



# The Implicit Association Test and sociolinguistic meaning

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## ABSTRACT

The Implicit Association Test (IAT), designed to measure how strongly an individual implicitly aligns two dichotomies, such as male/female vs. home/career, is adapted in this study to analyze sociolinguistic variation. Three experiments test the IAT's ability to detect relationships between sociolinguistic variables and social categories and between related sociolinguistic variables. In Experiment 1, associations are shown between the English variable (ING) on the one hand and Northern/Southern states, blue collar/white collar professions and country singers/news anchors on the other, using written forms. In Experiment 2, associations are shown between audio tokens of (ING) and Northern/Southern states and between (ING) and /ay/ monophthongization, both tied to the ideologically well-defined Southern accent, but not between (ING) and /t/ release, which do not share an enregistered variety. Experiment 3 documents the lack of correlation between IAT measures and two more explicit measures of association: direct question and social evaluation. These results suggest that sociolinguists should take dual processing models of social cognition into account in considering the cognitive processing of socially loaded linguistic forms and that the IAT may be useful tool for the analysis of sociolinguistic meaning.

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## 1. Introduction

### 1.1. Variation, indexicality and cognition

Variation studies has always addressed the relationship(s) between language forms and social structures. Recent work, referred to as the third wave (Eckert, 2005), has privileged the indexical relationship (Ochs, 1992; Silverstein, 1976) as a central construct. Indexical relationships are links through which language forms invoke various aspects of social structure, allowing them to be used interactionally to shape social dynamics. While most often studied through interaction, in order to function as theorized, indexical relationships must also be represented cognitively. The cognitive processes responsible for indexical associations are thus a fascinating and to date understudied area of both sociolinguistics and linguistic cognition more generally. In this paper I use the Implicit Association Test (IAT) to show that what sociolinguists have been referring to as indexical links are similar to, if not a subset of, what social psychologists have been calling implicit associations.

Interest in the cognitive aspects of socially meaningful variation has grown over the past decade, in sociolinguistics but also in psycholinguistics, phonetics and syntax, among others. Exemplar models, in particular, which have gained adherents among linguists (e.g. Bybee, 2006; Pierrehumbert, 2001), are notable for the integration they propose between linguistic and nonlinguistic information, suggesting that unspecified but comprehensive amounts of information are stored in memory

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with each exposure to a linguistic element like a phone (Johnson, 2006). Given these interests, a better understanding of sociolinguistic processing has the potential to contribute substantively to the understanding of language more generally.

The most developed area to date has been social influences on phonetic perception, for example, Strand's (1999) work showing that listeners shift their category boundaries between phonemes like /s/ and /ʃ/ based not only on whether the speaker they hear is male or female, but how typically gendered the speaker is perceived to be by naive judges. Perceived nationality has also been examined, showing that speakers from Michigan are more likely to accurately characterize raised tokens of /aw/ if they believe the speaker is a Canadian (recognized as having this feature) than if they believe she is from Michigan (believed by Michiganders to not have this feature) (Niedzielski, 1999). More recent work has suggested that this effect may not even require a belief about the speakers themselves; merely exposing New Zealand participants to stuffed animals iconic of Australia prompted shifts in their subsequent vowel identification processes, with women moving towards and men away from an Australian-like vowel norm (Hay and Drager, 2010). Other linguistic levels have been less well studied, although Staum Casasanto (2008) demonstrated an influence of race on lexical access, based on expectations regarding phonetic variation.

One overarching theme in research on social influences on language processing is that language perception especially is typically considered a rapid behavior subject to little conscious control (Fodor, 1983). This is in conflict with existing, albeit largely tacit, characterizations within sociolinguistics of complex social reasoning as being conscious in nature. In recent years, however, advances in social cognition have shown that individuals' ability to reason unconsciously about social constructs is far greater than previously suspected.

## 1.2. *Implicit social cognition*

Dual systems models, common in cognitive and social psychology, propose that people have (at least) two different types of reasoning systems (for an overview, see Evans, 2008). While the details of dual systems theories differ, one type of reasoning is characterized as some combination of associative, automatic, low effort, rapid, domain specific and/or unconscious while the other is propositional, controlled, effortful, general purpose, relatively slow and/or available to conscious introspection. A full summary of the various systems and their strengths and weaknesses is beyond the scope of this paper, but language processing, particularly perception, has long been recognized as falling into the former category (e.g. Fodor, 1983). Over the past two decades, social cognition research has established that many forms of social reasoning can also occur rapidly and without conscious, deliberative control (Bargh and Chartrand, 1999).

Most relevant for the current discussion is impression formation, a specialized process for learning about other individuals (Asch, 1946; Kelley, 1950). By grouping information into trait-based clusters, this process leads to better subsequent recall than simple memorization, particularly for personality-relevant information, such as behavior at odds with known traits (Hamilton et al., 1980, 1989). The system can be prompted by telling participants directly that the information they receive describes an individual and instructing them to form an impression of that person, but it can also be triggered through less direct means, by giving participants a task that primes words like *impression* and *personality* prior to presenting them with a list of behavioral information (Chartrand and Bargh, 1996; McCulloch et al., 2007).

