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Communicating Epistemic Stance: How Speech and Gesture Patterns Reflect Epistemicity and Evidentiality

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This study investigates how epistemic stance is encoded and perceived in face-to-face communication when language is regarded as comprised by speech and gesture. Two studies were conducted with this goal in mind. The first study consisted of a production task in which participants performed opinion reports.

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Results showed that speakers communicate epistemic stance both verbally and non-verbally, and that specific prosodic and gestural patterns are used to express different epistemic and evidential meanings. The second study consisted of a rating task in which listeners rated the degree of certainty expressed by the opinion reports. Results showed that the number of gestural high certainty markers used by a speaker was a good predictor of the perception of epistemic high certainty. We thus claim that prosodic and gestural markers can be regarded as overt manifestations of epistemicity and evidentiality, and they appear to be especially effective in the communication of epistemic stance.

INTRODUCTION

A key aspect of human interaction lies not only in the expression of propositional content in the form of spoken words but also in the expression of the commitments and feelings of the interlocutors with respect to those propositions, in what has been called the epistemic stance. Human languages have developed a varied set of linguistic markers that are specialized in the expression of epistemic stance. A good amount of research has been carried out on the linguistic marking of epistemicity across languages (Aikhenvald, 2004; Chafe, 1986; de Haan, 2001, 2005; Nuyts, 2001; and others). According to de Haan's (2001, p. 201) classic distinction between evidentiality and epistemicity, whereas evidentiality (sometimes referred to as epistemic modality) refers to "the marking of the source of the information of the statement," epistemicity refers to "the degree of confidence the speaker has in his or her statement." In other words, epistemicity refers to the degree of commitment a speaker has in the truth-value of a proposition, whereas evidentiality refers to the linguistic encoding of the source of the information the speaker uses.

The relationship between evidentiality and epistemicity has been approached differently by various authors who have analyzed it, and most researchers today support an in-between approach whereby the epistemic and evidential categories are interrelated and overlap to a certain extent in the construction of the speakers' epistemic stance yet are neither completely conflated nor may be treated totally separately.[1] During the past decades, linguists have focused largely on languages that encode epistemicity and evidentiality by means of specific morphemes, offering "morphocentric" perspective on the grammatical expression of these categories, and especially evidentiality (for an extensive bibliography on languages with morphological marking of these features, see Aikhenvald, 2004;

[1]The different positions on this subject are exemplified in Chafe and Nichols (1986), Palmer (1986), van der Auwera and Plungian (1998), de Haan (2001, 2005), Aikhenvald (2004), Nuyts (2001, 2005), Dendale and Tasmowski (2001), Hoye (2008), Mushin (2001), Marín Arrese (2004, 2011), Bednarek (2006), Du Bois (2007), Hoye (2008), and Cornillie (2009), among others.

Chafe & Nichols, 1986; de Haan, 2001). For example, the descriptions of the Tibetan evidential system distinguish three categories of evidentials, namely direct, ego, and indirect (Denwood 1999; Garrett 2001; Speas, Kalsang, Garfield, & Devilliers, 2011). In this language, the direct evidentials *'dug* and *song* (the latter being used for past tense) are used when the speaker has witnessed a situation with his or her own eyes and to report internal states of the speaker. For example, Speas et al. (2011) offer the following case of direct evidential marking (1).

(1) *Kha sang* *khong* *'khrom la* *slebs* *'dug.*
yesterday he market (LOC) arrived 'DUG
'Yesterday he arrived at the market (and the speaker witnessed the event).'

On the other hand, indirect evidentials (*yod sa red* and *yod kyi red*) are used to mark that the speaker has not witnessed the event he or she is reporting, which is based on mediated knowledge or inferences. The so-called ego evidentials (*yin*, *yod*, and sometimes *'dug*) are used when a speaker is reporting a state of his or her own mind or body that is accessible to him or her alone.

Researchers have also explored language systems where epistemicity and evidentiality are encoded by means lexical marking (e.g., modal particles, sentential adverbs, etc.) (see, among others, Bross [2012] for a review of the literature about modal particles, with special attention to German and Cornillie [2010] for epistemic and evidential adverbs in Spanish). German has a rich set of modal particles, among which there is *wohl*. *Wohl* is used to mark that the speaker is uncertain about the proposition (see the example in (2), taken from Thurmair, 1989, p. 142):

(2) *Der* *Typ* *da* *drüben,* *der* *hat* *sie* *wohl* *nicht* *mehr alle!*
The guy there over he has her WOHL not more all
'This guy over there, he's probably crazy.'

Other languages, such as Manado Malay, use both epistemic and evidential particles, as in the examples offered by Stoel (1995) and reported in (3).

(3) *So mo ujang sto.*
'it is probably going to rain''
So mo ujang no.
'it is definitely going to rain'
So mo ujang kata.
'someone said it is going to rain'
So mo ujang kote'.
'I sense that it is going to rain (I felt the first raindrops)'

Yet, although some languages have specific morphosyntactic markers of epistemicity and evidentiality, most languages do not. Although earlier investigations on evidentiality and epistemicity focused on the morphosyntactic

and lexical marking of epistemicity and evidentiality, in the last few decades growing attention has been paid to other aspects and perspectives. Researchers working within the framework of Conversational Analysis have investigated epistemicity in spontaneous social interactions, thus going beyond the description of the "grammatical resources for evidential marking in different languages" (Hanks 2012, p. 169). Some researchers have pointed out that the expression of epistemicity and evidentiality in naturally occurring interactions is also constrained by a set of sociopragmatic aspects. For example, participants in a conversation have epistemic "rights" because of their social status or social relationship (see Enfield, 2011; Raymond & Heritage, 2005, 2006; and others). This can be seen in patient–doctor conversations, where there is usually an implicit agreement that the doctor, because of his or her social role, has a higher epistemic "authority" (see Enfield, 2011).

Another suggestion made by conversation analysts that is particularly relevant for this research is that epistemic stance can be also conveyed by intonation (Heritage, 2012, pp. 23–24, who refers to the findings by Stivers & Rossano, 2010; Heritage, 2013, pp. 565–569). These authors claim the relation between epistemicity and intonation is a very general one: In English a rising intonation—whether in a question or in an unfinished statement—is used to mobilize a response. As Heritage (2013, p. 569) puts it, "If final rise as a practice has an underlying 'semantics', it must be to mobilize response. In this capacity, it can contribute an urgency to whatever interactional project is 'in play', and what the project is will be grasped, at least in part, by reference to the epistemics that are also in play at the moment." Heritage (2013, p. 3) nevertheless claims the role of intonation is limited, insofar as in a conversation "when there is consensus about who has primary access to a targeted element of knowledge or information, that is, who has primary epistemic status, then this takes precedence over morphosyntax and intonation as resources for determining whether a turn at talk conveys or requests information."

Even though studies like Heritage (2013) have pointed to the link between prosody and epistemic stance (e.g., the final rise in English), little is known about how epistemic stance is encoded through speech and gestural patterns in face-to-face communication. Studies within the audiovisual prosody perspective have shown that gestural and prosodic patterns can act as conveyors of several different pragmatic meanings, among which we find the degree of certainty of the speaker (Borràs-Comes, Roseano, Vanrell, & Prieto, 2011; Dijkstra, Krahmer, & Swerts, 2006; Swerts & Krahmer, 2005).[2] Some of the first insights into the issue

[2]Other pragmatic meanings that gestural and prosodic patterns have been found to convey include contrastive focus (e.g., Dohen & Loevenbruck, 2009; Krahmer, Ruttkay, Swerts, & Wesselink, 2002; Swerts & Krahmer, 2004, 2008), interrogativity (Borràs-Comes & Prieto, 2011; House, 2002; Srinivasan & Massaro, 2003; Swerts & Krahmer, 2004, 2005, 2008), and mirativity (Crespo-Sendra, Kaland, Swerts, & Prieto, 2013).

of the audiovisual marking of the speaker's degree of certainty (i.e., his or her epistemic positioning) were provided by Swerts and Krahmer (2005). This study showed the speakers' epistemic positioning (or, as they call it, his or her "feeling of knowing") is cued by a number of visual and verbal properties and that, importantly, human observers can distinguish responses with high feeling of knowing from responses with low feeling of knowing, especially when stimuli are presented bimodally (i.e., audiovisually). Borràs-Comes et al. (2011) showed that although lexical choice is important for conveying degrees of certainty (by the use of epistemic adverbials such as *surely*, *probably*, or *perhaps*), the lexical meaning can be easily overridden by prosodic and gestural patterns. Moreover, when gesture and prosody are in conflict, gesture seems to be a more salient and powerful cue. The study demonstrated that Catalan speakers encode degrees of certainty by means of specific prosodic and gestural patterns. Uncertainty statements are typically produced with a slow speech rate and a L+H* !H% nuclear pitch configuration involving a mid-final boundary tone (see also Vanrell, Borràs-Comes, Roseano, & Prieto, 2011). On the other hand, head nods typically encode a higher degree of certainty than shoulder shrugs and downward stretched mouths, which encode a low degree of certainty.

Figure 1 contains two sets of still images corresponding to two productions of the same sentence *La Marina* 'Marina.' The still images in the upper panel show the production of a high certainty utterance (characterized by confident nodding), whereas the still images in the lower panel show the production of a low certainty utterance (characterized by shoulder shrugging and downward stretched mouth).

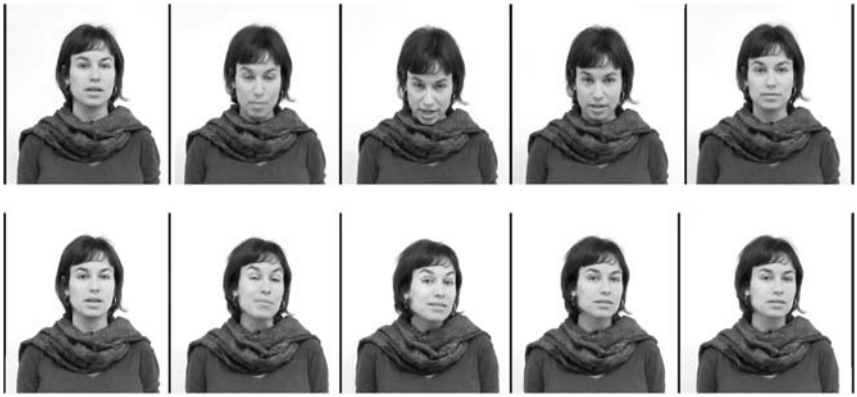

FIGURE 1 Two series of still images corresponding to two productions of the sentence *La Marina* 'Marina,' as potential answers to the question 'Who's coming for dinner?' with the upper panels showing a highly certain answer and the lower ones an uncertain answer (Borràs-Comes et al., 2011).

It is important to point out that in the examples in Figure 1 the epistemic stance is conveyed only by means of gestural patterns because there is no differential textual marking of epistemicity.

These studies have provided important evidence that speakers use prosody and gesture to convey degrees of certainty. Yet this research has focused almost exclusively on the marking of uncertainty in isolated utterances in the laboratory. Further insights can be gained from studying the audiovisual marking of epistemic stance in face-to-face discourse. First, although previous research has assessed how speakers convey epistemicity, to our knowledge there has been no attempt to investigate epistemic stance as a whole or to determine whether evidentiality is also reflected in oral discourse by means of prosodic or gestural strategies. As far as the gestural marking of evidentiality is concerned, because this category is deictic in nature insofar as it *points* at the source of evidence (Haßler, 2010, p. 227; Mushin, 2001, p. 33–34), we would expect that deictic gestures (i.e., pointing) might be used by speakers with an evidential meaning.

