

The hands, head, and brow: A sociolinguistic study of Māori gesture

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Abstract

This paper examines the speech-accompanying gesture and other kinesic behaviour of bilingual English-Māori and monolingual English speakers in New Zealand. Physical expression has long been regarded a key component of Māori artistic and spoken performance, as well as in personal interactions. This study asks (1) if there are gestures more common to or exclusively employed by the Māori population of New Zealand and (2) if their frequency and form is influenced by speaking Māori? More generally, the study considers the effect of different languages on gesture within the same speaker. Four bilingual Māori and six monolingual New Zealanders of European ancestry were recorded providing similar narrations. We report three differences between the speaker groups: a prevalence among Māori speakers for flat-handed motion gestures, gestures of the head, and eyebrow flashes. The findings highlight the probabilistic nature of culturally-grounded variation in gesture and the appropriateness of sociolinguistic approaches to their study.

Keywords: Gesture; eyebrows; non-verbal behaviour; Māori; cross-cultural comparison.

1 Background

Speech accompanying gesture has been shown to differ across cultural and linguistic groups in a variety of ways (dating back to at least Efron, 1972; reviewed in Kita, 2009). A culturally-grounded understanding of directional and spatial reference is one such distinction that shapes one's use of iconic and deictic gestures (Levinson, 1996; Levinson, 2003; Wilkins, 2003). In addition to hand gestures, other kinesic cues have been shown to guide interactions and discourse in a way that can be highly culture-specific, such as the higher frequency of head nods employed by Japanese speakers and listeners (Maynard, 1986; Maynard, 1990; Kita & Ide, 2007). Another oft-mentioned difference is that languages or cultures may exhibit a "high" or "low" gesture frequency (Goldin-Meadow & Saltzman, 2000; Pika, Nicoladis, & Marentette, 2006; So, 2010), though little quantitative data as yet supports this contention.

Distinctions that are solely linguistic in origin have also been reported (Duncan, 1996; McNeill & Duncan, 2000; Kita & Özyürek, 2003; Gullberg, 2011). In one example, McNeill & Duncan (2000) describe how grammatical properties of English, Mandarin, and Spanish affect the implementation of motion gestures by their respective speakers. In many cases though, linguistic and cultural influences are difficult to tease apart. Kendon (2004, pp. 349) states, it is "unclear how far differences (in gesture) may be due to differences in the languages spoken or how far they may be due to wider differences in customs...We need more comparative studies to explore this issue."

This paper represents such a study. We explore the cultural and linguistic bases for speech-accompanying kinesics in the Māori population of New Zealand. Māori

present an informative case study for multiple reasons, detailed in the following section. Our research seeks to address two main questions.

1. Are there gestures or gestural features which are more common to or exclusively employed by Māori as opposed to Pākehā (New Zealanders of European ancestry)?
2. If so, are the form and frequency of Māori-associated gestures influenced by speaking Te Reo Māori, “*the Māori language*”?

To investigate, we conducted sociolinguistic interviews with bilingual Māori men and monolingual Pākehā men. From these interviews, we focus on one portion of the interview wherein the participants retold the events of a cartoon stimulus. Our analytic approach focuses on the gestural articulators (the hands or otherwise), their form, and probabilistic tendencies in their use. For likely sources of variation between Māori and Pākehā speakers, prior impressions from other authors (e.g. Metge & Kinloch, 1978) and the intuitions of New Zealand-based researchers led us to emphasise certain handshapes in our inquiry and to consider a range of speech-accompanying behaviours beyond those performed manually (namely, the head, the eyes, the eyebrows, the torso).

We present three sets of findings in this paper. One, we describe the use of manual gestures and handshapes, concentrating on a specific path-depictive gesture preferred by the Māori speakers. Two, we describe gestures produced by the head and their use by Māori speakers. Finally, we consider raising of the eyebrows, a widely-noted Māori feature and stereotype.

1.1 Māori and the Māori physical world

There are good reasons to suspect that communicative expression for Māori differs from the majority population of New Zealand, and that some of this difference is manifest in movement of the hands, head, face, and eyes. Matthews (2004) describes the distinct physicality evident in the culturally-prominent practice of *kapa haka* (Māori performing arts). The art of *whaikōrero* (oratory) similarly has a strong visuo-physical component highlighted by specific gaits and expressions of the face and body (Rewi, 2010). Most importantly, there is a long history of academic and lay observations noting a distinct Māori countenance and non-verbal code (Best, 1924; Metge & Kinloch, 1978; Metge, 2005).

Māori are the indigenous people of New Zealand, descendants of Polynesian settlers to the islands from around CE 1300. Following European contact, conflicts and warfare characterised an early period of settler migration and colonization (1815-1900), which in turn gave way to institutionalised marginalisation of the Māori population in the 20th Century (Walker, 2004). Though problems persist, such as a proportionally higher demographic of Māori living in poverty or lacking access to health and human services (Ministry of Social Development, 2010), the past few decades have seen a revitalization of national interest and pride in the Māori heritage of the islands, amongst both Māori and non-Māori. Linguistic and cultural groups examined in gesture studies often coincide with nationalities (e.g. Dutch, Japanese, varieties of English). By contrast, Māori language and culture exists as a distinct and influential minority within the broader national culture of New Zealand. Following the Māori Language Act of 1987, Te Reo

Māori bears special status as an official cultural treasure (*taonga*) of Māori per the 1840 Treaty of Waitangi and is recognised as an official language of New Zealand.

One indication of this influence is the growing visibility of the Māori English ethnolect (Holmes, 2005; Maclagan, King & Gillon, 2008). Māori English (ME) refers to the concentrated usage of a bundle of phonetic qualities and lexical forms, although these elements are present to some degree in the speech of most New Zealanders. It stands to reason that if certain linguistic forms are particular to the English speech of many Māori, than certain kinesic forms may be characteristic to this speech community as well. Note that many ethnic Māori are not speakers of ME, while an increasing number of Pākehā and non-Māori adopt these elements into their speech, and it has been commented that, “the most unmistakably New Zealand part of New Zealand English is its Māori element” (Deverson, 1991, pp. 18).

The adoption and wider recognition of Māori cultural forms is perhaps nowhere more apparent than in the pre-match *haka* performed by the All Blacks, New Zealand's national rugby union team. *Haka* is a posture dance accompanied by chant, typically performed by a group in serried rows, with an emphasis on assumed poses intended to welcome, acknowledge, insult, intimidate, or even terrify the intended audience (Kāretu, 1993). It is a form of *kapa haka*, a more general term for a range of performing arts combining dance and song and performed by men, women, and children (Mazer, 2011). Some of the more well-known *haka* consist of scripted actions and poses performed in unison, but others are more or less unscripted and allow for (and in fact, encourage) individual artistic flourishes. Whether scripted or not, the movements and accompanying song (*reo whakaniko*) of a *haka* are disciplined, well-practiced, and ritualised. Thus, there

is individuation in performance, but this individuation occurs within a repertoire of norms. For instance, the *wiri* is a quivering motion of the flattened hand that is a primary component of all *haka*. It may be realised in a variety of directions with the palms held away, held up or down, or with the forearms supine. But in all cases, the palm is flat with all fingers held together and extended. Similarly, *pūkana* (Figure 1) is a dramatic facial display with a slightly tilted head, a widened and wildly-transfixed gaze, and for men, the *whētero*, or extended tongue. *Pūkana* is a central component of *kapa haka*, but is known widely outside of these performances as well.



Figure 1. *Pūkana*

Whaikōrero is the tradition of Māori-language oratory performed on the *marae*, the tribal or community meeting place. Perhaps not as obviously a physical performance as the *haka*, *whaikōrero* similarly utilises a stock of partially-conventionalised gestures, poses, and gaits to augment the rhythm and authority of the speech. Rewi (2010, pp. 93) states, “There are no hard and fast rules about the types of movement that can be used,”

but that the moves are careful and deliberate in their execution, and draw upon familiar actions from *haka* and elsewhere.

Historically, both *kapa haka* and *whaikōrero* were integral parts of Māori public life. Today, they remain prominent as expressions of Māori heritage, and are still regularly used for their function of conveying social or political messages (Matthews, 2004). Though much of the contemporary Māori population has migrated from rural areas near *marae* to urban centres (Statistics NZ, 2001), many Māori are still regularly exposed to these practices and view them as positive and enriching activities, and many are performers themselves.