Further evidence for some automatic processes in person perception is provided by Bargh et al. (2008), who show that activating particular templates of evaluation shows "spillover" effects in which another individual's rudeness is seen differently. In that study, participants asked to evaluate an actor as a potential reporter (a profession in which politeness might be less valued than others) showed higher likeability ratings of a different actor who behaves somewhat rudely than those evaluating the original actor as a waiter and those told simply to observe a conversation. In contrast, the polite version of the "interrupter" actor showed no difference in ratings across the three conditions.

Such spillover effects may also be seen in more active social behaviors like interactional stances. Experiment participants assigned the role of "helper" in an experimental task (deciphering ambiguous images) show more helpful qualities in irrelevant decisions (predicted alumni giving and experimental participation for no incentive) which are introduced in the middle of the setting, an effect which disappears when the tasks are introduced after the conclusion of the helping task (Bargh et al., 2008). This suggests that even seemingly very choice-based social behaviors, such as deciding how much money one might donate to one's university in the future, are managed at least in part through automatic systems. If this is the case, it provides a solution to the question of how linguistic forms not available to social introspection can still correlate with seemingly agentive social goals. It also provides a potential solution to the related speed problem, frequently raised by linguists in response to third wave theories: namely, how can something as complex as social reasoning be integrated with something as fast as linguistic processing. The answer is that while social reasoning, like language, is indeed complex, parts of it, also like language, are accomplished through automatic systems.

A well-studied aspect of automatic social processing is the activation of stereotypes by group exemplars, even among individuals with motivation to counteract or conceal stereotyping (Blair and Banaji, 1996). Once activated, stereotypes not only influence perceptions of the members of stereotyped groups, but also facilitate the identification of stereotype-relevant items including words (Wittenbrink et al., 1997) and visual images like guns (Payne, 2006). Research on stereotypic associations has primarily used faces or names as prompts to represent examples of stereotyped groups, but in interaction socially meaningful variation is a common method of identifying group membership, making stereotype activation by linguistic forms a key issue for both sociolinguists and social psychologists.

The sociolinguistic activation of stereotypes and other social information also has important implications for linguists generally, given that social processes, including person perception and goal pursuit, often take place simultaneously with

language production and perception. The sociolinguistic literature as a whole testifies to the many connections between social and linguistic knowledge, involving all linguistic levels of structure. The sociophonetic work outlined above documents a handful of known connections between social and linguistic cognition. The extent and character of these connections can offer valuable insight into the workings of both types of processes. The current study approaches this question by asking whether and how socially meaningful linguistic forms participate in associative networks of social information, using the Implicit Association Test.

### 1.3. The Implicit Association Test

First developed by Greenwald et al. (1998), the Implicit Association Test (IAT) is an experimental paradigm designed to measure the degree to which individuals align two dichotomies. Early uses focused on valence of attitudes towards marginalized groups, showing for example a tendency to associate Black faces with negative concepts and White faces with positive concepts (Greenwald et al., 1998). Further work introduced more content-based alignments, for example a tendency among White Americans to associate *American* with White faces and *foreign* with non-White faces (Devos and Banaji, 2005), underlining the fact that stereotypes carry content, not simply valence, and suggesting that the IAT may be useful to sociolinguists examining sociolinguistic associations.

The key concept of the IAT is that sorting items into multiple categories is easier (and therefore faster) when the grouped categories are associated. Consider the task of sorting items into the two dichotomies *insects/flowers* and *good/bad*. Through the experimental procedure, some of the blocks involve the participant pressing the left hand button to select *insects* and *bad* and the right hand button to select *flowers* and *good*. In other blocks, they are asked to press the left hand button to select *insects* and *good* and the right hand button to select *flowers* and *bad*. To the extent that the participant prefers flowers over insects, *flowers* and *good* will resolve itself into a more coherent shared category, as will *insects* and *bad*, compared to the alternate arrangement. These shared categories allow for easier, and therefore faster (and less error-prone) responses in that condition. The difference in response times across the two combinations thus can be taken to represent a measure of implicit connection across the two dichotomies.

The IAT has been used by linguists in a handful of instances. Babel (2010) examined tendencies among New Zealand speakers to converge phonetically while shadowing an Australian speaker and showed that positive or negative attitudes towards Australia more generally, as measured by an IAT score, predicted tendency to converge. Pantos (2010) used an IAT task aligning native US English speech vs. Korean accent English (labeled as *foreign*) against *good* vs. *bad* to show prejudice concealed by more explicit measures, in which participants (enrolled in linguistics classes) reported no bias. Redinger (2010) similarly used an IAT as part of a comprehensive study of language attitudes toward French and Luxembourgish in Luxembourg. To date, however, linguists have used the IAT only to assess positive/negative attitudes towards groups, rather than to examine sociolinguistic meanings.

