DE GRUYTER MOUTON Cognitive Linguistics 2021; 32(3): 455–486

John L. A. Huisman*, Roeland van Hout and Asifa Majid

Patterns of semantic variation differ across body parts: evidence from the Japonic languages

https://doi.org/10.1515/cog-2020-0079
Received July 9, 2020; accepted August 9, 2021; published online September 2, 2021

Abstract: The human body is central to myriad metaphors, so studying the conceptualisation of the body itself is critical if we are to understand its broader use. One essential but understudied issue is whether languages differ in which body parts they single out for naming. This paper takes a multi-method approach to investigate body part nomenclature within a single language family. Using both a naming task (Study 1) and colouring-in task (Study 2) to collect data from six Japonic languages, we found that lexical similarity for body part terminology was notably differentiated within Japonic, and similar variation was evident in semantics too. Novel application of cluster analysis on naming data revealed a relatively flat hierarchical structure for parts of the face, whereas parts of the body were organised with deeper hierarchical structure. The colouring data revealed that bounded parts show more stability across languages than unbounded parts. Overall, the data reveal there is not a single universal conceptualisation of the body as is often assumed, and that in-depth, multi-method explorations of understudied languages are urgently required.

Keywords: body parts; Japonic; Ryukyuan; semantic variation; semantics

1 Introduction

One of the central themes in cognitive approaches to language has been the use of metaphor and metonymy, in which existing semantic categories are used to conceptualise the world in new ways, by expressing one concept in terms of another. One of the most important source domains to do so is the human body

***Corresponding author: John L. A. Huisman**, Centre for Language Studies, Radboud University, Nijmegen, The Netherlands; and International Max Planck Research School, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, E-mail: j.l.huisman@let.ru.nl. https://orcid.org/0000-0002-8321-106X
Roeland van Hout, Centre for Language Studies, Radboud University, Nijmegen, The Netherlands
Asifa Majid, Department of Psychology, University of York, York, UK

(see e.g., Goossens 1990; Heine 1997; Lakoff 1987; Lakoff and Johnson 1999; Sweetser 1990). Numerous studies have explored possible metaphorical mappings, showing that terms for body parts can be extended beyond their basic referential use to express, for example, space (Heine 1997; Svorou 1993), emotion (Enfield and Wierzbicka 2002; Kövecses 2003), as well as knowledge, reasoning, social interactions, and values (Kraska-Szlenk 2014). While all natural languages make use of body parts in metaphor, it is also clear that languages differ in how particular body parts are recruited (Kövecses 2005). Nevertheless, embodied theories of meaning place the body at the centre of human cognition: "What is important is that the peculiar nature of our bodies shapes our very possibilities for conceptualization and categorization" (Lakoff and Johnson 1999: p. 19). As the human body serves as a primary source domain for languages to conceptualise the world, it is important to study how the body itself is conceptualised across different languages if we are to understand its broader use in cognition. The aim of this study is to broaden our understanding of variation in body part semantics through an in-depth empirical study of body part terminology in the Japonic language family.

Because of the central role of the human body, it goes without saying that all languages have terms for its parts. Some parts are considered so universal that they are included in basic vocabulary lists intended for translation (e.g., Greenhill et al. 2008; Swadesh 1952; Tadmor 2009). These approaches, however, assume that the parts are the same across languages. For example, the inclusion of 'nose' in most major basic vocabulary lists assumes it refers to the exact same part of face across languages, but this is not necessarily the case (e.g., Tarascan, Andersen 1978). Translation using putative "basic concepts" can provide a first view into a language's lexicon, but it can be misleading for establishing the exact referential meaning of a term (Majid 2019).

Nevertheless, one might expect considerable cross-linguistic similarities in the semantics of the body and its parts due to its significance, and early cross-linguistic studies on the semantics of body part terminology proposed several concepts as universals. Of these, 'the body' as a whole was considered the starting point for a hierarchically structured lexicon, in which each subsequent level consists of "parts of" the previous level (Andersen 1978; Brown 1976; see also Wierzbicka 2007). Other proposed universals include 'head' and 'hand' (Andersen 1978; Brown 1976; Wierzbicka 2007), as well as several parts of the face which has its own dedicated neural circuitry (Kanwisher et al. 1997)—e.g., 'eyes', 'nose' and 'mouth' (Andersen 1978; Wierzbicka 2007).

At the same time, different cultures conceptualize the world differently, and recent work in semantic typology provides reason to question the equivalence of body part terms across languages. A series of studies of unrelated languages found the body part lexicon is not universally organised in a hierarchical fashion (see contributions in Majid et al. 2006) contrary to previous claims (Andersen 1978; Brown 1976). In addition, the granularity of distinctions made for body parts varies across languages: some languages have a general term encompassing the arms and legs (Lavukaleve; Terrill 2006), and others lack a generic term but distinguish upper arm, lower arm, upper leg, and lower leg (e.g., Jahai, Burenhult 2006).

In another cross-linguistic study of body part categories, Majid and van Staden (2015) asked speakers of Japanese, Dutch, and Indonesian to colour in body parts. Although Japanese and Dutch both have terms that would be translation equivalents of ‘arm’, their extensional meaning was not equivalent—only one Japanese speaker included the ‘hand’ when colouring in *ude* ‘arm’, but Dutch participants did colour in the hand when prompted with *arm*. Interestingly, a similar pattern was not found for Dutch *been* ‘leg’, where the foot was less likely to be included, showing that parallelism between upper and lower limbs is not a given (contra Andersen 1978; Brown 1976). At the same time, other parts showed far less variation across languages (e.g., ‘eye’, ‘nose’, ‘forehead’), suggesting that some body parts may indeed be more universal than others. This suggests an urgent need to better understand both universals and variation in body part lexicons across languages.

The cross-linguistic work to date samples a diverse array of languages, leaving variation within related languages understudied. However, a recent study of semantic variation of body parts within the Germanic language family used a body part naming task, and found body parts display considerable similarity in closely related languages (Majid et al. 2015), although once again differences could be found for specific body parts (see, e.g., Levisen 2015). The current study aims to contribute to our understanding of semantic variation of body part vocabulary in related languages by studying the Japonic language family, which was chosen because of the considerable lexical (form) variation found for body parts in The Linguistic Atlas of Japan (National Institute for Japanese Language and Linguistics 1968).

The Japonic language family is spoken across the Japanese archipelago and consists of two major branches. The first branch, Japanese, comprises the varieties spoken on the four main islands and its surrounding islands. The Japanese branch is generally subdivided into Eastern, Western, Kyushu, and Hachijo Japanese (spoken on several islands south of Tokyo); see Shibatani (1990). The second major branch, Ryukyuan, includes the varieties spoken across the smaller islands in the south. Ryukyuan is generally subdivided into Northern Ryukyuan (Amami and Okinawa) and Southern Ryukyuan (Miyako, Yaeyama and Yonaguni)—see Pellard (2015). Previous work on the semantics of body part terms in Japanese have looked at diachronic change (e.g., in terms for ‘head’—Miyaji 1973, 1982), the role of body parts in conceptualising emotion (Hasada 2002) and space (Matsumoto 1999), and the extensional range of body part terms (Majid and van Staden 2015).

Rather than assume semantic equivalence, as in dictionary-based approaches, we collected new primary data from native speakers through two standardised tasks. In Study 1, we collected body part naming data from speakers of six languages: Standard Japanese and Tohoku Japanese (Eastern Japanese), which are among the most divergent mainland dialects (Huisman et al. 2019), plus four Ryukyuan languages, Amami, Okinawa, Miyako, and Yaeyama. Importantly, while Standard Japanese body part vocabulary has been the subject of experimental study previously (Majid and van Staden 2015), the Ryukyuan languages—which are lesser-described and endangered (Moseley 2010)—have not. This paper provides the first in-depth quantitative study of body parts within the Japonic language family. Next, in Study 2, we collected body part colouring-in data from five languages (Tohoku, Amami, Okinawa, Miyako, and Yaeyama), in which speakers were asked to colour in the range of various body part terms on a line drawing of the human body (see van Staden and Majid 2006). The use of standardised non-linguistic stimuli provides a frame of reference against which similarities and differences across languages can be systematically compared, and the combination of naming and colouring data provides converging evidence about the referential semantics of body part terminology.

We first aimed to establish how similar body part vocabulary is within the Japonic language family. We predicted that body part vocabulary would be more similar for languages that are more closely related, i.e., that variation in body part vocabulary reflects the overall geographical differences between the Japonic languages, and that speakers from the same language are more similar to each other. To address this hypothesis, we analysed the body part naming data from Study 1, examining both variation between languages, as well as variation between speakers.

Next, we investigated the body part lexicon by applying cluster analysis for the first time to body part naming data. We separately examined parts of the face and parts of the body, following the observation above that there may be less variation for the face than body. Since the parts of the face are generally well delimited, in contrast to the diverse principles along which the body can be divided (see Majid et al. 2006), we expected less variation in the extension of terms for parts of the face than body. To test this, we considered both semantic distinctions and lexical (form) variation (Study 1).

In addition, we also investigated the semantic extension of face and body part terms in Study 2. While the naming task provides us with some information about the extension of the terms elicited, competition between terms at different levels of granularity can obscure the complete picture. So, we collected additional data by asking speakers to colour in face and body parts in a drawing of the human body, providing us with a common frame through which we could directly compare the extension of specific terms.

2 Study 1: Body part naming task

2.1 Methods

2.1.1 Languages and speakers

Data for the body part naming task was collected from 66 speakers in six language areas (two Japanese and four Ryukyuan) during four fieldtrips conducted between 2017 and 2019. For all areas, data was collected from multiple localities, i.e., in multiple dialects. Apart from Tokyo Japanese, which serves as the *de facto* national standard, there is no standardised variety of Tohoku Japanese or the Ryukyuan languages (Heinrich et al. 2015). As such, we will refer to Tokyo Japanese as "Standard Japanese", and use the term "language area" for the other five varieties for the remainder of this paper, e.g., the Amami language area. Given the endangered status of Ryukyuan, the data was collected from elderly native speakers, some of whom had little experience in performing standardised linguistic elicitation tasks, so some interview sessions were conducted with multiple speakers simultaneously. To minimise potential confounds, all analyses were conducted on sessions rather than speakers—see also Section 2.1.3. Table 1 shows information about the number of speakers and sessions per language area.

Table 1: Speaker and session information for body part naming task.