Finally, numerous authors have reported a distinct Māori physicality in casual conversation and interactions, but this issue has to date not been empirically substantiated. The earliest description comes from Best (1924, pp. 114):

“The Māori employs the aid of gesture to a considerable extent, and exercises this art in a facile and appropriate manner. In describing any incident he brings hands, arms, body, head, and features into play in his animated description. These gestures are in most cases of a natural and easily understood nature—indeed, they serve to illustrate the narrative. A few call for some knowledge of native usages ere one can understand them. Whether used as an accompaniment to spoken language of intercourse, or to posture dances, these gestures are never awkward or unpleasing to the eye.”

A more modern observation comes from Metge (2005), who describes the versatile interplay between three languages with which modern Māori communicate – English, Te Reo Māori, and Māori body language. Metge argues that body language is a powerful resource for communication amongst Māori but also a potential source of miscommunication with non-Māori. Her examples focus on (i) the communicative facility of the eyebrows for Māori and (ii) gaze behaviour in conversation.

The eyebrows are a particularly well-noted facet of Māori, and more generally Polynesian, expression. Highly-arched eyebrows are famously used in the *pūkana*, but raised brows have wider currency beyond this ritualised facial display. A Māori proverb, *ngā tukemata o Kahungungu* “the eyebrows of Kahungungu” references the legendary striking eyebrows of Kahungungu, the eponymous ancestor of the Ngāti Kahungungu tribal group.

Eyebrows also feature prominently in popular and social media depictions of Māori. The Māori reputation for communicating with the eyebrows and face is on display in the short film *Tama Tū* (Waititi, 2004). The film follows an all-Māori patrol in WWII forced to take shelter in silence. Eyebrow flashes of acknowledgment quickly develop into a game of increasingly elaborate facial contortions and jokes.

Internet memes and other cultural references illustrate how the eyebrows routinely function as a Māori ethno-cultural marker in the public consciousness. These uses seem to be perpetuated by both Māori (e.g., the Facebook group “Saying churr with you're (sic) eyebrows cause you're Māori”) and non-Māori (e.g. Māori eyebrow guy, a frequent vehicle for reinforcing distasteful stereotypes).

To summarise, there are commonalities between anecdotal accounts of Māori gestural patterns in conversation and the more ritualised movement patterns observed in Māori cultural practices. At the beginning of last century, Best (1924, pp. 134) wrote that activities such as *kapa haka* and *whaikōrero* were “much practiced, such that (the) rhythmic movements and facial distortion were universal acquirements.” It is interesting to speculate as to whether these forms became prominent because of their featured role in performing arts, or if their incorporation into the performances is a reflection of their

wider prominence in Māori physical expression? Regardless of their origin, ritualised elements such as the *wiri* and *pūkana* form a starting point for identifying Māori gestural habits that have become ingrained in what Kendon (2004, pp. 343) has termed the “ritual of everyday interaction”.

1.2 Gesture in multi-lingual speakers

In addition to analysing the gesture of Māori and Pākehā speakers, the present study also considers the gestures used by the Māori speakers when speaking English and when speaking Te Reo Māori. Previous studies of gesture across languages within bilinguals (or multilinguals) have primarily examined the degree to which gestural patterns associated with one language occur with another language in the same speaker -- i.e. gestural transfer. The evidence indicates that gestural transfer does occur, for both highly competent bilinguals (Choi & Lantolf, 2009) and in the first language (L1) (Brown, 2007) and second language (L2) (Pika et al., 2006) of asymmetric bilinguals. Various types of transfer have been explored (e.g. semantic properties in Brown & Gullberg, 2008), but a sizable group of studies have tested whether language-intrinsic rates of gesturing transfer in bilinguals (Nagpal, Nicoladis, & Marentette, 2011; Sherman & Nicoladis, 2004; Smithson, Nicoladis, & Marentette, 2011; So, 2010). Findings here are often contradictory and likely obscured by methodological issues, foremost a tenuous foundation on the assumption that there are language-intrinsic gesture frequencies.

The issue of transfer aside, bilinguals may gesture at different rates in each language according to levels of proficiency. This influence is germane to the present study given the dominant role of English in day-to-day life in New Zealand. However,

the direction of this influence is not clear. On one hand, more proficient and complex expression in a dominant tongue could be tied to more gesturing (Nicoladis, Mayberry, & Genesee, 1999). On the other hand, gesture may compensate for disfluencies or assist speakers through a difficult task, thus yielding more gestures (So, 2010) or more of a certain type of gesture (Gullberg, 1998) with a less-proficient or less frequently-used language. Alternatively, Nicoladis (2007) proposes that bilinguals simply gesture *more* than monolingual speakers of the languages concerned. This proposal and the findings for bi-directional transfer between L1-L2 nicely coincide with results from the psycholinguistic literature that indicate that word activation and recognition for a single language in bilingual listeners is filtered through their knowledge of both languages (Weber & Cutler, 2004; Spivey & Marian, 1999). In other words, both languages are to a degree active at all times and potentially influencing the gestures produced with speech.

Influences other than linguistic structure could lead bilinguals to produce particular gestures with each language. A considerable literature has shown that a person's experience listening to and speaking language throughout their lifespan influences their speech (Evans & Iverson, 2007; Harrington, Palethorpe, & Watson, 2005; Munro, Derwing, & Flege, 1999)¹. As a bilingual's experiences in each language are bound to differ from one another, it follows that their speech and gesture, would subsequently differ as well.

Altogether, the research described above is in line with Grosjean's (2001) assertion that a bilingual speaker is not two monolinguals in one, while also suggesting that bilinguals do not employ a single hybrid mode of expression regardless of language.

¹ It is, as yet, an unstudied question how experiential language models extend to gesture, though culturally-grounded gestures provide indirect evidence in the sense that inter-personal transmission of gestural forms clearly happens.

Rather, it seems best to say that bilinguals have a range of gesture modes according to the linguistic context in which they are speaking that to some degree reflect gestures associated with monolinguals of each language. Admittedly, this is not remarkably different from the behaviour of monolinguals, whom we should presume also have a range of gesture modes according to the sociolinguistic context in which they are speaking that reflects their experience both producing and observing gestures in those contexts. In this view, multilinguals are only different in that they have additional dimensions of experience in distinct linguistic settings.

2 Methods

This section gives an overview of how the interviews that comprise our data were organised, conducted, and recorded. As we investigated behaviours with rather distinct criteria for the coder (hands, head, eyebrows), the description here concerns only the annotation tools and analysis employed across all of the data. Detailed accounts of annotation criteria and techniques, annotator reliability, specific statistical hypotheses, and analytical methods can be found individually for manual gestures, head gestures, and the eyebrows, in their relevant sections below. The study's design and materials were all reviewed and approved by the Human Ethics Committee of the University of Canterbury.

2.1 Participants

Four ethnic Māori (bilingual English-Māori) and six Pākehā (monolingual English) speakers participated in the study. Participants were recruited by word of mouth from the University of Canterbury community and the Māori community of the Christchurch area.

All were young males between 21 and 35 years of age. Two research assistants, (i) a male Pākehā student and (ii) a male Māori student fluent in both English and Māori, conducted all of the interviews. Participants were informed that the interview concerned “story-telling” techniques and were not aware of the study’s purpose until debriefing.

2.2 Procedure

Complete interviews lasted 30-60 minutes and consisted primarily of directed conversation. The data reported in this paper are drawn from one portion of the interview in which participants retold the events of a cartoon stimulus that they had just watched. The cartoon, *Canary Row* (Freleng, 1950), is a series of vignettes in which Sylvester the cat fails to capture Tweety the bird, and has been used successfully in numerous studies of co-speech gesture originating with McNeill & Levy (1982).