## 2. Variables

The primary sociolinguistic variable chosen for this study was the English variable (ING), the alternation at the end of multisyllabic words between word-final [ɪn] or [ən], here referred to as *-in* and [ɪŋ], called *-ing*. (ING) was chosen for this project because it has been extensively studied across the English-speaking world and shown to carry similar associations across a wide range of communities (for an overview, see Hazen, 2005). It also has been well represented in the literature on social perception of variation (Campbell-Kibler, 2007, 2008, 2009; Labov et al., 2006a). In the US, (ING) is tied to region, with *-in* form more prevalent in the South (Hazen, 2008) and strongly associated in the popular imagination (Campbell-Kibler, 2007) with the Southern accent, which itself is the most well-known accent in the country (Lippi-Green, 1997; Preston, 1997). Other strong associations are socioeconomic status, education, and articulateness (Campbell-Kibler, 2009), as well as masculinity (Campbell-Kibler, 2007; Kiesling, 1998). Region and class, as the strongest documented perceptual associations, were selected for the current study.

Two other variables are used in this study. The first is the monophthongization of the PRICE vowel class (Wells, 1982). This vowel change is suggested by (Labov et al., 2006b) to be the triggering event of the Southern Vowel Shift (SVS) and is used by them as the defining characteristic of the South dialect region in the US. In addition to actually being found in the area, the feature is a well-known stereotype, in the terminology of Labov (1972), meaning a feature that speakers are consciously aware of and can comment on. Eye dialect representations of Southerners in popular culture, for example, use both this feature and (ING) (see the cartoons such as Snuffy Smith, in Harkins, 2004).

The release or non-release of /t/ is the third linguistic variable used. Less studied than either of the other two, it has been associated in the literature with education and articulate speech in a handful of diverse contexts (Eckert, 2008). Benor (2001) showed that Orthodox Jewish men used the released variant more than their female counterparts. She hypothesized that this was due to the variable's link to education, more valued for men than women in the community. Bucholtz (1999) reported increased use of /t/ release among “nerd girls” in a California high school as compared to other girls. Podesva (2006) explored different dimensions of the release with data from a single speaker across two dissimilar situations. In the professional setting, the speaker released word-final /t/ more frequently but it was in the social setting, while performing a “diva” persona, where the releases that did appear were longer and more intense. This literature suggests a diverse set of associations centered around articulateness, professionalism, precision and/or education. Most recently, in a study of well-known US

politicians, Podesva et al. (forthcoming) found associations (for individual politicians) between /t/ release and articulateness, intelligence and friendliness, as well as perceived Southernness, the first example of a regional association for /t/ release.

### 3. General methods

This paper presents a three related IAT-based experiments which assess implicit associations between known sociolinguistic variables and social categories or other variables. In the first experiment, text tokens of (ING) were paired with three pairs of social categories: Northern/Southern states, blue-collar/white-collar professions and names of country singers/news anchors. In the second, audio representations of (ING) were paired with audio versions of Northern/Southern states and with /ay/ monophthongization and /t/ release. Finally, the third experiment investigated correlations with two more explicit measures: a paired social evaluation task and a direct question. This experiment applied all three metrics to the relationships between (ING), /ay/ monophthongization and /t/ release on the one hand and Northern/Southern states and education/profession on the other.

Methods used in the current study were taken from the guidelines provided by Lane et al. (2007). In all experiments, participants were students at the Ohio State University, and were offered course credit for participation. They were primarily but not exclusively from Ohio and as a result of this lack of diversity, regional origin was not examined as a factor in subsequent analyses. Previous work has, however, indicated that despite regional variation in (ING) use, US Southern and non-Southern university students show little to no difference in social evaluations of (ING) (Campbell-Kibler, 2007). Participants were run in groups of up to three, seated at Dell workstations with E-Prime on Windows XP, wearing Bose noise-canceling headphones. During each block, labels appeared on the upper left and upper right areas of the screen, indicating the categories (e.g. *-in* on the left and *-ing* on the right) currently in use. In each trial, a word appeared on the screen or was played through the headphones, and participants pressed either the rightmost or leftmost button on a PST serial response box<sup>1</sup> to classify it as belonging to either the left label or right label. The reaction time from the appearance of the word on the screen or from the beginning of the audio file to the button press formed the basis for the association measure as described below.

Five block types (seven blocks total) were presented. In Block 1, participants sorted only the “variable” categories (e.g. (ING)) for 20 trials, then switched in Block 2 to sorting only the “valence” task (e.g. states) for another 20 trials. These blocks allowed participants to learn the left/right side assignments and to learn the assignment of any individual category members they happened to be unfamiliar with. These were followed by two blocks of the same type, Block 3 with 20 trials and Block 3b with 40, in which both sets were sorted simultaneously, onto the same sides as previously learned. During these combined blocks, the left and right hand labels on the screen included all category labels, e.g. *-in or Southern* and *-ing or Northern*. For half the participants, this combination created a “congruent” block, in which the two dichotomies were aligned in the manner predicted to be easier, e.g. *-in* words with Southern states and *-ing* words with Northern states. The other half of the participants had the “incongruent” alignment.

Block 4 returned to providing only the variable categories, but with the category previously on the left now on the right and vice versa. To overcome the challenge of relearning a previously learned assignment, Block 4 contained 40 trials instead of only 20.<sup>2</sup> Finally, two combined Blocks, 5 and 5b tested the variable and valence together with the opposite alignment (the variable having been reassigned sides while the valence stayed the same). Thus participants previously exposed to the “congruent” alignment now sorted items in the “incongruent” alignment and vice versa. Participants were given opportunities to take a break between each block and between individual IAT tasks. Most chose not to pause more than briefly. The sides (left or right) for each combination were counterbalanced across participants to avoid side-based preferences.