Japanese	
Tokyo	8 speakers (6 female) in 8 sessions
Tohoku	8 speakers (3 female) in 8 sessions
Ryukyuan	
Amami	17 speakers (7 female) in 12 sessions
Okinawa	7 speakers (3 female) in 4 sessions
Miyako	18 speakers (11 female) in 16 sessions
Yaeyama	8 speakers (5 female) in 8 sessions

2.1.2 Materials and procedure

Data was collected using 52 line drawings of the human body: 39 showed the full human body from the front and back, and 13 depicted the head and face (see Figure 1). In each drawing, a red dot was placed somewhere on the body, and participants had to say where the dot was located. The drawings were presented in three blocks: a first block of 39 drawings of the full body, a second block of 10 drawings of the head with the mouth closed, and a third block of three drawings of the head with the mouth opened. The presentation order of the blocks was kept constant across speakers, but stimuli were presented in two fixed orders—one the reverse of the other—within each block, which was randomised across speakers. This stimulus set was newly created for this project, but was inspired by earlier stimuli (Majid et al. 2010). Figure 1 consolidates the separate drawings into a single image, with stimulus order indicated.

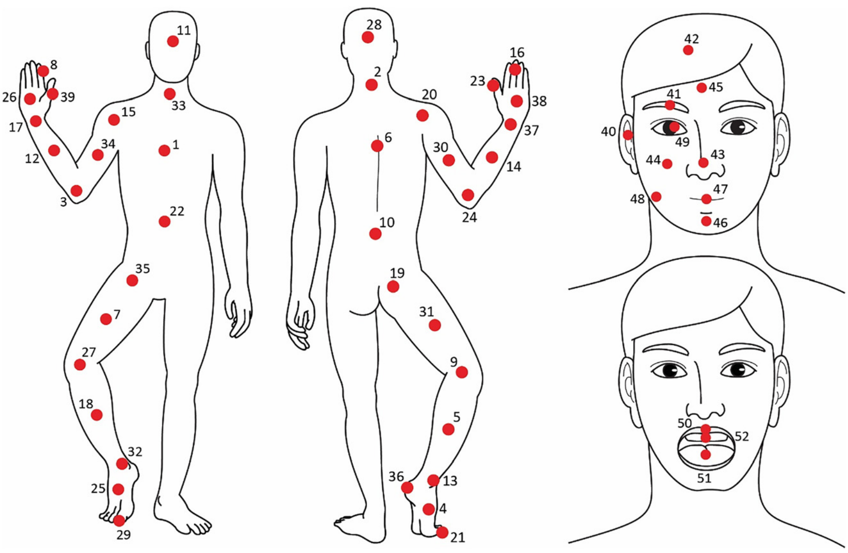


Figure 1: Stimuli used in the naming task. In the elicitation task, only one dot appeared in each figure, and participants had to identify where the dot was located.

Speakers saw the drawings one by one on a tablet, i.e., they saw one red dot at a time, and were asked to name the body part marked by the red dot, by answering the question "What is the place of the red dot called?". Speakers could give responses of any length. All sessions were minimally audio-recorded, and sometimes video-recorded for later transcription. Speakers gave informed consent before participating. Data collection was approved by the Ethics Assessment Committee of the Centre for Language Studies at Radboud University.

2.1.3 Coding

We extracted, per session, the full response(s) for each stimulus, which could include multiple responses. In sessions with multiple speakers, we coded all unique responses, i.e., if two speakers named the stimulus differently, we coded both responses. Next, we coded main response(s) using the following coding scheme: main responses were monolexemic responses (e.g., English *arm*) and polylexemic responses that are conventionalised and untransparent (e.g., English *forearm*). Locatives such as left/right, front/back, upper/lower were excluded when they were compositional and transparent (e.g., the meaning of English *upper arm* can be derived from the elements *upper* and *arm*, so only *arm* was coded). If the meaning of combined elements referred to a different body part which could not be reduced to a single element (e.g., English *between the eyes*), the full response was coded. There were not many such cases in the Japonic data: two in Standard Japanese and one in the Amami language area, and none in the other four language areas.

2.2 Results

2.2.1 Regional and individual variation of body part vocabulary in Japonic

The first aim of the current study was to establish the variation in body part lexicons of related languages. To assess this, we ask whether body part vocabulary is more similar for languages that are more closely related. We investigated variation by comparing individual sessions to each other, hypothesising that sessions from the same language area would be more similar than sessions from another language area.

We created a session-by-stimulus matrix in which we coded the main responses for cognacy—i.e., whether the main responses have a common etymological origin. For example, stimulus 22 (‘belly’), received the monolexemic responses *o-naka* (Standard Japanese), *hara* (Tohoku) and *wata ~ bata* (Ryukyuan). These were coded as *belly-A*, *belly-B* and *belly-C*, respectively because none of these are cognate. For polylexemic responses, we coded the cognacy of individual elements. As the focus of the current study is body part vocabulary, only content elements were coded for cognacy, and so case marking particles and the copula were excluded in the coding. So, for example, the elements in the Standard Japanese response *aɕi=no oja.jubi* [leg=GEN parent.digit] to stimulus 29 (‘big toe, front’) were coded as *leg-A*, *parent-A* and *digit-A*, whereas the elements in the Yaeyama response *paɴ=nu bu:.jubi* [leg=GEN large.digit] were coded as *leg-B*, *large-A* and *digit-A*. In cases where there were multiple, (partially) overlapping responses, each element was only counted once.

Next, we used the session-by-stimulus matrix in a series of pairwise comparisons to assess the similarity between sessions. The analysis was conducted in

GABMAP (Nerbonne et al. 2011), an online tool for dialectometry. For each pair of sessions, cognacy overlap was calculated using the Jaccard Index (*J*; Jaccard 1901, 1912) for each stimulus separately. Thereafter, the mean cognacy overlap over all stimuli was taken as a general measure of similarity between sessions. Doing this for all sessions creates a session-by-session similarity matrix that we analysed with multidimensional scaling, as well as cluster analysis using Ward's method (Ward 1963), both in base R (*cmdscale* and *hclust* functions, R Core Team 2020).

Figure 2 shows the results of the multidimensional scaling analysis, and reveals Tohoku and Standard Japanese sessions were much closer to each other than the Ryukyuan sessions—average similarity between the mainland Japanese sessions was $M_J = 0.65$ ($SD = 0.09$), whereas average similarity between the Ryukyuan sessions was $M_J = 0.48$ (SD = 0.10). The Amami sessions showed a wide spread, suggesting more variation in that language area in particular. Some Amami sessions showed similarities to both the Japanese mainland and others to Ryukyuan sessions. Several Yaeyama sessions also fell in between the Northern and Southern Ryukyuan sessions. Miyako sessions appeared to be the most divergent.

A cluster analysis (Figure 3) of the same data recapitulated the results of the multidimensional scaling for the most part. Mainland sessions (Japanese and Tohoku) were grouped together and most Ryukyuan sessions (Amami, Okinawa, Miyako and Yaeyama) grouped together, roughly corresponding to the results of the multidimensional scaling analysis (Figure 2). In addition, the cluster analysis shed further light on distinctions within subgroups. Within the mainland cluster, all Standard Japanese and Tohoku sessions were grouped separately and within the Tohoku cluster, two subgroups were distinguished that correspond largely to

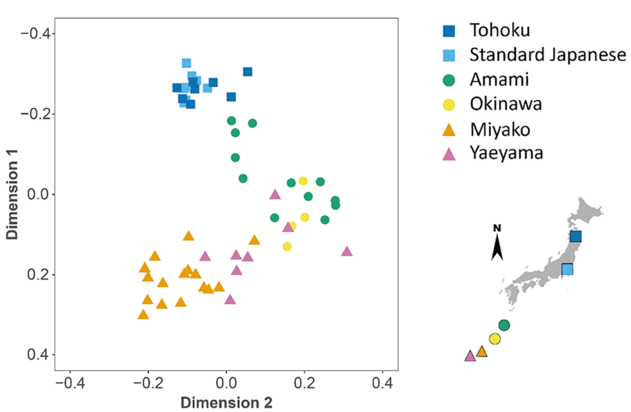


Figure 2: Multidimensional scaling analysis of body part naming data, left. Each symbol represents a session. Plotting the second dimension on the *x*-axis and the first dimension on the *y*-axis roughly recreates the geographic layout of the language area, shown bottom right.

the traditional division between Nambu dialects (Hachinohe) and Tsugaru dialects (Aomori and Hirosaki). Consistent with the multidimensional scaling analysis, four Amami sessions grouped together with the mainland clusters. Closer inspection revealed these speakers to be some of the youngest in the sample, and they used several Standard Japanese terms not generally used in the Ryukyuan languages (e.g., *çiza* for 'knee' rather than *tsubusɨ*, and *kakato* for 'heel' rather than *ado*). Within Ryukyuan, there was a large cluster of sessions from the Northern Ryukyuan area, split into an Amami subgroup and a distinct Okinawa subgroup. Finally, there was a large cluster of only Southern Ryukyuan sessions, split into a subgroup of all Miyako sessions plus a single Yaeyama session, and another subgroup of the remaining Yaeyama sessions.

Overall, the multidimensional scaling and cluster analyses show body part naming data largely reflect the geographical differences between the Japonic languages (see e.g., Pellard 2015; Shibatani 1990), with individual sessions mirroring larger patterns of variation. In addition, the Japanese mainland varieties resembled each other more than the Ryukyuan varieties (see also e.g., Huisman et al. 2019). We return to the high variability of Ryukyuan in the General Discussion.

2.2.2 Semantic distinctions in parts of the face and parts of the body

We next examined the lexicon for parts of the face and parts of the body for all Japonic languages as a whole. To do this, for each language area, we create a stimulus-by-cognate frequency matrix where, for each stimulus, we coded how often per session a stimulus was described by each cognate term in the naming task. We calculated, for each pair of stimuli, the cosine similarity based on naming responses—in R; *cosine* function in the *lsa* package (Wild 2015). Doing this for all stimulus pairs creates a stimulus-by-stimulus similarity matrix that encodes, for each language area, the body part categories and the relationship between them. To generate an overall frame of reference that covers the common structure of the body part lexicon across the Japonic language family as a whole, we averaged the six stimulus-by-stimulus similarity matrices to create a single overall matrix, on which we performed cluster analysis using Ward's method in base R (*hclust* function). While this analysis does not provide language-specific body partonomies, it does provide a common frame of reference by which we can compare across languages. The cluster analyses can be taken to reveal a covert conceptual structure common to the Japonic languages considered here (cf. Majid et al. 2008).