Monolingual participants performed two interviews, one with each research assistant, held more than a week apart. Bilingual participants performed three interviews, similarly spaced apart. The Māori and English language interviews were conducted with the same Māori bilingual research assistant in order to control the interviewer’s effect across interviews in different languages. Interview order was counter-balanced across the Pākehā participants with respect to the interviewer ethnicity. The order could only be partially counter-balanced for the Māori participants, as three possible conditions (in English with Pākehā interviewer, in English with Māori interviewer, and in Māori with Māori interviewer) yield 6 possible order permutations, and there were just 4 participants. As an alternative, we ensured that each condition constituted the first interview for at least one participant.

Interviews were conducted in the NZILBB Observation Lab² and were captured with three digital video cameras (at 25 fps): one directed at the participant's face, another with a full body perspective, and a third capturing both the participant and interviewer. Participants sat in a cushioned seat without armrests positioned orthogonally to the interviewer's seat. Each wore a headset microphone while an overhead microphone recorded the interaction.

2.3 Data Annotation and Analysis

Narratives of the cartoon retelling were excised from each interview using Adobe Premiere Pro. The resulting video clips, ranging from two to six minutes long, were saved as Quicktime movies and imported to the ELAN annotation tool for gesture coding (Brugman & Russel, 2004). Separate annotation tracks were designated in ELAN for each attribute under investigation.

The study employed two annotators (henceforth, Annotators A & B) for the twenty four separate video clips. Each coded at least 15 video clips, six in common to allow cross-checking of coder consistency. In certain cases, additional researchers (Annotators C & D) served as ad hoc annotators for a specific quality across all of the video narratives. Results for coder reliability are provided in the appropriate section for each coded variable. Initially, a wide set of behaviours was annotated for eight of the speakers (4 Pākehā, 4 Māori). Once the variables of interest were identified, data for the additional two Pākehā speakers were subsequently annotated for just these variables. For this reason, the analysis of manual gestures compares four speakers from each group, while the more constrained analysis of head and eyebrow motions compares 6 Pākehā

² Details available at <http://www.nzilbb.canterbury.ac.nz>

and 4 Māori (and thus a balanced number of 12 interviews for each speaker ethnicity group).

Statistical analysis was performed by mixed-effects logistic or linear regression (where appropriate) in the R statistical software (R Core Team, 2012) using the lme4 package (Bates, Maechler, & Bolker, 2012) for linear models. Mixed models can test fixed effects in the study design while including random effects, such as the individual speaker, which are known to affect the outcome variable but do not concern the research question at hand. That is, we know that there is considerable speaker heterogeneity in language and gesture production (Nagpal, Nicoladis, & Marentette 2011) -- it is not necessary to statistically test if individual speakers have different behaviours. However, a statistical model which incorporates this knowledge is preferable to one that does not. Therefore, we contend that such an approach is better suited than ANOVA comparison of means for the statistical analysis of gesture (see Baayen, 2008; Hay, 2010, regarding the utility of hierarchical regression models in linguistics and social sciences).

3 Manual Gestures

Our results show that the frequency of manual gestures did not consistently differ according to the ethnicity of the speaker, the interviewer, or the language being spoken. Individual speakers gestured at different frequencies across these conditions, but no pattern held across the wider set of speakers. Differences in *form* of the manual gestures, not *frequency*, were evident between the Māori and Pākehā speakers. There was a strong tendency for the Māori speakers to employ a flat handshape (i.e. a hand in which all fingers are fully extended and both palm and fingers display minimal bend), particularly

for depictions of movement. These behaviours are described and exemplified below. Overall, the findings offer further evidence of the varied ways that cross-cultural differences are manifest in gesture.

3.1 Method: Annotation, Reliability, and Analysis

Annotation first identified each gesture phrase, and for each phrase, the *gesture type* (representational or not), its *stroke*, the *hand used*, *handshape*, *size*, and type of *trajectory*. The “gesture phrase” in this context, following Kendon (1980, 2004) is a unit encompassing the orchestration of motions that surround and include the stroke, the main expression of a gesture’s communicative goal.

The set of annotations comprising each gesture enabled us to also explore how frequently certain handshapes, trajectories, and gesture amplitudes were produced by each speaker, as well as any interaction between these qualities and the gesture type. Ultimately, these statistics served as a heuristic to draw out specific qualities for closer examination. For purposes of brevity, we limit our discussion to two of the most interesting findings - (a) the rate of gesturing and gesture types and (b) the frequency of certain handshapes.

Gesture Phrases Manual gesture phrases were segmented with a start point at either (i) initial movement from a rest position or, (ii) when immediately following another gesture phrase, at a moment reflecting the initiation of movement in a new direction from that prior gesture. Precisely the reverse held for identifying the phrase end point at either (i) the return to a resting position or (ii) the transition point selecting the beginning of a

subsequent phrase. The primary annotators A and B were said to agree if the following three conditions were met: (i) the two gesture annotations from A and B overlapped, (ii) a stroke within each phrase annotation also overlapped and (iii) neither annotation from A nor B was used to agree with another annotation, ensuring that each match was unique. Following these criteria, the two annotators agreed on the placement of 257 of 294 total gesture phrases (87.4%) in the 6 narrations coded in common.

Classification of Representational vs. Non-representational Gesture phrases were identified according to a modified version of McNeill's (1985, 1992) taxonomy collapsed into a simple two-way classification between *representational* and *non-representational* gestures. It has been noted by McNeill (2005) and others that labels such as *iconic*, *deictic*, *metaphoric* do not represent categorical divisions, but imagistic or semantic properties which any given gesture may exhibit simultaneously and to varying degrees. Even so called "non-representational" gestures are not devoid of symbolic value, but are comparably deprived. By focusing on just the dimension of representationality in our analysis, we sought to separate gestures clearly associated to the semantic content of the narrative from those more clearly associated with the language-specific properties of rhythm and other prosodic qualities.

Two criteria were used to identify non-representational gestures. One, there existed no obvious semantic connection to the speech content besides emphasis, and two, the motion was simple -- composed of only a stroke and retraction along a single plane, without preparatory or hold phases. Assignment of representational and non-representational labels were cross-checked to ensure coding consistency. A third

annotator (C) reviewed all twenty four videos with gestures already segmented and identified the gesture type for each existing gesture phrase annotation. Annotator C agreed with the identifications of A & B in 569/623 cases (91.3%), Cohen's K = 0.786.

Handshapes Handshapes were classified into one of eight categories: *circle*, *cup*, *fist*, *flat*, *open*, *pinch*, *pointer*, and *other*. On the basis of pilot data, the classification *flat* is highlighted in the analysis. Criteria for identifying *flat*, and its differentiation from *cup* and *open*, are described below. *Circle*, *fist*, *pinch*, *pointer*, and *other* were coded closely following groupings of the ASL handshapes outlined by McNeill (1992, pp. 87-88, in a description of Friedman's 1977 study)³. The categories describe the form of the hand and not its function. Thus, *pointer* handshapes indicate an extended index (and possibly other) fingers, but not necessarily the act of pointing. Dynamic handshapes over the course of a gesture phrase were classified according to the handshape at the stroke apex.

Although *other* was an option, in practice, *open* served as the primary otherwise case, as it applied to an open palm with the fingers mostly extended and no manipulation matching other classifications. *Cup* was similarly formed with an open palm and extended fingers, but distinguished by a curvature of the hand's longitudinal arch and a collective bend of all fingers at the proximal phalanges. That is, *cup* bent fingers at the base knuckle (the metacarpophalangeal joint) and *open* handshapes bent all or some of the fingers at any of the minor knuckles (interphalangeal joints). In contrast, *flat*

³ For example, *pinch* corresponded to configurations that resembled ASL handshapes 'F, X1, tapered O, and baby O'. The class *other* applied to handshapes that did not match the seven other labels or used mixed handshapes in a two-handed gesture. Agreement between coders was generally high, with disagreements highlighting some of the ambiguities between these classes (see below).

handshapes bent fully extended fingers minimally at all phalangeal joints (disregarding the thumb).

Handshapes were coded by supplemental annotators C and D, both unaware of the hypothesised association between Māori speakers and flat handshapes. They separately reviewed every segmented gesture phrase in the data (with empty values) and assigned a handshape for any active hand. Agreement between C and D was 79.3%, Cohen's Kappa = 0.711. Most disagreements involved 3 pairs of configurations: *cup* with *open*, *flat* with *open*, and *pinch* with *circle*. Annotator C was always more restrictive in assigning non-open values. Therefore, C's annotations were used for all further analysis, with the additional restriction that *flat* annotations were only kept when both annotators agreed to *flat*⁴.