For each instance of the task, a measure of association was calculated, using the algorithm determined by Greenwald et al. (2003) to be most resistant to artifacts, most correlated with self-report and most internally consistent. First, individual trials with reaction times greater than 10,000 ms were removed, as were any participants with greater than 10% frequency of trials shorter than 300 ms (there were none). Next, trials on which the incorrect response was given were assigned a reaction time of the block mean plus a 600 ms penalty. Pooled standard deviations were calculated for Blocks 3 and 5 together (the shorter, first pass at each joint sorting task) and for 3b and 5b together (the second, longer joint sorting block). The differences in mean reaction time between Blocks 3 and 5 and between Blocks 3b and 5b were then taken and divided by their respective standard deviations. The final *D* measure was the average of these two quotients.

### 4. Experiment 1

#### 4.1. Methods

The first experiment presented participants with three written versions of the IAT task, each aligning a different pair of social categories with tokens of the English variable (ING), represented by the text strings *being, having, doing, saying and making*, and *bein', havin', doin', sayin' and makin'*. Task 1 aligned (ING) with region, represented by state names, with five

<sup>1</sup> In a few instances of the first experiment, due to technical difficulties, the P and Q keys on the regular keyboard were used.

<sup>2</sup> Due to a technical error, on incongruent-first versions, the 40-trial block was accidentally assigned to Block 1 instead of Block 4 as desired. If this impacted the results, it would have been solely to reduce the observed strength of implicit preference among those participants and thus does not change the conclusions presented below.

Southern states contrasted with five Northern states. Northern states were all selected from the New England area, for two reasons. First, New England states are geographically closely clustered, ensuring that all would qualify as unambiguously Northern. Second, New England is frequently characterized in perceptual dialectology work as a region with high linguistic capital, in contrast to the stereotypes of the Southern region (Preston, 1989). While Boston as a city is often marked as an accented variety possibly associated with *-in*, the use of the state names was felt to be sufficient to avoid this association. The Northern states used were *Massachusetts, Connecticut, Rhode Island, Maine* and *Vermont*. The Southern states *Mississippi, Georgia, Alabama* and *Virginia* were likewise chosen to be unambiguous for Ohio participants, although two participants noted afterward that they did not consider Virginia to be clearly Southern. Due to the training phases and feedback, participants were able to learn the experimental assignment prior to the critical blocks. While response times to less-central category members are likely to be extended, this effect should apply equally across the critical blocks.

Attention was also paid to visual similarities between the two sets, for example Mississippi and Massachusetts were selected as visually striking and were chosen to offset one another, to make it more likely that participants had to read and process the word to identify the category. For similar reasons, no two states in the same category were chosen that began with the same letter, to avoid establishing a particular letter as a reliable cue to category (Lane et al., 2007).

In the second task, (ING) was tested against education and occupational class, represented by white-collar vs. blue-collar professions, which were glossed for the participants as professions which either do or do not typically require a university degree to enter. As with the states, profession categories were selected for clear identifiability and balancing of visual cues such as length and first letter. The white collar professions used were *architect, banker, doctor, lawyer* and *professor*, while the blue-collar professions were *carpenter, plumber, trucker, janitor* and *mechanic*.

Finally, the third task presented a set of categories intended to represent differing language ideologies, contrasting country singers, whose professional personae require a particular brand of informal speech, against network news anchors, icons of standard language ideology (Bonfiglio, 2002). This specific dichotomy had not previously been studied in relation to (ING) and was included to investigate whether related but relatively idiosyncratic social associations would also show an effect or whether the implicit associations would be limited to more conventional social categories.

Names were again selected based on identifiability and care was taken to ensure the same number of women across categories (one each). Country singers were selected to be as clearly country as possible, rather than country-pop or crossover. The exemplars were *Billy Ray Cyrus, Dolly Parton, Toby Keith, Garth Brooks* and *Johnny Cash* for country singers, and *Walter Cronkite, Diane Sawyer, Brian Williams* and *Peter Jennings* for anchors. In a few cases, participants failed to recognize one of the names, but the training phases allowed them to learn them prior to the critical trials. In this case, cues apart from the person described were unavoidable, such as the tendency for singers' names of choice to be nicknames or short names while the anchors' names are more formal. This difference is fortunately tied to the social effect of interest, however, and so was considered acceptable.

Twenty-four participants, primarily from Ohio, completed this experiment in exchange for partial course credit. Due to technical difficulties, data for one participant was collected only on the country singer/news anchor and states tasks, while another had data only for the professions task.