The main goal of the present study is to investigate how epistemic stance is communicated (and understood) in discourse when we regard utterances as being made up of speech and gesture. The main goal of Experiment 1 was to assess the marking of epistemic stance in spontaneous oral opinion reports in Catalan. Experiment 1 consisted of a production experiment in which 30 Catalan participants were asked to give two oral opinion reports to his or her conversational partner. Experimentally, two conditions were created by using one issue under discussion that was potentially controversial (the properties and effects of acupuncture) and another that was less controversial (the properties and effects of aspirin). These two conditions were created to elicit two distinct epistemic stance conditions that would in turn generate different types of discourse strategies. The goal of the study was to assess the information contained in speech and gesture relating to epistemicity and evidentiality in the two experimental conditions.

Catalan, like other Romance languages, does not use specific morphemes of epistemicity and evidentiality but rather uses lexical and discourse marking strategies. Some previous studies have dealt with the marking of evidentiality in this language and how it is encoded by means of lexical markers like adverbs, verbal periphrasis (González, 2005, 2011; González & Ribes, 2008), and modal particles (Torrent, 2011). For example, the Catalan verbal periphrasis *es veu qu*e (literally 'it is seen that') encodes indirect evidence (González, 2011, p. 154), as in (4).

(4) *S'han quedat sense llum, a Girona. Es veu que hi ha nevat.*
Self have remained without light in Girona ES VEU QUE there has snowed
The electricity has gone off in Girona. Presumably there has been lots of snow.

At the textual level, Catalan encodes epistemicity by means of lexical items like epistemic adverbials and also verbal constructions like *crec que* 'I think that', *estic segur que* 'I'm sure that', or *és clar que* 'it is clear that' (González, 2004), as in (5) (González, 2011, p. 154). Experiment 1 assesses the textual and prosodic and gestural strategies Catalan speakers use to communicate epistemic stance at the discourse level.

(5) *És clar que* *aniré* *a* *la* *teva* *festa!*
ES CLAR QUE go(FUT) to the your party
Of course I will go to your party!

The goal of Experiment 2 was to empirically test whether the relative density of lexical versus gestural markers plays an important role in the perception and assessment of epistemic stance by Catalan listeners. The experiment consisted of a perception task in which participants were asked to rate by means of a seven-point Likert scale the speaker's degree of certainty as expressed in each of the 30 opinion reports from the first experiment. Afterward, these independent perception ratings were correlated with the number of textual and gestural markers observed in each opinion report.

The central question of this investigation is to test how epistemicity and evidentiality are conveyed by means of nontextual channels (i.e., prosody and gesture) and what is the relative importance of prosodic and gestural encoding in the assessment of epistemic stance. This general question is addressed in each of the two experiments described below. Experiment 1 tests four hypotheses:

1. We expect speakers to convey their epistemic stance not only by means of textual elements but also by means of prosody and gesture.
2. Semantic marking of epistemicity will be more abundant at the multimodal level than at the textual level, which means that prosody and gesture convey information that is not present at the textual level.
3. Epistemic markers will be more abundant in the reports about debatable issues, as it has been shown that (inter)subjective assessment plays a major role in discourses about a debatable issue (Martin & White, 2005), whereas evidential markers (especially those implying high certainty) will prevail in the reports about nondebatable issues.
4. Specific intonational and gestural patterns will be used to convey epistemic and evidential meanings.

Experiment 2 tests the hypothesis that we expect the number of gestural and prosodic high certainty or low certainty markers used by a speaker in offering an opinion will be good predictors of the perception of epistemic stance on the part of an independent observer/listener.

EXPERIMENT 1

Methodology

The present study used a within-subjects design with two conditions: the *debatable text* condition and the *nondebatable text* condition. As we will see below, the stimulus materials consisted of two texts that dealt with a nondebatable issue (the properties and effects of aspirin) and a debatable issue (the properties and effects of acupuncture). In each condition, the participant first explained the content of an informational text to a conversational partner and then expressed orally his or her opinion about the topic of the text. The opinion reports produced by participants in this experimental context can be described as semi-spontaneous discourse, insofar as they are more spontaneous than laboratory speech or even the type of speech analyzed in previous studies, like McNeill (1992), in which the speakers were asked to describe video clips they had previously watched. By controlling the content issue under discussion (debatable vs. nondebatable issue) in the experimental materials, we can investigate the encoding of epistemicity and evidentiality in two distinct epistemological positionings.

Participants and Materials

Thirty students (23 women and 7 men) aged between 19 and 29 years (*M*, 21.9 years) from the Universitat Pompeu Fabra in Barcelona participated in the experiment.[3] Because we wanted the participants to feel at ease so they would produce a natural discourse, they were asked to volunteer in pairs of friends. The fact that all participants in the experiment were students of the same age, social status, and academic background helps to avoid the potential effects of interlocutors having unequal epistemic "rights" in the expression of epistemic stance (Raymond & Heritage, 2006) and "authority" (Enfield, 2011).

All participants were native speakers of Catalan and, when asked to declare their own linguistic dominance, said they used it as the main language of their daily life (on average, they reported using Catalan during 66.2% of their daily activities and in the remaining 33.8% they used Spanish or other languages). All of them received a small payment of 10 euros for their participation.

The stimulus materials consisted of two texts about medical issues taken from the Catalan version of Wikipedia. The two texts were approximately one page in length, and both were written in an objective encyclopedic style (i.e., neither of the texts included ethical judgments on the medical procedure in question and

[3]Participants gave their informed consent to participate in accordance with EU regulations, Spanish law, and the regulations of the host university.

both offered the same type of evidential argumentation in its favor). Whereas one text contained information about an issue that, in the cultural context of early 21st century Catalonia, is somewhat controversial (the effectiveness of acupuncture; Figure 2, left), the other text contained information about what is at this point a completely noncontroversial matter (the properties and effects of aspirin; Figure 2, right). An English translation of both texts can be found in Appendices 1 and 2.

To test the suitability of the target materials, a pilot procedure was carried out with four independent participants, who were also undergraduate students. They were asked to read each text and then rate the effectiveness of the procedure described. The pilot results confirmed the suitability of the materials chosen for the experiment, insofar as all participants declared they were unsure about the effectiveness of acupuncture, selecting the third ("I think it works") and fourth ("I don't know whether it works") options on a seven-point Likert scale, whereas all of them were sure about the efficiency of aspirin, choosing the first ("I know it works") and second ("I'm sure it works") options on a seven-point Likert scale.

Experimental Procedure

The experiment took place in a quiet room at the Universitat Pompeu Fabra where there was sufficient space for the two participants to stand facing each other. Upon their arrival at the experiment site, we informed the two participants

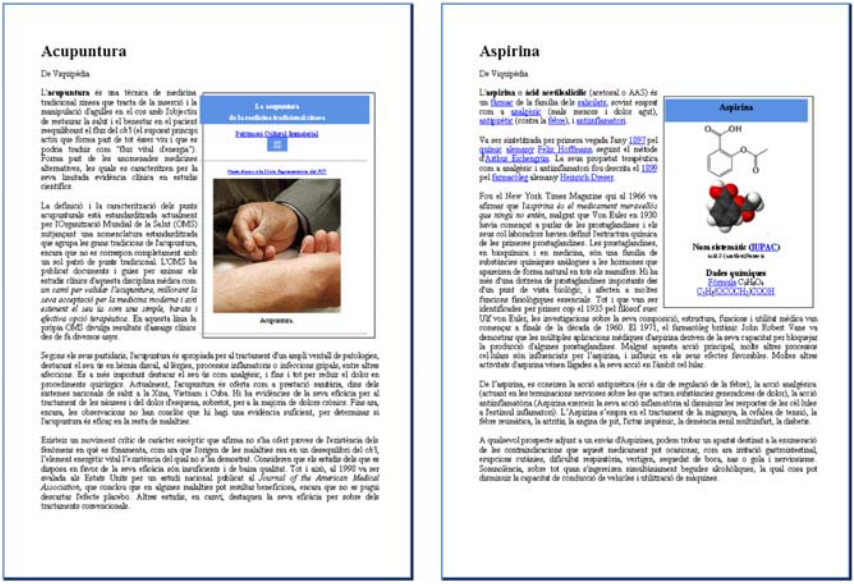

FIGURE 2 Screenshots of the stimulus materials.

that the goal of the experiment was to analyze the way people exchange information in a communicative context (however, nonverbal communication was not mentioned). To this end, they were instructed to assume different conversational roles: One of them would speak, and the other would listen. Each pair of participants then decided between themselves who would assume each role. That done, the listener was asked to wait outside the room where the interaction would take place.

At this point, participants were given specific instructions separately such that each was ignorant of the instructions the other had received. The speaker was given a text to read for 5 minutes and was told that he or she would have to convey the contents of the text verbally to the listener, offering as much detail as possible but without looking at the text again. For his or her part, the listener waiting outside was told what to expect on return to the room and instructed to listen in silence while his or her partner was describing the text contents, confining him- or herself to offering positive nonverbal feedback by nodding. After the description report, the listener was instructed to ask the speaker the following question: "*I tu, què en penses, de l'acupuntura/aspirina?*" 'And what is YOUR opinion about acupuncture/aspirin?', and again instructed to listen in silence and show positive feedback by nodding.[4] Thus, for each pair of participants, the speaker performed orally (1) a description of the contents of one of the articles and (2) an opinion report about those contents. Only one member of each pair read the texts. Both the oral description and the opinion report were videotaped with a Panasonic HD AVCCAM camera connected to a Røde NTG-2 microphone. The camera faced the speaker, focusing on his or her upper body.

To test whether the assumed distinction between debatable versus nondebatable topics (i.e., the idea that in 21st century Catalan society aspirin is considered effective, whereas acupuncture is still regarded as controversial) was working, we collected confidence ratings from all participants in the experiment. After they had finished the experimental procedure for one of the two texts, each pair of participants (speaker and listener) independently rated on a seven-point Likert scale in Catalan their degree of confidence in the medical treatment described. Slightly different versions of the Likert scale were used for speaker and listener,[5] and the text of the scale also made reference to either acupuncture or aspirin depending on the text that had been described. Table 1

[4]Admittedly, having given the listener instructions not to intervene verbally while listening to the opinion report indeed reduced the spontaneity of the communication, but on the other hand this offered the methodological advantage of reducing the number of factors to be taken into consideration in the latter analysis. Crucially, it controlled for the potential effects of turn-taking, whose importance is well known in the Conversation Analysis literature.

[5]In both the listener and the speaker versions of the Likert scales, the sentences referred to the speaker, so that for the speaker it read *I think it works*, but for the listener it read *He/she thinks it works*.

TABLE 1
Seven-Point Likert Scale Options Given to Participants in Catalan with the English Translation

Catalan	*English*
Escull l'opció que descriu millor la teva opinió.	*Choose the option that best reflects your opinion.*
En relació a l'acupuntura:	With regard to acupuncture:
3. Sé que funciona.	3. I know it works.
2. Estic convençut/da que funciona.	2. I'm quite sure it works.
1. Crec que funciona.	1. I suspect that it works.
0. No sé si funciona o no.	0. I don't know whether it works.
− 1. Dubto que funcioni.	− 1. I suspect it doesn't work.
− 2. Estic convençut/da que no funciona.	− 2. I'm quite sure it doesn't work.
− 3. Sé que no funciona.	− 3. I know it doesn't work.

shows the speaker's version of the scale used for the text on acupuncture along with an English translation.

