

John Benjamins Publishing Company



This is a contribution from *TResponses to Language Varieties. Variability, processes and outcomes*.

Edited by Alexei Prikhodkine and Dennis R. Preston.

© 2015. John Benjamins Publishing Company

This electronic file may not be altered in any way.

The author(s) of this article is/are permitted to use this PDF file to generate printed copies to be used by way of offprints, for their personal use only.

Permission is granted by the publishers to post this file on a closed server which is accessible to members (students and staff) only of the author's/s' institute, it is not permitted to post this PDF on the open internet.

For any other use of this material prior written permission should be obtained from the publishers or through the Copyright Clearance Center (for USA: www.copyright.com).

Please contact rights@benjamins.nl or consult our website: www.benjamins.com

Tables of Contents, abstracts and guidelines are available at www.benjamins.com

Implicit attitudes and the perception of sociolinguistic variation

Brandon C. Loudermilk
University of California-Davis

We investigated individual differences in processing the social dimensions of speech, addressing whether the degree of implicit stereotypical attitude towards language variants modulates brain activity during comprehension. Subjects listened to spoken stories, in which sentence-final critical words were manipulated for ING/IN' variant which was congruent/incongruent with the variants in the preceding discourse and which was typical/atypical of speaker dialect. Subjects participated in an Implicit Association Test as a measure of language attitudes towards ING/IN' variation and were classified as high or low stereotype. Results showed that listeners with low IAT scores had higher N400-like negativities while processing word variants that violated dialectal expectancies (ING uttered by a Southern speaker and IN' spoken by a Californian). Our results provide evidence that the cognitive mechanisms that support language comprehension are sensitive not just to *what* is said, but also to *how* it is said, *who* says it, and *who* hears it.

1. Introduction

Variationist sociolinguistics concerns itself with the relationship between the language forms of a speech community and the mediation of these forms by social structures. Definitions of the speech community take as a starting point the notion of a shared set of social and linguistic norms. Gumperz (1968), for example, argues that “regardless of the linguistic differences among them, the speech varieties employed within a speech community form a system because they are related to a shared set of social norms” (p.116). Labov (1972) as well defines membership in a speech community as “participation in a set of shared norms... [which] may be observed in overt types of evaluative behavior, and by the uniformity of abstract patterns of variation which are invariant in respect to particular levels of usage” (pp. 120–121). For Labov, the defining characteristics of a speech community are illustrated by (1) a shared set of sociolinguistic norms that can be observed in linguistic behavior – for example, speakers within a community all style-shift in

the same direction (Fig. 1); and (2) a shared set of evaluative behavior or language attitudes to these sociolinguistic norms – for example, recognition that *IN'* forms are less formal than *ING* variants. In the present study we sought to investigate the relationship between individuals' attitudes towards (*ING*) variation and how these attitudes influence language processing.

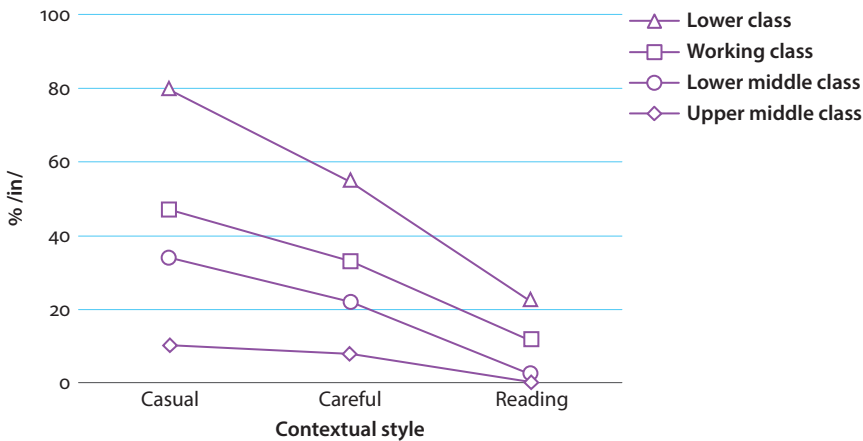


Figure 1. Style-shifting in NYC (Labov 1966). Reproduced from Labov et al. (2011)

From a socio-cultural perspective, language attitudes operate as stereotypes to justify and explain intergroup relations (Tajfel 1981), which can have real-world implications for speakers of non-standard dialects such as discrimination through “linguistic profiling” (e.g., Baugh 2000; Purnell et al. 1999). In the study of language attitudes researchers have typically relied on three broad approaches: the societal treatment approach, which typically involves participant observation and ethnography; the direct approach in which participants are directly questioned about their language beliefs and attitudes (Henerson et al. 1987); and the indirect approach, or matched-guise technique (Garrett et al. 2003). The societal treatment approach is primarily qualitative in nature and has been criticized on the grounds that the researcher is inferring attitude from behavior. Likewise, the direct approach has been criticized on “whether subjects’ [overt] verbal statements of their attitudes” accurately reflect their “underlying disposition” (Knops & van Hout 1988).

The matched-guise technique (MGT) developed by Lambert and colleagues (1960) addresses these short-comings by trying to covertly elicit language attitude. In MGT studies, participants listen to repeated passages of speech read by a single speaker under different guises (e.g., language, dialect, etc.), and are asked

to make judgments on some aspect of the speaker (e.g., intelligence, friendliness, etc.). Because the speaker and the content of the recording are held constant, and because the listener *believes* they are listening to different speakers, it is argued that any attitudinal differences that are elicited can only be attributed to the manipulation (i.e. guise) under study.

Although the MGT has primarily been used to investigate attitudes towards gross features of dialects and languages, it has been adopted to investigate language attitudes towards individual sociolinguistic variables. Labov et al. (2011), for example, conducted a series of MGT experiments that manipulated the frequency of (ING) variants. In their experiments, subjects were asked to rate the speech of a “newscaster-in-training” on measures of professionalism. Across these experiments, the researchers found similar overall results, namely a logarithmic progression between the relative frequency of vernacular IN’ and the negative evaluation of speaker professionalism. As illustrated in Figure 2, listeners hearing passages with no IN’ variants rated the speaker as the most professional, but as frequency of IN’ variants increased, passages were evaluated as increasingly negative. In an additional experiment using a Southern dialect speaker, they found no differences in overall evaluation compared to the non-Southern speaker, suggesting that the frequency of the vernacular IN’ variant was the determining factor in eliciting these overt attitudes.