#### 4.2. Results

In all three tasks, (ING) showed an association with the social categories in the expected direction, supporting the hypothesis that speaker/hearers implicitly link variables and social categories. Table 1 shows the mean *D* values for each of the three tasks, and the *p* values of one-tailed *t*-tests for each set of *D* values. To provide some context for the size of these effects, it is useful to consider previous IAT research. Nosek et al. (2007) presented findings from 17 different IAT tasks testing a range of attitudes and stereotypes regarding race, gender, disability and political preferences. Conducted over the web, these tasks each had thousands of participants (*N*s ranging from roughly 23,000 to over 350,00). Of the 17 tasks, only two, age attitude and disability attitude, showed greater than 0.40 mean *D* measure (0.49 and 0.45 respectively). Eight more had means between 0.30 and 0.40, while the remaining seven had means less than 0.30. Within this context, then, the first two means of Table 1 are relatively large, while the third is moderate.

In addition, the weakest association of the three, country singers/news anchors, showed a significant correlation with each of the other two associations (states: 0.47,  $p = 0.027$ , professions: 0.49,  $p = 0.023$ ). The associations between (ING) and states on the one hand and between (ING) and professions on the other showed no correlation, however. One possible explanation is that the IAT, because it measures associations, is capable of detecting indirectly linked concepts and that the association between (ING) and country singers/news anchors is actually due to both dichotomies being associated with a

**Table 1**  
Experiment 1 results.

|           |                 | <i>D</i> mean | <i>p</i> -Value |
|-----------|-----------------|---------------|-----------------|
| (ING) vs. | States          | 0.38          | <0.001          |
|           | Professions     | 0.44          | <0.001          |
|           | Singers/anchors | 0.24          | 0.002           |

**Table 2**  
Experiment 2 results.

|           |        | <i>D</i> mean | <i>p</i> -Value |
|-----------|--------|---------------|-----------------|
| (ING) vs. | States | 0.30          | 0.002           |
|           | /ay/   | 0.18          | 0.004           |
|           | /t/    | 0.09          | NS              |

third concept, possibly one of the other two studied. Another possibility is that the country singers/news anchors is weaker because it is in some way an artifact of the experimental task, having been preceded by the two others.

#### 4.3. Experiment 2

While some linguistic variables can be represented in text, many cannot, making a text-only version of the IAT less useful for sociolinguistic purposes. The second experiment switched from text to audio. The first aim was verify that similar results would emerge using the same task but with audio instead of text stimuli. To that end, a replication of the first task of Experiment 1, on the association of (ING) and Northern/Southern states, was constructed, using spoken stimuli. The other two social dichotomies were not re-tested, assuming that if results transferred to audio cues in one case, they would be likely to do so in all cases.

A second goal of Experiment 2 was to use the transition to audio to investigate a question which required (or was facilitated by) audio stimuli. This was whether linguistic variables with similar associations show associations to one another. Accordingly, (ING) was paired with /ay/ monophthongization in one task and /t/ release in the other, both being variables that overlap different areas of (ING)'s indexical field of meanings (Eckert, 2008). As discussed above, /ay/ monophthongization is associated with the South and /t/ release with education and articulateness.

#### 4.4. Methods

All stimuli were recorded by the study author (who does not have /ay/ monophthongization natively) and were presented with no written accompaniment. In the first task, tokens of (ING) were tested against the state names from Experiment 1. In the second task, the audio tokens of (ING) were paired against audio tokens *my*, *eye*, *buy*, *tie* and *pie*, pronounced with or without /ay/ monophthongization. Participants were asked to identify the latter using the category labels *ay*<sup>3</sup> on the one hand and *ah* on the other and the former, as in the previous experiment, with labels *-in* and *-ing*. Finally, the third task paired the same audio tokens of (ING) against *burst* or *no burst* versions of monosyllabic words ending in /t/: *cat*, *bat*, *mat*, *pat* and *hat*. Again produced by the study author, these tokens were all produced with the burst, then non-burst versions were created by trimming the sound files. Fifteen new participants completed this experiment in exchange for partial course credit.

#### 4.5. Results

Experiment 2 confirmed that the association of (ING) with Northern and Southern states also holds for audio stimuli. In addition, (ING) is associated with the variable /ay/ monophthongization, but not with /t/ release. Table 2 gives the mean *D* values for each task and the *p* values of one-tailed *t*-tests for each set of *D* values.

The non-zero *D* value in the (ING) vs. /ay/ task suggests that linguistic forms with similar social indexes are associated with one another. This may be a general result of sharing social meanings, or more specifically could indicate that the two forms are directly linked in an enregistered (Agha, 2003) variety. In the first case, the lack of association between (ING) and /t/ release could be due to the two variables having different indexical meanings—like (ING), /t/ release has been tied to education (Benor, 2001; Podesva et al., forthcoming), but has not been tied to region. In the second case, this lack could indicate that (ING) and /ay/ do belong to a common enregistered variety, namely the Southern accent, while /t/ release is not linked to this variety.<sup>4</sup>

A separate possibility is that the lack of effect in the third task is a result of the relative lack of definition of /t/ release, in that not all participants recognized the distinction and as a result may have had more trouble performing the task. It also may be that the preceding tasks led participants to focus on the regional associations of (ING), in effect drawing its social meaning away from its area of overlap with /t/.<sup>5</sup>

#### 4.6. Experiment 3

The third and final experiment examined the correlations between implicit associations and two other measures of association: direct questions and a guise-based social evaluation task. All three tools were applied to the six relationships

<sup>3</sup> The text string *ay* was chosen to more visibly align with *ah* as the other option. It is possible that in early trials participants were inclined to interpret *ay* as /ey/, but the impact on the results is not likely to be significant, given the structure of the task.