The whole procedure was repeated twice for each pair of participants, first using the text on aspirin and then using the text on acupuncture, or vice versa, but as noted the speaker and listener roles remained constant. Counterbalancing was achieved by presenting the two texts in different orders. Pairs of participants for whom the researchers had assigned even numbers (e.g., Pair 2, Pair 4, Pair 6, etc.) started with the text about acupuncture and later dealt with the text about aspirin. Pairs of participants who had been assigned uneven numbers (Pair 1, Pair 3, Pair 5, etc.) started with the text about aspirin and later dealt with the text about acupuncture. A total of 30 opinion reports were obtained (for a total of 3,643 words, corresponding to 21:39 minutes). These opinion reports constitute the acupuncture and aspirin oral opinion data which we analyze in this study. The average duration of the full experimental procedure for each pair of participants was approximately 40 minutes, including briefing, the two oral reports for the two target texts, answering the Likert questionnaires, and carrying out administrative paperwork.

Data Coding

The audiovisual recordings of the opinion reports were orthographically transcribed and labeled for their prosodic, gestural, and semantic information by means of Elan (Lausberg & Sloetjes, 2009). Given that the semantic coding of the data related to epistemicity and evidentiality might be influenced by prosody and gesture, we decided to perform the semantic coding at two levels, namely, what we will call textual semantic labeling and multimodal semantic labeling (see Semantic coding, below). Textual semantic labeling was carried out by the second author of the article by means of Atlas.ti and was later imported into Elan.

The general audiovisual coding of the data (orthographic, prosodic, gestural, and multimodal semantic) was carried out by the first author using Elan. Praat (Boersma & Weenink, 2013) served as a helpful tool for the prosodic transcription, which was imported into Elan. Importantly, multimodal semantic labeling and textual semantic labeling were carried out independently and by different researchers to control for potential influences between textual only and multimodal semantic codings. Data were then exported from Elan (by Max Planck Institute for Psycholinguistics) to SPSS (by IBM) for statistical analysis.

Figure 3 shows a snapshot of the coding performed with Elan after the prosodic labeling and the textual semantic labeling was imported. The leftmost column shows the 13 tiers representing the orthographic transcription ('Words' tier), the prosodic transcription ('ToBI' tier), the gestural transcription ('Gest_detail_head', 'Gest_detail_mouth', 'Gest_detail_shoulders', Gest_detail_hand', Manual_function', 'Meaning', and 'Pointed' tiers), as well as the textual and multimodal semantic coding ('Text-Epistemicity', 'Text-Evidentiality',

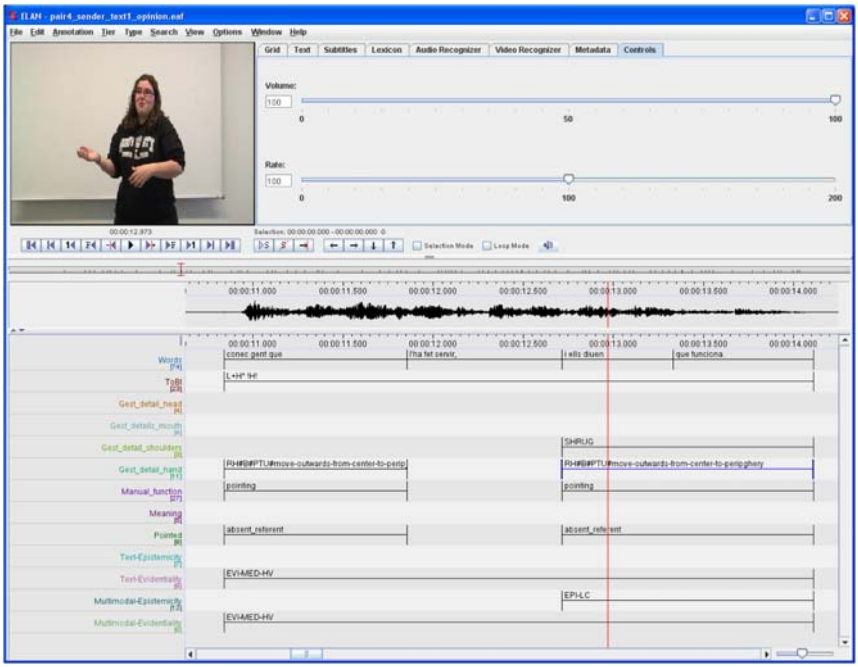

FIGURE 3 Screenshot of data coding with Elan. The column on the left of the screen contains the 13 tiers used for annotation.

'Multimodal-Epistemicity', and 'Multimodal-Evidentiality' tiers). These tiers are explained below.

Semantic coding. As mentioned above, one of the goals of the study was to assess how epistemic stance is manifested when we consider semi-spontaneous discourse as containing both speech and gesture. Because we want to assess the contribution of textual versus multimodal marking to epistemic assessment, the data were labeled textually and multimodally. As noted, the textual semantic labeling of the oral texts was performed by the third author on the orthographic transcription of the oral opinion reports, without access to the video recordings, and was later imported to Elan. The coding of the audiovisual data was performed independently by the first author by means of Elan. Two main semantic categories were taken into account, namely epistemicity and evidentiality

The semantic coding of epistemicity was based on, among others, Palmer (2001), van der Auwera and Plungian (1998), and Marín-Arrese (2004, 2011). These authors propose three levels of certainty, as represented in Table 2. At the textual level, high certainty (henceforth HC) utterances were, for example, *El prendria sense cap dubte que em faria l'efecte que jo vull o necessito* 'I'd take it without the slightest doubt that it would have the effect that I want or need' [Aspirin; speaker 1]; *Si tens mal de cap i te'n prens una sí que funciona* 'If you have a headache and you take one, it DOES work' [Aspirin; speaker 2]; *En principi, sé que funciona* 'In general, I know it works' [Aspirin; speaker 4]. One should note that HC is not only present in the traditional opinion verbs like *believe* or *know* but can also be expressed by means of more complex discourse strategies, like in *Bueno, clar, jo prenc aspirines* 'Well, as a matter of fact, I take aspirin' [Aspirin; speaker 7].

Medium certainty (henceforth MC) was expressed by utterances such as *Jo crec que funciona*. 'I think it works' [Acupuncture; speaker 3] and *Estic bastant convençuda que funciona* 'I'm pretty sure it works' [Aspirin; speaker 1]. Of course, MC need not only be expressed by means of opinion verbs like *think* or *be rather sure that*; it can also be expressed by means of more complex discourse strategies, like in *Pot tenir molts pros però també pot tenir molt contres* '[Aspirin] may have lots of pros but it may also have lots of cons' [Aspirin; speaker 8].

TABLE 2
Semantic Coding of Epistemic Markers Based on Palmer (2001), van der Auwera and Plungian (1998), and Marín-Arrese (2004, 2011), Among Others

Epistemicity		
High certainty (HC)	Medium certainty (MC)	Low certainty (LC)

Low certainty (henceforth LC) was expressed by utterances like *Potser funciona*. 'Maybe it works' [Acupuncture; speaker 2]; *I llavors també tinc . . . els meus dubtes . . . per segons leyendas urbanas que diuen que l'aspirina fa . . . espesseix la sang* 'And I also have some . . . doubts . . . 'cause according to some urban legends aspirin thickens your blood' [Aspirin; speaker 7]; *No tinc ni idea de si funciona o no* 'I have no idea whether it works or not' [Acupunture; speaker 1]. As with HC and MC, LC too can be conveyed not only by means of explicit opinion verbs like *doubt* but also by means of more articulated discourse strategies like in *Igual hi ha gent que ho ha provat i li funciona* 'It's possible that some people have tried it and it has worked for them' [Aspirin; speaker 4].

Our semantic coding of evidential marking is based on Plungian's (2001, pp. 352–354) classification and is represented in Table 3. An example of direct evidentiality is the sentence *A mi m'ha funcionat*. 'I have tried it and it has worked for me' [Acupuncture; speaker 3]. The utterance *Deu ser que és força efecte placebo* 'It must be pretty much a placebo effect' [Acupuncture; speaker 9] is an example of reflected (inferred) evidence. Mediated scientific evidence emerges in sentences like *Hi ha unes evidències científiques* 'There is scientific evidence' [Aspirin; speaker 1]. Mediated evidence with explicit reference to tradition is present in sentences like *És un sistema per . . . de curació, mmm mil·lenari i . . . tradicional* 'It's a system for . . . to cure, mmm, that is a thousand years old and traditional' [Acupuncture; speaker 14]. Common knowledge sometimes serves as the basis for mediated evidence, as in *L'aspirina ho cura tot* 'Aspirin is good for everything' [Acupuncture; speaker 16]. Finally, anecdotal evidence emerges in statements like *Conec gent que l'ha fet servir, i ells diuen que funciona* 'I know people who have used it, and they say it works' [Acupuncture; speaker 4].

Prosodic coding. The oral data were prosodically labeled following the Cat_ToBI system (Escudero Aguilar, Vanrell, & Prieto, 2012; Prieto et al., 2015).

TABLE 3
Semantic Coding of Evidentiality

	Indirect				
		Mediated			
Direct	*Reflected (Inferentials + Presumptives)*	*Scientific*	*Tradition*	*Common Knowledge*	*Reported*
Personal access to information Speaker's personal involvement		Nonpersonal access to information Speakers' nonpersonal involvement Mediated knowledge coming from third parties			

Adapted from Plungian (2001, pp. 352–354).

According to this system, pitch accents in Catalan have seven categories (namely, L*, H*, L+H*, L+¡H*, L*+H, L+>H*, and H+L*) and boundary tones have eight categories (namely, L%, H%, !H%, HL%, LH%, L!H%, HH%, and LHL %). Only nuclear configurations were labeled, because this part of the contour is the one that typically conveys the pragmatic meaning of the utterance (see Ladd, 1996, among others). Figure 4 exemplifies the prosodic annotation of two nuclear pitch configurations that, as we see later, are related to the epistemic stance of the speaker, namely categorical (i.e., HC) statements (characterized by falling H+L* L% nuclear pitch configurations) and uncertainty statements (characterized by a pitch movement that raises from low to high and then falls to a mid-boundary tone, annotated L+H* !H%; see Borràs-Comes et al., 2011). The upper panel in Figure 4 contains an HC statement, whose nuclear configuration is H+L* L% (i.e., there is a sharp F0 fall from the pretonic syllable *fun-* to the tonic syllable *-cio-* of the word *funciona*, and then F0 remains at a low level till the end of the utterance). The lower panel, on the other hand, contains an utterance characterized by the nuclear configuration L+H* !H% (i.e., there is a sharp F0 rise in the last tonic syllable *-ri-* of the word *funcionaria*, and then F0 falls to a mid level in the posttonic syllable).