3.2 Gesture Frequency

Analysis As an initial stage of analysis, we examined the overall rate of gesturing performed by each speaker in each of their iterations of the narrative. The measured variable was the rate of gestures per minute of speech⁵, calculated as the overall number of gestures in a narration divided by its length in minutes. Given the reported emphasis on physical expression in Māori culture (see §1.1), it was tentatively hypothesised that Māori was a high gesture frequency culture, and Te Reo Māori a high frequency gesture language. Māori speakers would then be expected to gesture more than Pākehā, and potentially gesture more when speaking Te Reo Māori.

⁴ In all, 67 *flat* handshapes were identified by both annotators. D identified 89 *flat* gestures, of which C agreed on 67. Conversely, all but 2 of C's 69 *flat* annotations were identified as *flat* by D.

⁵ The rate per 100 spoken words was also calculated. Analysis by either metric did not substantially alter the results.

Results The frequency of gesture phrases for each speaker in each interview condition (interviewer, language) is charted in Figure 2. There were no group differences in the rate of representative gestures as tested by separate regression models with *Speaker Ethnicity* as the sole fixed effect (Pākehā $\beta = 2.67$, $SE = 4.17$, $p = 0.5301$), non-representative gestures (Pākehā $\beta = -0.05$, $SE = 1.68$, $p = 0.9751$), nor the combined total (Pākehā $\beta = 2.62$, $SE = 5.3$, $p = 0.6273$). Corresponding tests with *Interviewer Ethnicity* as the fixed effect were similarly non-significant (representative, Pākehā Interviewer $\beta = 1.29$, $SE = 1.98$, $p = 0.5222$; non-representative, Pākehā Interviewer $\beta = 1.13$, $SE = 0.68$, $p = 0.1164$; combined, Pākehā Interviewer $\beta = 2.38$, $SE = 1.91$, $p = 0.2282$).

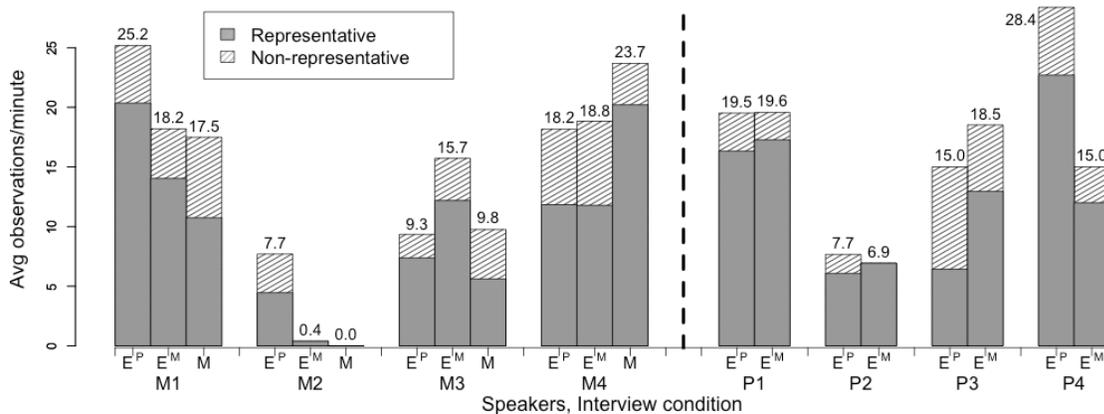


Figure 2. Gesture Rate - Manual gesture phrases per minute of speech, by Speaker and Interview condition. Each bar represents results for a single narration. Māori speakers performed three interviews: E^P in English with Pākehā interviewer, E^M in English with Māori interviewer, and M in Te Reo Māori with Māori interviewer. Pākehā speakers performed just the two English speaking interviews. Dashed vertical line separates the Māori from the Pākehā speakers. Combined rate of gestures per minute is given atop each bar. To demonstrate, M1 gestured 25.2 times per minute in his English interview with the Pākehā interviewer, roughly 20 of these were representational.

Similar regression analysis is inappropriate for the effect of the *Language* spoken, as a comparison is limited to two data points for each of four bilingual speakers. Two of

the bilingual participants (M1, M3) gestured less whilst speaking Māori, while another (M4) gestured more. Impressionistically, M3 was the most hesitant and slowest Māori language speaker, suggesting that speech disfluencies in his less-frequently spoken language may have yielded fewer gestures. Overall, the possibility remains that the bilingual speakers gestured *differently* with each language, but there is little evidence to claim that they gestured *more* or *less*.

The most influential factor in predicting gesture frequency is the individual and his personal speaking and gesture style. That is, neither Māori nor Pākehā speakers reliably gesture more often. A Māori speaker, M4, is the most active gesturer in our study while another Māori, M2, gestures the least.

Speakers maintained a roughly consistent gesture frequency across repetitions of the task, with a few exceptions (M1-E^P, M2-E^P, M3-E^M). This suggests that an individual gesture style outweighed other potential factors such as *Language*, *Interviewer Ethnicity*, and *Interview Order*. There was a larger proportion of representational gestures (except for speaker P3), likely due to the nature of the narration task as speakers sought to describe the various intricate and implausible actions of the animated characters. Whether performing the narration for the first time, or repeating it in a subsequent interview, position in the *Interview Order* did not consistently induce more or less gestures⁶.

⁶ Nor can repetitions of the narration serve as an explanation for the few exceptional cases. Speaker M3 gestured the most in his first interview session (the English^{Māori} condition), while Speaker M1 had an exceptionally high gesture rate in what was his 2nd of 3 interviews (English^{Pākehā}) and Speaker M2 only gestured in his 3rd and final interview (English^{Pākehā} condition).

3.3 Handshapes

A preliminary test considered the handshapes of representational gestures in our data and found strong support for the hypothesis that Māori speakers used *flat* handshapes more often (Pākehā speaker: $\beta = -2.49$, $SE = 0.50$, $p = <0.001$). Examining the context of use for each of the *flat* gestures, one particular use of *flat* stood out in the Māori data and appeared to be driving this statistical difference – a flat hand to depict paths of movement. Our discussion focuses now on the findings regarding this specific gestural form, demonstrated in Figure 3.

“He goes straight to the door. Runs up the stairs.”



(a) he goes straight... (b) to the door. (c) Runs... (d) up the stairs.

Figure 3. Two consecutive flat-handed depictions of motion events by M4

In Figure 3, speaker M4 describes two stages of the cat's hurried movement – first across a street and into an apartment building and second, up a flight of stairs. Both motion events are depicted with a flat palm and fingers and the fingers held closely together (images b, d above). Furthermore, both gestures depict the path of the movement following the course of the hand as led by the finger tips, as though the fingers are collectively pointing in the direction of the movement. The gesture bears similarities in form and function to the flat hand pointing described by Orié (2009) for Yoruba speakers, though considerable flexibility exists for the hand's orientation - the palm could face down, inward (as in Figure 3 above), toward or away from the speaker.

Indeed, this pairing of form and meaning is not exclusive to Māori speakers, nor to speakers of a select few languages. Flat hands may indicate directions or demonstrate paths in various cultures (and professions⁷) and similar flat-handed motions are employed on occasion by the Pākehā participants in this study. The Māori flat hand gesture was not notable for its uniqueness, but for the overwhelmingly greater frequency with which it was employed.

For the Māori speakers in the present study, a flat hand was used to describe a variety of motion – descending stairs, crossing a street, entering a building, climbing inside a drainpipe attached to the outside of a building, falling quickly down that pipe, or for the path of a tram car travelling the course of its electric lines. The flat-path gesture was also used routinely by the Māori speakers in portions of the interview other than the cartoon retelling. The sequence of images in Figure 4 is from a childhood story told by speaker M1. He is recounting an episode from his childhood wherein he and a group of friends chase down and tackle a pig.

What characterises the gesture here and elsewhere is an emphasis on the speed, urgency, or directness of a motion event. The fingers, straightened and held together, collectively point together with the flattened palm to strengthen the depiction.

