DOI: 10.17469/O2106AISV000012

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Adapting the Implicit Association Test to speech: Issues and methodological proposals

This contribution aims to present and to discuss how speech sciences can fruitfully apply the IAT (Implicit Association Test) protocol, an experimental procedure developed in the psycho-sociological fields designed to reveal and to measure implicit attitudes toward social objects (e.g., speech varieties). Currently, few studies employ IAT to evaluate speech attitudes applying different protocols, especially in the production and treatment of stimuli. This proposal intends to outline a framework of IAT use in spoken language study and to discuss a number of features potentially capable of constituting a valid and reproducible standard for IAT use in speech: stimuli duration, content and familiarity.

Key words: sociolinguistics, attitudes, Implicit Association Test.

1. *Preliminary Remarks*

1.1 Attitudes in linguistics

The evaluation of attitudes in linguistics is supported by relevant literature (Cooper, Fishman, 1974; Giles, Billings, 2004), and individual attitudinal states prove to have a key role in many phenomenological aspects of speech. Interlinked as they are with different behavioral, psychological and social aspects, attitudes seem to play a crucial part in the regulation of socially-motivated sound change (Labov, 1963), in speakers' social networks constitution, cohesion (Labov, 1966) and hierarchization (Ryan, Bülik, 1982), as well as in Second Language Acquisition (Anisfeld, Lambert, 1961; Lambert, Gardner, Olton & Tunstall, 1968; Mariani, 2010), interlingual intelligibility (Wolff, 1959) and correctness/pleasantness judgment (Fridland, Bartlet, 2006). As this non-exhaustive review shows, attitudes can be involved in both active and passive linguistic processes, and it is important to highlight the two-ways connections they establish with other factors that prove significant to linguistics, like motivation, grouping, self-esteem and so on.

Circumscribing the notion of attitude is often complex. If it is true – and it is – that attitudes represent some "state[s] of readiness [...] exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (Allport, 1935: 798), it is also true that attitudes themselves are often manifested as behaviors, and therefore they appear to be dynamical rather than fixed states. Moreover, attitudes seem to vary considerably across time and situations (McGuire, Lindzey & Aronson, 1985): these features impose the utmost rigor during their experimental elicitation.

However, in very few cases linguistics research addresses the substantial difference between explicit (mainly conscious) and implicit (mainly unconscious) attitudes; a difference considered instead crucial within psychological and psycho-social sciences. Explicit and implicit attitudes show, in fact, profound differences in their characteristics and in their modes of action: firstly, explicit attitudes exist on the conscious level, and they are deliberately constituted and often overtly accepted by the social group; on the contrary, implicit attitudes are mostly unconscious: their formation is involuntary, and they frequently represent potential objects of stigmatization (cfr. Bassili, Brown, 2005). Moreover, combined enquiries reveal a general and substantial discrepancy between explicit and implicit attitudinal constructs in one and the same person (Dunham, Baron & Banaji, 2008). Nevertheless, implicit attitudes, as well as explicit, are formed as a result of punctual or lasting experiences that "mediate favorable or unfavorable feeling, thought, or action toward social objects" (Greenwald, Banaji, 1995). This definition embraces individual experiences (traumas, familiar issues and so on) as well as forms of "social experience" like, for example, the integration in a covertly xenophobic community or the ingroup constitutions mechanics (Tajfel, 1974). In this sense, the study of attitudes is often able to reveal existing sociological processes and trends, in addition to individuals' psychological states.

1.2 Eliciting Implicit Attitudes: the IAT protocol

On an experimental level, implicit attitudes are considerably harder to elicit and to quantify, while explicit attitudes are readily revealed by tested subjects and relatively easy to measure. Nevertheless, as suggested in the previous paragraph, to outline a comprehensive picture of the attitudinal construct in a subject or in a group, it is necessary to collect data referring to implicit attitudes. It is not surprising, therefore, that the Implicit Association Test protocol (IAT, Greenwald, McGhee & Schwartz, 1998) generates particular interest among researchers, given its experimental validity and its considerable design malleability.