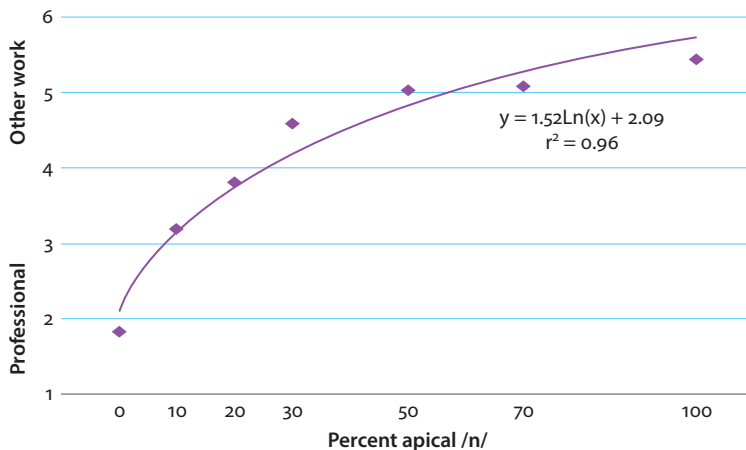


Figure 2. Frequency of vernacular IN’ on ratings of newscaster professionalism. Reproduced from Labov et al. (2011)

Other researchers have used variations of the MGT to measure attitudes towards (ING) realization. Campbell-Kibler (2009), for example, played participants

the spontaneous speech of Southern and West Coast dialect speakers that varied in (ING) pronunciation. Analysis revealed that the (ING) strongly affected perceptions of intelligence and education as well as the casual/formal dimension (Table 1). These effects of (ING) on listeners' attitudes towards speaker education/intelligence interacted however with the perceived social class and geographic region of the speaker. When listeners perceived a speaker to be working class, ING guises increased the perceived intelligence/education of the speaker; in contrast listening to speakers described as non-working class had no effect on listeners' judgments of speaker intelligence/education. However, as illustrated in Fig. 3, these effects were only observed when speakers were perceived to be both working class and non-Southern (so-called "anywhere" or a-regional speakers). These results illustrate the complex interplay of how listeners' perception of speakers' social and regional identities mediate attitudes towards stereotypical sociolinguistic variables such as (ING).

Table 1. Factor analysis on (ING) realization. Reproduced from Campbell-Kibler (2009)

	Factor 1	Factor 2
Educated	.815	.260
Intelligent	.844	.256
Shy/outgoing		.808
Speech rate	.126	.547
Casual/formal	.380	
Knows addressee	.152	-.233
Accented	-.171	-.292
Masculine (Feminine)		

In a subsequent study, Campbell-Kibler (2010) manipulated speaker profession in a matched guise study, asking whether perceived profession and (ING) realization influences listeners' judgments. Specifically, speakers were presented as authorities in a specific field (e.g., juvenile crime) representing one of three different professions: university professor (e.g., law professor), political candidate (e.g., district attorney), or professional (e.g., social worker). Results showed that for professors ING realization increased the perceived knowledge of the speaker. In contrast, professionals were seen as more knowledgeable in their IN' guise. No effect on perceived knowledge was observed for the politician speakers. These results suggest that variable (ING)'s "relationship to a central feature of competence may thus be not only heightened or mitigated by contextual information but also inverted" (Campbell-Kibler 2010: 218).

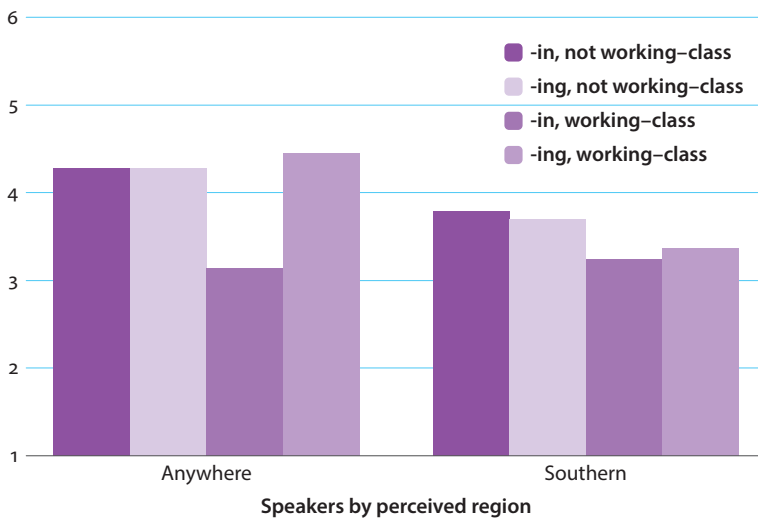


Figure 3. Perceived socio-economic status and dialect region of speaker on ratings of intelligence/education. Reproduced from Campbell-Kibler (2009)

Although single-variable MGT studies (e.g., Campbell-Kibler 2009; Campbell-Kibler 2010; Labov et al. 2011) are promising, the validity of these results remains in question. Lee (1971), for example, has argued that repeating the message forces subjects to focus on form (i.e. the linguistic features) in a manner that may not be commensurate with more naturalistic processing. Gardner and Lambert (1972) acknowledge that the measured attitudes may not accurately reflect underlying mental states, but rather what the participants *think* they should say. Moreover, it is possible that subjects have underlying attitudes which they might not be consciously aware of, nor have access to (Greenwald et al. 2002). The present study attempts to overcome these limitations by utilizing two techniques that provide more precise and more direct measures of real-time sociolinguistic cognition: the implicit association test and event-related brain potentials.

2. The implicit association test

One promising technique that addresses some of the limitations of matched-guise studies is the implicit association test (IAT) – a chronometric technique that can measure the strength of association between concepts, attitudes, and social stereotypes (Greenwald et al. 1998). Typically, the IAT has been used to examine a wide range of social phenomena including issues of racial and gender stereotyping

(Amodio & Devine 2006; Dasgupta et al. 2000). For example, Greenwald et al. (1998), in examining attitudes towards marginalized social groups, showed that individuals show a tendency to associate black faces with negative concepts and white faces with positive concepts. Although the IAT has primarily used visual stimuli (e.g., written words and pictures), recent work shows promise for linguistic audio stimuli (e.g., Babel 2010; Pantos 2010). This is important because it provides a new tool for studying implicit attitudes towards spoken sociolinguistic variation.