Gesture coding. Based on McNeill (1992, pp. 78–89, 377–380), manual gestures were labeled for their function and shape (Table 4). The codes used for labeling the shape of manual gestures refer to the following features: (1) specific hand used (LH = left hand, RH = right hand, 2SH = both hands doing the same thing, and 2DH = each hand doing different things); (2) the handshape (for the purposes of our research, we used only four labels: A = closed hand, B = open hand, G = index finger extended, and X = unclear handshape [the latter is not included in NcNeill's inventory]); (3) the orientation of the palm (P) or finger (F) (PTU/FTU = palm/finger toward up, PTD/FTD = palm/finger toward down, PTC/FTC = palm/finger toward center, PAB/FAB = palm/finger away from body (outward), PTB/FTB = palm/finger toward body (inward), and PAC/FAC = palm/finger away from center (left or right)); and (4) gestural motion.[6] We followed Allwood et al. (2005) for head and shoulder gestures (see Tables 5 and 6, respectively) and Nonhebel, Crasborn, & van der Kooij, (2004) for mouth

[6]We decided to abide strictly by McNeill's (1992) labeling rules. We therefore labeled motion, too. According to McNeill's labeling system, motion is described in two dimensions: direction of motion and location in the space where motion is articulated. The description of motion, especially direction, turned out to be the most difficult to label, because movements can have several and complex trajectories. The location in space where the movement is articulated is defined according to McNeill (1992, p. 378) along the center/periphery, left/right, inner/outer, or upper/lower dimensions. Subsequent analyses demonstrated that this aspect of gesture was not especially meaningful in the expression of epistemic stance.

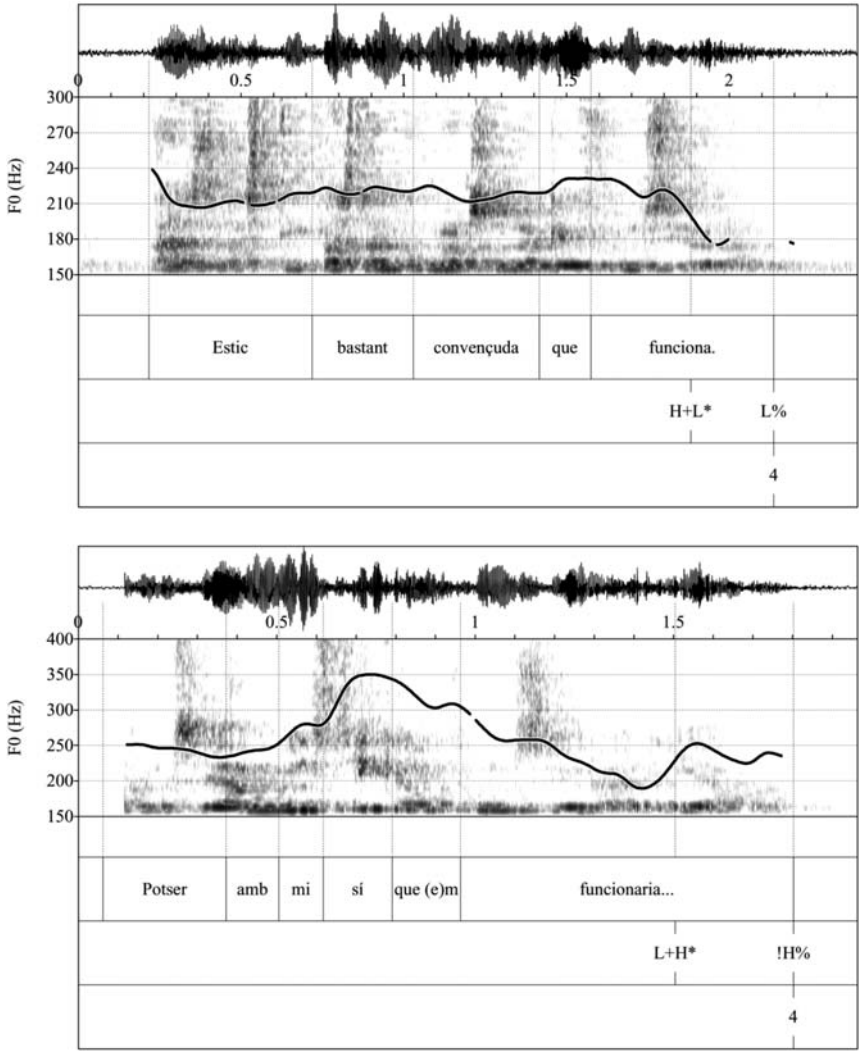

FIGURE 4 Spectrogram, orthographic transcription, and prosodic annotation of the categorical statement *Estic bastant convençuda que funciona* 'I'm pretty sure it works' [Aspirin; speaker 1] (top) and the uncertainty statement *Potser amb mi sí que em funcionaria*... 'It might work for me' [Acupuncture; speaker 1] (bottom).

TABLE 4
Labeling of Manual Gestures Following McNeill (1992), with Examples in the Right Column

Function	*Pointed to/ Meaning*	*Shape and Motion*
BEAT	—	
POINTING	Self	2SH#l#FTB#point-at-self
	Material object	RH#B#PTB#point-at-head
	Absent referent	RH#B#PTB#moves-in-circle-from-left-periphery-to-right-periphery
ICONIC	Inserting a needle	RH#B#FTB#move-towards-arm
	Detaching	LH#A#PTB#pulls-from-left-to-center
	etc.	
METAPHORIC	Listing	RH#B#PTC#moves-to-finger-of-LH
	Openness	2SH#B#PTC# move-outwards-from-center-to-periphery
	Pros and cons	RH#L#PTC#moves-from-periphery-to-center-and-back
	etc.	

TABLE 5
Labeling and Definitions of Head Gestures, Based on Allwood et al. (2005)

Shape	*Definition*
NOD	Lowering and raising one's head slightly and briefly
HEADSHAKE	Turning the head from left to right (or vice versa) and back again, often repeatedly
TURN	Turning the head to the left or to the right and maintaining it in that position
TILT	Moving the head laterally into a sloping position

gestures (see Table 7). The four panels of Figure 5 illustrate a selection of the four types of gesture (head nod, shoulder shrug, mouth stretched down, and manual pointing) that are significant in the analysis presented in Results.

Reliability Test

As it is generally advisable when a labeling system is first implemented, an interrater reliability test was carried out to test the effectiveness and the reliability of the system.[7] The abovementioned prosodic, gestural, and semantic labeling systems were therefore submitted to an intertranscriber agreement test. Twenty percent of the opinion reports (a total of six audiovisual recordings) were

[7]As it is common in studies about prosody and/or gesture, the aim of the reliability test is not to assess the reliability of a single transcriber but of the transcription system in general (Breen et al., 2012; Escudero et al., 2012; Grice et al., 1996; Jun et al., 2000; Petrelli et al., 1994; Syrdal & McGory, 2000; Yoon et al., 2004).

TABLE 6
Labeling and Definitions of Shoulder Gestures, Based on Allwood et al. (2005)

Shape	*Definition*
SHRUG	Raising one's shoulders
SWING	Moving repeatedly from side to side

TABLE 7
Labeling and Definitions of Mouth Gestures, Based on Nonhebel et al. (2004)

Shape	*Definition*
MOUTH STRETCHED DOWN	Lips are stretched and the corners of the mouth are pulled downward
MOUTH STRETCHED	Lips are stretched and the corners of the mouth are pulled toward the sides of the face
LOWER LIP FORWARD	Lower lip is pushed forward
CORNERS UP	Corners of the mouth are pulled up

randomly selected from the database by the first author, taking into account that they were uniformly represented across speakers and conditions (debatable and nondebatable texts). Three researchers (namely the third and fourth authors, in addition to another member of the *Group of Prosodic Studies* at the Universitat Pompeu Fabra) were trained during two 4-hour sessions to use the labeling systems described in the previous sections. After training, they were asked to independently annotate the subset of six audiovisual recordings.

Results revealed a good consistency rate for all variables. The percentages of agreement among transcribers was high for gestural coding (93% for head gestures, 96% for mouth gestures, 95% for shoulder gestures, 77% for manual function, and, for pointing gestures only, 92% for the object that was pointed at). The percentage of intertranscriber agreement for the semantic labeling was almost as high (79% in the case of lexical markers of epistemicity, 80% for audiovisual marking of epistemicity, 82% for lexical markers of evidentiality, and 84% for multimodal marking of evidentiality). Regarding intonation, the percentage of overall agreement for nuclear configurations was 67%, which rises to 85% if one considers only final boundary tones.

The Online Kappa Calculator (Randolph, 2008) was used to calculate the Fleiss kappa statistical measure (Yoon et al., 2004). This tool provides two variations of kappa: fixed marginal multirater kappa and Randolph's free marginal multirater kappa (Randolph, 2005; Warrens, 2010). Because raters did not know previously about the presence of any intonational, audiovisual, or semantic event for each sentence, free marginal kappa was used. For gestures, free marginal kappa ranged from 0.71 to 0.95 (0.89 for head gestures, 0.95 for

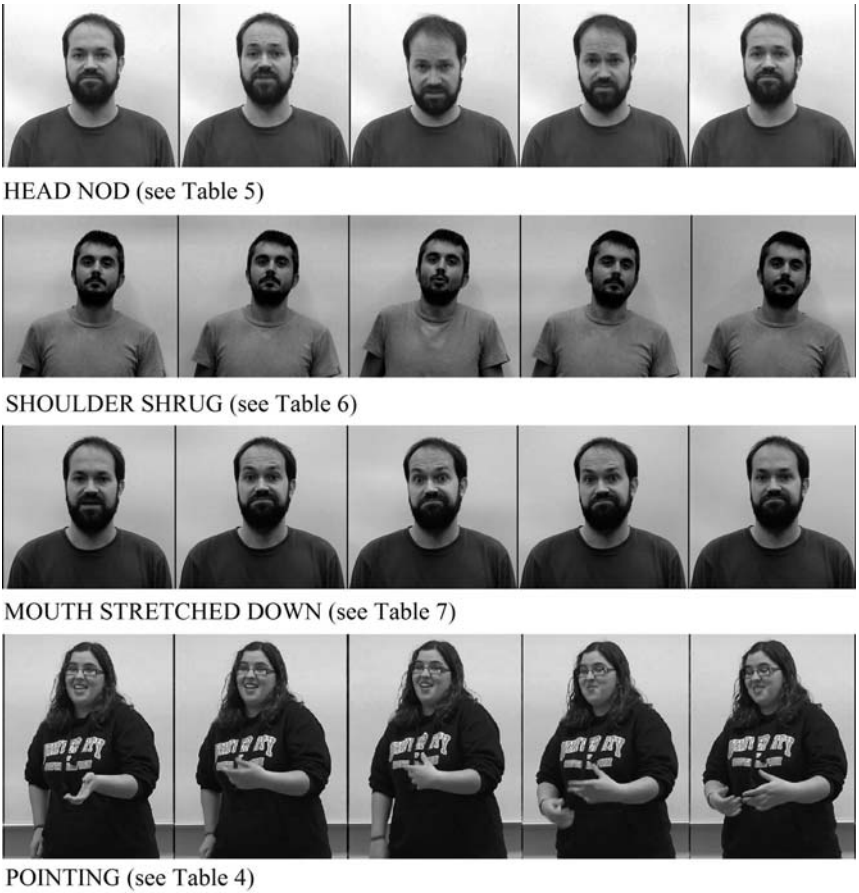

FIGURE 5 Four series of still images illustrating a selection of four types of annotated gestures, namely head nod, shoulder shrug, mouth stretched down, and manual pointing (see definitions in corresponding tables).

mouth gestures, 0.90 for shoulder gestures, 0.71 for manual function, and, for pointing gestures only, 0.92 for the object pointed at). For semantic labeling, kappa was equally high (0.72 in the case of lexical marking of epistemicity, 0.72 for multimodal marking of epistemicity, 0.80 for lexical marking of evidentiality, and 0.81 for multimodal marking of evidentiality). The free marginal kappa statistic obtained for intonation was the lowest (0.60 for nuclear configurations and 0.78 for boundary tones). In sum, free marginal kappa values were in all cases but one $\geq$ 0.70, a good level of agreement, which indicates that the labeling system was reliable.