The IAT is a widely-used cognitive-behavioral paradigm that measures the strength of automatic (i.e., implicit) associations between concepts in people's memory; during the test, the participant is asked to quickly classify a stimulus visualized on a computer screen. Stimuli are generally provided in the form of written words or images and can be classified in four categories: two of those categories represent concepts (e.g., normal weight and obese[1] people), the other two represent polar attributes (e.g., good and bad); the classification task consists in associating each stimulus with its reference category. A primary characteristic of the IAT is to equip the participant with only two distinct keys to operate the classification; as a consequence, two categories (a concept and an attribute) are associated to the same key.

The protocol is intended to create an overlap of elaborations that highlights the existence of an unconscious association between an attribute (e.g., bad) and a target (e.g., obese people). This results in a faster classification of the stimuli when pre-

[1] See, for exemple, the Project Implicit's "Fat/Thin IAT", https://implicit.harvard.edu/implicit/selectatest.html.

sented one after another. It is clear that IAT design can be laid out after a specific hypothesis definition or, in other words, in the assumption of the existence of a pairing between an attribute and a concept category (e.g., obese people and bad).

An IAT test is generally composed by a variable number of successive sets of stimuli called blocks; in this sense, initial blocks serve as practice and provide the subject's latency tare. For each block, the attribute-categories associated to keys are inverted: the same key is associated with the hypothesis-consistent pair in one block, and with the hypothesis-inconsistent in the following. The overall score of the test (the so-called *D-score*; Greenwald, Nosek & Banaji, 2003) is computed in four steps: a) the mean of latency of hypothesis-inconsistent practice blocks is subtracted from the mean of latency of hypothesis-consistent practice-blocks; b) the difference is divided by the pooled standard deviations of latency in both practice-blocks; c) the operations a) and b) are repeated for the experimental-blocks; finally, d) the average of the practice-blocks and experimental-blocks is calculated as *D*.

In general, the higher the *D* the stronger the association between the 'hypothesis-consistent' pairings. Conversely, low and negative *D-scores* suggest a stronger association between the 'hypothesis-inconsistent' pairings. IAT protocols and their derivatives have been extensively applied to investigate implicit phenomena like the in-group favoritism in racial prejudice development (Baron, Banaji, 2006), the incidence of sexual preferences in gender prejudice (Anselmi, Vianello, Voci & Robusto, 2013), but also the role of self-esteem in social anxiety (Egloff, Schmukle, 2002) and the insurgence of suicidal tendencies (Nock, Park, Finn, Deliberto, Dour & Banaji, 2010).

To complete the picture, it is useful to recall that the use of IAT, also in virtue of its quick and extensive spread, has raised several doubts and criticisms both in public and academic worlds. In particular, some scholars invite to a deeper reflection about the psychological object that is detected by the Implicit Association protocol. As observed by Ottaway, Hayden and Oakes (2001) fluctuations in latency can be motivated also by an influence of stimuli familiarity (see infra), or, as highlighted by Rothermund and Wentura (2004), of stimuli salience. It goes without saying that these issues should be considered in the definition of the test's hypothesis and during the IAT design planning.

1.3 IAT implementation in linguistics

The versatility showed by the IAT in the collection of data for the social prejudicial constructs justifies the interest in employing this protocol for sociolinguistic studies. The possibility of replacing visual with auditive stimuli was firstly considered in Vande Kamp (2002). Campbell-Kibler (2012) clearly proved the potential of IAT in assessing the social meaning of language areal variation (e.g., northern and southern American English). IAT protocols generally highlight a more positive implicit attitude towards in-group language varieties (non-accented vs. accented American English; Pantos, Perkins, 2012; Pantos, 2017; Roessel, Schoel & Zimmerman, 2017 and regional varieties of Dutch; Rosseel, Geeraerts & Speelman, 2018) and towards the historically more prestigious variety (Standard South Afrikaans English vs.