Because the IAT uses response latency to measure the implicit strength of association between concepts, it circumvents the limitations of end-state self-report procedures like the matched-guise technique. During IAT experiments, subjects sort stimuli representing four concepts into two response categories (Greenwald et al. 2003). For example, an IAT study investigating positive/negative attitudes towards race could have subjects sort positive and negative words (e.g., *good, happy, beautiful* versus *bad, horrible, sick*) and pictures of black and white faces. As illustrated in Table 2, the IAT consists of seven experimental blocks. In block #1, subjects practice categorizing positive and negative words. In block #2, subjects practice sorting photos of black and white faces. Block #3 is another practice block, but here subjects must sort both positive/negative words and black/white faces. Block #4 is a test block for the compatible condition (Positive/White mapped to one key, Negative/Black mapped to another key). Block #5 is another practice block for positive and negative words, but with the key mappings reversed relative to block #1. Block #6 is a combined sorting task, but with an incompatible pairing of race and valence (i.e. Negative/White versus Positive/Black). Block #7 is the test block for the incompatible condition.

Table 2. Illustration of IAT to measure implicit associations between race (black/white) and valence (positive/negative)

Block	No. of trials	Function	Items assigned to left-key response	Items assigned to right-key response
1	20	Practice	Positive Words	Negative Words
2	20	Practice	White Faces	Black Faces
3	20	Practice	Positive or White	Negative or Black
4	20	Test	Positive or White	Negative or Black
5	20	Practice	Negative Words	Positive Words
6	20	Practice	Negative or White	Positive or Black
7	20	Test	Negative or White	Positive or Black

Subjects' D scores – a measurement of strength of association – are calculated by taking the difference in mean reaction times to the compatible and incompatible conditions (e.g., block #4 and block #7, in this example), divided by the pooled standard deviations. A positive D score indicates an association in the predicted direction (i.e. a subject responds faster for the compatible condition Positive/White versus Negative/Black) compared to the incompatible condition (Negative/White versus Positive/Black). The magnitude of the D score indicates the relative strength of this stereotypical association, ranging from -2 to 2. A strong association is $D > 0.5$, a moderate association is $D > 0.35$, and a weak association is $D > 0.15$.

Greenwald and colleagues (1998) have demonstrated that the IAT technique can measure valence differences for attitudes that are believed to be (almost) universal as well as attitudes that are culturally specific. Their first experiment showed that subjects responded significantly faster with compatible mappings (flowers or pleasant words and insects or unpleasant words) versus incompatible mappings (flowers or unpleasant words and insects versus pleasant words). Experiment #2 used two different subject groups, Korean Americans and Japanese Americans, who sorted Korean and Japanese surnames and pleasant and unpleasant words. Each group was significantly faster when the sorting groups were consistent with their own ethnicity. These studies additionally demonstrated that the IAT was free from several possible sources of procedural artifact including hand mapping and ISI, which are comparable between 150 ms to 750 ms. Subsequent studies have shown that the IAT measurement is not influenced by stimulus familiarity (Dasgupta et al. 2000; Ottaway et al. 2001; Rudman et al. 1999). Test-retest reliability of the IAT across a number of different studies has averaged approximately $r = .6$ (Greenwald et al. 2002). The IAT typically shows moderate to strong correlations in the expected direction with other explicit and implicit measures of attitude (Greenwald et al. 1998).¹

In the attitude literature, depending on the particular study and type of stimuli being employed, IAT effect sizes vary considerably. The Korean-Japanese study mentioned previously reported very strong effects, $D = 1.88$ (Greenwald, et al., 1998). Other domains show smaller effects, for example male-female/math-arts ($D = .37$) and black-white/weapons-gadgets ($D = .30$) (Sriram & Greenwald 2009). In a study measuring racial attitude, Dasgupta et al. (2000) reported significantly

1. Among social psychologists it is believed that automatic measurements (e.g., evaluative priming and the IAT) measure the stored evaluative association, whereas more deliberate measures (e.g., semantic differentials and the MGT) tap both the stored evaluative association as well as downstream cognitive processes (Petty, Brinol & DeMarree 2007). Thus there exist theoretically motivated reasons why implicit and explicit measurements might diverge, for example, in measuring pervasive social stereotypes.

different effect sizes depending on the stimuli (i.e. racially stereotypical names, $D=.93$ versus pictures of Black and White faces, $D=.53$).

Recently, Campbell-Kibler (2012) used the IAT technique to measure associations between single sociolinguistic variables and their typical social and linguistic correlates. For example, she tested participants using written (ING) forms (e.g., *making/makin'*) contrasted with northern/southern states, white/blue collar professions, and news anchors/country singers. Results showed significant D values in the predicted direction, indicating weak to moderate associations between orthographic ING/IN' variants are their common social correlates (Fig. 4).

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

Figure 4. IAT results for written (ING) vs. states, professions, and singer/anchors. Reproduced from Campbell-Kibler (2012)

In a subsequent experiment, Campbell-Kibler used audio (ING) tokens in lieu of orthographic variation, and contrasted them with northern/southern states, /ay/ monophthongization, and /t/ release. Results showed significant associations in the predicted direction between (ING) and States and /ay/ monophthongization, but not with /t/ release (Fig. 5). These results show that the IAT is sensitive enough to capture associations between (ING) and its common social and linguistic correlates.

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

Figure 5. IAT results for audio (ING) vs. States, /ay/, and /t/. Reproduced from Campbell-Kibler (2012)

3. The event-related potential technique

Another method which has shown promise in recent years for measuring aspects of sociolinguistic cognition is the event-related potential (ERP) technique. This approach entails recording participants' EEG while they perform

some task – typically listening to language, reading words, making semantic/phonological judgments, etc. The EEG signal, which has been time-locked to stimulus onset, is then averaged across experimental conditions, thus increasing the signal-to-noise ratio, providing a spatially and temporally distributed waveform. The resulting ERP components are argued to reflect specific cognitive computations involved in processing the language stimuli (e.g., phonological, syntactic, and semantic processing). One such well-studied ERP component is the so-called N400 – a broad negative deflection of the waveform that peaks 400 ms after the visual or auditory presentation of a word, that is typically maximal over centro-parietal electrode sites (Holcomb & Neville 1991; Kutas & Hillyard 1980). Although all content words elicit an N400 component, the ERP response is larger for words that are semantically anomalous or less expected (Hagoort & Brown 1994; Kutas & Hillyard 1984). For example, listening to the sentence ‘I like my coffee with cream and *sugar/sweetener/socks*’, the expected word *sugar* elicits the smallest N400, the plausible but less expected *sweetener* elicits a larger waveform, and the semantically anomalous *socks* elicits the largest N400 response. Thus the N400 is often interpreted as an index of ease or difficulty in semantic conceptual integration (Brown & Hagoort 1993; Hagoort & Van Berkum 2007).