<sup>4</sup> Many thanks to Michael Silverstein for this suggestion.

<sup>5</sup> Thanks to an anonymous reviewer for this suggestion.

between the three linguistic variables: (ING), /ay/ monophthongization and /t/ burst on the one hand and two social categories: Northern vs. Southern states and blue-collar vs. white-collar professions, on the other.

Although the competence-related dichotomy for the IAT used professions, the terms blue-collar and white collar were considered potentially problematic. Earlier work had indicated that similar participants (other university students) were less comfortable evaluating speakers explicitly with respect to class, but more comfortable discussing education (Campbell-Kibler, 2008). As a result, the speaker evaluation and direct question tasks were developed asking participants to indicate the more Southern and more educated variants or guises. While occupation type and education are not identical concepts, they are tightly intertwined, and associations with one indicate a high probability of associations with the other.

#### 4.7. Methods

In the first task, participants were not yet aware of which linguistic variables were of interest. They were presented with three pairs of short recordings of spontaneous speech, each manipulated to differ with respect to one of the three variables. All three speakers were young, White and had some college education. The (ING) pair was taken from previous research (Campbell-Kibler, 2007), and featured a young man from California. The recording for /ay/ monophthongization was selected for featuring a prominent and clearly monophthongal /ay/, for which a match was created by resynthesizing a diphthongal version in Praat (Boersma and Weenink, 2008). The original speaker was a young woman from North Carolina. Finally, a male speaker from Massachusetts with highly prominent /t/-bursts was selected and a sample of his speech was altered to create a non-burst version by excising the bursts. Presented with a pair of recordings, participants were asked which of the two sounded more Southern and which sounded more educated and in each case how big the difference was, on a scale of one to five.

After this evaluation task, participants were asked directly which of two sets of forms sounded more Southern and more educated, described as *words like doing or being vs. words like doin' or bein'*, *words like my or pie pronounced like "ay" vs. words like my or pie pronounced like "ah"* and *words like bat or hat with the t fully pronounced vs. words like bat or hat without the t fully pronounced*. After each decision, participants were asked to rate the size of the difference, on a scale of one to five.

For both the social evaluation and direct question tasks, association scores were based on the degree of difference scores, multiplying the score by -1 in the cases where the unexpected choice (e.g. -ing selected as more Southern) was made. The ratings thus ranged from -5 (strongly associated in the unexpected direction) to 5 (strongly associated in the expected direction), skipping 0, since the first decision was forced-choice.

Finally, participants completed six IAT tasks, using the stimuli from the previous experiments. Individuals' *D* values for each of the six IAT tasks were then tested for correlation against their responses to the direct question and social evaluation measure. 31 new participants completed this experiment in return for partial course credit.

#### 4.8. Results

Table 3 shows the mean values from each of the three tasks (social evaluation, direct question and IAT) for the six associations investigated in Experiment 3. When explicitly asked, participants reported ideologies of the expected type in all

**Table 3**  
Experiment 3 results: IAT and explicit measure mean associations.

| IAT tasks         |               |                 |               |                 |
|-------------------|---------------|-----------------|---------------|-----------------|
|                   | States        |                 | Professions   |                 |
|                   | <i>d</i> Mean | <i>p</i> -Value | <i>d</i> Mean | <i>p</i> -Value |
| (ING)             | 0.12          | 0.016           | 0.14          | 0.003           |
| /ay/              | 0.16          | 0.004           | 0.16          | 0.004           |
| /t/               | 0.06          | NS              | 0.29          | <0.001          |
| Direct questions  |               |                 |               |                 |
|                   | Southern      |                 | Educated      |                 |
|                   | Mean rating   | <i>p</i> -Value | <i>d</i> Mean | <i>p</i> -Value |
| (ING)             | 3.38          | <0.001          | 3.42          | <0.001          |
| /ay/              | 1.85          | 0.001           | 2.15          | <0.001          |
| /t/               | 1.77          | <0.001          | 2.00          | <0.001          |
| Social evaluation |               |                 |               |                 |
|                   | Southern      |                 | Educated      |                 |
|                   | Mean rating   | <i>p</i> -Value | <i>d</i> Mean | <i>p</i> -Value |
| (ING)             | 1.03          | <0.001          | 1.10          | <0.001          |
| /ay/              | 1.81          | <0.001          | 0.29          | NS              |
| /t/               | 0.61          | 0.011           | 0.26          | NS              |

six cases: *-in, ah* forms and not fully pronounced /t/ were all described as more Southern and less educated. On the IAT tasks, five of the six associations likewise yielded a significant result in the expected direction, the exception being /t/ release and region. The social evaluation metric was less consistent, lacking the education connection for both /ay/ and /t/. The fact that the Southernness judgments showed the expected effect for both variables suggests that participants were able to (consciously or unconsciously) detect the variable manipulations themselves, but that the other linguistic cues available in the speech stream reduced the impact on education (see Campbell-Kibler, 2008), despite participants' willingness to link the two variables to education in the abstract.