Afrikaans-accented English; Álvarez-Mosquera, 2017; Álvarez-Mosquera, Marìn-Gutierréz, 2018). All these studies employ speech as a stimulus, but with different operational strategies: from short words (e.g., Campbell-Kibler, 2012) to entire sentences (e.g., Álvarez-Mosquera, Marìn-Gutierréz, 2017). Mitchell (2018), uses the IAT to assess attitudes towards artificial speech, whereas the other ones presented studies involving natural human speech.

All these works share a common point: the substitution of the target visual stimuli (e.g., pictures, written words) with auditive linguistic stimuli (speech) in their IAT designs: however, as this quick review clearly shows, arrangements concerning the production of those stimuli are far from a homogeneous standard; moreover, they appear to underestimate some potentially influential issues. A number of these issues will be analyzed and discussed in the following paragraph.

2. *Adapting IAT for Speech: issues and proposals*

The Implicit Association protocol is organized around the participant's reaction to the presented stimuli: it is therefore natural that this aspect of the design requires to exercise caution during the adaptation of the IAT for speech sciences, and thus during the selection of the linguistic auditive stimuli, whereas the classical protocol only provides graphic elements.

As seen in the introductive paragraphs, a major issue regards the duration of stimuli, that can vary significantly from one study to another. In a similar way, the question of the stimuli content appears to be poorly considered in the IAT adaptation for speech, while it receives great attention in the classical IAT designs. The issue of stimuli content recalls the equally crucial element of stimuli familiarity, an attribute that a participant can assign (or not) to a presented element and that can exert its influence on latency times. These three issues will be discussed in detail in this section. Where possible, some practical examples will be provided: such examples are taken from two specific tests developed by the author and currently employed in two ongoing studies. The first test is designed to explore the attitudes showed by Italian teachers towards Chinese-accented Italian speech (Chinese-accented Italian IAT; Calamai, Ardolino, 2020); the second one assesses the attitudinal constructs of Italian migrants in France towards French language (Italian/French IAT; Ardolino, forthcoming). Both protocols have been developed using a specific psychometric software (Implicit 5): to visualize the test structure, Figure 2 shows different phases of the Italian/French IAT. The labels for target and attribute categories are displayed on the top of the screen, while all the relevant information (instructions, graphic stimuli, feedbacks) appears in the center. It is important to highlight that, although short (around 10 minutes), the completion of an IAT can be a stressful activity, because it requires high reactivity and a significant amount of attention; the use of a headset is necessary in order to isolate the subject from environmental noise. For the same reason, the test should be submitted in a quiet room.

Figure 1 - *Screens from the Italian/French IAT (English translation provided in Appendix)*

2.1 Stimuli duration

The duration of stimuli presentation in IAT is crucial, since the scoring algorithm for IAT developed in Greenwald et al. (2003) is based on the latency times showed by subjects in their response and measured from the end of the submission of a stimulus. Therefore, classical IAT's *D* considers the reaction time elicited in relation to a visual stimulus, which remains homogeneous during the prefixed amount of time. On the contrary, the auditive stimulus varies through time, and this feature is potentially able to distort the results of the test. The duration of an IAT stimulus is quantified in 150-750 ms (see Greenwald et al., 1998; Nosek, Greenwald & Banaji, 2005); a longer stimulus affects the automatic nature of responses.

It goes without saying that an auditive linguistic stimulus must also comply with these restrictions. However, as suggested, such a small amount of time can hardly contain sentences, even short, as well as multisyllabic words; for instance, to fit this measure an Italian word should be two-three syllables long as a maximum (depending on the speaker's individual variability).

The production of suitable speech stimuli must, above all, consider the main aim of the IAT implementation. A number of language features can be inferred just from voice quality (see Keller, 2005), and the use of grammatical, senseful words is not always strictly indispensable (see infra).

If the studies exclusively require the use of senseful words as stimuli, these need to be carefully selected to be similar in terms of structure, duration and content. Avoiding words that are excessively different in the syllable number and structure can help to set up rigorous experiments. Alternatively, supposing that the aims of the specific studies so allow, a speech sample can be artificially produced or accelerated (preserving its comprehensibility, see Foulkes, Sticht, 1969) in order to fit the

time span. Nevertheless, the major stimuli issues refer often to their content: the next paragraph specifically addresses this aspect.