Consistently, studies over the past three decades have shown that the closer a word’s meaning fits with the prior context (broadly construed), the greater the reduction in N400 amplitude. Importantly, however, N400-like effects show differences in amplitude distributions and latency depending on modality (visual/aural), stimulus characteristics, and task (Kutas & Federmeier 2011). Recently, a number of studies have demonstrated that the N400 response can be modulated by specific contextual factors such as discourse, pragmatics, and world knowledge (Camblin, Gordon & Swaab 2007; Hagoort et al. 2004; Nieuwland & Van Berkum 2006; St. George, Mannes & Hoffman 1994; Van Berkum, Hagoort & Brown 1999; Van Berkum, Zwitserlook, Hagoort & Brown 2003). Given this evidence, one interpretation of the N400 is that it is an index of “effort” or difficulty in integrating the meanings of individual words into higher-order units of meaning (e.g., sentence-level interpretation).

Unfortunately, relatively little is known about how measures of implicit attitude relate to electrophysiological measures such as ERPs. It is only recently that studies have begun to employ both techniques simultaneously. The most thorough of these is Williams and Themanson (2011) who used a group bias IAT (i.e. gay/straight) while recording participants’ EEG in order to better understand the effects of compatible and incompatible conditions on early and late ERP components. Specifically, they examined the following ERP components: the N1, P2, N2, N400, and LPP, looking for ERP modulation by IAT condition. Results showed no modulation by compatibility for the early components (i.e. N1, P2, and N2),

but they did observe a frontal N400-like effect, with incompatible trials eliciting greater negativities than compatible trials. This finding suggests greater semantic incongruity for incompatible compared to compatible IAT trials, and that “both semantic and affective properties of the stimuli... contribute to the stronger association of the compatible items” (Williams & Themanson 2011:74).

4. Predictions

In the present study, we sought to investigate individual differences in processing the sociolinguistic aspects of speech, asking whether the degree of implicit stereotypical attitude to (ING) differentially modulates brain activity during language comprehension. In distinction to Williams and Themanson (2011), we did not record ERPs while subjects performed an IAT, but rather used the IAT as a separate measure in order to assess the role of implicit attitude towards (ING) variation during perception of (ING) variants during real-time language comprehension. In order to address this question, we divided participants into two groups using a median split on IAT D score: low stereotype and high stereotype.

We consider three possible accounts of the relationship between implicit attitude towards variation and perception of variation.

1. Implicit attitudes are *not* involved in lexical semantic processing as indexed by the N400. This could be due to latency differences in these two processes (e.g., attitudes are only evoked post semantic processing). This account predicts no differences in N400 modulation between the low and high stereotype groups, though group differences might be observed before or after N400 effects.
2. Individuals that show a *large* IAT effect for (ING) will show heightened sensitivity to conditions that violate (ING) stereotypes. This account predicts heightened N400-like negativities for the high stereotype listeners compared to the low listeners for conditions where the dialect of the speaker conflicts with the register and variant uttered. This account supports the proposition that the emotional valence of spoken words is processed concurrently with word meaning and the sociolinguistic aspects of language use.
3. Individuals that show a *small* IAT effect for (ING) will show heightened sensitivity to conditions that violate (ING) stereotypes. This account predicts larger N400-like negativities for the low stereotype listeners compared to the high listeners. Such a pattern of results would be consistent with the proposition that strong implicit attitudes towards variation block or attenuate normal spoken language processing. This account suggests that the emotional valence of words is processed concurrently with word meaning, but that these mechanisms are partially distinct and that listeners with high stereotypes of

(ING) do not process the sociolinguistic aspects of speech as deeply as individuals with low (ING) stereotypes.

5. Methods

5.1 ERP experiment and participants

In this study, subjects listened for comprehension to short, semantically rich stories which varied in (ING) realization (Fig. 6). Half the critical words were realized with ING and half realized as IN'. All sentence final words were highly predictable, as established by a previous cloze probability task (mean cloze probability 74.9%, range 20.7% – 100%). The time-locked critical words were either preceded by a formal register context containing four embedded ING words or by an informal context containing four IN' words. In addition, however, half of the passages were read by Californian speakers and half were read by Southern speakers. In summary, we used a 2×2×2 factorial design: Variant (ING/IN') × Register (Formal/Informal) × Speaker Dialect (Californian/Southern).

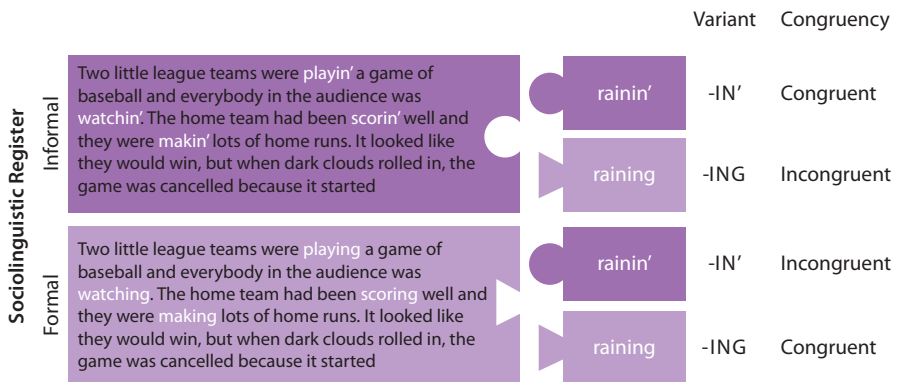


Figure 6. Stimuli conditions

EEG data was collected from 19 native-speaker participants (female = 11). These participants ranged in age from 19 to 24 years and all were raised in Northern California (primarily the Bay Area and Central Valley). Because we used a median split on D value, we removed the median subject to have 9 subjects in each group.

