

Reduced sensitivity to prosodic attitudes in adults with focal right hemisphere brain damage

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Abstract

Although there is a strong link between the right hemisphere and understanding emotional prosody in speech, there are few data on how the right hemisphere is implicated for understanding the emotive “attitudes” of a speaker from prosody. This report describes two experiments which compared how listeners with and without focal right hemisphere damage (RHD) rate speaker attitudes of “confidence” and “politeness” which are signalled in large part by prosodic features of an utterance. The RHD listeners displayed abnormal sensitivity to both the expressed confidence and politeness of speakers, underscoring a major role for the right hemisphere in the processing of emotions *and* speaker attitudes from prosody, although the source of these deficits may sometimes vary.

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1. Introduction

It is commonly observed that the processing of vocal expressions of human emotions such as “anger” or “sadness” in speech shows a distinct right-sided bias in lesion and neuroimaging studies (Gandour et al., 2003; Pell, 1998, 2006; Wildgruber, Pihan, Ackermann, Erb, & Grodd, 2002). However, a closer look at the prosody research promotes the idea that understanding speech prosody engages broadly distributed and bilateral networks in the brain (Gandour et al., 2004; Mitchell, Elliott, Barry, Cruttenden, & Woodruff, 2003; Pell & Leonard, 2003) and that asymmetries in network functioning, when detected, reflect differential sensitivity of the two hemispheres to behavioural, stimulus, and/or task-related variables (Kotz et al., 2003; Pell, 2006; Tong et al., 2005; Wildgruber et al., 2002). In particular, evidence that hemispheric sensitivities for prosody are dictated by the functional significance of prosodic

cues in speech is strong (Baum & Pell, 1999; Gandour et al., 2004). In large part, these findings may reflect the *relative* dominance of the right hemisphere at stages for evaluating the emotional significance of prosodic events (Schirmer & Kotz, 2006; Wildgruber et al., 2004; cf. Poeppel, 2003 for a different perspective). These conclusions emphasize the critical importance of how prosody functions in language for understanding prosody-brain relationships as was cogently described by Van Lancker (1980) who underscored the operation of pitch in prosodic communication.

However, as characterized by Van Lancker’s (1980) functional laterality continuum, prosody fulfils a wider array of functions than is currently being investigated in the neuro-cognitive research. Of main interest here, little is known about how the cerebral hemispheres respond to prosodic events that serve an interpersonal or *attitudinal* function in speech (“prosodic attitudes”). For example, prosody assumes a key role in communicating the likely veracity of a statement being uttered, the extent to which a speaker affiliates with ideas or individuals under discussion, or the speaker’s intended politeness toward the hearer when making a request; these cues are routinely understood by

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listeners as the attitudes held by a speaker (Brown, Strong, & Rencher, 1974; Ladd, Silverman, Tolkmitt, Bergmann, & Scherer, 1985; Uldall, 1960). The attitudinal functions of prosody may be considered ‘emotive’—as opposed to emotional or linguistic—in nature because they encode various *relational* meanings which are socially relevant to the speaker–hearer in the interpersonal context in which they appear (Caffi & Janney, 1994). The ability to infer the mental states and attitudes of a speaker and integrate these details with other sources of information represents a vital area of pragmatic competence which guides interpersonal communication (Pakosz, 1983).

In contrast to emotional prosody which can at times be understood in the absence of language content (Pell, 2005; Scherer, Koivumaki, & Rosenthal, 1972), the ability to understand speaker attitudes from prosody is typically intertwined with functional properties of language such as speech acts. Thus, when studying “prosodic attitudes,” one must bear in mind that prosodic cues tend to coincide with specific linguistic strategies or devices which mark these attitudes, and the ability to correctly infer the emotive position of the speaker is often the product of *comparative relations* in the significance of prosody and concurrent language features (as well as other interpersonal variables such as existing knowledge of the speaker–hearer, situational cues, etc.). In fact, many speaker attitudes are achieved when speakers intentionally violate highly conventionalized, cross-channel associations in the use of prosody and linguistic strategies which acquire emotive meanings through their association over time (Burgoon, 1993; Wichmann, 2002).