2.2 Stimuli content

The content of a stimulus comprehends all the elements available for the subject's elaboration. The number and type of these elements highly influences the response and therefore the shape of the experimental result (Bricker, Pruzansky, 1966).

A first crucial distinction must be considered between classic visual IAT stimuli (typically simple images, e.g. a photograph) and auditive stimuli (specifically, speech excerpts). The constituents of a visual stimulus (colors, shapes, objects) appear at the same time during the test and remain on the screen for the total time of the stimulus presentation. On the contrary, a speech sample represents a more complex stimulus, since it is composed of different kinds of information (phonetic-phonologic, morphologic, prosodic, syntactic, semantic, indexical, emotive) that vary throughout the time unit. A similar discontinuous overlap can potentially mask the target elicitation and affect the reaction time (Foroni, Bel-Bahar, 2010), so strategies must be put in place in order to limit and control such complexity.

To simplify input overlapping, employing as stimulus short words (words pronounced in a time span that is sufficiently short to avoid a deeper elaboration) can be useful on itself; however, other aspects of speech have to be homogenized so as to exclude their role on the subject's reaction.

First, it is important to notice that different grammatical categories seem to produce a different response in association-like test settings (see Bagger Nissen, Henriksen, 2006). If possible, words from the same word class should be chosen. The semantic domain exerts a powerful effect on word processing; the semantic priming effect must be considered in the stimuli production, since the sharing of a same domain shortens considerably the reaction time (and vice versa, different domains induce longer reaction times), beyond the actual aim of the test (Masson, 2001).

Semantics is also implicated in the emotional content of a word. The emotivity evoked by a word can sometimes be very strong, and such a connotation may complicate the input processing and make the elicited answer ambiguous. The emotional content of a word can be evaluated using a pre-test phase (e.g., using a Likert-like enquiry, see Alvaréz-Mosquera, Marín-Gutiérrez, 2017, Alvaréz-Mosquera 2017) or by reference to a specific database like EMOTE (see Grühn, 2016).

Studies aimed to reveal implicit attitudes towards sex, age, as well as other biological and physiological features can consider using nonwords, since target characteristics can be recognized only from the indexical details of the speaking voice. As abovementioned, voice quality (see Trask, 1996: 381) itself entails a series of processable indexical information. In order to circumscribe the effects of such information on the answer, if stimuli are produced by a speaker, it is important to ensure that the same subject produces all the stimuli, without relevant modification in voice quality; at least, and if the experimental design consents so, different speakers can be involved in the production of stimuli if they share the same bio-physical

and linguistic characteristics: same sex, comparable age, similar accent and so on. In alternative, a speech production software can be considered in order to limit the amount of socio-indexical information extractable from the speech used as stimulus. Nonwords can also be used as target stimuli for studies involving attitudes towards different languages or varieties. In this case, a same nonword can be declined in two different ways in order to follow language- (or variety-) specific phonological forms.

The use of nonwords as auditive stimuli has been practically applied in the creation of the Italian/French IAT: a total of 13 nonwords, randomly created in order to respect a CVCV structure and to not exceed 600 ms length (see Table 1), have been synthetized as speech segments with a text-to-speech software that contains synthetic voices programmed on specific languages (DSpeech); through DSpeech, each nonword has been uttered in its Italian and French phonological forms. The Italian/French IAT protocol was then successfully completed by 15 bilingual participants: no one showed perplexity about the stimuli classification task and, furthermore, stimuli classification was operated with a relatively short latency (M = 829.2, SD = 252.4, in milliseconds). This leads to believe that spoken non-words are unambiguously and quickly recognized. The advantages of the so-constructed stimuli are multiple: the substantial homogeneity of indexical information (due to the involvement of a synthetic uncharacterized voice), the absence of a recognizable semantics (due to the use of non-words) and, consequently, the impossibility to extract a radically different emotive content from the stimulus, not to mention the fact that synthetic speech stimuli are considerably easier to produce.