We conducted separate cluster analyses for the face and the body. These analyses showed that the naming data for the face had a relatively flat structure with few embedded subclusters (Figure 4), but the naming data for the body

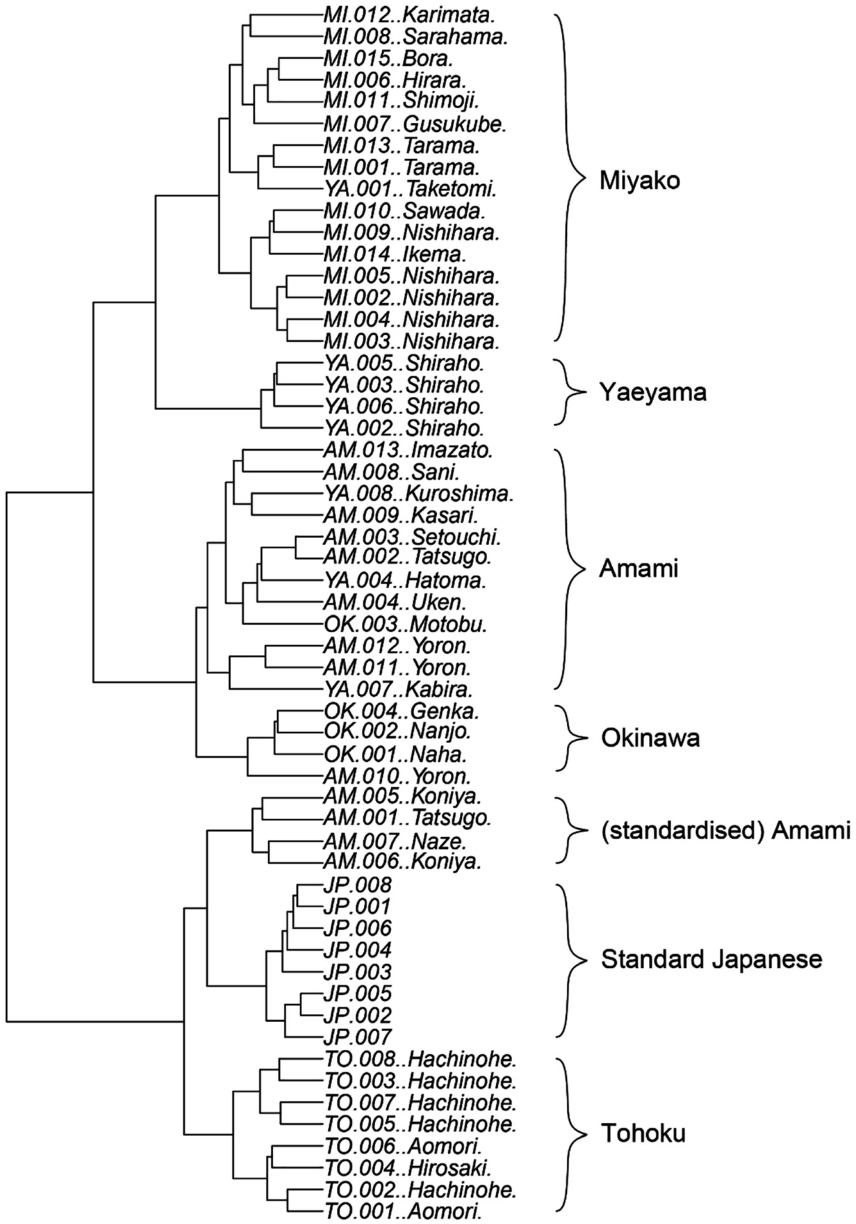
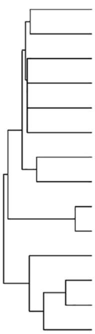
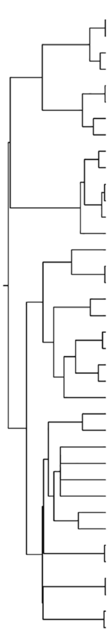


Figure 3: Cluster analysis of body part naming data by session recapitulates language areas.



	Lexical similarity	Standard Japanese	Tohoku	Amami	Okinawa	Miyao	Yaeyama
hair	M_{cos} = .210	*kami*	*kami*	*kamatsɨ*	*karadʑi*	*aka*	*amadʑi*
forehead	M_{cos} = .254	*çitai*	*nandzugi*	*mittɕu*	*çitɕe:*	*futai*	*futeɴ*
tongue	M_{cos} = .689	*ɕita*	*bero*	*ɕitɕa*	*ɕiba*	*sɨta*	*ɕita*
tooth	M_{cos} = .845	*ha*	*ha*	*ha*	*ha:*	*pa:*	*futsɨ nu paɴ*
nose	M_{cos} = .996	*hana*	*hana*	*hana*	*hana*	*pana*	*pana*
ear	M_{cos} = .960	*mimi*	*mimi*	*miɴ*	*mimi*	*mim*	*misɨkurumiɴ*
eye	M_{cos} = .833	*me*	*managu*	*mɨ*	*mi:*	*mi:*	*miɴ*
eyebrow	M_{cos} = .708	*majuge*	*konoŋe*	*maju*	*mi:maju*	*maju*	*maju*
mouth	M_{cos} = .986	*kutɕi*	*kudzi*	*kutɕi*	*kutɕi*	*futsɨ*	*futsɨ*
lip	M_{cos} = .701	*kutɕibiru*	*kudzibiru*	*kutɕibiru*	*kutɕibiru*	*sɨba*	*supa*
chin	M_{cos} = .669	*ago*	*odoŋɛ*	*agu*	*utuge:*	*utugai*	*agu*
jaw	M_{cos} = .279	*ago*	*aŋo*	*agu*	*kakudʑi*	*kamagita*	*mutɕi*
cheek	M_{cos} = .361	*ho:*	*hoppeda*	*fu:*	*fu:dʑira*	*kamatsɨ*	*mutɕi*
face	M_{cos} = .317	*kao*	*tsura*	*tsɨra*	*tɕira*	*mipana*	*mutɕi*

Figure 4: Cluster analysis of the face stimuli, with average lexical (form) similarity (calculated using cosine distances), and the most commonly elicited cognate for each language variety.



	Lexical similarity	Standard Japanese	Tohoku	Amami	Okinawa	Miyako	Yaeyama
upper arm (front)	M_{cos} = .581	*ni no ude*	*u^{n}de*	*ˀudɨ*	*ke:na*	*udi*	*(ti: nu) udi*
upper arm (back)	M_{cos} = .615	*ni no ude*	*u^{n}de*	*ˀudɨ*	*ke:na*	*udi*	*(ti: nu) udi*
lower arm (front)	M_{cos} = .728	*ude*	*u^{n}de*	*tɨ*	*ti:*	*udi*	*ti: / udi*
lower arm (back)	M_{cos} = .712	*ude*	*u^{n}de*	*tɨ*	*ti:*	*udi*	*ti: / udi*
wrist (front)	M_{cos} = .968	*tekubi*	*teku^{m}bi*	*tɨɴkubi*	*ti: nu kubi*	*ti:fug^{z}ɨ*	*ti: nu kubi*
wrist (back)	M_{cos} = .960	*tekubi*	*teku^{m}bi*	*tɨɴkubi*	*ti: nu kubi*	*ti:fug^{z}ɨ*	*ti: nu kubi*
hand (palm)	M_{cos} = .785	*te no çira*	*te no sura*	*tɨɴçira*	*ti: nu wata*	*tibɨdza*	*ti: nu pisa*
hand (back)	M_{cos} = .774	*te no ko:*	*te no ko*	*tɨɴko:*	*ti: nu ˀura*	*ti:*	*ti: nu pisa*
middle finger (back)	M_{cos} = .878	*jubi*	*ju^{m}bi*	*ˀibɨ*	*ˀi:bi*	*uibi*	*ti: nu:bi*
index finger (front)	M_{cos} = .803	*çitosaɕijubi*	*ju^{m}bi*	*ˀibɨ*	*saɕiˀi:bi*	*uibi*	*ti: nu:bi*
thumb (front)	M_{cos} = .838	*ojajubi*	*ojaju^{m}bi*	*ˀujaˀibɨ*	*ˀufuˀi:bi*	*upuuibi*	*bu:jubi*
thumb (back)	M_{cos} = .827	*ojajubi*	*ojaju^{m}bi*	*ˀujaˀibɨ*	*ˀufuˀi:bi*	*upuuibi*	*ti: nu bu:jubi*
big toe (front)	M_{cos} = .828	*aɕi no ojajubi*	*asu no ojaju^{m}bi*	*ˀujaˀibɨ*	*çisa nu ˀi:bi*	*pag^{z}ɨ nu upuuibi*	*paɴ nu bu:jubi*
little toe (back)	M_{cos} = .602	*tsumasaki*	*asu no ju^{m}bi*	*hagiɴˀibɨ*	*çisa nu ˀi:bi*	*pag^{z}ɨ nu uibi*	*paɴ nu:bi*
hip joint	M_{cos} = .320	*aɕi no tsukene*	*asu no tsukene*	*hagiɴtsukene*	*mata*	*mumuni*	*paɴ nu ni:*
upper leg (front)	M_{cos} = .764	*futomomo*	*momota*	*mumu*	*mumu*	*mumuni*	*mumu*
upper leg (back)	M_{cos} = .772	*futomomo*	*momota*	*mumu*	*mumu*	*mumuni*	*mumu*
lower leg (front)	M_{cos} = .555	*sune*	*sune*	*sunɨ*	*kuɴda*	*karasɨni*	*paɴ*
lower leg (back)	M_{cos} = .489	*fukurahagi*	*fukurahaŋi*	*hagi*	*kuɴda*	*kuvva*	*paɴ nu taru*
ankle (inner)	M_{cos} = .402	*aɕikubi*	*kuru^{m}busu*	*haginkubi*	*çisakubi*	*amambuni*	*paɴ (nu katu)*
ankle (outer)	M_{cos} = .388	*aɕikubi*	*asuku^{m}bi*	*kurubuɕi*	*çisakubi*	*amambuni*	*paɴ (nu *)*
foot (instep)	M_{cos} = .356	*aɕi no ko:*	*asu no ko*	*hagiɴko:*	*çisa*	*ssabidʑa*	*paɴ nu pisa*
foot (sole)	M_{cos} = .268	*aɕi no ura*	*asu*	*hagi*	*çisawata*	*p^{s}isa*	*paɴ nu pisa*
heel	M_{cos} = .348	*kakato*	*agudo*	*ˀado*	*ˀadu*	*adu*	*paɴ nu adu*
throat	M_{cos} = .643	*kubi / nodo*	*no^{n}do*	*nudɨ*	*nu:di:*	*nudu*	*nudu*
neck (back)	M_{cos} = .528	*kubi*	*bonnogo*	*kubi*	*kubi*	*nubui*	*nubuɕiɴ*
head (back)	M_{cos} = .090	*ko:to:bu*	*usuroko^{n}do*	*kamatɕi*	*ˀuɕi nu kubu:*	*ussɨ*	*ussoɴ*
chest	M_{cos} = .899	*mune*	*mune*	*munɨ*	*ɴni*	*mmivtsɨ*	*ɴni*
belly ; navel	M_{cos} = .476	*onaka ; heso*	*hara ; hettɕo*	*wata ; fuɕu*	*wata ; fusu*	*bata ; m:bu*	*bata ; putsu*
buttocks	M_{cos} = .175	*oɕiri*	*kettsu*	*mari*	*tɕibi*	*tɕibi*	*ɕipi*
lower back	M_{cos} = .803	*koɕi*	*kosu*	*kusɨ*	*kuɕi*	*kusɨ*	*buɕa*
upper back	M_{cos} = .450	*senaka*	*senaga*	*kusɨ*	*nagani*	*kusammi*	*futɕa*
shoulder (front)	M_{cos} = .961	*kata*	*kada*	*kata*	*kata*	*katamusɨ*	*kata*
shoulder (back)	M_{cos} = .935	*kata*	*kada*	*kata*	*kata*	*katamusɨ*	*kata*
elbow (front)	M_{cos} = .924	*çi^{d}ʑi*	*su^{n}dzu*	*çidzɨ*	*çidʑi*	*pidzɨ*	*pitɕi*
elbow (back)	M_{cos} = .952	*çi^{d}ʑi*	*su^{n}dzu*	*çidzɨ*	*çidʑi*	*pidzɨ*	*pitɕi*
knee (front)	M_{cos} = .462	*çi^{d}za*	*su^{n}dzaka^{m}bu*	*tsɨbusɨ*	*tɕiɴɕi*	*tsɨgusɨ*	*sɨpuɕiɴ*
knee (back)	M_{cos} = .435	*çi^{d}za*	*su^{n}dzaka^{m}bu*	*tsɨbusɨ*	*tɕiɴɕi*	*tsɨgusɨ*	*sɨpuɕiɴ*