5.2 IAT design and procedure

After recording participants' ERPs during the main experiment, subjects were given a single seven block IAT task designed to measure individuals' strength of

stereotypical response to (ING) variation. During IAT pilot testing, we pitted (ING) variation against several well-known correlates, including intelligence/education, gender, and socio-economic status. Preliminary results showed effects in the predicted direction for all correlates; however, the IAT effect for intelligence/education was the largest and we chose this version for the actual experiment. The basic IAT design is illustrated in Table 3. In order to reduce block and handedness effects, we developed four versions of the basic design, balancing block order and left-right key mappings, and randomly assigned participants to one of the four designs.

Category items were determined by a word association task given to 20 undergraduate students who did not participate in the experiment. Given the category label Intelligent, participants were asked to write down as many associated words as they could in two minutes. The eight most frequently listed items for each category were chosen. Intelligent words: *smart, bright, educated, genius, brilliant, clever, quick, and wise*. Stupid words: *dumb, moron, ignorant, slow, idiot, imbecile, dopey, and uneducated*. Although these word groups differ in written frequency, orthographic length, and number of syllables, these factors should not bias individuals' D scores, as this measure is calculated by taking the difference between the compatible and incompatible blocks, thus mitigating this potential confound. The ING/IN' words were: *doing/doin', feeling/feelin', looking/lookin', moving/movin', running/runnin' taking/takin' training/trainin', and working/workin'*.

Table 3. IAT design for (ING) variation

Block	No. of trials	Function	Items assigned to left-key response	Items assigned to right-key response
1	20	Practice	Educated Words	Uneducated Words
2	20	Practice	ing	in'
3	20	Practice	Educated or ing	Uneducated or in'
4	20	Test	Educated or ing	Uneducated or in'
5	20	Practice	Uneducated Words	Educated Words
6	20	Practice	Uneducated or ing	Educated or in'
7	20	Test	Uneducated or ing	Educated or in'

The IAT effect (D score) for each participant was calculated by taking the difference between test block means (blocks 4 and 7) divided by the standard deviation of all latencies in the test blocks. This algorithm outperforms candidate algorithms in terms of (a) correlations with self-reports, (b) resistance to speed of response artifacts, (c) internal consistency, (d) sensitivity to known influences,

and (e) resistance to known procedural influences (Greenwald et al., 2003). This procedure removes individual trials with reaction times greater than 10,000 ms and removes participants that have more than 10% of reaction times shorter than 300 ms. Trials with an incorrect response are assigned the RT for the mean block plus a 600 ms penalty.

The participants were given the following task instructions:

In this experiment you will both listen to words and read words and press a key to indicate what type of word it is.

1. In the first block, you will see the categories ING and IN' at the top left and right of your screen. You will hear spoken words that alternate in their -ing pronunciation. If you hear the word ending in ING, you hit the left key button (E); if you hear the word with a missing g, you will hit the right key (I). For example, if you heard the word *workin'* you would press the key that corresponds to the IN' category. You should go as fast as you can while making as few mistakes as possible.
2. In the second block you will see the categories Intelligent and Stupid at the top left and right of the screen. Now you will read words and categorize them (e.g., the word smart, for example, should be categorized as Intelligent).
3. Eventually, you will get a more difficult task where you will both read words (meaning Intelligent or Stupid) and listen to words (ING or IN'). Remember to always read the instructions before starting a block, and look at the top left and right to see what the categories are. The entire experiment takes about 10 minutes to complete.

5.3 Analysis

In order to study the role of implicit attitude in modulating the ERP response, we conducted a repeated measures ANOVA, Variant (ING/IN') x Congruency (Congruent/Incongruent) x Dialect (Californian/Southern), adding listener D value as a between groups factor with two levels (low/high).

6. Results

6.1 IAT results

Participants were evenly split into two groups, High D (n=9) and Low D (n=9) based on the median D value ($D = .675$) of subjects with sufficient ERP trials for statistical analysis. The Low D group had a mean D value of 0.40 (min 0.11, max 0.65) and the High D group had a mean D score of 0.83 (min, 0.7, max 1.05).

A single-tailed T-test showed statistically significant differences between groups ($p < 0.001$). Results show that all subjects had an IAT effect in the expected direction (i.e. stronger associations of ING with intelligence and IN' with stupidity than with ING with stupidity and IN' with intelligence).

6.2 ERP results

Variant \times Dialect \times D (180–290 ms)

Between 180–290 ms we observed a significant interaction of Variant \times Dialect \times D [$F(1,16) = 7.796$, MSE 173.2, $p = 0.013$]. Pairwise comparisons revealed increased negativities for High D listeners compared to Low D listeners for IN' words spoken in a Southern dialect ($p = 0.043$, 2.20 mV) and ING words spoken in a Californian dialect ($p = 0.069$, 1.63 mV). For Low D listeners, but not High D listeners, IN' words elicited greater negativities than ING words by Californian speakers ($p = 0.005$, 2.83 mV difference, Fig. 7).

