energy and development, among others.

5. ACKNOWLEDGMENTS

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