⁷ Thanks to Adam Kendon for noting this connection. Airline attendants' safety instructions are routinely accompanied by a flat-handed point. Similarly, staff at luxury hotels are often trained to provide directions with their entire (flat) hand to avoid index-finger pointing which may be deemed rude by certain guests (per first author).

“The three fastest runners. (chuckles) (800ms) Ah, well we saw the (indecipherable). (1s)
So the three fastest runners ran past this pig.”



- (a) The three fastest runners (chuckling)... (4.56s)...
- (b) So the three fastest runner ran ...
- (c) past this pig.

Figure 4. Flat-handed depiction of motion event by M1

Reviewing the path-depictive gestures produced by Pākehā speakers, one sees more casual depictions of movement. The hands are often open, with splayed fingers loosely apart and bent. When *flat*, the orientation of the hand often differs from the finger-led motion of Figures 3 and 4.

To test this observation, we restricted the analysis to only gestures which depict the path of a motion event. Additionally, *flat* handshapes were further classified as either *flat.fingers* or *flat.others*, where *flat.fingers* captures the specific orientation of the hand to motion described above. *Flat.others* includes orientations for which the motion is led by the palm (see Fig. 5a-b), by the top of the hand with outward flicks of the wrist (see Fig. 5c-d), or by the hand's edge.



- (a) Instead of swinging ...into the window, he...
- (b) ...he smashes into the wall.
- (c) Down the stairs...
- (d) out into the alley.

Figure 5. Orientation of flat-handed motion gestures

Figure 6 gives the proportion of each handshape class for path-depictive gestures, with the data pooled by *Speaker Ethnicity* and the interview session. The prevalence of the *flat.fingers* configuration in the Māori data (bottom three rows) is easily discernable. The distribution of each handshape class, though not tested in the analysis, is included in Figure 6 to provide a sense of handshape variation across the groups and thus offers useful context for interpreting the findings for flat-handedness. For the rate of FLAT.FINGERS, logistic regression showed a significant main effect of *Speaker Ethnicity* (Table 1 and Figure 7), while effect sizes for *Interviewer*, *Language*, and *Interview Order* were non-significant and the factors dropped from the model.

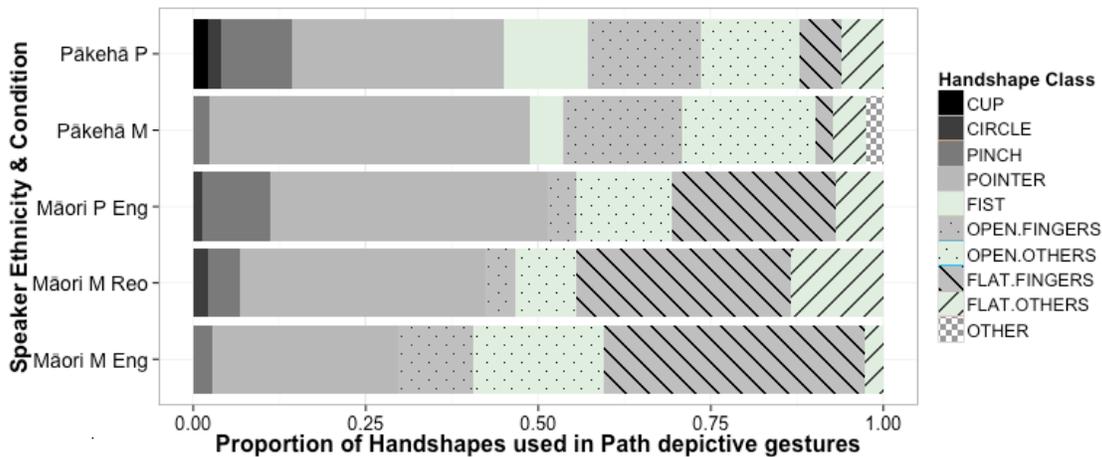


Figure 6. Handshapes used with path-depictive gestures

Binomial model fit by Laplace approximation
 $\text{FlatPath} \sim \text{SpeakerEthnicity} + (1|\text{Speaker})$
 Number of observations: 244, groups: Speaker, 8

Fixed effects:	β	SE	z	p
(Intercept)	-0.96	0.31	-3.13	0.0018**
SpkEth Pāk	-2.16	0.67	-3.24	0.0012**

Table 1. Summary of binomial mixed-effects model for FLAT.FINGERS shape in path gestures

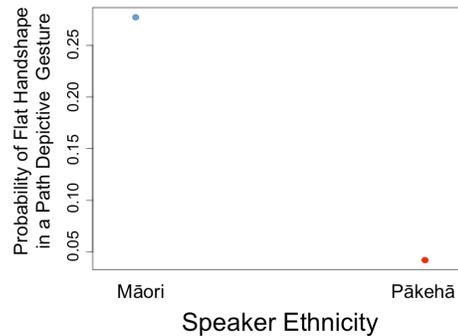


Figure 7. Probability of FLAT.FINGERS shape for path gesture (back transformed from log odds in Table 1)

The depiction of path and manner in motion events has been much discussed in cross-linguistic studies of gesture, in regards to the ways in which path and manner are encoded in language influence the form of the gestures that depict these movements (as in Kita & Özyürek, 2003). Our observations concern not whether an event is depicted or not, but the form with which it is depicted. Language did not affect this form in our data, but the speaker ethnicity did. That is, the Māori speaker tendency for flat-handed path gestures did not differ according to the language spoken. It is a worthwhile question for future consideration whether the use of this gesture is still influenced by language, as the difference between Māori and Pākehā speakers could lie in how they choose to describe the motion events in either language.

3.4 Discussion

Comparisons of gesture rate were not revealing. Rather, narrowing the question and tallying the frequency of specific forms provided insightful measures of behavioural differences.

A quality that was noted but evaded quantification was a precision to many of the Māori gestures that did not exist for the Pākehā speakers. It evaded quantification in part because it was manifest in a multitude of ways, but is best summarised by stating that the Māori speakers seemed to pay more attention to the actions of their hands. The annotators commented that the Māori speakers used longer and more methodical preparatory phases to position and shape the hand for the anticipated stroke, and that the subsequent strokes and gesture phrases were often easier to demarcate during a continuous stream of motion, because each phase of the gesture phrase had clearer start and end points. Pre-stroke and

post-strokes more clearly delineated the preparation and retraction of gestures. Between consecutive gestures, the hands would frequently return, if only briefly, to an obvious rest position. The flat-handed path gestures likely provide some impression of this precision. In a prototypical instance of this gesture, the hand raises from the lap prior to the stroke and is held flat, often quite rigidly so, at mid-torso. Following the stroke, the hand returns fully to the starting position on the lap before the following gesture is enacted.

Finally, the manual gestures (or lack thereof) of M2 deserve particular mention. Speaker M2 produced almost no manual gestures in two of his three narrations, but when he did use his hands, the results were quite distinct. He frequently stops talking while his hands are in a rest position (often tucked under the opposing arm), then in a formal and measured manner moves the hands to a preparatory position before a succinct stroke. Only upon returning his hands to the same rest position as at the beginning does he resume talking and describe the events or items affiliated with the preceding gesture. His manual gestures thus seem to be neither spontaneous nor speech-accompanying, but are instead thought-out actions that work alongside his utterance rather than as part of the utterance itself. However, his head, gaze, and eyebrows often fill in this gap, performing a number of “gestures” simultaneous to his speech.

This use of the head, for M2 and all of the Māori speakers, is explored in the next section.

4 Head Gestures

4.1 Overview

During speech, people move their head a great deal, and they do so in a variety of ways that perform a variety of linguistic and social functions. McClave (2000) surveys and demonstrates a number of these functions - from marking prominence, clause boundaries, or semantic content of the accompanying speech (Birdwhistell, 1970; Kendon, 1972, 2004) to managing feedback and turn-taking in dialogue (Duncan, 1972; Hadar, Steiner, Grant, & Rose, 1983; Bavelas, Chovil, Lawrie, & Wade, 1992) to their role in dismissing speech errors and highlighting any subsequent repairs (Dittman, 1972; Hadar, Steiner, Grant, & Rose, 1984). Annotators for our study noted numerous dimensions of head movement, but our analysis focuses on just those movements which performed a gesture-like illustrative function.