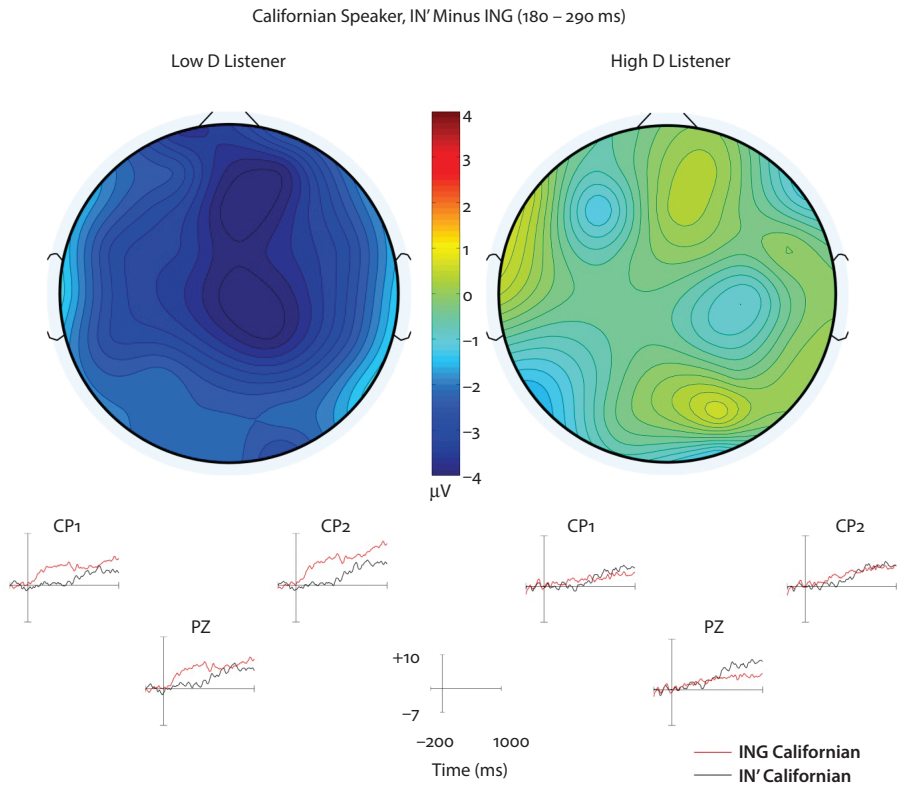


Figure 7. Californian vernacular IN' effect for low and high stereotype listeners. Positive plotted up

For Low D listeners, hearing IN' words spoken by Californian speakers elicited greater negativities than when spoken by Southern speakers ($p = 0.023$, 2.21 mV difference, Fig. 7, left). In distinction, for Low D listeners, hearing ING words spoken by Southern speakers elicited greater negativities than those spoken by Californian speakers ($p = 0.022$, 1.50 mV difference, Fig. 8, right).

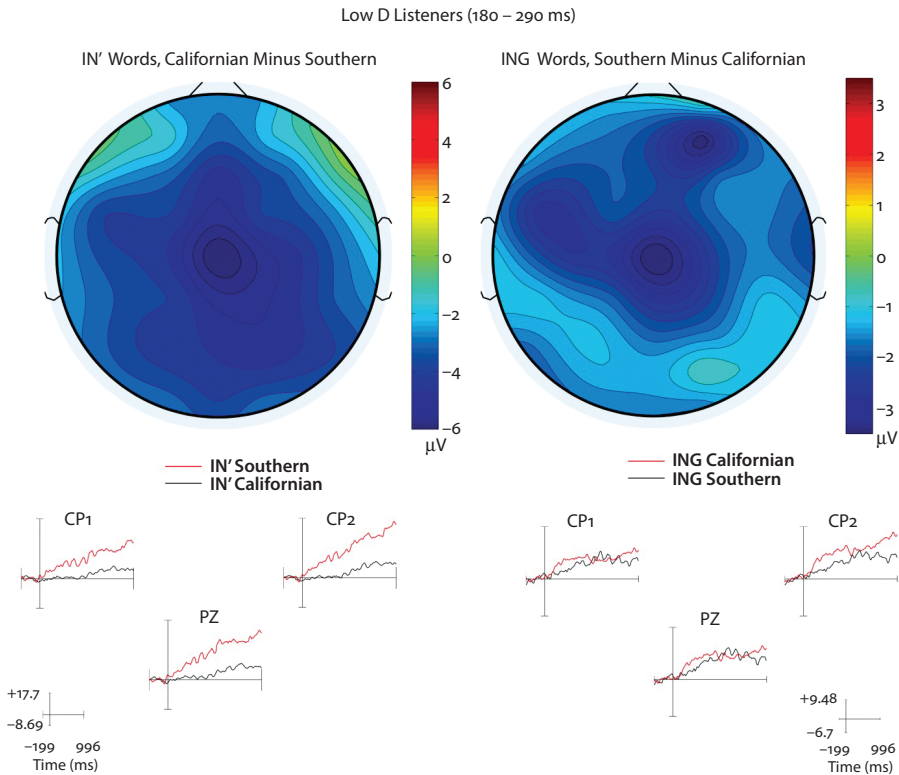


Figure 8. Variant dialect effect for low stereotype listeners. Positive plotted up

Dialect \times LR \times D (180–290 ms)

Within the 180–290 ms window, we observed a statistically significant Dialect \times LR \times D interaction [$F(1,16) = 5.584$, MSE .664, $p = 0.031$]. For Southern speakers, High D listeners showed greater negativities than Low D listeners in the left ($p = 0.041$, 1.35 mV difference) and right ($p = 0.060$, 1.24 mV difference) hemispheres. For Low D listeners, Californian speakers elicited greater right hemispheric negativities ($p = 0.051$, .41 mV difference).

Congruency x AP x LR (180–290 ms)

Between 180–290 ms, Congruency x AP x LR interacted [$F(1,16)=6.550$, $MSE .381$, $p = 0.021$]. Pairwise comparisons showed that critical words that were congruent with the preceding sociolinguistic register elicited greater right hemispheric negativities at anterior sites ($p = 0.001$, .56 mV difference).

7. Discussion

The purpose of this experiment was to investigate the relationship between individuals' strength of stereotypical association towards variation and characterize the neural bases of sociolinguistic cognition. In the current analysis, we added participants' IAT D score as a between groups factor, with participants categorized as high or low (ING) stereotype. We observed several novel findings. Between 180–90 ms after the acoustic onset of the ING/IN' allomorph, we observed that: (1) for dialect typical variants (i.e. Southerner IN' and Californian ING) High D listeners showed greater negativities than Low D listeners; (2) Low D listeners, but not High D listeners, showed an N400-like effect of vernacular variant for Californian speakers; (3) Low D listeners showed increased negativities for IN' words spoken by Californians compared to Southerners; and (4) Low D listeners showed increased negativities for ING words spoken by Southern speakers compared to Californian speakers. No additional effects were observed for either group of listeners.

In this analysis, we observed modulation of N400-like potentials based on individuals' strength of implicit stereotypical attitude towards (ING). The significant differences in waveform amplitude between conditions and groups as well as the timing of these effects suggest that attitudinal processing occurs concurrently or in parallel with lexical semantic processing. Contrary to the proposal that high stereotype listeners should have the largest N400 response to sociolinguistic violations, we observed these effects only in the group of listeners with relatively smaller stereotypical response. Only the low stereotype listeners showed sensitivity to mismatches of dialect and sociolinguistic variant.