Table 1 - *Nonwords selected as stimuli for the Italian/French IAT, with transcription, and duration*

Nonword	**Voice**	**IPA**	**Msec**
cosso	ITA	/ˈkos:o/	434
	FRA	/koˈs:o/	521
garo	ITA	/ˈgaro/	395
	FRA	/gaˈʁo/	558
mitta	ITA	/ˈmit:a/	487
	FRA	/miˈt:a/	513
motti	ITA	/ˈmot:i/	454
	FRA	/moˈt:i/	576
piro	ITA	/ˈpiro/	319
	FRA	/piˈʁo/	448
rini	ITA	/ˈrini/	336
	FRA	/ ʁiˈni/	543
roto	ITA	/ˈroto/	415
	FRA	/ʁoˈto/	644
sari	ITA	/ˈsari/	388
	FRA	/saˈʁi/	528

Nonword	Voice	IPA	Msec
saro	ITA	/ˈsaro/	400
	FRA	/saˈʁo/	537
siro	ITA	/ˈsari/	395
	FRA	/saˈʁi/	525
sitta	ITA	/ˈsit:a/	522
	FRA	/siˈt:a/	549
tesso	ITA	/ˈtes:o/	420
	FRA	/teˈs:o/	518
tollo	ITA	/ˈtol:o/	370
	FRA	/toˈl:o/	482

2.3 Stimuli familiarity

Considering that the IAT is specifically developed to capture implicit attitudes towards objects from the informants' social context, it not surprising that the target stimulus will mostly contain elements that are somehow familiar to the subject's social experience. However, the familiarity variable must be treated carefully, since this appears as one of the most influential factors on response latency times (see Ottaway, Hayden & Oakes, 2001; Dasgupta, McGhee, Greenwald & Banaji, 2000; Zogmaister, Castelli, 2006). Stimuli with a higher degree of familiarity are usually processed and categorized faster, regardless of their effective positive/negative value. In a visual IAT, the content of a graphic stimulus can be easily evaluated by the experimenter in terms of familiarity, on the basis of the social and personal characteristics of the informants. Experimental design itself led to a focused participants' selection depending on their overt social experience (e.g., inhabitants of multiethnic neighborhoods would be systematically familiar with a foreign ethnicity).

Assuming the familiarity of a sociolinguistic object is definitely more complex, because it presupposes a deeper knowledge of the subject's social behavior, of his linguistic use and exposition. To bridge this gap, it is useful to collect data within a representative population; in this respect, an enquiry can be conducted through the submission of a sociolinguistic questionnaire designed to collect exhaustive information on the linguistic behavior of the potential informant. Specific points should cover usual interlocutors, typical communicative context, and which languages/varieties are used or listened more often. If the stimulus comprehends senseful words, their frequency can be estimated through a lexical frequency corpus such as, for Italian, the CoLFIS (Bertinetto, Burani, Laudanna, Marconi, Ratti, Rolando & Thornton, 2005). In general, high-frequency words are easily processed (Brysbaert, Mandera & Keuleers, 2018) and require a shorter latency time; therefore, it is important for the stimuli words to have a comparable lexical frequency.

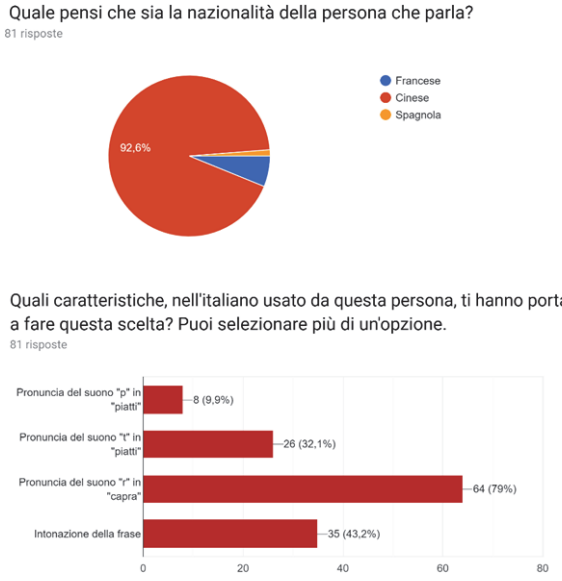
Partly connected to the stimulus' familiarity is the value of its recognizability. An IAT test produces valid results when the stimulus grants a quick recognition