Data Extraction and Statistical Analyses

The two parts of the corpus (i.e., debatable vs. nondebatable text conditions) have different lengths, in terms of both total minutes of duration and total number of words. The aspirin opinion reports altogether lasted 9:50 minutes and contained 1,689 words in total, whereas the acupuncture opinion reports lasted a total of 11:49 minutes and contained 1,954 words. Because the length in number of words of the two subcorpora is different, the tokens of epistemic and evidential markers were normalized on a 10,000-word basis. Normalization to 10,000 is commonly used in corpus linguistics (see Römer & Wulff 2010, among many others).

The data were submitted to SPSS for further statistical analyses. The dependent variable in many of our analyses is the number of epistemic and evidential markers found in our databases, which has a Poisson distribution. A generalized linear model allows for the analysis of these sorts of data, which do not exhibit a normal distribution (Crawley, 2007).

Results

Debatability and Epistemic Stance

As noted, to check whether the debatable versus nondebatable variable played the expected role in our study, we asked both speakers and listeners to rate their degree of belief in the effectiveness of the procedures by means of a seven-degree Likert scale (see above). Figure 6 shows the distribution of the number of participants according to their judgments on the Likert confidence scale of the debatable (acupuncture) and nondebatable (aspirin) texts. The results confirm the debatability issue triggered different degrees of confidence, that is, whereas 14 of 15 participants rated the effectiveness of acupuncture as "not sure whether it works" (a combination of $-1, 0$, and 1 ratings on the Likert scale), 12 of 15 participants rated aspirin as "very or quite sure it works" (a combination of the 2 and 3 ratings on the Likert scale).

Number of Epistemic and Evidential Marking at the Textual and Multimodal Levels

Figure 7 shows the mean number of epistemic and evidential markers (per recording) at the textual and multimodal levels, separated by the factor issue under discussion (see above on the how textual semantic labeling and multimodal semantic labeling were performed). The results in Figure 7 show that the number of epistemic markers at the multimodal level almost doubles the markers at the textual level, which indicates the important amount of nonverbal information contained in multimodal discourse.

A GLMM (Generalized Linear Mixed Model) analysis was conducted with the number of markers as the dependent variable (Gamma distribution, log link) and

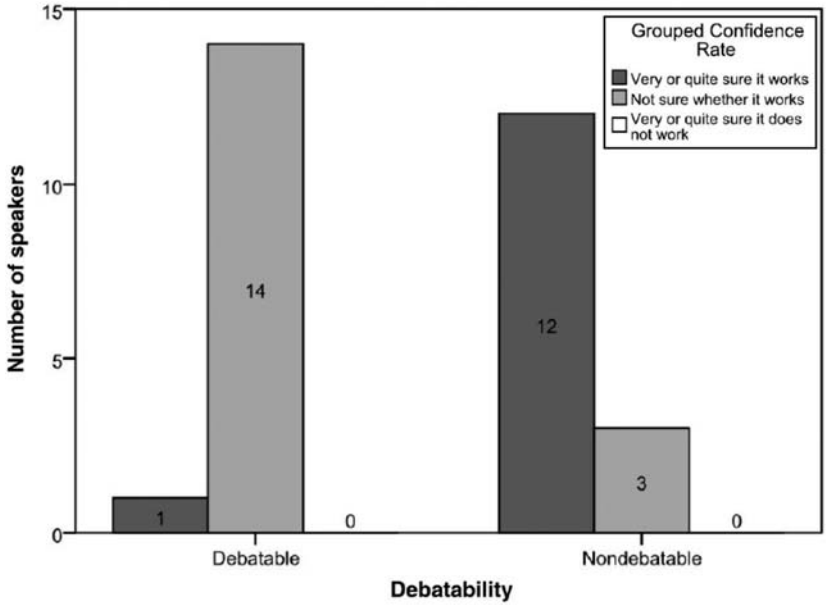

FIGURE 6 Distribution of the number of participants according to their judgments on the Likert confidence scale of acupuncture (debatable issue) and aspirin (nondebatable issue).

DEBATABILITY (two levels: debatable vs. nondebatable), SEMANTICCATEGORY (two levels: evidential vs. epistemic marking), MODALITY (two levels: textual vs. multimodal marking), and all their possible combinations as fixed factors. SUBJECT PAIR was set as random factor. A main effect was found for both SEMANTICCATEGORY (F (1, 88) = 47.505, $p < .001$) and MODALITY (F (1, 86) = 14.319, $p < .001$) but not for DEBATABILITY (F (1, 87) = 0.099, $p = .754$). A significant interaction was found for SEMANTICCATEGORY × MODALITY (F (1, 86) = 14.319, $p < .001$), which confirmed our second hypotheses, that the multimodal level provided more epistemic markers than the textual level (whereas the number of evidential markers was similar in the two levels). Another significant interaction was found for DEBATABILITY × SEMANTICCATEGORY (F (1, 87) = 7.785, $p = .006$), which indicated epistemic markers were more abundant in the reports about a debatable issue, which in turn confirmed our third hypothesis, that debatable issues would trigger a higher number of epistemic markers than nondebatable ones. The three-way interaction between DEBATABILITY, SEMANTICCATEGORY, and MODALITY was not significant (F (1, 86) = 0.045, $p = .833$).

The following two subsections contain a closer examination of the speech and gesture information found in utterances that were coded as containing evidential and epistemic meanings.

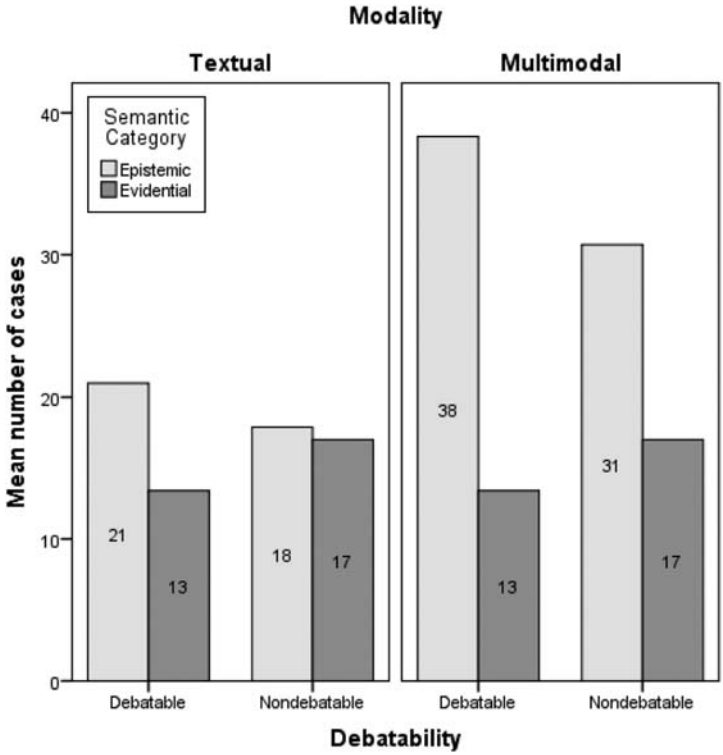

FIGURE 7 Mean number of epistemic and evidential markers found in the debatable (acupuncture) and nondebatable (aspirin) reports, at the textual (left) and multimodal levels (right).

Multimodal marking of evidentiality. With respect to the nonverbal marking of evidentiality, the results in the previous sections revealed the semantic labelings related to evidentiality were the same at the textual and multimodal levels, in both the debatable and the nondebatable reports (see Figure 7). This means *in our data* we found no occurrences of gesture-only marking of evidentiality. Rather, we found a few[8] occurrences of nonverbal marking of evidentiality, which always occurred with evidential utterances.

Our data show that pointing gestures occur together with evidential utterances. Two kinds of pointing gestures were found in the opinion reports,

[8]A total of five instances of simultaneous gestural and textual markers of evidentiality were found in our database. Because of this low number of occurrences, we were not able to carry out a GLMM analysis to test for the significance of these patterns.

Jo personalment no m'hi he tractat mai. *Tota la gent al meu voltant sempre s'ha pres aspirines.*

I've never tried it personally . Everybody around me has always taken aspirin.

FIGURE 8 Examples of evidential pointing from the corpus.

depending on the direction of pointing, namely pointing to self and pointing to an absent referent. Figure 8 contains an example of each kind. Whereas in the left panel the speaker points to herself while saying *Jo personalment no m'hi he tractat mai* 'I've never tried it personally' (classified as a direct evidential), in the right panel the same participant points at an abstract referent when saying *Tota la gent al meu voltant sempre s'ha pres aspirines* 'Everybody around me has always taken aspirin' (classified as a mediated evidential).

If we consider the simultaneous occurrence of the two kinds of pointing (pointing to self vs. pointing to an absent referent) with the kind of textual evidence (mediated, inferred, and direct evidential), we observe that pointing to self gestures occurred with utterances expressing direct personal evidence. In other words, speakers point to themselves when talking about their personal experience. On the other hand, pointing to an absent referent occurred with utterances expressing mediated evidence. In short, our data show that pointing gestures often accompany and reinforce the textual marking of the source of evidence (be it direct or mediated). As it has been pointed out in the introduction, as far as the gestural marking of evidentiality is concerned, because this category is deictic in nature, insofar as it points at the source of evidence (Haßler, 2010, p. 227; Mushin, 2001, pp. 33–34), we expected that deictic gestures (i.e. pointing) might be used by speakers with an evidential meaning. The data of our corpus seem to confirm this hypothesis, and, to our knowledge, this constitutes the first observation of a gestural correlate of evidentiality. Nevertheless, the low occurrence of this kind of data in our corpus requires further specific research.