Williams and Themanson (2011), measuring participants' ERPs during an IAT task, reported a correlation of N400 amplitude with subjects' IAT effect size. Rather than a straight linear relation between the two measures, the authors report a curvilinear relationship: for participants with low IAT effect scores, N400 amplitude increased as RT differences between incompatible and compatible trials increased; however, for participants with larger IAT effects, N400 amplitude differences decreased as RT differences increased. We too observed a similar pattern: participants with low stereotypical bias towards (ING) variation showed increased

N400 negativities for conditions where speaker dialect was incongruent with the ING/IN' variant uttered; in contrast, participants with relatively larger IAT effects showed no such N400 modulation (Fig. 6 and 7).

The question that emerges is why do only the low stereotype listeners show sensitivity to the social aspects of language? One plausible interpretation of these results is that dual processes are involved in language comprehension. In addition to lexical semantic processing, we speculate that both word meaning and the emotional or attitudinal aspects of words are processed concurrently perhaps relying upon a single shared limited capacity resource. For listeners with little attitudinal bias to variation, emotional processing is minimized compared to listeners that hold strong implicit attitudes towards variation. For these high stereotype listeners, who show difficulties with incompatible IAT trials, we speculate that additional neural resources are recruited for processing the emotional and attitudinal aspects of language. As more cognitive resources are deployed for attitudinal processing, fewer can be devoted to the lexical semantic aspects of language processing, resulting in an attenuation of the N400 response compared to the low attitude listeners.

Future work will need to determine what are the exact components of cognition which are taxed under these conditions. Two possible candidates for future investigation are attention and working memory, both of which are typically conceived as limited capacity cognitive processes. Attention, the ability to selectively attend to or concentrate on a stimulus while ignoring other sources of information, is one such candidate. In language processing, the role of attention can be observed in the so-called "cocktail party" problem (Cherry 1953) – how does an individual selectively attend to the message of a single speaker while ignoring the cacophony of voices around her. One of the fundamental bases of attention is the processing tradeoffs that occur when multiple "sources" of information are presented – "better processing of one source seems to require poorer processing of another" (Kinchla 1992). Similarly, the observed results could be due to limitations of working memory, conceived of as "a limited capacity system that provides the temporary storage and manipulation of information for performing a wide range of cognitive activities" (Baddeley 2012: 7). Could the high stereotype listeners be attending more to the emotional and attitudinal aspects of speech at the cost of shallower lexical semantic processing? Future work will need to address such concerns.

Whatever the precise interpretation of these effects, the results from the present study show that the attitudinal aspects of sociolinguistic variation can influence real-time language processing. Individuals with strong negative stereotypes to variation show less sensitivity to the dialectal and sociolinguistic aspects of speech as indexed by the N400. In contrast, individuals with relatively little attitudinal bias appear to more deeply process the social dimensions of language.

8. Conclusion

This present study testifies to the importance of including independent measures of implicit language attitude while investigating language perception. Differences in brain activity masked through aggregate analysis were revealed by taking into account the strength of stereotypical attitude of the listeners. Results from this study revealed increased N400 negativities for listeners with low attitudinal bias towards variable (ING), suggesting that language processes may be blocked or attenuated for individuals with strong implicit biases towards variation.

References

- Amodio, David M. & Devine, Patricia G. 2006. Stereotyping and evaluation in implicit race bias: Evidence for independent constructs and unique effects on behavior. *Journal of Personality and Social Psychology* 91(4): 652–661. DOI: 10.1037/0022-3514.91.4.652
- Babel, Molly. 2010. Dialect convergence and divergence in New Zealand English. *Language In Society* 39: 437–456. DOI: 10.1017/S0047404510000400
- Baddeley, Alan. 2012. Working memory: Theories, models, and controversies. *Annual Review of Psychology* 63: 1–29. DOI: 10.1146/annurev-psych-120710-100422
- Baugh, John. 2000. Racial identity by speech. *American Speech* 75: 362–364. DOI: 10.1215/00031283-75-4-362
- Brown, Colin & Hagoort, Peter. 1993. The processing nature of the N400: Evidence from masked priming. *Journal of Cognitive Neuroscience* 5: 34–44. DOI: 10.1162/jocn.1993.5.1.34
- Camblin, Christine C., Gordon, Peter C. & Swaab, Tamara Y. 2007. The interplay of discourse congruence and lexical association during sentence processing: Evidence from ERPs and eye tracking. *Journal of Memory and Language* 56(1): 103–128. DOI: 10.1016/j.jml.2006.07.005
- Campbell-Kibler, Kathryn. 2009. The nature of sociolinguistic perception. *Language Variation and Change* 21: 135–156. DOI: 10.1017/S0954394509000052
- Campbell-Kibler, Kathryn. 2010. The effect of speaker information on attitudes toward (ING). *Journal of Language and Social Psychology* 29(2): 214–223. DOI: 10.1177/0261927X09359527
- Campbell-Kibler, Kathryn. 2012. The Implicit Association Test and sociolinguistic meaning. *Lingua* 122(7): 753–763. DOI: 10.1016/j.lingua.2012.01.002
- Cherry, Colin. 1953. Some experiments on the recognition of speech, with one and with two ears. *J. Acoust. Soc. Am.* 25(5): 975–979. DOI: 10.1121/1.1907229
- Dasgupta, Nilanjana, McGhee, Debbie E., Greenwald, Anthony G. & Banaji, Mahzarin R. 2000. Automatic preference for White Americans: Eliminating the familiarity explanation. *Journal of Experimental Social Psychology* 36: 316–328. DOI: 10.1006/jesp.1999.1418
- Gardner, Richard G. & Lambert, Wallace E. 1972. *Attitudes and Motivation in Second-language Learning*. Rowley MA: Newbury House.
- Garrett, Peter, Coupland, Nik & Williams, Angie. 2003. *Investigating Language Attitudes: Social Meanings of Dialect, Ethnicity, and Performance*. Cardiff: University of Wales Press.