4.2 Method: Annotation, Annotator Reliability and Analysis

We investigate the use of the head to referentially depict within-narrative objects and events and we label this class of movement 'Narrative-internal Illustrators'. This type of concrete iconic gesture performed by the head has generally not been discussed in the research concerning speech-accompanying head movement, and not without reason, as it represents a small minority of the nearly constant movement produced by speakers. Indeed, (Hadar, 1989) states that motoric movements of the head greatly outnumber symbolic ones and that, within his research group's studies, "Head movement appeared not to have iconic or ideographic properties because of its physically restricted complexity." (1989, pp. 246). Iconic and ideographic depictions by the head, while

infrequent, do happen of course. Casual observation of our recorded interviews suggested that the ethnic Māori participants more frequently and conspicuously used their heads in this manner. The following example illustrates. In Figure 8, Speaker M2 is describing a scene wherein Sylvester the cat sets up a simple lever in order to catapult himself skyward to the window of his prey⁸. As the participant describes the lever's design, he places a wooden plank in front of himself and depicts its horizontal length from left to right, and he does this entirely without the use of his hands. His head turn and directed gaze lay out the size, shape, and position of the object – iconic and deictic information that is more typically and familiarly conveyed by manual means.

“He lays up a block and across it a plank.”



(a) he lays up...(440ms) a block... (1s)...

(b) and across it

(c) a plank.

Figure 8. Narrative-internal gestures with hands (a) and head/gaze (b, c)

The example also serves to demonstrate a number of points about the identification of Narrative-internal Illustrators for analysis. A Narrative-internal Illustrator was said to occur when the head either (i) depicted an actor or object in the narrative, or an attribute of that actor or object, (ii) depicted movement or direction of some movement, (iii) made

⁸ A short video of M2's narration described here and in Figure 8 is available as supplementary on-line content.

deictic reference to a location in the narrative, or (iv) was part of an embodied portrayal of an actor, reflecting the character's viewpoint (and often accompanied by a facial display mimicking the character). The example in Figure 8 meets these criteria in both its iconicity (identifying the shape and position of the plank) and narrative-internal reference (the plank is a physical object within the story).

In contrast, the same speaker directly follows this description with a rightward tilt of the head and raised right brow while uttering, “*He throws a... (360ms) five hundred 'L' 'B' iron*”. The head movement in this case provides a meta-narrative comment indicating the incredulity of the story's proceedings. It is in some sense an “illustrator”, as it is an iconic representation of dubiousness. But it is also clear in this case that it illustrates an idea *about* the narrative rather than an event *within* the narrative. Movement with a meta-narrative function was not included for multiple reasons. First, it was not clear that the Māori and Pākehā speaker groups behaved differently in this regard, at least in frequency of the action. Secondly, it is not a straightforward task to reliably discriminate between head movement serving meta-narrative, discourse, interactive, or cognitive functions (such as those outlined in McClave, 2000) and non-symbolic “motoric” movement (in Hadar's (1989) terms) or ostensibly less symbolic movement that contributes kinetic emphasis to moments of prominence in the speech signal. Nor is it clear that such a division is desirable -- the various functions that head movement can serve are probably not realised to the exclusion of one another, but may co-exist within a single action. By comparison, Narrative-internal Illustrators, head gestures which specifically depict objects and events from the narrative have little of this ambiguity and could be identified with confidence across annotators in our study. In Figure 8 above, there is little doubt that

the speaker's head does not pan left-to-right merely to accentuate the emphasis on the verb “lays out”, but that he is in fact laying out the object with this motion.

Among head gestures identified as Narrative-Internal Illustrators, we further identified whether the motion was performed independently of any hand motion or whether it interacted with simultaneous motion performed by the hands. We labelled these alternatives as “Independent” or “Accompanied” head gestures. The example above presents an Independent head gesture. The speaker's hands are folded under each arm and are disengaged from the image creation. Hypothetically, were the speaker (M2) in this instance to have also placed his hands open with the palms facing one another so as to indicate the ends of the plank, the head gesture would have been labelled as “Accompanied”. Note that this categorization makes no claims about whether the head or manual action is any way primary or supplementary, but merely that the actions are simultaneous and relate to the same imagistic representation.

4.3 Results

Māori speakers produced more narrative illustrating head gestures, both independent and accompanied. Or rather, the Pākehā speakers produced almost none. Figure 9 provides the familiar comparison of observations/minute for each speaker in each interview condition. Fitting of a linear mixed-effects model revealed no significant effects for *Interviewer Ethnicity*, *Interview Order*, and *Language* (for the bilingual Māori speakers) as fixed factors. The resulting model is given in Table 2, showing a significant effect size for *Speaker Ethnicity* ($p = 0.0265$). The coefficients show estimates of just under 2 head gestures per minute for the Māori speakers and roughly 0.7 for Pākehā speakers.

Particularly notable were the head gestures of M2. Not only did Speaker M2 use his head in this manner more than any other speaker, but he almost exclusively used his head to perform any gesture in two of his three narrations. While his hands remained locked under the opposite arms for much of these narrations, the activity of his head (and eyebrows - see below) compensated.

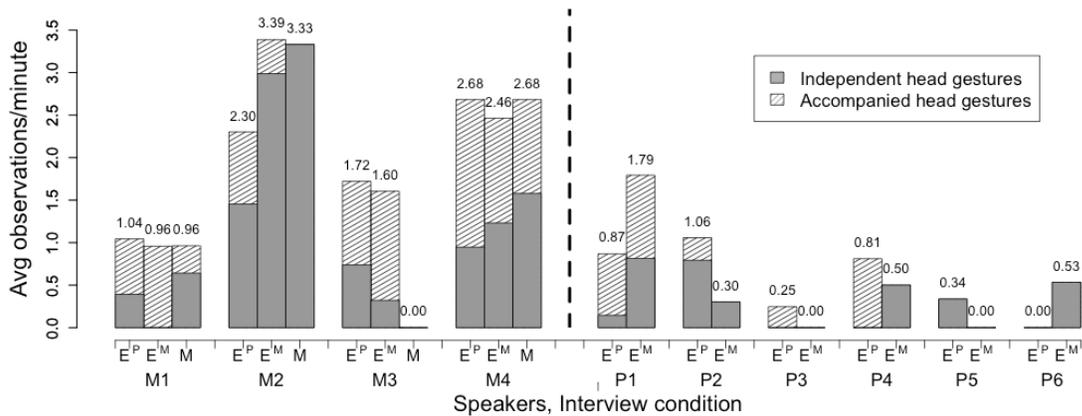


Figure 9. Head Gesture Rate - Narrative-internal Illustrative Head Gestures per minute of speech

Linear mixed model fit by maximum likelihood

HeadGP ~ SpeakerEthnicity + (1|Speaker)

Number of observations: 24, groups: Speaker, 10

Fixed effects:	β	SE	t	p
(Intercept)	1.93	0.33	5.89	0.0000
SpkEth Pāk	-1.39	0.43	-3.23	0.0038 **

Table 2. Summary of linear mixed Model for Head gestures

Quantitative analysis scarcely captures the strength of the difference between the groups' non-manual gestures. Qualitatively, the head gestures of the Māori and Pākehā participants, while counted in the same way, were of a different nature. Māori head gestures swung the head from one side to the other or cocking it far backwards while placing and moving objects with their gaze. In the portion of the narrative seen in Fig. 8,

Speaker M2 vividly lays out the wooden plank vault and follows by shooting his head up to indicate the cat's rapid upward trajectory and then back down for the cat's descent. By comparison, Pākehā narrative-illustrating head gestures were mostly constrained to subtle tosses or nods of the head accompanying descriptions of simple movement. For instance, Speaker P2 tips his head back while uttering, “And Sylvester gets thrown out once again” in a way that clearly aligns with the character's departure but lacks any of the elaboration of the face or range of motion found in the Māori illustrative gestures of the head.