Multimodal marking of epistemicity. A crucial aspect of the opinion data that emerges from our results is the fact that epistemic multimodal marking is approximately twice as abundant as verbal-only epistemic marking (see Figure 7). In total, 1,079 instances of multimodal marking of epistemicity were found in normalized terms (599 in the acupuncture texts and 480 in the aspirin texts). Figure 9 presents a frequency distribution of the textual and gestural correlates of multimodal epistemic marking, depending on their occurrence patterns with verbal information (text only, gesture only, text and gesture, neither text nor gesture) as a function of debatability (debatable vs. nondebatable). Because manual gestures occur with epistemic marking very seldomly, only nonmanual gestures were included in the analysis. The results show that semantic epistemic markings at the multimodal level have the following correlates. First, in approximately 30% of the data, only textual features appear (e.g., see left and right panels of Figure 9). Figure 10 shows an example of textual-only marking of epistemicity, where no accompanying gestures were found. Second, in approximately 25% of cases, nonmanual gestures are the only correlate of epistemicity. Third, manual gestures and text occur simultaneously in another 25% of cases. Finally, in the remaining 19% of cases, epistemic marking is conveyed by neither text nor gesture, that is, it is probably conveyed by means of prosody (we return to the subject of intonation and epistemicity in the last

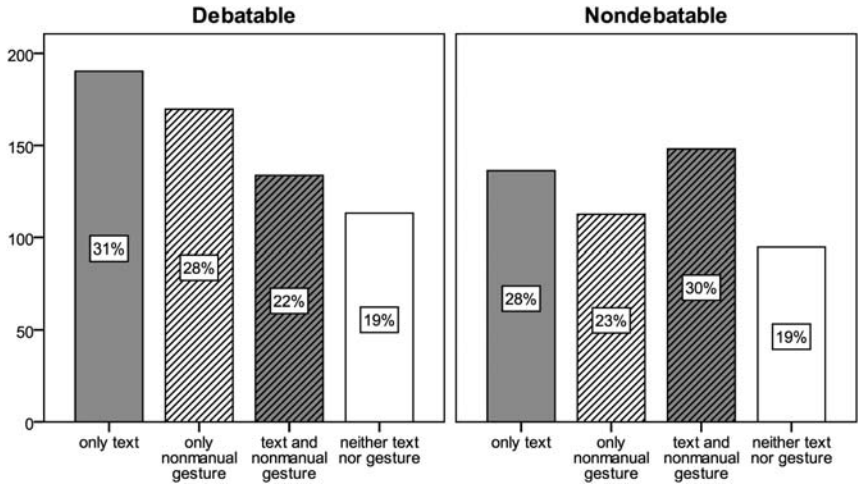

FIGURE 9 Frequency distribution of the textual and gestural correlates of multimodal epistemic marking, depending on their occurrence patterns with verbal information (text only, gesture only, text and gesture, neither text nor gesture), as a function of debatability (left panel = debatable, right panel = nondebatable).

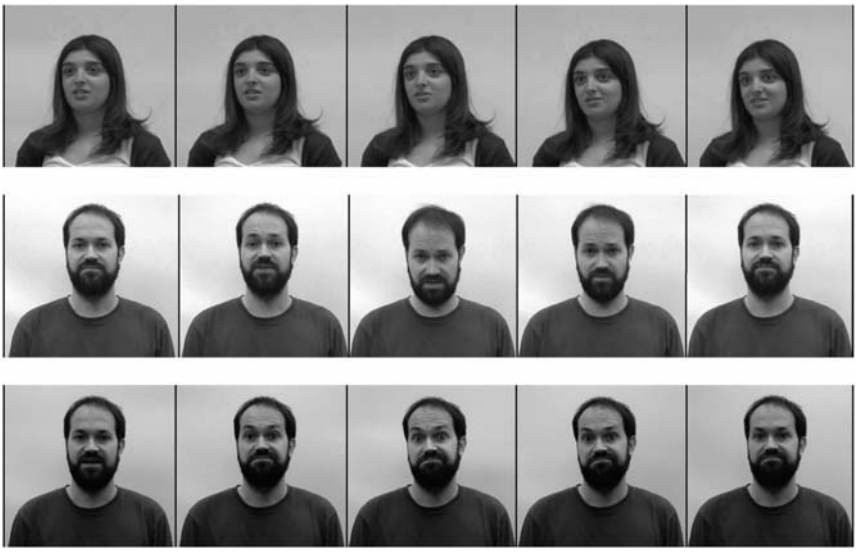

FIGURE 10 Three series of still images corresponding the production of the target sentence *Jo sí crec que funciona de veritat* 'I for one believe it really works' uttered without noteworthy facial gestures (top), *Diuen que funciona* 'They say it works' uttered with HC facial gestures (middle), and *Diuen que funciona* 'They say it works' uttered with LC facial gestures (bottom).

part of this section). These results are important insofar as they confirm that epistemicity can be encoded nonverbally and nonverbal marking of epistemicity does not need to occur with verbal correlates of epistemicity. Thus, the results show that even though speakers show some degree of semantic overlap between epistemic gestures and their corresponding speech, in at least 25% of cases epistemic gestures are used independently of the semantics of the corresponding text. This point will be further developed below.

Figure 10 consists of sequences of stills showing speakers producing three different utterances. The upper panel shows textual-only marking of epistemicity, whereas the lower two show nontextual marking only. In the upper panel, the utterance was classified as conveying HC (*Jo sí crec que funciona de veritat* 'I for one believe it really works') and was produced without simultaneous specific gestures. Textual-only encodings of epistemicity exemplified like this represented about 30% of the total number of utterances conveying epistemic meanings. The central and the lower panels of Figure 10 show a minimal pair: during the recordings the same subject pronounced twice the sentence *Diuen que funciona* 'They say it works', which does not contain any explicit epistemic

marking.[9] In the first case (central panel) the sentence was labeled as HC at the multimodal level (note the speaker is nodding), whereas in the second case (lower panel) it was labeled as LC (note the speaker is stretching his mouth downward).

Another goal of the study was to assess the types of gestures found in the opinion reports and see whether they co-occurred with specific epistemic meanings. To this end, we examined the correlation between different types of nonmanual gestures and specific epistemic values in the multimodal transcription. Figure 11 shows the distribution of three types of nonmanual gestures (head nod, shoulder shrug, and mouth stretched downward; see above for examples of each kind) as a function of the epistemic value assigned to the utterance (LC, MC, and HC). Other types of nonmanual gestures were excluded from the analysis because they showed a very low frequency of occurrence. The results in Figure 11 show that shoulder shrugs and to a lesser degree mouth stretched downward co-occurred more frequently with utterances classified as LC utterances, whereas head nodding co-occurred more frequently with utterances classified as HC.

Three GLMM analyses were conducted with the number of epistemic gestures found in our recordings as the dependent variable (Gamma distribution, log link), one for each type of gesture (head nod, shoulder shrug, and mouth stretched down). CERTAINTY (three levels: HC, MC, and LC) was set as fixed factor. A main effect was found for CERTAINTY in all analyses, with different directions of the effects in each one: head nod (F (1, 15) = 3.798, p = .046; HC > LC), shoulder shrug (F (1, 24) = 5.964, p = .008; LC > MC), and mouth stretched down (F (1, 16) = 6.874, p = .018; LC > HC). Therefore, we can conclude that while nodding is most frequently associated with HC utterances, shoulder shrugging and mouth stretched down are gestural correlates of uncertainty.

At this juncture, it is important to also consider the role of intonation and its relationship with epistemic marking. Remember that in 19% of the utterances epistemic marking was conveyed by neither textual nor gestural features (see Figure 9). We thus suspect that prosody also played an important role in the assessment of epistemicity. Figure 12 shows the distribution of nuclear configurations as a function of the semantic epistemic value of the corresponding

[9]As suggested by one of the reviewers, if one were to rely exclusively on textual marking, this sentence might be interpreted as conveying LC because the speaker might be implying that "they" (i.e., someone else, not me) says it works. It could thus easily communicate LC to a hearer because the speaker is setting up a "me/them" situation in which the speaker is distancing him- or herself from the assertion about the efficacy of aspirin/acupuncture. Nevertheless, the examples presented in Figure 13 show that a similar sentence from a textual perspective can be interpreted either as LC or as HC, depending on the gestural and prosodic realization of the sentences (see also Figure 1 for an example of a similar minimal pair).

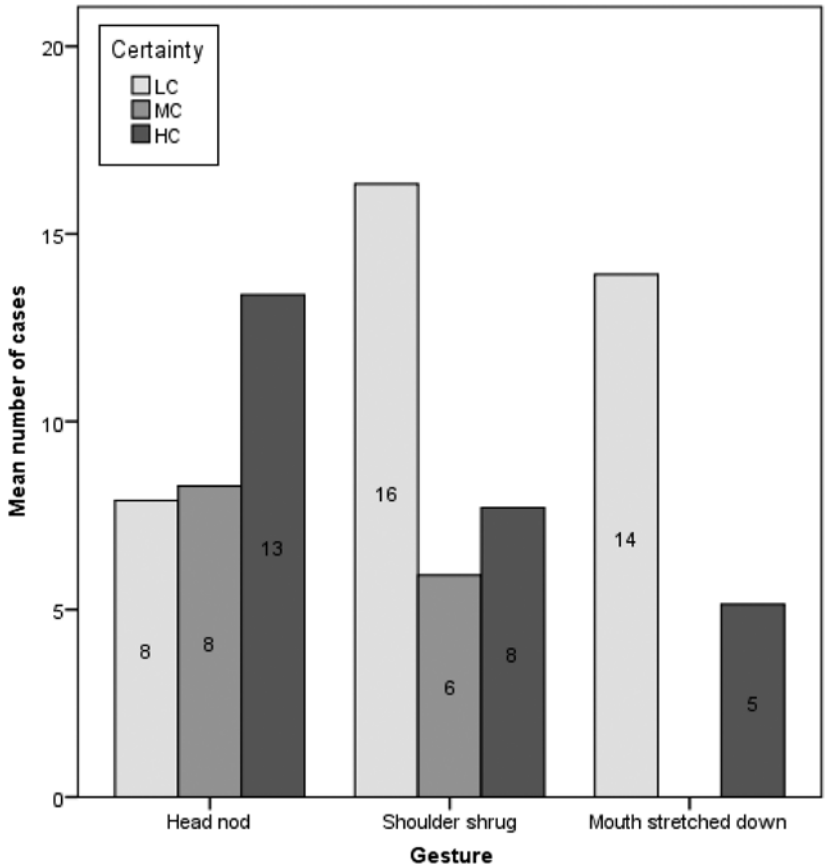

FIGURE 11 Mean number of head, shoulder, and mouth gestures co-occurring with LC, MC, and HC multimodal epistemic coding.

utterance (namely, LC, MC, and HC).[10] The results in Figure 12 show that although the L+H* !H% nuclear configuration almost always appears with LC codings, the H+L* L% and the L* L% nuclear configurations appear more frequently with HC codings.

A GLMM analysis was conducted with the number of epistemic markers as the dependent variable (Gamma distribution, log link). INTONATION (three levels: L+H* !H%, L+H* L%, and L* L%), CERTAINTY (three levels: HC, MC, and LC), and their interaction were set as fixed factors. The difference noted above in

[10]Figure 4 offers examples of the L+H* !H% and H+L* L% nuclear configurations.