Figure 5: Cluster analysis of the body stimuli, with average lexical (form) similarity (calculated using cosine distances), and the most commonly elicited cognate for each language variety.

exhibited a deeper hierarchy, with clusters embedded within higher-order clusters (Figure 5).

Overall, speakers of all languages tended to distinctly name ‘hair’, ‘forehead’, ‘tongue’, ‘tooth’, ‘nose’, ‘ear’, ‘eye’, ‘eyebrow and ‘mouth’, although there were a few exceptions to this. First, ‘eye’ and ‘eyebrow’ were grouped together because some Amami and Okinawa varieties used the lexeme for ‘eye’ in a polylexemic term for ‘eyebrow’—as in English. Second, the terms ‘mouth’ and ‘lips’ showed a closer relationship as many varieties used the lexeme for ‘mouth’ in a polylexemic term for ‘lips’. In addition, there was a subgroup comprising ‘face’, ‘cheek, ‘jaw’ and ‘chin’, as some Ryukyuan varieties did not distinguish between ‘face’ and ‘cheek’, and Standard Japanese did not distinguish ‘chin’ from ‘jaw’. Moreover, while most non-standard varieties had a separate term for ‘chin’, not all speakers used it. Finally, the ‘cheek’ and ‘jaw’ stimuli received similar responses in some sessions, which could be due to the placement of the red dot, which led to varied interpretations of these stimuli across sessions.

In contrast to the high level of distinctness found for parts of the face, Figure 5 revealed a deeper hierarchical relationship between parts of the body. There were four major subgroups: the upper limb (arm and hand), the digits (fingers and toes), the lower limb (leg and foot), the torso (its various parts), as well as some joints as separate subgroups (shoulder, elbow, knee).

Within the upper limb subgroup, the upper and lower arm were distinct from the hand and wrist. For the hand, speakers from all varieties except those from the Yaeyama language area distinguished the palm and the back of the hand—albeit through polylexemic responses for both. Distribution of the modal (most frequent) responses suggests the upper limb parts are lexicalised differently across language areas (see Figure 6). Responses belonging to the *te* cognate set responses were elicited for all parts of the upper limb across the Ryukyuan varieties, whereas they were restricted to the hand in the mainland varieties. In contrast, responses belonging to the *ude* cognate set were elicited for the upper and lower arm (lower arm only for Okinawa), but never the hand. Yaeyama speakers (of the Shiraho variety in particular) were the only ones to use the genitive construction *ti:=nu udi* when describing the upper or lower arm. Finally, responses belonging to the *kaina* cognate set (elicited in Tohoku, Amami, Okinawa and Miyako) also showed variation: they only appeared for the upper arm in Amami and Okinawa, but for both the upper and lower arm in Tohoku and Miyako where the term was used interchangeably with *ude*-type responses. For Tohoku, this appears to be individual speaker variation, but for Miyako it was more systematic with some varieties only using *udi*, whereas others only using *kaina*.

Moving to the digits, all varieties used cognate forms for fingers and toes, with the toes more likely to be named with the genitive construction *lower limb=GEN*

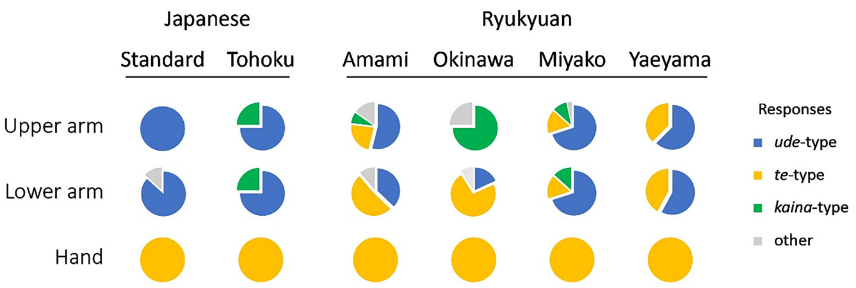


Figure 6: Main response types for the upper limb across the Japonic languages.

digit. In addition, speakers of the mainland varieties also used variants of the compound *tsuma.saki* to describe toes, but never fingers. Finally, there was some variation between speakers in whether they named specific digits distinctly, with the thumbs and big toe more likely to be named with a dedicated polylexemic term.

In general, the individual parts of the lower limb were named with specific terms. That there are distinct terms for the front and back of the lower leg, but not for the front and back of the arm, suggests that there is finer-grained naming for the lower limb than upper limb in the Japonic languages. The core set of cognates was fairly similar across the language areas (Figure 5), and often occurred with language-specific affixes, e.g., *momo.ta* ‘upper leg’ in Tohoku (cf. *momo* ‘upper leg’ in Standard Japanese) or *kara.suni* ‘front of the lower leg’ in Miyako (cf. *sune* ‘front of the lower leg’ in Standard Japanese). Three cognate sets meaning ‘lower limb’ (*aɕi* ~ *asü*; *hagi* ~ *pag*^{z}*ɨ* ~ *paɴ*; and *çisa*) were elicited either monolexemically or as part of a compound or genitive construction (see Figure 7). In the latter case, Ryukyuan speakers were more likely to use a term referring to the entire lower limb when naming its different subparts—either in a monolexemic responses or as *lower limb=GEN [part]*. Yaeyama speakers in particular tended to use this genitive construction, mirroring naming for the upper limbs. The use of a ‘leg’ term for thigh and hip suggests that speakers extend its meaning across the entire lower limb. Only Miyako and Yaeyama speakers seem to distinguish between ‘leg’ and ‘foot’, both using *pisa* for the foot.

Within the torso subgroup, ‘head’, ‘chest’, ‘belly’, ‘navel’ and ‘buttocks’ were all distinctly named across the six language areas. For some parts there was considerable lexical variation (e.g., Standard Japanese *atama*; Tohoku *adama*; Amami *kamatsɨ*; Okinawa *tɕiburu*; Miyako *kanamai*; and Yaeyama *amasi̥kuru* for ‘head’) whereas for others there was less (e.g., for Stadnard Japanese *heso*; Tohoku *hettɕo*; Amami *fuɕu*; Okinawa *fusu*; Miyako *m:bu*; and Yaeyama *putsõ:* for ‘navel’). The front of neck (‘throat’) was often named separately, but some speakers named

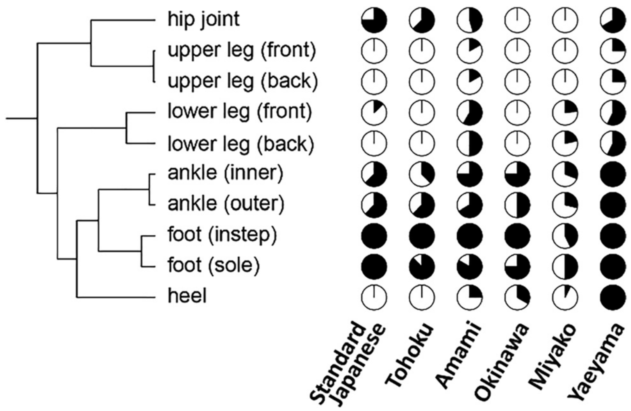


Figure 7: Proportion of sessions in which a term that refers to the lower limb as a whole was used in responses describing its subparts (in black).

it using the same term they also used for the back of the neck. The upper and lower back were distinguished in most varieties (except most Amami varieties), which suggests a clean subdivision between the two, rather than a part-whole relationship.

Finally, three joints turned up as separate branches in the cluster analysis, two of which showed high form similarity across the entire Japonic language family. Only one cognate is used to describe the shoulder across all sessions (e.g., Standard Japanese *kata*; Tohoku *kada*; Amami *kata*; Okinawa *kata*; Miyako *katamusɨ*; Yaeyama *k̥ata*). The elbow is also named with a single cognate set across all sessions (e.g., Standard Japanese *çi*^{d}*ʑi*; Tohoku *çi*^{n}*dzï*; Amami *çidzɨ*; Okinawa *çidʑi*; Miyako *pidzɨ*; Yaeyama *p̥itɕi*). There were two cognate sets for the knee, distributed between the mainland varieties (Standard Japanese *çi*^{d}*za*; Tohoku *çi*^{n}*dʑaka*^{m}*bü*), and the Ryukyuan varieties (Amami *tibuɕi̥*; Okinawa *tɕiɴɕi*; Miyako *tsɨgusɨ*; Yaeyama *sɨ̥puɕiɴ*).