Fig. 1 plots the relationships between IAT D scores, question responses and speaker evaluation responses, across all the data combined (the three variables and two social dimensions). Because the question and evaluation measures are integers only, small amounts of jitter (random noise) has been added to those values to make the data distribution easier to see.

The three tasks showed little correlation with one another across individuals. This could be due to measurement error or bias in one or more of the techniques, such that their shared cause is not well captured. For example, the other linguistic and content cues in the speaker evaluation task may reduce or otherwise shape variability in responses. Likewise, the choice of description in the direct question and exemplars in the IAT may be influencing the responses in ways that lead to divergent results. The direct question and social evaluation are also both more subject to overt control, and asked participants to assess how big the social difference was between the two options in each case. It is possible that variability in the responses to one or both of these tasks reflects at least in part general language ideologies regarding how much linguistic cues indicate social characteristics.

Alternatively, it is possible that the three measures reflect different constructs entirely, rather than different views on the same underlying "attitude". For example, the direct questions may assess consciously controlled, ideologically informed beliefs about the linguistic forms in question. The IAT, in contrast, may assess a learned association that individuals may not explicitly endorse. Speaker evaluations may reflect a third construct or perhaps the work of both of the others in combination.

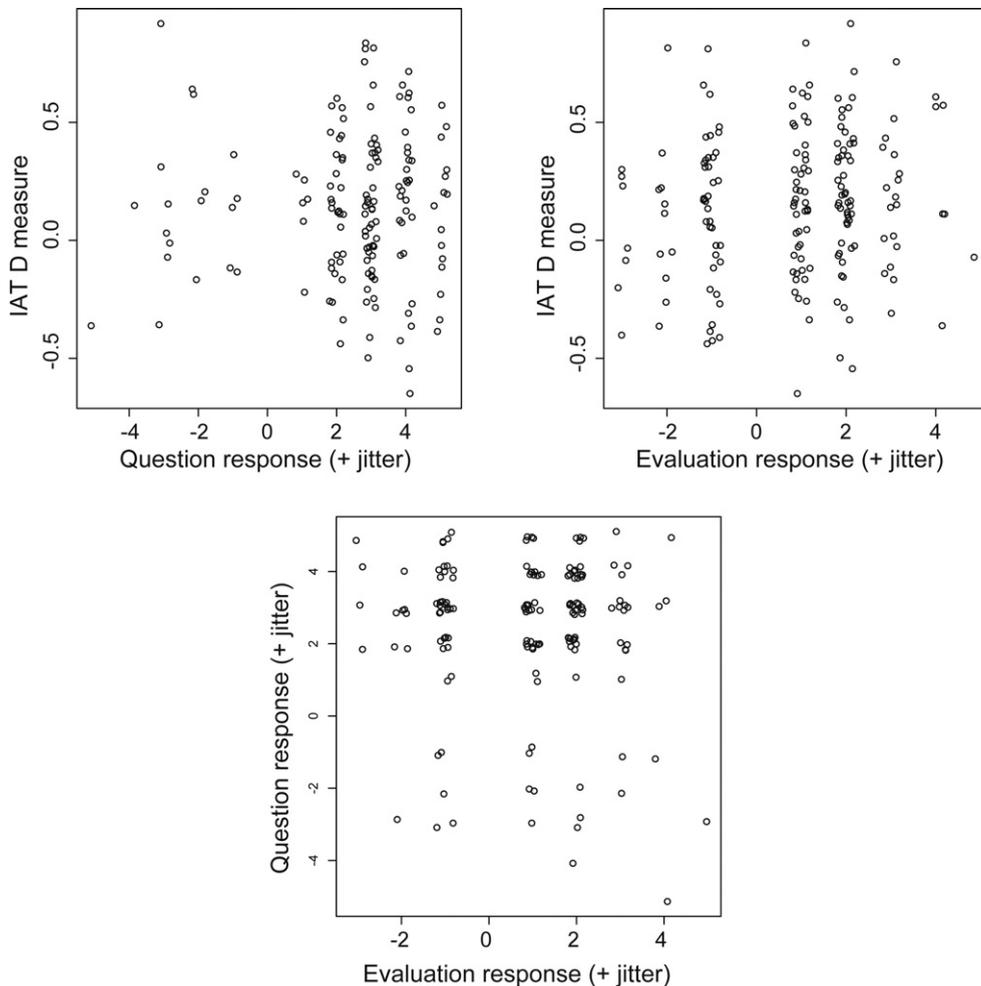


Fig. 1. No correlations between IAT, guise measure and direct question.

Exactly what constructs are measured with implicit and explicit metrics and how they relate to one another is in dispute in the literature. Implicit measures often diverge from self-report (Greenwald et al., 1998; Karpinski and Hilton, 2001). On the one hand, their ability to detect attitudes and/or associations that participants are unwilling to report or are unaware they hold is one of the reasons for their popularity. While the IAT is susceptible to faking to a degree (Fiedler and Bluemke, 2005), it is less so than explicit measures (Steffens, 2004). On the other hand, implicit/explicit divergence raises questions about exactly what implicit techniques measure and whether the divergence is due to fundamental difference between the constructs or to problems with the metrics themselves (Kinoshita and Peek-O'Leary, 2006).