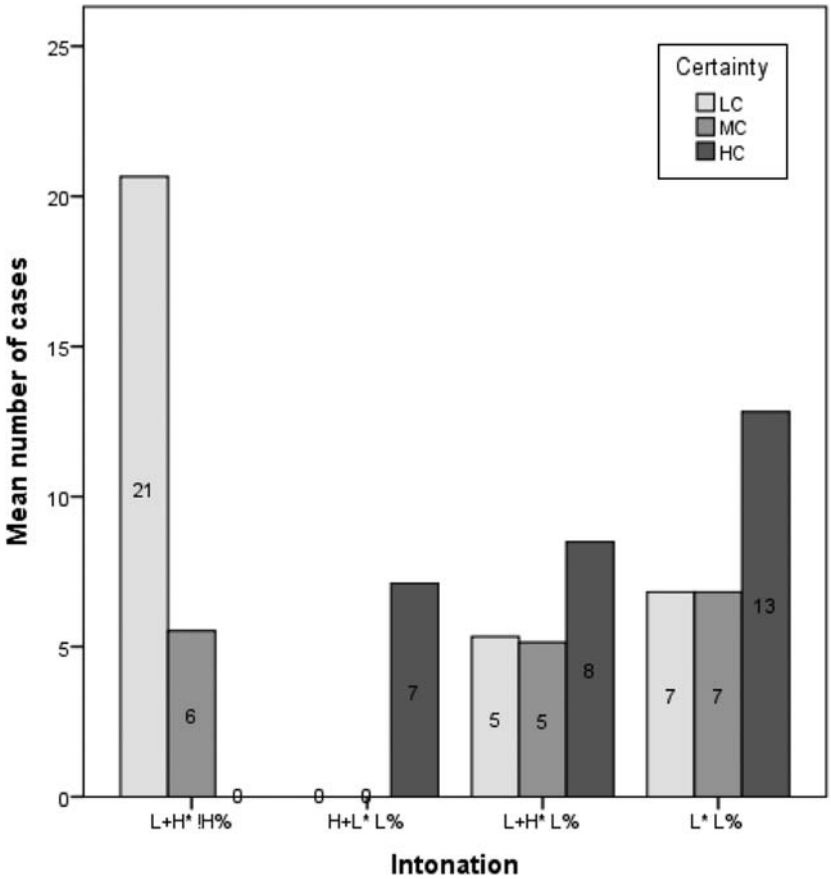

FIGURE 12 Mean number of pitch nuclear configurations occurring with LC, MC, and HC multimodal epistemic coding.

the distribution of the nuclear configurations proved to be statistically significant (INTONATION × CERTAINTY [F (3, 43) = 22.233, $p < .001$]). Moreover, these results are in line with previous findings showing that L+H* !H% in Catalan is an intonational correlate of LC, whereas L* L%, H+L* L%, and L+H* L% characterize HC broad focus statements (Prieto & Cabré, 2013; Prieto et al., 2015).

Epistemic meanings at the textual and multimodal levels. A focal question for this study is the relative role of speech and gesture in conveying epistemicity (and specifically different degrees of certainty). Figure 13 shows

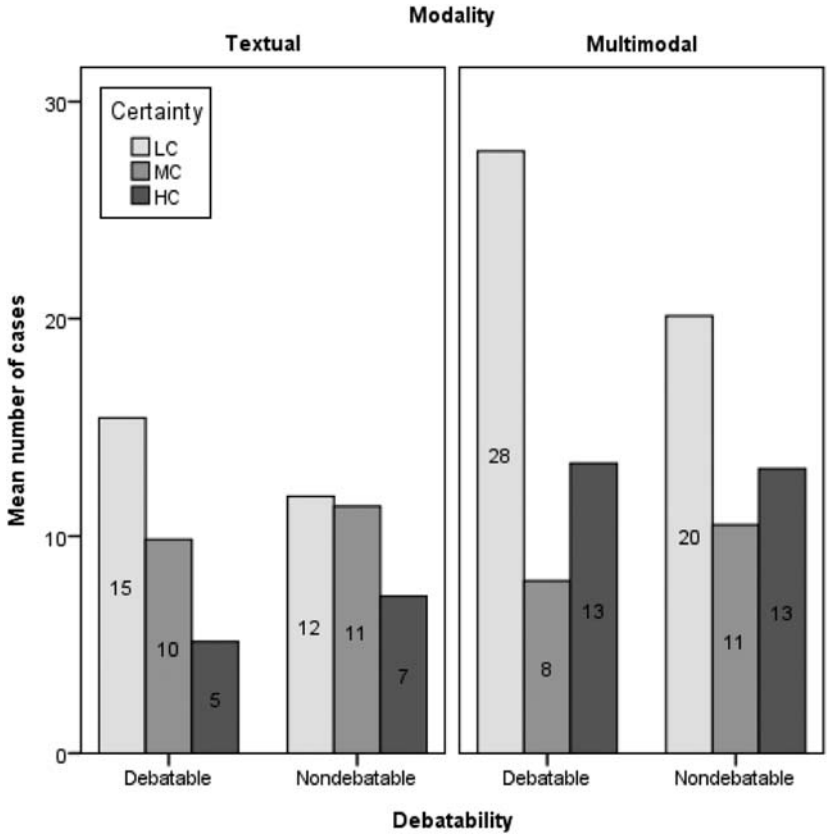

FIGURE 13 Mean number of epistemic markers found at the text-only level (right) and multimodal level (left) in participant performance when referring to the debatable (acupuncture) and nondebatable (aspirin) issues, separated by degree of certainty (LC, MC, and HC).

the number of epistemic markers found at the textual level (left panel) and multimodal level (right panel), in participant performance when referring to the debatable (acupuncture) and nondebatable (aspirin) issues, separated by degree of certainty (LC, MC, and HC). The graph reveals a very interesting pattern, namely that although the number of MC markers is roughly the same at the textual and multimodal levels, the number of both HC and LC markings is higher at the multimodal level.

A GLMM analysis was conducted with the number of epistemic markers as the dependent variable (Gamma distribution, log link). DEBATABILITY (two levels: debatable and non-debatable), CERTAINTY (three levels: HC, MC, and LC), MODALITY (two levels: textual and multimodal), and all their possible

combinations were set as fixed factors. SUBJECT PAIR was set as random factor. A main effect was found for both CERTAINTY (F (2, 112) = 21.535, $p < .001$) and MODALITY (F (1, 112) = 15.890, $p < .001$). The interaction CERTAINTY × MODALITY was found to be statistically significant (F (2, 112) = 7.263, $p = .001$), which indicates that HC and LC markers were more frequent at the multimodal level, whereas the number of MC markers was roughly the same at both levels of analysis.

Interim Discussion

The results of Experiment 1 have allowed us to confirm several hypotheses we put forward in the Introduction 1. First, results of this experiment confirm that epistemicity and evidentiality are conveyed by means of nontextual channels and that specific intonational contours and gestures are associated with high or LC.

In addition, it has become clear that prosody and gesture convey semantic information that is not present at the textual level. Interestingly, although the number of MC markers is roughly the same at the textual and multimodal levels, the number of both HC and LC markings is higher at the multimodal level. This suggests that potentially ambiguous MC textual marking is disambiguated at the multimodal level by means of prosody and gesture. To investigate this issue further, Experiment 2 was intended to analyze how the concentration of gesture and speech epistemic markings affects the listener's assessments of the epistemic stance.

Our results also show that epistemic markers are more abundant in the reports about debatable issues, as we had hypothesized. However, we cannot confirm the hypothesis that evidential markers (especially those implying HC) prevail in the reports about nondebatable issues.

EXPERIMENT 2

The goal of Experiment 2 was to investigate the role of gesture and speech in the general assessment of epistemic stance. To test this, we carried out a rating task to investigate the potential correlation between the density of gestural and textual markers in a given oral opinion report and the assessment of its epistemic stance, as perceived by listeners.

Methodology

Twelve native speakers of Catalan (all undergraduate students at the Universitat Pompeu Fabra) watched the opinion reports videotaped in Experiment 1 and were told to rate the degree of certainty expressed by the speakers, by means of the seven-point Likert scale represented in Table 8 (see also above). None of these

TABLE 8
Seven-Point Likert-Scale Options Given to Participants in Catalan with the English Translation

Catalan	*English*
Escull l'opció que descriu millor la teva opinió.	*Choose the option that better corresponds with your opinion.*
En relació a l'acupuntura:	With regard to acupuncture:
3. Sap que funciona.	3. S/he knows it works.
2. Està convençut/da que funciona.	2. S/he is quite sure it works.
1. Creu que funciona.	1. S/he suspects that it works.
0. No sap si funciona o no.	0. S/he doesn't know whether it works.
−1. Dubta que funcioni.	−1. S/he doubts that it works.
−2. Està convençut/da que no funciona.	−2. S/he is quite sure it doesn't work.
−3. Sap que no funciona.	−3. S/he knows it doesn't work.

participants had taken part in Experiment 1. Each listener rated 15 videos (of a total of 30 reports), and the total number of ratings obtained was 180 (12 raters × 15 reports).

Results

First, data were distributed in two groups, namely the recordings perceived as expressing a high degree of perceived certainty (scores that ranged from 3 to 2 on the Likert scale, with a mean of 2.1) and the recordings rated as showing a low degree of perceived certainty (scores that ranged from 1 to −1 on the Likert scale, with a mean of 0.1). A total of 12 opinion reports was classified on average as "high degree of perceived certainty" and 18 opinion reports were classified as "low degree of perceived certainty." As expected, no opinion report obtained scores ranging from −2 to −3 on the Likert scale, corresponding to a perceived high degree of certainty in the belief that the medical procedure described does *not* work.

Figure 14 shows the normalized average number of LC and HC textual, prosodic, and gestural epistemic markers present in two groups of opinion reports, namely reports perceived as LC (left panel) and reports perceived as HC (right panel). Focusing first on the left panel showing reports perceived as LC, as expected, within each of the three communication channels (i.e., textual, prosodic, and gestural), the number of LC markers is higher than the number of HC markers. Because they were more heavily marked as LC, it is easy to understand why they should tend to be perceived as such. Interestingly, however, in terms of the relative weight of each of these three channels within each of the two levels of certainty, one observes that although the number of LC markers is roughly the same at the textual, prosodic, and gestural levels, the number of *textual* HC markers is dramatically low in reports perceived as LC.

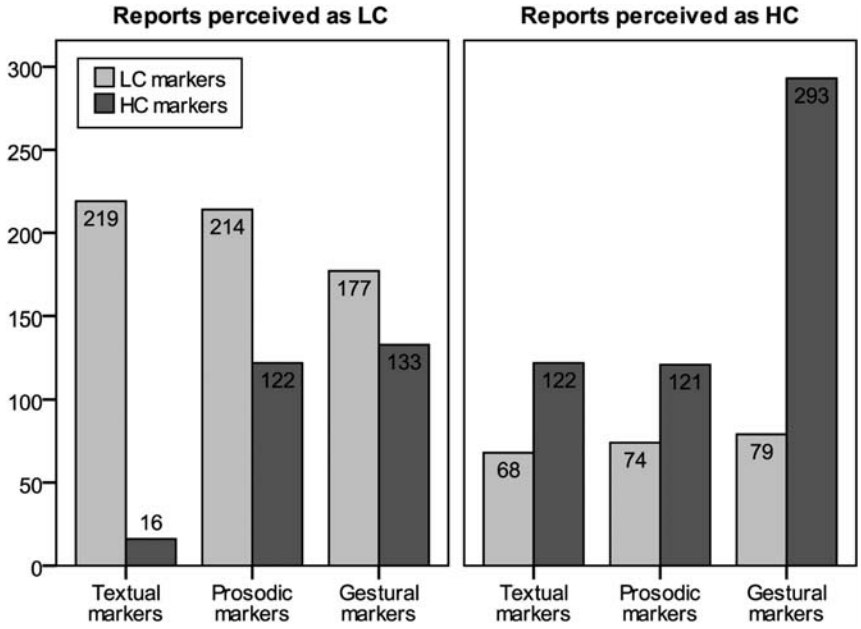

FIGURE 14 Normalized average number of LC and HC textual, prosodic, and gestural epistemic markers present in two types of opinion reports, namely reports perceived as LC (left panel) and reports perceived as HC (right panel).