Overall, our results suggest that parts of the face showed a relatively flat hierarchy with little variation between languages, whereas parts of the body were organised in a more hierarchical structure with relatively more variation between languages.

2.2.3 Lexical similarity in terms for face and body parts

The previous section showed differences in the hierarchical structure of face and body parts in the Japonic language considered as a whole. In addition, while some parts were described with cognate terms, others showed more variation in forms.

To investigate whether face parts show more lexical similarity than body parts, we measured lexical similarity—i.e., degree of overlap between terms used for each part—by calculating the cosine similarities between all language pairs for each stimulus, using the *cosine* function in the *lsa* package (Wild 2015). If two languages used the same cognates to name a stimulus, the cosine similarity was 1, and if they used different cognates, 0 (see Table 2).

Table 2: Lexical similarity (the degree of overlap between languages in terms used; M_{cos}) for face and body parts, calculated as the mean cosine similarity between all language pairs for each stimulus.

Face		Body			
	M_{cos}		M_{cos}		M_{cos}
Nose	0.996	Wrist (front)	0.968	Neck (front)	0.643
Mouth	0.986	Shoulder (front)	0.961	Upper arm (back)	0.615
Ear	0.960	Wrist (back)	0.960	Little toe	0.602
Tooth	0.845	Elbow (back)	0.952	Upper arm (front)	0.581
Eye	0.833	Shoulder (back)	0.935	Lower leg (front)	0.555
Eyebrow	0.708	Elbow (front)	0.924	Neck (back)	0.528
Lip	0.701	Chest	0.899	Lower leg (back)	0.489
Tongue	0.689	Middle finger	0.878	Belly	0.476
Chin	0.669	Thumb (front)	0.838	Knee (front)	0.462
Cheek	0.361	Big toe	0.828	Upper back	0.450
Face	0.317	Thumb (back)	0.827	Knee (back)	0.435
Jaw	0.279	Lower back	0.803	Ankle (inner)	0.402
Forehead	0.254	Index finger	0.803	Ankle (outer)	0.388
Hair	0.210	Hand (palm)	0.785	Foot (instep)	0.356
		Hand (back)	0.774	Heel	0.348
		Thigh (back)	0.772	Hip joint	0.320
		Thigh (front)	0.764	Foot (sole)	0.268
		Lower arm (front)	0.728	Buttocks	0.175
		Lower arm (back)	0.712	Head (back)	0.090

There was no significant difference between the lexical similarity for parts of the face (M_{cos} = 0.63, SD = 0.29) and parts of the body (M_{cos} = 0.64, SD = 0.24), $t(50) = 0.12$, $p = 0.9$, contrary to the prediction that face parts may be more similar.

2.3 Summary

We found body part vocabulary between languages was more similar the more closely related and physically closer the languages. The multidimensional scaling analysis largely recapitulated the geographic layout of the Japonic language family, except for Miyako. The distinctness of Miyako within the body part domain is likely the result of a combination of lexical innovations (e.g., *kanamai* for 'head', *mipana* for 'face'), and semantic innovations (e.g., a distinct 'foot' category).

We also compared parts of the face with parts of the body, addressing both the semantic organisation of the lexicon and lexical similarity between forms. We found that parts of the face had a relatively flat hierarchy, whereas parts of the body were organised in a more hierarchical structure. The modal responses also show that face parts were generally named using monolexemic terms, whereas polylexemic terms were more common for body parts. The use of polylexemic terms partially contributed to the hierarchical structure of body parts, especially in cases where genitive constructions (e.g., limb=GEN digit) were used. In addition, some speakers chose to be more specific in naming body parts (e.g., 'thigh' instead of 'leg'), perhaps because of pragmatic pre-emption.

Lexical partonomies have been constructed for individual languages previously on the basis of part-whole judgements, e.g., asking people if the *hand is part of the arm* (cf. Anderson 1978; Brown 1976; Cruse 1986). However, researchers disagree about whether this is really the best principle by which to construct body partonomies. Some researchers have argued that body parts are not organised in terms of part-whole relations, but in terms of possession (e.g., *the hand has fingers*, see, e.g., van Staden 2006; Swanson and Witkowski 1977), or alternatively using spatial relations instead (Majid 2006; Palmer and Nicodemus 1985). There is considerable variation across languages in how to best construct body partonomies or even whether such partonomies are possible in the first place (cf. contributions in Majid et al. 2006; Ponsonnet 2011).

The approach taken here is quite different. We uncovered a (covert) hierarchical structure by applying cluster analysis to our naming data. To our knowledge, this is the first time this has been done in this way (cf. Crowe and Prescott 2003). We believe this opens interesting possibilities for future cross-linguistic work on body part categorisation as it does not require asking people to make explicit linguistic judgements or presuming a specific type of relation between words. We return to this in the General Discussion.

Finally, we did not find that the amount of lexical similarity differed between parts of the face and body, despite the earlier suggestion that face parts may be more stable. Within parts of the face, we see highest lexical similarity for bounded parts (i.e., nose, mouth, ear, and eye), whereas for parts of the body, lexical similarity was generally highest for parts of the upper limb.

3 Study 2: Colouring-in of body parts

Study 1 provided information about how a part is named. However, the same part can be named at different levels of granularity and the nature of the naming task results in a choice between choosing specific terms (e.g., *thigh*) or generic terms (e.g., *leg*), limiting the ability to establish the exact extension of body part terms. Therefore, Study 2 asked speakers to colour in a pre-established list of body part terms on a drawing of the body, to provide further information about the extension of each term.

3.1 Methods

3.1.1 Speakers

Data for the colouring-in task was collected from 37 speakers in five language areas (one Japanese and four Ryukyuan) during a single fieldtrip in 2019. As with the naming task, data was collected from multiple localities, i.e., in multiple dialects. Where possible, speakers had not participated in the naming study, although this was not always possible (given the endangered status of Ryukyuan). As with Study 1, some interview sessions were conducted with multiple speakers, as some elderly native speakers had little experience in performing standardised linguistic elicitation tasks, so analyses were conducted on sessions (see Table 3). In some sessions, younger family members helped with use of the tablet (see Section 3.1.2) but these are not included in the speaker counts in Table 3.

3.1.2 Materials and procedure

Data was collected using the blank line drawings of the human body used in Study 1 (Figure 1). Two drawings were used: a unitary image of the front and back views of

Table 3: Speaker and session information for body part colouring in task.

Japanese	
Tohoku	8 speakers (4 female) in 7 sessions
Ryukyuan	
Amami	7 speakers (3 female) in 4 sessions
Okinawa	10 speakers (6 female) in 6 sessions
Miyako	7 speakers (3 female) in 6 sessions
Yaeyama	5 speakers (2 female) in 4 sessions

the whole body, and a close-up image of the head/face with the mouth closed. We selected several terms of interest from each subgroup of the cluster analysis from Study 1 (see Table 4). We did not restrict our choice to terms that were modal responses across all language areas, but instead chose cognate terms and non-modal terms if these were of relevance to the current study (e.g., terms that are cognate with Okinawa *ke:na* were used in other language areas as well, but not frequently). We excluded joints and digits for further elicitation.

The task was performed on an iPad Pro tablet using an Apple Pen stylus using the Adobe Photoshop Sketch app. The blank line drawings of the human body were used as the background layer of an image file. All colouring was done in a single file with multiple layers, with a separate layer used for each prompt. After completing the colouring for a given prompt, the layer containing that colouring was hidden and a new layer was created, so that speakers started with a ‘clean

Table 4: List of body part terms used as prompts in the colouring-in task for each language area.

	Tohoku
Face	*aŋo, hana, hoppeda, kudzi, managu, mimi, na^{n}dzugi, odoŋe*
Torso	*adama, hara, ketsu, koɕi, ku^{m}bi, mune, senaga*
Upper limb	*kena, te, u^{n}de*
Lower limb	*aɕi, ko^{m}bura/fugurahaŋi, momota/yorota, sunegara*
	Amami
Face	*agu, fuː, hana, kutɕi, mɨ, mɨttɕu/maki, miɴ, utugə*
Torso	*kamatʃi, kubi, kuʃi, mari, munɨ, wata*
Upper limb	*kəːnja, tɨ, udɨ*
Lower limb	*hagi, kubura, mumu, sunɨ*
	Okinawa
Face	*çitɕeː/mukoː, fuːdʑira, hana, kakudʑi, kutɕi, miː, mimi, utugeː*
Torso	*kubi, kuɕi, nagani, nni, tɕibi, tɕiburu, wata*
Upper limb	*ke:na, ti:, udi*
Lower limb	*çisa, kuɴda, mumu, ɕini*
	Miyako
Face	*agu, futai, futsɨ, kamatsɨ, miː, mim, pana, utugai*
Torso	*bata, kanamai, kusammi, kusɨ, mnifutsɨ, nubui, tɕibi*
Upper limb	*kaina, ti:, udi*
Lower limb	*karasumi/sukara, kuvva, mumuni, pag^{z}ɨ, pisa*
	Yaeyama
Face	*agu, futai, futsɨ, miː, miɴ, pana*
Torso	*bata, buʃa, kusɨ, nubi, nni, tɕibi, tsɨburu/amasɨkuru*
Upper limb	*ti:, udi*
Lower limb	*dabura, mumu, paɴ, pisa, sɨni*

Forms listed in the table are for illustrative purposes; specific forms of the body part terms differ per local dialect. Body part terms separated by a slash represent variants.

sheet' for every prompt. Participants were presented with each body part term one at a time and were asked to colour in the part it referred to. For the body, participants were instructed to colour in the left, right, front, and back, as applicable. There was only a single image for the face, so speakers simply coloured in the part of the face referred to by the prompt term. In contrast to previous studies that used written forms (Devylder et al. 2020; Majid and van Staden 2015), we presented the body part terms as auditory words as there is no standard orthography for any of the Ryukyuan language varieties (Heinrich et al. 2015). This is also the method used in previous studies of body parts in under-described languages (e.g., Ponsonnet 2011; van Staden 2006; Terrill 2006; Wegener 2006).

3.1.3 Image processing

We superimposed all colourings that were elicited with the same term, creating a multi-layered image in which each layer represented one session, thus creating a single image showing the extensional range of each body part term.

3.2 Results

The body colouring data is presented according to the subgroups in Table 4 (i.e., face, torso, upper limb, lower limb). The full data is available through an Open Science Framework repository (see *Data availability statement*).