To the degree that implicit and explicit measures diverge, it is tempting to conclude that one is in some way more accurate, particularly in being more predictive of behavior. It appears that which measures predict behavior depends on the specifics of the attitude and the behavior examined. McConnell and Leibold (2001) found correlations between all three: the IAT, explicit measures and White participants' interactional behaviors toward White and Black experimenters. In contrast, Steffens and König (2006) showed a correlation between IAT measures and spontaneous behavior on four of the "big five" personality traits (namely neuroticism, extraversion, agreeableness and conscientiousness), while explicit measures correlated with behavior on only extraversion and openness. More promising for sociolinguistic questions, Gawronski et al., 2003 showed that IAT-measured gender stereotypes predicted patterns of impression formation based on gender and individuating information. The relationship between behavior and both implicit and explicit attitudes is thus complex and seems to depend on, among other factors, the amount of time and effort an individual is able and willing to give to making a particular decision (an observation fundamental to many dual systems models, see Evans, 2008).

## 5. Discussion

The connections between linguistic forms and social concepts are of obvious interest to sociolinguists, but they also have implications for researchers of language more generally. As noted above, sociophonetic work has gathered a range of instances in which social information influences the processing of linguistic stimuli. Linguists who wish to effectively model how the human mind produces and understands language will need to understand how it reasons about the social aspects of socially meaningful linguistic forms at the same time.

This study proposes the IAT as a method for sociolinguistic investigation. Less susceptible to conscious manipulation than direct questioning, it allows the investigation of implicit sociolinguistic associations with less interference from explicit ideologies. The matched guise technique, designed to circumvent such ideological distortions (Lambert et al., 1960), is nonetheless subject to influence based on other linguistic or extralinguistic cues which can alter or eliminate the effect of a linguistic form in a given context. The IAT provides a potential method of assessing connections that exist in a speaker's mind but only emerge as an evaluational influence in specific, possibly difficult to construct, circumstances.

At the same time, the IAT has limitations which need to be taken into account. The dichotomous structure is central to the method, requiring both variable and valence to be presented as paired categories. This works well for binary variables, or continuous variation which can be represented by examples from either pole. It is more problematic for variables with more than two realizations and reinforces the assumption that variables, rather than variants, are linked to social meanings cognitively, which may be inaccurate (Campbell-Kibler, 2011). As a result, in some circumstances other tasks which lack this binary structure may be more appropriate, such as the single-category IAT (Karpinski and Steinman, 2006), the go/no go association task (Nosek and Banaji, 2001) or the extrinsic affective Simon task (De Houwer, 2003).

Another issue is that the IAT requires all four categories (both ends of both pairs) to be named and comprehensible to participants, to the extent that they are able to reliably categorize exemplars. As noted above, this may prove challenging for even stable and widespread variables like /t/ release that have not been well defined as sociolinguistic stereotypes. Related tools such as priming (Fazio et al., 1986) may be appropriate here. Another approach, currently being tested, uses an IAT task in which participants identify spoken stimuli by voice (e.g. is this Meg or Mary?) rather than by variant, as a measure of the influence of a given feature on the implicit similarity between voices. In this way, participants need not recognize the features consciously as representing a particular class of forms, so long as examples of speech featuring the variant are heard as more similar to one another than those featuring a different variant.

The results presented here suggest that sociolinguistic variables carry implicit associations to social categories and to each other. In so doing, they highlight the relevance for sociolinguists of dual processing models currently in use in cognitive and social psychology. Sociolinguists have existing models which reflect similar distinctions, for example markers—variables which speakers alter with formality shifts but cannot identify vs. stereotypes—variables which are subject to explicit comment (Labov, 1972). Language attitudes research has likewise distinguished between explicit self-report measures and less explicit guise-based evaluation techniques (Giles and Billings, 2004). In exploring the connections between these concepts and psychological models, we may be able to expand the generality of our models.

Modeling sociolinguistic meaning using an associational structure may help to explain, for example, how a given meaning does or does not emerge in the course of a specific social evaluation. Existing models of language attitudes emphasize that a feature may trigger a given attitude, but whether that results in an explicit belief about the speaker depends on the other available information regarding the speaker and the context (Campbell-Kibler, 2009; Cargile and Giles, 1997; Giles and Billings, 2004). But associations that listeners do not themselves endorse may also contribute to the final evaluation, either from implicitly held attitudes the listeners are unaware of, or even unrelated information, since even subliminal and/or irrelevant primes can influence the process of impression formation (Bargh et al., 2008; Bargh and Pietromonaco, 1982). Such

unwanted and/or misleading conclusions may be readily explained by a model in which multiple associations from various cues compete with each other and with deliberative reasoning to contribute to the resulting impression.

While models abound for language processing and for social cognition, model development for sociolinguistic cognition is still very much in the beginning stages. In addition to its inherent scientific value, sociolinguistic cognition holds great promise for illuminating both social and linguistic processing. The current study suggests that what sociolinguists refer to as indexical meaning is, at the cognitive level, a form of what social psychologists call implicit associations. This approach expands the utility of the IAT for sociolinguists and offers useful directions for future thinking and research regarding sociolinguistic processing.

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