On the other hand, the graph in the right panel shows the number of HC markers is higher than the number of LC markers in each of the three communication channels. It is therefore unsurprising that these reports were perceived as HC. Once more, if one compares the relative weight of each of the three channels within the two levels of certainty, one observes that although the number of LC markers is roughly the same at the textual, prosodic, and gestural levels, the number of HC gestures is more than twice than the number of HC textual or prosodic markers. This suggests that gesture patterns are playing a key role in the transmission of the epistemic stance in terms of HC.

Correlation analyses support the interpretation of the data presented above. To test the statistical significance of the correlations between the numbers of different kinds of epistemic markers and mean certainty ratings, we first calculated the internal proportion of epistemic markers of each kind (namely LC, MC, and HC) produced within each opinion report (15 speakers × 2 debatability conditions). For instance, an opinion report having eight textual epistemic markers in total, four of them being LC markers, another two MC, and the last two HC, reflected relative proportions of 0.5 LC, 0.25 MC, and 0.25 HC. After this, we

assigned different weights to each type of certainty level, i.e., 0 for LC markers, 0.5 for MC markers, and 1 for HC markers. Thus, for example, to calculate the textual certainty conveyed by this particular opinion report, we calculated $(0.5 \times 0) + (0.25 \times 0.5) + (0.25 \times 1)$, yielding a textual certainty value of 0.375. The same operation was carried out for each marker type (i.e., textual, prosodic, and gestural). By this method we obtained for the first opinion report a textual certainty value of 0.92, a prosodic certainty value of 0.40, and a gestural certainty value of 0.0. The same procedure was applied to all the remaining opinion reports. On the other hand, we calculated the mean perceived certainty rates given to each opinion report by the participants. The original seven points of the Likert scale were aggregated into four different levels by collapsing negative and positive options with the same integer value into single categories, such that, for example -3 "S/he knows it doesn't work" and 3 "S/he knows it works were both assigned a value of 3, thus yielding a four-point perceived certainty scale (0–1–2–3). Three Pearson correlations were then conducted between marker certainty values for each type (textual, prosodic, and gestural) and mean perceived certainty rates. In all cases, correlations were significant between the three pairs of measures (at $p < .001$). Moreover, the correlation coefficients showed that (1) these correlations were positive (i.e., a higher concentration of HC markers correlated with perceived greater degree of perceived certainty) and (2) the correlations with perceived certainty were higher for gestural markers (0.353) than for prosodic (0.331) and textual markers (0.265). This means that although all three marker types are useful to convey a speaker's epistemic stance, gestural and prosodic markers seem to be particularly efficient for expressing epistemic stance.

On the whole, the results of Experiment 2 allow us to draw two important conclusions. First, within each of the three communication channels (textual, prosodic, and gestural), the number of HC markers is higher than the number of LC markers in reports perceived as HC and, conversely, the number of LC markers is higher than the number of HC marker in reports perceived as LC. This means the three channels tend to contribute cohesively to the communication of epistemic stance. Second, if one seeks to evaluate the role played by each channel, one sees that gestures seem to be the most important cue in predicting a HC assessment, whereas LC assessments seem to rely on a more balanced evaluation of textual, prosodic, and gestural markers. The asymmetry found between the assessment of LC and HC seems to reflect the fact that opinion reports with very low occurrence of textual HC markers will induce listeners to assess LC (see Figure 14, left).

In short, this experiment showed that in the case of reports rated as expressing LC, a balanced mix of multimodal components is a better predictor of the perception of the degree of certainty than the monomodal components taken individually. In the case of reports rated as expressing HC, our data suggest that the gestural communicative component plays a particularly important role in the assessment of epistemic stance.

DISCUSSION AND CONCLUSIONS

How do speakers communicate epistemic stance in face-to-face interactions? And what is the role of speech and gesture in the assessment of epistemic stance by listeners? The present study has addressed these questions by investigating some verbal and nonverbal strategies used by speakers and listeners to convey or assess epistemic stance in a set of semi-spontaneous opinion reports. It has involved assessing the semantic role of spoken language (including prosody and gestural actions) as well as gestural on the conveyance of epistemic stance. Although traditional linguistic studies have tended to focus predominantly on the verbal aspects of the communication of epistemic stance, this study has focused on its nonverbal aspects. To this end, a production study (Experiment 1) and a rating task (Experiment 2) were carried out.

Experiment 1 had the specific goal of investigating how epistemic stance surfaces in face-to-face semi-spontaneous discourse. Fifteen pairs of Catalan speakers were asked to perform oral opinion reports after reading short articles on two topics, namely, a controversial issue (the properties and effects of acupuncture) and a less controversial issue (the properties and effects of aspirin). The resulting audiovisual reports were coded semantically (for evidentiality and epistemicity features), gesturally, and prosodically. The results showed that both epistemicity and evidentiality are encoded by means of specific textual, intonational, and gestural cues in both conditions. The analysis of the specific gestural and prosodic patterns found in the data partially confirm what previous studies have found for laboratory speech, namely that epistemicity has specific gestural and intonational markers (for Catalan see Borràs-Comes et al., 2011). As far as the gestural encoding of evidentiality is concerned, our results show that pointing gestures (pointing to self, pointing to absent referent) can have an evidential function and can act as a personal evidential or mediated evidential, respectively. These results confirm our expectations, as evidentials have been considered to be deictic categories by nature insofar as they *point* at the source of evidence (Haßler, 2010, p. 227; Mushin, 2001, pp. 33–34). The multilevel encoding of these two components has thus allowed us to document specific gestural cues for epistemicity and evidentiality (e.g., pointing gestures). These results represent an argument in favor of a view of epistemic stance as a combination of these two components, namely source of evidence (evidentiality) as well as a more subjective epistemic component (see Bednarek, 2006; Cornillie, 2009; Du Bois, 2007; Hoye, 2008; Marín-Arrese, 2004, 2011; Nuyts, 2001).

Regarding the semantic contribution of verbal and nonverbal features to the communication of epistemic stance, the analysis of our data showed two interrelated results. First, gestural and prosodic markers can occur independently from epistemic textual markers. Second, there is a large amount of epistemic information encoded in gesture. Both findings imply that the multimodal level of

analysis contains more semantic information than the textual level. Moreover, utterances labeled as MC were found to be less frequent at the multimodal than at the textual level, suggesting that potentially ambiguous textual epistemic meanings are disambiguated at the multimodal level by means of prosody and gesture. Therefore, these two results suggest that prosody and gesture convey information that is not present at textual level and consequently have the potential to enhance communication.[11]

To investigate this issue further, Experiment 2 analyzed how the relative concentration of gesture and speech epistemic markings in those opinion reports can potentially have an effect on the listeners' assessments of the epistemic stance conveyed by speakers uttering those reports. Twelve independent raters were asked to evaluate the degree of certainty expressed by the opinion reports that were videotaped in the first experiment. Results showed that, in general, the perception of opinion reports as expressing LC or HC could be traced back to the fact that those opinion reports contained a higher proportion of LC or HC markers, respectively, and that, specifically, the relative proportion of *gestural* HC markers in discourse was an especially good predictor of HC.

To sum up, the findings reported in this investigation reveal that a language like Catalan, with no morphosyntactic marking of epistemicity or evidentiality, displays a wide range of linguistic strategies for epistemic and evidential marking, be they lexical, prosodic, or gestural. Moreover, nonverbal marking emerges as a form of communication that is especially effective in the expression of epistemic stance and, at the same time, is able to disambiguate textual marking. All in all, the results obtained can be interpreted as an argument in favor of considering both gesture and speech as interactive components in the making of epistemic meaning in face-to-face oral communication.

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[11]We acknowledge a point raised by one of our reviewers: Even though the strategy used in this study of isolating discourse into its component parts allows us to get a complete picture of what is happening in multimodal discourse, we should be aware that some information might be lost when we reduce the whole to its parts in this way.

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APPENDIX 1

English Translation of the Acupuncture Text

Acupuncture is a traditional Chinese medical technique that aims at restoring health and well-being in patients by means of the insertion and manipulation of needles in the human body, re-equilibrating the flow of ch'i (the presumed active part of all living things, which could be translated as "vital energy flow"). It belongs to the so called alternative therapies, which are characterized by limited clinical evidence in scientific studies. The definition and characterization of acupuncture points is currently standardized by the World Health Organization (WHO), which suggested a nomenclature that is based on the major traditional acupuncture schools, although it does not completely correspond with any traditional pattern. The WHO has published documents and clinical guidelines to encourage this discipline "as a way of validating medical acupuncture, improving its acceptance and spread within modern medicine and its use as a simple, cheap and effective treatment." The WHO itself has Publisher results of clinical trials involving acupuncture for several years. According to its supporters, acupuncture is suitable for treating a wide range of diseases, especially hernia, allergies, inflammation and the flu. It is also important to emphasize its use as an analgesic, and even to reduce pain in surgical procedures. Today, acupuncture is included as a medical treatment within the health systems of China, Vietnam and Cuba. There is evidence of its effectiveness for the treatment of nausea and back pain as well as for most types of chronic pain. So far, though, observations have concluded that there is insufficient evidence to determine whether acupuncture is effective in the treatment of other diseases. There is a skeptical critical movement which argues that there is no evidence of the existence of the notion that underpins acupuncture, namely that the origin of disease lies in an imbalance of ch'i. Critics say that the studies which claim prove of the effectiveness of acupuncture are few and of poor quality. However, in 1998 acupuncture was backed in the United States by a national study published in the Journal of

the American Medical Association, which concluded that it may be beneficial in the treatment of some diseases, although the placebo effect cannot be excluded. Other studies, however, argue that it is more effective than conventional treatments.

From http://ca.wikipedia.org/wiki/Portada.

APPENDIX 2

English Translation of the Aspirin Text

Aspirin or acetylsalicylic acid (acetosal or AAS) is a drug belonging to the family of salicylates. It is often used as an analgesic (for minor injury and acute pain), antipyretic (against fever), and anti-inflammatory. It was first synthesized in 1897 by the German chemist Felix Hoffmann, following the method of Arthur Eichengrün. Its properties as an analgesic and antiinflammatory drug were described in 1899 by the German pharmacologist Heinrich Dress. In 1966 the New York Times Magazine stated that "Aspirin is the wonderful drug that nobody understands." In 1971, the British pharmacologist John Robert Vane showed that aspirin's multiple medical applications derived from its ability to block the production of certain prostaglandins. Although prostaglandins were first identified in 1935 by the Swedish philosopher Ulf von Euler, research on their composition, structure, functions and medical use began in the late 1960s. Prostaglandins in biochemistry and medicine are a family of chemicals similar to hormones that are naturally present in all mammals. There are over a dozen prostaglandins that play a major role in biology and are relevant in many essential physiological functions. Although aspirin's main effect seem to be its effect on prostaglandins, aspirin has favorable effects on several other cellular processes. Many other effects of aspirin are linked to its action in the cell. The following effects of aspirin are known: the antipyretic effect (i.e. regulation of fever), the analgesic effect (acting on the same nerve endings affected by pain-generating substances), and the anti-inflammatory effect (aspirin reduces the responses of cells to the inflammatory stimulus). Aspirin is used in the treatment of migraine, tension headache, rheumatic fever, arthritis, angina, ischemic stroke, senile dementia, and diabetes. In the prospectus attached to a container of Aspirin, one can read a list of contraindications that this drug can have, such as gastrointestinal irritation, rashes, breathing difficulties, dizziness, dry mouth, nose or throat, nervousness or drowsiness (especially when alcohol is ingested simultaneously), which can reduce the user's ability to drive vehicles and operate machines.

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