3.2.1 The face

As is clear from Figure 8, there is considerable similarity between the language areas in the extension of terms for parts of the face. Bounded areas (e.g., eyes, nose, ears and mouth) were virtually the same across languages, whereas more variation was evident in unbounded parts (e.g., forehead, cheeks)—see also Majid and van Staden (2015). Most parts of the face were named with distinct terms across languages in Study 1, except the 'cheek' in Yaeyama, which all but one speaker named using a term that refers to the face as a whole, so this was not included as a prompt.[1] The 'cheek' also showed the most variation, especially in Okinawa where its range was more circumscribed than in the other Ryukyuan languages.

1 Speaker 2 (Shiraho variety) in Study 1 used the term *kamutɕi* for 'cheek'—see also *kamutsɨ* in the related Hateruma variety (Miyara 1980, p. 1250)—but the speakers that performed the colouring task for the current study were not familiar with this term.

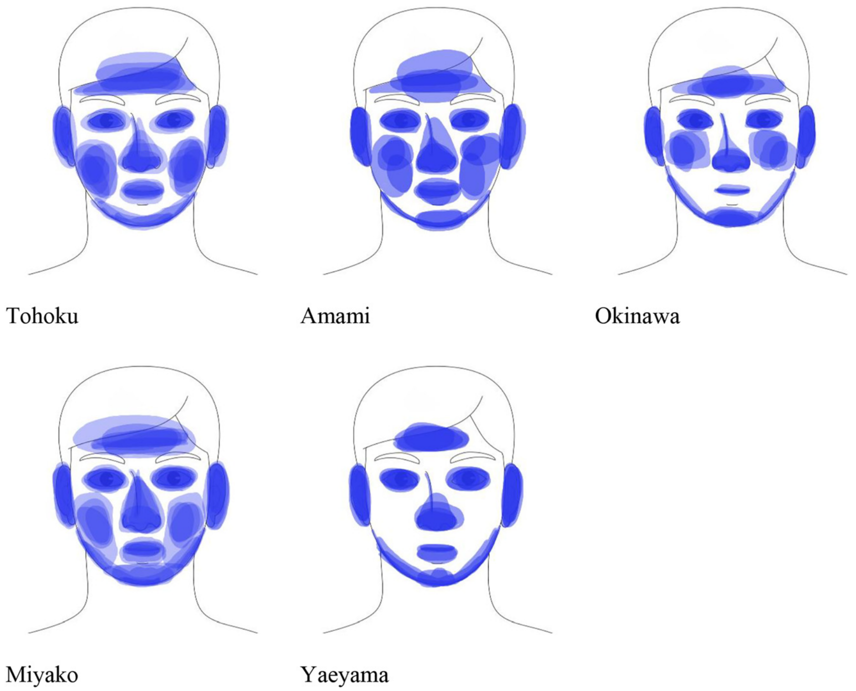


Figure 8: Extension of terms for parts of the face. Figures are composite images of the colouring-in data for participants in each of the five language areas.

We found there was little to no overlap in the extension between different parts, even though participants coloured in each part independently (without seeing what they had coloured in previously), suggesting that the parts of the face are highly distinct and do not form a clear hierarchy. The only part-whole relationship that might be present is between the jaw and the tip of the jaw (chin): when prompted with forms of the *otogai* cognate set, speakers only coloured in the tip of the lower jaw, whereas the whole jaw was coloured for the corresponding terms (Tohoku *aŋo*; Amami/Miyako/Yaeyanma: *agu*, Okinawa: *kakudẓi*). However, not all speakers and varieties distinguish between 'chin' and 'jaw', and speakers often coloured in a wider area below the mouth for *otogai*, whereas the *aŋo* ~ *agu* and *kakudẓi* generally only prompted colouring of the bony structure.

3.2.2 The torso

The colouring data for the neck, chest, belly, and buttocks were highly differentiated with no overlap between them (Figure 9). In Tohoku, most speakers coloured in the entire back for *senaga*, and only the lower back for *kosu*, indicating a part-whole relationship between the two. Amami speakers generally recognised only one 'back' term, but the exact range differed between speakers. Okinawa speakers showed a pattern similar to Tohoku, with one term referring to the entire back (*nagani*) and another to the lower back (*kuɕi*). Finally, speakers of the Miyako and Yaeyama language areas used distinct terms for 'upper back' (*kusammi* and *buɕa*, respectively) and 'lower back' (*kusɨ* ~ *kutɕa*) that did not overlap in extensional range. Some Miyako speakers only coloured in the spine for the *kusammi*, and one speaker of the Tarama dialect coloured in a larger area for *kusɨ*, stating *kusammi* is not used in that variety.

Study 1 showed large lexical variation across the Japonic varieties for 'head', and the colouring in data likewise found considerable variation in the extension of 'head' terms (Figure 10). Tohoku speakers' data for *adama* was similar to what has been previously reported for Standard Japanese *atama* (Majid and van Staden 2015), in that speakers generally excluded the face. Similarly, Amami and Okinawa speakers also did not include the face, and not all speakers coloured the back of the head either, focusing on the top of the head instead (similar to Jahai, Burenhult 2006). In contrast, Miyako and Yaeyama speakers coloured the front and back parts of the head as well.

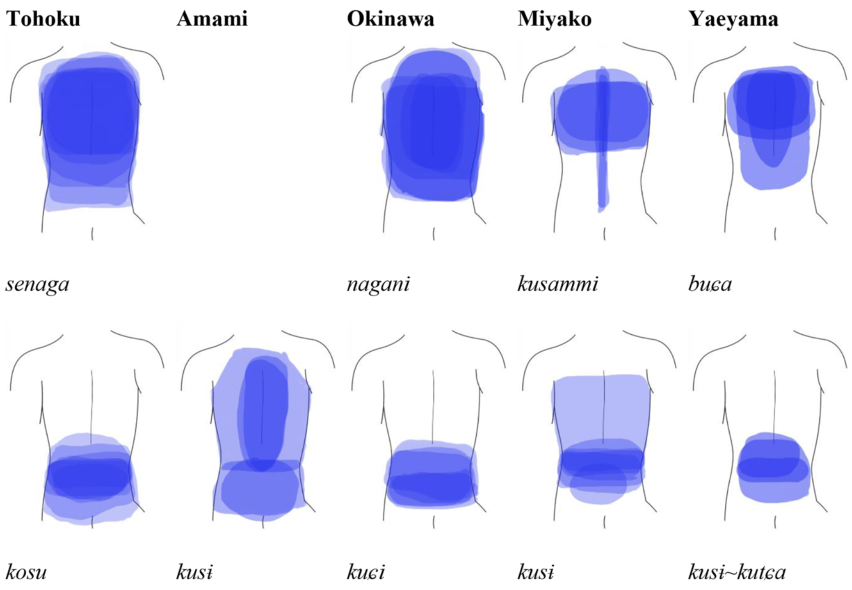


Figure 9: Extension of terms for the back of the torso. Figures are composite images of the colouring-in data for participants in each of the five language areas.

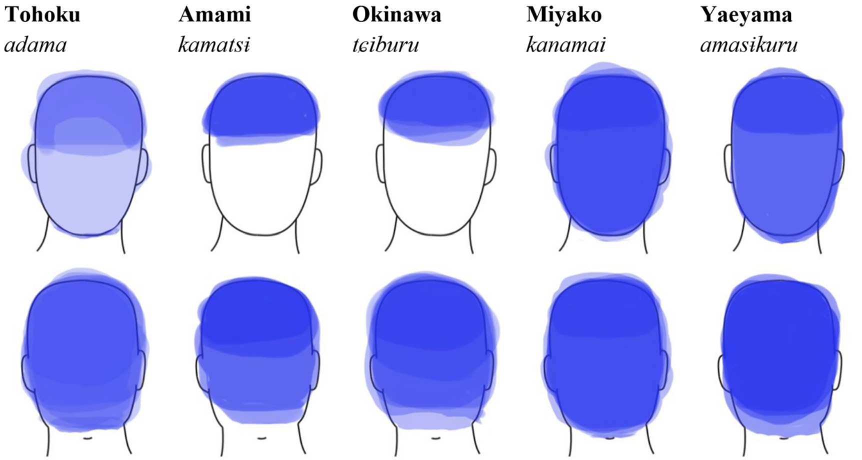


Figure 10: Extension of terms for the head (front and back). Figures are composite images of the colouring-in data for participants in each of the five language areas.

3.2.3 The upper limbs

The Tohoku varieties generally distinguished a separate hand category *te*, and an arm category *u*ⁿ*de* that covered the area between the shoulder and wrist (Figure 11). Most speakers also recognised a third term *kɛna* that referred primarily to the upper arm, but some speakers in the colouring in task also included the lower arm. Ryukyuan varieties did not have a specific hand term. Instead, the data revealed an upper limb category *tɨ* ~ *ti:* encompassing the arm and hand, and *udɨ* ~ *udi* ~ *udẓi* (alternatively *kaina* in some Miyako varieties, e.g., Karimata) which covered the area between the shoulder and the wrist. In Okinawa, *udi* did not refer to the upper and lower arm, but instead seemed to be restricted to the lower arm, with *ke:na* being used for upper arm. However, as in Tohoku, some speakers coloured in both upper and lower arm for *ke:na*.

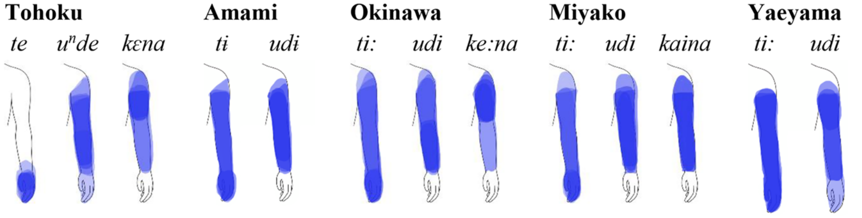


Figure 11: Extension of terms for parts of the upper limb (front). Figures are composite images of the colouring-in data for participants in each of the five language areas.

3.2.4 The lower limbs

There was substantial similarity in the extension of the lower limb parts across languages (Figure 12), in contrast to the variation found for upper limbs. Speakers of all varieties tended to colour in the entire lower limb (including foot) for *asu*, *hagi* ~ *pag^{z}ɨ* ~ *paɴ*, and *çisa*, respectively—although some speakers of Tohoku only coloured in the foot. For *sune* and its equivalents, some Tohoku and Amami speakers coloured in the entire lower leg, but mostly speakers only coloured in the shin. The two Ryukyuan varieties Miyako and Yaeyama distinguished a separate 'foot' category, whereas the other languages did not. 'Foot' appears to be a subpart of 'leg' based on Figure 12.