- Greenwald, Anthony G., Banaji, Mahzarin R. & Nosek, Brian A. 2003. Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology* 85(2): 197–216. DOI: 10.1037/0022-3514.85.2.197
- Greenwald, Anthony G., McGhee, Debbie E. & Schwartz, Jordan L.K. 1998. Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology* 74: 1464–1480. DOI: 10.1037/0022-3514.74.6.1464
- Greenwald, Anthony G., Rudman, Laurie A., Nosek, Brian A., Banaji, Mahzarin R., Farnham, Shelley D. & Mellot, Deborah S. 2002. A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review* 109(1): 3–25. DOI: 10.1037/0033-295X.109.1.3
- Gumperz, John J. 1968. The speech community. *International Encyclopedia of the Social Sciences* 9(3): 382–386.
- Hagoort Peter, Hald, Lea A., Bastiaansen, Marcel & Petersson, Karl Magnus. 2004. Integration of word meaning and world knowledge in language comprehension. *Science* 304: 438–441. DOI: 10.1126/science.1095455
- Hagoort Peter & Brown, Colin M. 1994. Brain responses to lexical-ambiguity resolution and parsing. In *Perspectives on Sentence Processing*, Charles Clifton Jr., Lyn Frazier & Keith Rayner (eds), 45–81. Hillsdale NJ: Laurence Erlbaum Associates.
- Hagoort, Peter & van Berkum, Jos J.A. 2007. Beyond the sentence given. *Philosophical Transactions of the Royal Society B: Biological Sciences* 362(1481): 801–811. DOI: 10.1098/rstb.2007.2089
- Henerson, Marlene E., Morris, Lyn L. & Fitz-Gibbon, Carol T. 1987. *How to Measure Attitudes*. Newbury Park CA: Sage.
- Holcomb, Philip J. & Neville, Helen J. 1991. The electrophysiology of spoken sentence processing. *Psychobiology* 19: 286–300.
- Kinchla, Ronald A. 1992. Attention. *Annual Review of Psychology* 43(1): 711–742. DOI: 10.1146/annurev.ps.43.020192.003431
- Knops, Uus & van Hout, Roland. 1988. Language attitudes in the Dutch language area: An introduction. In *Language Attitudes in the Dutch Language Area*, Roland van Hout & Uus Knops (eds). Dordrecht: Foris. DOI: 10.1515/9783110857856
- Kutas, Marta & Federmeier, Kara D. 2011. Thirty years and counting: Finding meaning in the N400 component of the Event-Related Brain Potential (ERP). *Annual Review of Psychology* 62: 621–647. DOI: 10.1146/annurev.psych.093008.131123
- Kutas, Marta & Hillyard, Steven A. 1980. Event-related potentials to semantically inappropriate and surprisingly large words. *Biological Psychology* 11: 99–116. DOI: 10.1016/0301-0511(80)90046-0
- Kutas, Marta & Hillyard, Steven A. 1984. Brain potentials during reading reflect word expectancy and semantic association. *Nature* 307: 161–163. DOI: 10.1038/307161a0
- Labov, William. 1966. *The Social Stratification of English in New York City*. Washington DC: Center for Applied Linguistics.
- Labov, William. 1972. *Sociolinguistic Patterns*. Philadelphia PA: University of Pennsylvania Press.
- Labov, William, Ash, Sharon, Ravindranath, Maya, Weldon, Tracey, Baranowski, Maciej & Nagy, Naomi. 2011. Properties of the sociolinguistic monitor. *Journal of Sociolinguistics* 15(4): 431–463. DOI: 10.1111/j.1467-9841.2011.00504.x
- Lambert, Wallace, Hodgson, Ricard C., Gardner, Robert C. & Fillenbaum, Samuel. 1960. Evaluational reactions to spoken languages. *Journal of Abnormal and Social Psychology* 60: 44–51. DOI: 10.1037/h0044430

- Lee, Richard R. 1971. Dialect perception: A critical review and re-evaluation. *Quarterly Journal of Speech* 57: 410–417. DOI: 10.1080/00335637109383086
- Nieuwland, Mante S. & van Berkum, Jos J.A. 2006. When peanuts fall in love: N400 evidence for the power of discourse. *Journal of Cognitive Neuroscience* 18(7): 1098–1111. DOI: 10.1162/jocn.2006.18.7.1098
- Ottaway, Scott A., Hayden, David C. & Oakes, Mark A. 2001. Implicit attitudes and racism: Effect of word familiarity and frequency on the Implicit Association Test. *Social Cognition* 19: 97–144. DOI: 10.1521/soco.19.2.97.20706
- Pantos, Andrew. 2010. Measuring Implicit and Explicit Attitudes toward Foreign-accented Speech. Ph.D. dissertation, Rice University.
- Petty, Richard E., Briñol, Pablo & DeMarree, Kenneth G. 2007. The meta-cognitive model (MCM) of attitudes: Implications for attitude measurement, change, and strength. *Social Cognition* 25(5): 657–686. DOI: 10.1521/soco.2007.25.5.657
- Purnell, Thomas, Idsardi, William J. & Baugh, John. 1999. Perceptual and phonetic experiments on American English dialect identification. *Journal of Language and Social Psychology* 18: 10–30. DOI: 10.1177/0261927X99018001002
- Rudman, Lea A., Greenwald, Anthony G., Mellott, Deborah S. & McGhee, Debbie E. 1999. Measuring the automatic components of prejudice: Flexibility and generality of the Implicit Association Test. *Social Cognition* 17: 437–465. DOI: 10.1521/soco.1999.17.4.437
- St. George, Marie, Mannes, Suzanne & Hoffman, James E. 1994. Global semantic expectancy and language comprehension. *Journal of Cognitive Neuroscience* 6(1): 70–83. DOI: 10.1162/jocn.1994.6.1.70
- Sriram, N. & Greenwald, Anthony G. 2009. The brief implicit association test. *Experimental Psychology* 56(4): 283–294. DOI: 10.1027/1618-3169.56.4.283
- Tajfel, Henry. 1981. *Human Groups and Social Categories*. Cambridge: CUP.
- van Berkum, Jos J.A., Hagoort, Peter & Brown, Colin M. 1999. Semantic integration in sentences and discourse: Evidence from the N400. *Journal of Cognitive Neuroscience* 11(6): 657–71. DOI: 10.1162/089892999563724
- van Berkum, Jos J.A., Zwitserlood, Pienie, Hagoort, Peter & Brown, Colin M. 2003. When and how do listeners relate a sentence to the wider discourse? Evidence from the N400 effect. *Brain Res. Cogn. Brain Res.* 17: 701–718. DOI: 10.1016/S0926-6410(03)00196-4
- Williams, John K. & Themanon, Jason R. 2011. Neural correlates of the implicit association test: evidence for semantic and emotional processing. *Social Cognitive and Affective Neuroscience* 6(4): 468–476. DOI: 10.1093/scan/nsq065