of the target element. Ethnicity (here intended as the physical and somatic characteristics due to a common origin), for example, is easily recognizable from a visual stimulus like the image of a face (see, e.g., Sporer, 2001). In the study of the attitudes towards linguistic varieties, ensuring the recognizability of the features of a speech sample requires caution, especially since the elements involved in variety recognition have not yet been clearly identified (see Clopper, Pisoni, 2007; van Bezooijen, Gooskens, 1999).

As for the familiarity variable, experimental validation for recognizability can be achieved through a wide-ranging perceptive pre-test, in which a population (possibly similar in composition to the expected informants) is invited to guess the origin of a speaker by listening a portion of accented speech.

A pre-test of this kind has been used to design the Chinese-accented Italian IAT. In this case, the enquiry is designed as an on-line quiz in order to simplify the approach and to maximize the spread. After hearing a short audio sample, in which brief Italian phrases are pronounced by three male speakers (native of China, France, and Spain), the participant is asked to guess the speakers' nationalities and to freely indicate which characteristics of the speech led him to that choice. The graphic in Figure 1 resumes the answers for one of the questions (a total of 82 people completed the survey randomly recruited on a popular Social Network). The pie chart clearly shows that the native Chinese speaker is easily recognized by the majority of the participants, whereas the bar graph indicates the substitution of the trill consonant as the most recognizable index of a native Chinese speaker: such pre-test results constitute a solid speculative base to select IAT stimuli.

Figure 2 - *Answers summary for one of the pre-test questions. The bar chart resumes the main elements detected by speakers as nationality detectors (English translation provided in Appendix)*



3. *Conclusions*

This contribution aimed to present a protocol that, although disputed, allows a new outlook on a complex and crucial psycho-social aspect such as implicit attitudes. At the same time, as highlighted throughout the article, there is a general need to standardize practices and methods in order to fully integrate the IAT within the sociolinguist's toolbox.

Although IAT effectiveness may be questioned, the role of implicit attitudinal constructs cannot be ignored in the analysis of social and sociolinguistic processes. In this sense, it is interesting to note that the simultaneous application of implicit ad explicit protocols often reveals the substantial incongruity between revealed and captured attitudes (see, among others, Campbell-Kibler, 2012; Pantos, 2017; Pantos, Perkins, 2012; Calamai, Ardolino, 2020). These evidences put forth a series of experimental questions that represent the potential future steps of the implicit attitudes research in sociolinguistics: what is the effective role of implicit attitudes in the regulation of social-communicative behaviors? Do implicit biases play a role in linguistic acquisition and loss? What are the consequences of persistent implicit attitudinal constructs within the speech community? These are matters that are evidently in close connection with the issues of linguistic prejudices, namely linguicism (Skutnabb-Kangas, 2015) and glottophobia (see Blanchet, Clerc Conan, 2018), which are sociolinguistic phenomena that produce significant effects of social stigma and discrimination (e.g., Vanegas Rojas, Fernández Restrepo, González Zapata, Jaramillo Rodríguez, Muñoz Cardona & Ríos Muñoz, 2016).

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Appendix

Figure 1, English translation:
- Place your index fingers on the keys (E) and (I). You're going to listen to a series of words. You'll have to decide if the speaking person is ITALIAN or FRENCH.
- To do it, classify each item in the LEFT category, by pressing the (E) key, or in the RIGHT category, by pressing the (I) key.
- If you fail, a red X will appear. Correct the mistake to continue.
- TRY TO ANSWER AS QUICKLY AS YOU CAN, WITHOUT MAKING MISTAKES
- Press START to continue.

Figure 2, English translation:
- What do you think is the nationality of the speaking person? (French - Chinese - Spanish)
- Which characteristic lead you to this choice? ("p" pronunciation - "t" pronunciation - "r" pronunciation - phrasal intonation).