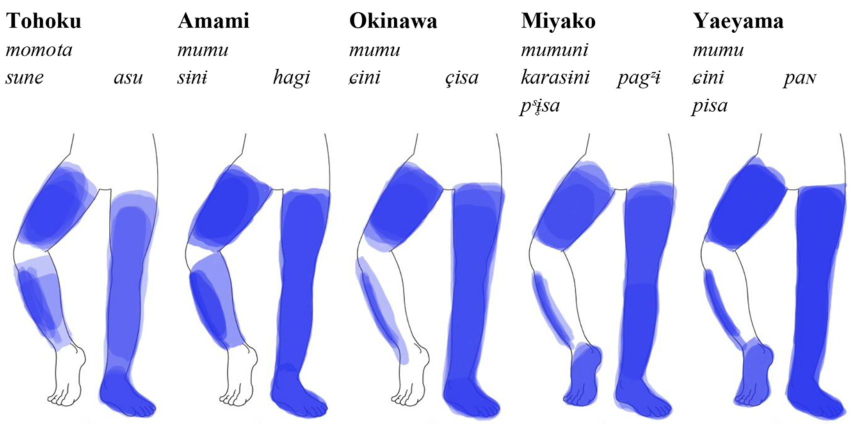


Figure 12: Extension of terms for parts of the lower limb (front). Figures are composite images of the colouring-in data for participants in each of the five language areas.

3.3 Summary

The body colouring task supported the broad patterns that emerged from the naming task in Study 1. Parts of the face were for the most part highly differentiated with little to no overlap. Within bounded parts of the face (eyes, nose, ear, mouth), there was substantial similarity between languages. In contrast, unbounded parts varied more, with most variation found in the cheek area—Okinawan participants indicated a smaller area for 'cheek' than other languages, whereas Yaeyama participants included in this study did not recognise a specific term for 'cheek' at all.

For parts of the body, the torso data revealed distinct categories with little overlap, with the exception of the upper back/lower back.[2] This pattern was similar across languages. For the limbs, there was clear evidence of part-whole relationships between subparts, and evidence of cross-linguistic variation. Tohoku participants displayed distinct 'hand' and 'arm' categories, which is likely a feature of the mainland Japanese varieties (see Majid and van Staden 2015). In contrast, most Ryukyuan participants did not have distinct 'hand' category counter to claims of 'hand' being a universal category (e.g., Wierzbicka 2007). If there is a distinction here, it is to have a separate 'upper + lower arm' or even a distinct 'upper arm' category (e.g., Tohoku and Okinawa[3]). Most of the languages had a single 'leg' category that included the 'foot', while only Miyako and Yaeyama have a distinct category for foot as well. Finally, all languages in addition had further distinctions between 'upper leg', 'shin' and 'calf', all of which were sub-parts of the lower limb.

4 General discussion

In the current study, we investigated the body part lexicon by examining both lexical and semantic variation. We found where there was little lexical (form) variation in the naming task, there was also relatively little semantic variation in the colouring task. In contrast, parts with high lexical variability were associated with more semantic variation. As predicted, we found more variation in the body part lexicon across the Ryukyuan varieties than the Japanese mainland. This is in line with both dialectometric approaches showing there is more overall linguistic variation in the Ryukyuan branch of Japonic (Huisman et al. 2019; Jeszenszky et al. 2019), as well as mutual intelligibility tests that show the intelligibility between Tohoku and Standard Japanese is slightly higher than between Amami and Miyako (both Ryukyuan; see Yamada et al. 2020). The amount of linguistic variation across Japonic appears to be amplified for body parts terms, not only at the level of varieties but also at the level of individual speakers.

One underlying possible cause of this could be standardisation—whereas the of lack standardisation for Ryukyuan languages leaves room for individual variation, the standardisation of Japanese may have resulted in increased conventionalisation and regimented responses. If language standardisation does lead

2 See also 'throat' and 'neck' for all colouring data in the OSF repository.

3 A distinct 'upper arm' category might also exist in Amami, but it might be restricted to some varieties there. Only one of the speakers included in the sample that performed the colouring-in task distinguished it through the term *gotə*; see also *gote* 'shoulder to elbow' in the Naze variety (Hirayama 1992).

to more conformity in body part naming, this may explain the high similarity found between Germanic languages previously (Majid et al. 2015). Future studies could systematically study whether body part semantics are more diverse in non-standardised languages.

Related to that are potential differences between written and spoken language. Our study used spoken language prompts to enable comparability between the Japanese and Rykyuan varieties where no standard written form exists. However, previous work has found interesting differences within a single language using written prompts. For example, Standard Japanese *ashi* can be written as either 足 or 脚, and Devylder et al. (2020) found the extensional range differed between the two: for *ashi*$_1$ 足, all speakers coloured the foot but only some included the upper and lower leg, whereas for *ashi*$_2$ 脚, all speakers coloured the upper and lower leg, but only a few included the foot. In the current study, there were speakers that only coloured the foot (i.e., like *ashi*$_1$ 足 in Devylder et al. 2020) when prompted with the lower limb term in every language, but no speaker coloured only the upper and lower leg excluding the foot, like *ashi*$_2$ 脚. It is therefore possible that the 脚 character leads to a conceptualisation that is specific to the written language[4]. More work is needed to determine the exact effect of stimulus format on conceptualisation, both in Japanese and other languages where similar cases exist.

Another possibility is that the Ryukyuan languages differ more from one another than the Japanese varieties because of language loss associated with their endangered status. Several speakers reported knowledge of terms for specific body parts, but were not always able to produce these in the moment during the naming task in Study 1. Speakers would then respond with a generic term (e.g., ‘leg’) or would not respond at all. Lexical retrieval is more difficult for elderly people, further challenging data collection (Wulff et al. 2019). Despite this, there were some striking similarities across the Ryukyuan languages with respect to missing responses—e.g., in all languages some speakers indicated they did not know about or have a specific term for ‘hip joint’ and ‘shin’, suggesting perhaps genuine lexical gaps rather than idiosyncratic failures of retrieval in individual participants. This demonstrates an additional, perhaps unexpected, value of stimulus-based elicitation. As well as uncovering possible lexical gaps within a language, elicitation can reveal knowledge gaps in endangered languages which can contribute to revitalisation efforts.

Intriguingly, speakers appear to have metalinguistic awareness about what is “standard language” and what is their local linguistic variety. This was most

4 Another example would be 暑い *atsui*$_1$ ‘hot (ambient)’ versus 熱い *atsui*$_2$ ‘hot (tactile)’, whose antonyms are lexically distinguished: *samui* ‘cold (ambient)’ and *tsumetai* ‘cold (tactile)’, respectively.

prominent for features such as pronunciation, with speakers saying: “What is pronounced *te* in Japanese, we pronounce as *tii*.”, for example. However, our colouring data demonstrates this also applied to the conceptualisation of body parts—otherwise there would be similar referential ranges for *te* and *tii*—with some speakers even commenting that “Japanese *te* refers to only the hand, but *tii* refers to the entire upper limb”. This raises interesting possibilities for future work on conceptual structure in bilinguals.

Moving beyond individual terms, our use of cluster analysis provided a framework for comparison across the Japonic languages for the overall structure of body part terms (Figures 4 and 5). The cluster analysis uncovered a hierarchy in the body part lexicon which was implicit in the data. Previous studies asked speakers to make judgements about the relations between terms using semantic elicitation—e.g., “Is the nail a part of the hand?”, but such judgements can be an unreliable basis for inferences about language (e.g., Dąbrowska 2010). Our method has potential to point to the structure of body partonomies without relying on such judgements. While our cluster analysis results are not a true partonomy, *stricto sensu*, e.g., there are no terms for internal nodes (as they reflect groupings not present in the stimulus set), we believe it nevertheless uncovers important structure. Minimally, it provides a common framework with which to compare individual language data (as in Figures 4 and 5).

It has been argued that there is no single organisational principle for the body part lexicon as a whole, but that if principles exist “they are more likely to be limited to distinct sub-systems such as the face, internal organs, or limbs” (Majid and Enfield 2017; see also Cruse 1986). The sub-systems uncovered in the cluster analysis suggest a new method for uncovering cross-linguistic regularities. Some subsystems resemble previously proposed universal body part categories—e.g., the upper limb (Andersen 1978; Brown 1976). Subsystems also correspond to the end points of cross-linguistic tendencies in semantic shifts (Wilkins 1981, 1996). Finally, there are some correspondences between the subgroups found here and those found in free-listing data from English speaking children (e.g., a cluster of digits—see Crowe and Prescott 2003). Future work on a broader sample of language families will have to confirm whether the observations reported here are specific to Japonic or whether they have wider applicability.

If there are indeed cross-linguistically stable sub-systems within the body part domain, this raises the question of whether some systems are more variable than others. In the introduction, we suggested that parts of the face might show more lexical and semantic similarity across languages because of the psychological salience of the face, and its dedicated neural architecture (Kanwisher et al. 1997). However, our study did not find support for this conjecture. Some parts for both the face and body showed high stability, and others were more varied. A post-hoc analysis of the World Loanword

Database (Haspelmath and Tadmor 2009), which has a measure that corresponds to lexical stability (called *Age score*), for the body part equivalents of our study also showed little difference between the face (mean Age score = 0.86) and body (mean Age score = 0.84). Instead, the results from the current study suggest that bounded parts of the face (e.g., nose, eyes, ears) are likely to show more stability than unbounded parts (e.g., cheek, jaw), and the same likely holds for bounded versus unbounded body parts. Majid (2010) suggested that joints may provide a perceptually salient boundary for the segmentation of parts (see also Majid and van Staden 2015). So, perhaps bounded parts are more lexically and semantically stable than unbounded ones. Future studies could be designed to test this proposal more systematically.

This study is the first to combine a body part naming and a colouring in task to uncover the lexical and semantic structure of the body. Overall, the results from the two methods provide converging evidence. As shown by the face versus body comparison, the free naming task provides the researcher with a starting point for the colouring data, but the colouring-in task helps better understand the extension of terms. In this study, the colouring data confirmed the distinctness of the parts of the face and their relative uniformity across languages. It also provided further clarity about the exact extension of terms referring to the upper and lower back, and confirmed the semantic variability for terms referring to limb parts. Both tasks are thus valuable in their own right for understanding body part terminology. This further highlights the value of systematic elicitation approaches as a counterweight to (over)reliance on introspective judgement that cognitive linguistics as a discipline is sometimes criticised for (see discussions in Divjak et al. 2016; Geeraerts and Cuyckens 2007; Zlatev 2009). Empirical studies based on corpus data also potentially address this issue, but is itself not without criticism (e.g., Dąbrowska 2016: p. 486), and—more importantly—the languages for which large-scale corpora exist do not represent the world's linguistic diversity. The tasks used in this study were designed to elicit lexical and semantic information from native speakers and provide another window through which we can study speakers' mental representations of the body and its parts.