5 Eyebrow Movement

5.1 Overview

We now examine whether the Māori speakers in our study moved their eyebrows with (i) greater frequency or (ii) different form than the Pākehā speakers. Raising or arching of the eyebrows and a widening of the eyes are widely-noted behaviours (and stereotypes) associated with ethnic Māori in New Zealand. Similarly, a “flash” of the eyebrows has often been identified as a frequent and prominent positive social-marker in Samoa, Tonga, and Polynesia generally (Eibl-Eibesfeldt, 1972).

Of course, people of all backgrounds and languages move their eyebrows expressively. Darwin ([1872] 1998, pp. 139) linked “raising and lowering of the eyebrows with definite states of mind” in man, and extensively discussed the role of the eyebrows in various emotive facial configurations used by humans, chimpanzees, baboons, and other primates. One of the early modern researchers to discuss the link between eyebrow movement and speech, Ekman, (1979) described the potential for the eyebrows to produce “batons” — beat-like actions that tap out the rhythm of speech.

Ekman's claim has since been supported by experiments revealing close synchrony between eyebrow raising and pitch-accented syllables in speech (Flecha-García, 2006, 2010; Cavé et al., 1996; Cavé, Guaïtella & Santi 2003; Guaïtella, Santi, Lagrue, & Cavé, 2009; Swerts & Krahmer, 2010). Furthermore, perceptual studies in Krahmer & Swerts (2007) and Swerts & Krahmer (2008, 2010) demonstrate that listeners' interpretation of focus is influenced by the "visual beats" produced by the eyebrows.

While the studies above yield compatible findings across a range of western languages – Australian English (Kim, Cvejic, & Davis, 2014), British English (Flecha-García, 2006, 2010), Dutch (Swerts & Krahmer, 2012), and French (Cavé et al., 1996) – the only cross-linguistic or cross-cultural investigation of the eyebrows to date is described in Grammer et al. (1988). Grammer et al. (1988) compare the form and conversational context of eyebrow flashes used by three groups of indigenous peoples located in the Amazon rainforest (Yanomami), Indonesian New Guinea (Eipo), and Papua New Guinea (Trobriand). They found nominal differences in the physical form of brow raises and no distinctive difference in the context in which the raises were employed. In most cases across the three linguistically and culturally-disparate groups, eyebrow raises were most frequent during initiations and were used to "underline a wide variety of meanings" that generally "mark(ed) positive signals" (pp. 298). An interesting feature of Grammer et al.'s (1988) analysis was their segmentation of the brow raise into its *onset*, *apex*, and *offset* moments. However, their most notable finding concerned the overall duration of each brow raising event. Empirically, their data formed two groups of behaviour according to this duration. "Short brow raises" taking less than 800ms were the more common of the two and are equated with eyebrow "flashes". "Extended brow

raises” were of widely-varying length greater than 800ms and were regarded as “a different facial signal” (p.298) with different communicative functions.

The experimental literature demonstrates that the eyebrows help to signal sentential focus (Swerts & Kraemer, 2008; Kim et al., 2014) and discourse structure (Flecha-García, 2010), by marking types of utterance function or the boundaries of speaker turns in dialogue. As Eibl-Eibesfeldt (1967, 1972) points out, a brow raise can function independently of speech as a greeting, acknowledgement, or as a simple “yes” (particularly in Polynesia). Yet all of these functions are typically identified with “flashes” or fast brow raises. Little has been said about the form or frequency of eyebrow motion and how it might differ across speech communities. The array of impressionistic evidence and New Zealand folk 'intuition' outlined in the introduction suggest that Māori speakers flash their eyebrows more frequently than Pākehā, and possibly move their brows in other ways more consistently.

5.2 Method: Annotation, Annotator Reliability and Analysis

Annotation of eyebrow movement was performed with video of the close-in camera feed with the audio removed. All upward movements were treated uniformly, such that finer distinctions (e.g., upward wrinkles, single brow raising, or complete arching of both eyebrows) were all coded as Up, and similarly for downward movements coded as Down. Annotations began with the video frame in which the brow(s) started to raise or lower and ended with the first frame of the return to a starting position⁹. Annotators A and B

⁹ Or a return to a loosely identified default position. This approach was pursued precisely because the alternative, ending the annotation when the eyebrow had completed its return to a starting position, relied on the accurate identification of this starting position. Identification of such a point was frequently ambiguous.

coded the brow movements in their respective portions of the data, while Annotator D coded the eyebrows in all 24 videos. Agreement was sought between the combined annotations of A and B with those of D. Annotations were said to agree if (i) A/B overlapped with D, allowing for a +/- 40 millisecond window to account for the video frame rate and (ii) neither the A/B nor D annotation had previously been said to agree with another annotation. Table 3 summarises the proportion of agreement, showing that of 1628 total eyebrow annotations, Annotator D agreed with the main annotators 1094 times (67.2%).

		Annotator D			Annotator D				
		Down	Up	N/A	Down	Up	N/A		
Annotator A	Down	78	11	46	Annotator B	Down	28	2	24
	Up	6	740	232		Up	2	248	97
	N/A	9	71	-		N/A	3	21	-
	<hr/>			<hr/>			28/33	248/271	+121
		78/93	740/822	+278			276/425 total		
		818/1193 total							

Table 3. Annotator agreement for brow movement

This rate of agreement was considered insufficient to employ just one coder's output for analysis. Therefore, our analysis only considered cases which both A/B and D separately identified, a restrictive approach which provided high confidence that each annotation genuinely reflected an eyebrow action (and not, for example, movement of the jaw or head providing the impression of brow motion). Annotator D additionally segmented the Apex of Up brow movements -- the frame in which the raising eyebrows first reach their highest amplitude. Apex tags were then used to calculate the onset-to-apex lag for each brow raise. Reviewing the set of lag values, 200ms (5 video frames) was selected as the

threshold which separated eyebrow *flashes* (200 ms or quicker) from slower eyebrow *raises* (> 200 ms from onset to apex). In this way, we classify eyebrow flashes according to their velocity, a departure from Grammer et al's (1988) classification according to duration of the entire brow raise.

5.3 Results

Figure 10 shows the rates (per minute) in each narration for each type of eyebrow motion: *flashes*, *raises*, and *down* movements. A greater rate of upward eyebrow movements is evident in the twelve Māori speaker interviews, with the exception of Pākehā speaker P1. Linear regressions with random intercepts for individual speakers tested the degree to which the fixed factors (*Speaker Ethnicity*, *Interviewer Ethnicity*, *Interview Order*, and *Language* for just the Māori data) predict the rate of eyebrow motions. A model for all upward movements combined (*flashes* + *raises*) showed a significant effect size for Speaker Ethnicity ($p = 0.0048$), Interviewer Ethnicity ($p = 0.0247$), and their interaction was just under α for significance ($p = 0.0497$). This effect appears to be driven by a difference in just *flash* upward movements, as a separate model for only *flashes* shows the same significant effects and interaction, but stronger (see summary in Table 4, interaction in Figure 11). Meanwhile, none of the factors in the study had significant effects on the regressions predicting *raises* and *down* movements.

The models confirm that Māori speakers raised their eyebrows more often than Pākehā, and more often when speaking to the Māori interviewer. In Figure 10, it also seems that the Māori speakers flashed their brows *most* often of all when speaking Māori to the Māori interviewer. However, a model of just the bilingual data finds no significant

effect of *Language* on the rate of eyebrow *raises* or *flashes* ($p = 0.0725$), though it is fairly impoverished with just four data points for the Te Reo Māori interviews. As it is, the estimates trend strongly, but insignificantly, towards a higher rate accompanying the Māori language.