According to social-pragmatic descriptions of emotive communication (Caffi & Janney, 1994), prosody and other speech-related cues serve as various ‘emotive devices’ for signalling the attitudes held by a speaker along such dimensions as *evaluation* (positive/negative), *evidentiality* (confident/doubtful), and *volitionality* (self-assertive/unassertive), among others. Other pragmatic frameworks emphasize how communicative strategies, such as changes in prosody or linguistic structure, serve to attenuate versus boost the illocutionary force of speech acts which may be inherently positive or negative toward the listener; these choices thus serve to communicate the degree of belief, commitment, or strength of feeling of the speaker’s intentions (Holmes, 1984). These concepts supply a principled basis for investigating how prosody and adjacent language features are understood by healthy and *brain-damaged* listeners when these features operate as emotive markers of a speaker’s attitudes during spoken language processing. Given the privileged role of the right hemisphere at stages of processing the emotional significance of prosody (Schirmer & Kotz, 2006), one might reasonably predict that the right hemisphere is also centrally implicated when drawing conclusions about the emotive or attitudinal characteristics of prosody. However, as noted earlier, there are few data to support this supposition.

In a recent study of emotional prosody, Pell (2006) evaluated three groups of adults who had focal right-hemisphere-damage (RHD, $n=9$), focal left-hemisphere-damage (LHD, $n=11$), or no brain damage (healthy control, HC, $n=12$). Each participant was required to discriminate, identify, and rate expressions of five basic emotions based on the prosodic features of “pseudo-utterances” which contained no emotionally-relevant language cues (e.g., *Someone miggged the pazing* spoken in a “happy” or “sad” tone) and to identify emotions from utterances with semantically-biasing language content (e.g., *I didn’t make the team* spoken in a congruent “sad” tone). The data established that both the RHD and LHD patients exhibited impairments when only prosody signalled the emotional interpretation (Cancelliere & Kertesz, 1990; Pell, 1998; Ross, Thompson, & Yenkosky, 1997; Starkstein, Federoff, Price, Leiguarda, & Robinson, 1994), although closer inspection of the group and individual data implied that the RHD patients displayed a more pervasive insensitivity to the emotional features of prosody, whereas LHD patients had greater problems interpreting prosody in the context of concurrent language cues. One can argue that these findings reiterate the central role of the right hemisphere in retrieving the emotional details represented by prosodic cues in speech prior to integrating this information with the meanings of language (Friederici & Alter, 2004; Pell, 2006).

The goal of the present study was to evaluate these same RHD individuals (Pell, 2006) further to determine whether their difficulties extend to problems recognizing speaker attitudes under similar testing conditions. In an initial experiment, the processing of speaker confidence which signals the reliability or correctness of an assertive speech act (along a continuum of confident/doubtful) was studied, and in a second experiment the processing of speaker politeness which encodes levels of speaker self-identification or self-assertiveness toward the listener (along a continuum of assertive/unassertive or polite/impolite) was investigated. Both the emotive value of prosody and language content were manipulated to achieve a fine-grained analysis of whether RHD listeners are insensitive to speaker attitudes based on a potential misuse of prosodic information, linguistic cues, or both.

2. Experiment 1: Understanding prosody as a cue to speaker confidence

The relative commitment of a speaker to the propositional content of their utterances, or its probable ‘truth value’ to the listener, is communicated through prosodic and verbal choices, although prosody is likely to play a dominant role in how these attributions are made in the auditory modality (Blanc & Dominey, 2003; Brennan & Williams, 1995). Research involving young, healthy listeners indicates that alterations in loudness, pitch (rising or falling intonation contour), and the temporal patterning of speech (e.g., pauses, speaking rate) are all important for inferring the degree of speaker confidence in an assertion

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