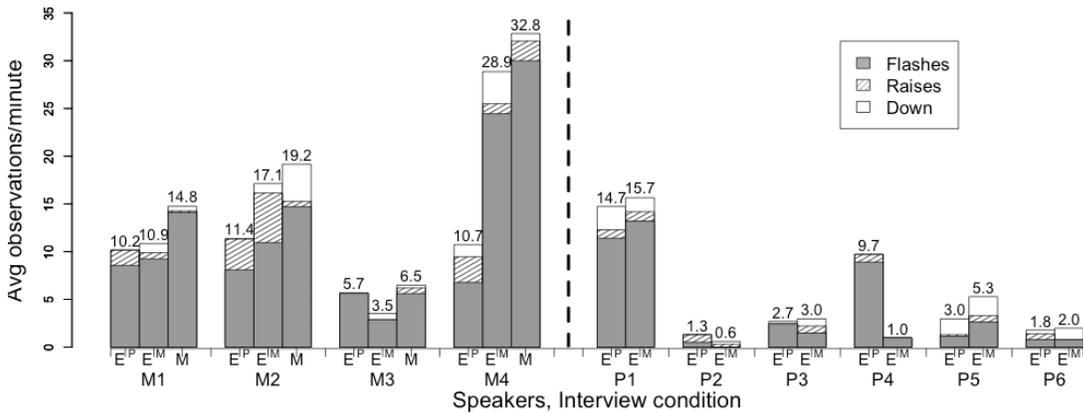


Figure 10. Eyebrow Comparison by Individual Speaker in each Interview Condition

Linear mixed model fit by maximum likelihood
 Flashes ~ SpeakerEth * IntrvwrEth+ (1|Speaker)
 Number of observations: 24, groups: Speaker, 10

Fixed effects:	β	SE	Z	p
(Intercept)	14.0	2.50	5.60	0.0000
SpkEth Pāk	-10.81	3.45	-3.13	0.0052 **
IntEth Pāk	-6.72	2.57	-2.62	0.0165
SpkP:IntP	7.75	3.53	2.19	0.0402 *

Table 4. Summary of linear model for rate of eyebrow flashes

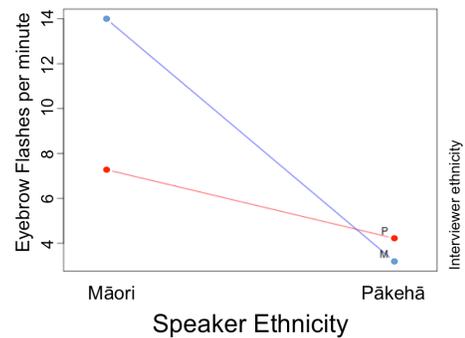


Figure 11. Plot of regression estimates for eyebrow flashes and interaction for eyebrow flashes and interaction between *Speaker* and *Interviewer Ethnicity*.

6 General Discussion

The study seeks to address whether (1) there are Māori-associated gestures and gestural features and (2) whether these are influenced by speaking Te Reo Māori. The distinction found in our data is primarily one of speaker ethnicity, which supports a positive response to question (1). Specifically, it was found that the Māori narrators employed flat-handed motion gestures, iconic narrative-illustrating head gestures, and eyebrow flashes significantly more often than the Pākehā participants. Evidence for question (2) is less clear, though a statistically insignificant trend existed for Māori language use to augment some of the ethno-culturally Māori-aligned tendencies. There were similar tendencies according to the interviewer ethnicity, such that more Māori-specific behaviour was produced when engaged with a Māori interviewer. However, the trends for both (i) interviewer ethnicity and (ii) the language spoken could not be confirmed in statistical models, because either the effect sizes were not significant (*Interviewer ethnicity*) or there were too few data points to yield a suitable analysis (*Language*; 4 speakers in two interviews with the Māori interviewer).

A central property of most gesture is non-conventionalised form (McNeill's "NO STANDARDS OF FORM", 1992, p. 22). Gesturing, thus, is not a codified system but a probabilistic one, tractable to quantitative examination (though constrained by the capacity to collect and annotate large enough samples of data). Yet, cross-cultural comparisons and descriptions of gesture production are more often qualitative than quantitative (Enfield, 2004; Kellerman & van Hoof, 2003; Kendon, 2004, Ch. 12-13; Sherzer, 1991). This body of research has born countless insights, for which much room exists for complementary quantitative investigation. To this end, we hope that the

analytic approach employed in this paper offers fruitful techniques for future such comparisons, as well as some insight into what may be less useful techniques.

A prominent issue for the statistical analysis of gesture is the idiosyncratic nature of gesture production (cf. Gullberg, 1998, Ch. 9; Hostetter & Alibali, 2007; Nagpal et al. 2011) – regardless of shared language, cultural background, and any myriad of contextual factors, personal style greatly shapes how and, particularly, how much people gesture. The regression models employed in this paper are suited to capture this interspeaker variation (via intercepts), as well as intraspeaker variation across contexts (via slopes) (Baayen et al., 2008). Our findings, while statistically robust despite this comparatively conservative approach, are limited by the number of observed speakers ($n = 10$), and should be extended to the wider Māori and Pākehā populations with appropriate caution.

There were no group differences between Māori and Pākehā in the rate of manual gestures. We contend that this negative finding does not so much reflect similar gesture rates across the groups as it illustrates inherent problems with the assumption that speech communities gesture at intrinsically high or low rates (see Kita, 2009 and discussion therein of Müller, 1998). A count of gestures depends firmly on the speaker style, the speech content, as well as the researcher's criteria for what constitutes a single gesture, such that it is not clear how generalizable an observed result for gesture rate is beyond the immediate communicative setting. Instead, differences in gesture rate are better suited to examining intra-speaker variation -- across topics and contexts (Bavelas et al., 1992), proficiency in bilinguals (reviewed in Nicoladis, 2007), or developmental age in children (Butcher & Goldin-Meadow, 2000).

Importantly, the differences between Māori and Pākehā speakers are not limited to statistical results. Quantitative analysis appropriately confirms certain aspects of these differences, but we do not contend the results above encapsulate the full extent of distinctions in the gestural style and repertoire employed by these speakers.

Elaborating on this point, two variables in the study were a type of head gesture and eyebrow raises. We counted and compared each of these behaviours separately as a way to operationalise tabulation, not because we believe the eyebrows and head operate in isolation. Rather, they serve as part of a dynamic whole that packages the brows and the head, but also gaze, eye widening and other facial displays to contribute to the discourse structure, narrative meaning, and social meaning of the speech act (Ekman, 1973, 1979).

It is compelling that many of the findings seem to be reflected in the established forms of the *pūkana* and the *wiri*, prevalent in Māori cultural practices (Kāretu, 1993). While we do not contend that the ritualised poses of *kapa haka* directly shape the gestures of the Māori participants in this study, the resemblance suggests that these elements (flat hands, raised eyebrows, widened eyes) are long-held and deeply entrenched aspects of a Māori non-verbal style.

It should be noted that the Māori participants in our study, necessarily bilingual and fluent speakers of Te Reo Māori, represent a select group of the New Zealand Māori population. As is often the case, these individuals are deeply involved in and committed to the local Māori community and all perform within *kapa haka* troupes. In contrast, the Pākehā participants in our study are assumed to be representative of the wider educated young, white male population of New Zealand.

Regardless, the findings indicate that a Māori kinesic “ethnolect” is shared by at least some ethnic Māori. The assumption is not that all Māori gesture in the manner described here, but do so to greater or lesser degrees in accordance with a range of possible influences from each individual's personal experience (as with spoken language, per Pierrehumbert, 2006; Harrington et al., 2005). Likewise, it is certainly not the case that eyebrow flashes, flat hands, and illustrative head gestures are exclusively used by Māori. But these actions form part of a more readily-called upon kinesic repertoire for Māori speakers. This understanding nicely parallels descriptions of the Māori English ethnolect, which is not signaled categorically by any particular feature, but by the concentrated use of certain forms found with most NZ English speakers (Holmes, 2005). Indeed, it is likely that verbal and kinesic ethnolects should not be regarded as separate. In this view, a Māori ethnolect is manifest not only in the commonly studied variationist domains such as phonetic implementation and lexical choice, but is also implemented via patterns of gestural repertoire and use.

While a considerable literature exists concerning cross-cultural differences in gesture, much of this work focuses on specific gestures, particularly quotable gestures, associated with specific cultural contexts (Brookes, 2001, 2004, 2011; Creider, 1977; Kita & Essegbey, 2001; among many). Our analysis of gestural patterns used by Māori and Pākehā in New Zealand is much broader, providing a clear case-study in which members of closely linked speech communities produce reasonably distinctive gestural dialects. While cross-cultural gesture is not usually studied in this way, we suspect that a substantial portion of culturally-grounded variation in gesture is in fact of exactly the sort

described in this paper: habitual tendencies in form that have different probabilistic distributions across different speech communities.

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