Our study adds to the growing body of work examining the linguistic diversity found in smaller linguistic communities by focusing on the Ryukyuan languages. The variation uncovered in the conceptualisation of the body and its parts raises intriguing questions about the potential consequences this has for metaphorical patterns where the body is the underlying source domain. Previous work has already shown that metaphorical patterns in smaller linguistic communities can differ considerably from those found in larger languages spoken in industrialized societies (see, e.g., Boroditsky and Gaby 2010; Evans and Wilkins 2000; O'Meara and Majid 2020; San Roque et al. 2018; Wnuk and Ito 2021).

Where many studies on meaning see the human body as a generally available source for further conceptualisation, our study falls back on Brown's (1976: p. 421) assertion that it is important to "first establish just what is labelled" before continuing with further analyses. If, as cognitive linguists, we aim to study the cognitive principles of body part extensions and embodiment, how can we do so without first studying how the body itself is conceptualised? Languages differ in the body parts they use to conceptualise other concepts, as well as in the metaphorical structures that are implemented (see, e.g., contributions in Maalej and Yu 2011). Studying how speakers conceptualise the body and its parts is critical if we are to empirically ground—not just presuppose—how the body as a source domain is represented. We must establish how perceptual and functional properties are used to determine similarity between a body part and the extended concept. In this light, the current study paves the way for further investigations into the Ryukyuan languages to determine whether the variation in segmentation of the body presented here is reflected in metaphorical extension patterns too.

5 Conclusion

Previous studies have suggested that body part semantics is negligibly different within a language family, although there may be cross-linguistic differences when comparing languages from different stocks. Our study of the Japonic language family shows that body part terminology can vary within a language family in substantive ways, suggesting the similarity uncovered so far may be limited to the specific language family studied (i.e., Germanic). Lexical similarity for body part terminology is more differentiated between the Japanese and Ryukyuan varieties, and this is reflected in semantics too. Within body parts, we see different structuring principles for parts of the face and parts of the body, with the former having a relatively flat hierarchy while the latter shows deeper hierarchical structuring. However, when examining specific parts, there are no broad differences between the face and body. Rather bounded parts seem to show more stability in lexical form and semantics than unbounded parts. Our multi-method exploration of body parts demonstrates that we cannot presume a universal conceptualisation of the body as is often assumed in cognitive linguistics. Despite the importance generally assigned to the body as an important source domain for conceptual metaphors, there have been relatively fewer in-depth studies of the diversity of body conceptualisations. Our study shows that further work on under-studied languages is urgently required to uncover the scope of variation found in the world's languages.

Acknowledgements: We would like to thank all speakers who participated in the study. We thank three anonymous reviewers for the insightful comments on a previous version of this manuscript.

Data availability statement: The body naming data, the code for the analyses described above, and the body colouring data are available through an Open Science Framework repository at https://osf.io/b89ze/.

References

Andersen, Elaine S. 1978. Lexical universals of body-part terminology. *Universals of Human Language* 3. 335–368.

Boroditsky, Lera & Alice Gaby. 2010. Remembrances of times East: Absolute spatial representations of time in an Australian aboriginal community. *Psychological Science* 21(11). 1635–1639.

Brown, Cecil H. 1976. General principles of human anatomical partonomy and speculations on the growth of partonomic nomenclature 1. *American Ethnologist* 3(3). 400–424.

Burenhult, Niclas. 2006. Body part terms in Jahai. *Language Sciences* 28(2–3). 162–180.

Crowe, Samantha J. & Tony J. Prescott. 2003. Continuity and change in the development of category structure: Insights from the semantic fluency task. *International Journal of Behavioral Development* 27(5). 467–479.

Cruse, D. A. 1986. *Lexical semantics*. Cambridge: Cambridge University Press.

Dąbrowska, Ewa. 2010. Naive v. Expert intuitions: An empirical study of acceptability judgments. *The Linguistic Review* 27(1). 1–23.

Dąbrowska, Ewa. 2016. Cognitive Linguistics' seven deadly sins. *Cognitive Linguistics* 27(4). 479–491.

Devylder, Simon, Christoph Bracks, Misuzu Shimotori & Poppy Siahaan. 2020. Carving the body at its joints: Does the way we speak about the body shape the way we think about it? *Language and Cognition* 12(4). 577–613.

Divjak, Dagmar, Natalia Levshina & Jane Klavan. 2016. Cognitive Linguistics: Looking back, looking forward. *Cognitive Linguistics* 27(4). 447–463.

Enfield, Nick J. & Anna Wierzbicka. 2002. Introduction: The body in description of emotion. *Pragmatics and Cognition* 10(1–2). 1–25.

Evans, Nicholas & David Wilkins. 2000. In the mind's ear: The semantic extensions of perception verbs in Australian languages. *Language* 76(3). 546–592.

Geeraerts, Dirk & Hubert Cuyckens (eds.). 2007. *The Oxford handbook of cognitive linguistics*. Oxford: Oxford University Press.

Goossens, Louis. 1990. Metaphtonymy: The interaction of metaphor and metonymy in expressions for linguistic action. *Cognitive Linguistics* 1. 323–340.

Greenhill, Simon J., Rober Blust & Russell D. Gray. 2008. The Austronesian basic vocabulary database: From bioinformatics to lexomics. *Evolutionary Bioinformatics* 4. EBO-S893.

Hasada, Rie. 2002. 'Body part' terms and emotion in Japanese. *Pragmatics & Cognition* 10(1–2). 107–128.

Haspelmath, Martin & Uri Tadmor. 2009. *Loanwords in the world's languages: A comparative handbook*. Berlin: Walter de Gruyter.

Heine, Bernd. 1997. *Cognitive foundations of grammar*. Oxford: Oxford University Press.
Heinrich, Patrick, Shinsho Miyara & Michinori Shimoji. 2015. Introduction: Ryukyuan languages and Ryukyuan linguistics. In Patrick Heinrich, Shinsho Miyara & Michinori Shimoji (eds.), *Handbook of the Ryukyuan languages. History, structure, and use*, 1–10. Berlin: De Gruyter Mouton.
Hirayama, Teruo. 1992. *Gendai Nihongo Hōgen Daijiten [Dictionary of contemporary Japanese Dialects]*. Meiji-shoin.
Huisman, John L. A., Asifa Majid & Roeland van Hout. 2019. The geographical configuration of a language area influences linguistic diversity. *PLoS ONE* 14(6). e0217363.
Jaccard, Paul. 1901. Étude comparative de la distribution florale dans une portion des Alpes et des Jura. *Bulletin de la Société Vaudoise des Sciences Naturelles* 37. 547–579.
Jaccard, Paul. 1912. The distribution of the flora in the alpine zone. 1. *New Phytologist* 11(2). 37–50.
Jeszenszky, Péter, Yoshinobu Hikosaka, Satoshi Imamura & Keiji Yano. 2019. Japanese lexical variation explained by spatial contact patterns. *ISPRS International Journal of Geo-Information* 8(9). 400.
Kanwisher, Nancy, Josh McDermott & Marvin M. Chun. 1997. The fusiform face area: A module in human extrastriate cortex specialized for face perception. *Journal of Neuroscience* 17(11). 4302–4311.
Kövecses, Zoltán. 2003. *Metaphor and emotion: Language, culture, and body in human feeling*. Cambridge: Cambridge University Press.
Kövecses, Zoltán. 2005. *Metaphor in culture: Universality and variation*. Cambridge: Cambridge University Press.
Kraska-Szlenk, Iwona. 2014. Semantic extensions of body part terms: Common patterns and their interpretation. *Language Sciences* 44. 15–39.
Lakoff, George. 1987. *Women, fire, and dangerous things: What categories reveal about the mind*. Chicago: University of Chicago Press.
Lakoff, George & Mark Johnson. 1999. *Philosophy in the flesh: The embodied mind and its challenge to western thought*. New York: Basic Books.
Levisen, Carsten. 2015. Scandinavian semantics and the human body: An ethnolinguistic study in diversity and change. *Language Sciences* 49. 51–66.
Maalej, Zouheir A. & Ning Yu (eds.). 2011. *Embodiment via body parts: Studies from various languages and cultures*. Amsterdam/Philadelphia: John Benjamins.
Majid, Asifa. 2006. Body part categorisation in Punjabi. *Language Sciences* 28(2–3). 241–261.
Majid, Asifa. 2010. Words for parts of the body. In Barbara C. Malt & Phillip M. Wolff (eds.), *Words and the mind: How words capture human experience*, 58–71. Oxford: Oxford University Press.
Majid, Asifa. 2019. Mapping words reveals emotional diversity. *Science* 366(6472). 1444–1445.
Majid, Asifa & Nick J. Enfield. 2017. Body. In Stamatios Gerogiorgakis, Johanna Seibt & Guido Imaguire (eds.), *Handbook of mereology*, 100–103. Munich: Philosophia.
Majid, Asifa & Miriam Van Staden. 2015. Can nomenclature for the body be explained by embodiment theories? *Topics in Cognitive Science* 7(4). 570–594.
Majid, Asifa, Nick J. Enfield & Miriam Van Staden (eds.). 2006. Parts of the body: Cross-linguistic categorisation. *Language Sciences* 28(2–3), 137–360.
Majid, Asifa, James S. Boster & Melissa Bowerman. 2008. The cross-linguistic categorization of everyday events: A study of cutting and breaking. *Cognition* 109(2). 235–250.
Majid, Asifa, Fiona Jordan & Michael Dunn. 2010. *Evolution of semantic systems: Procedures manual*. Nijmegen: Max Planck Institute for Psycholinguistics.

Majid, Asifa, Fiona Jordan & Michael Dunn. 2015. Semantic systems in closely related languages. *Language Sciences* 49. 1–18.

Matsumoto, Yo. 1999. On the extension of body-part nouns to object-part nouns and spatial adpositions. In Barbara A. Fox, Dan Jurasky & Laura A. Michaelis (eds.), *Cognition and function in language*, 15–28. Stanford: CSLI.

Miyaji, Atsuko. 1973. Shintaigoi no henka: kaube, kasira, atama, naduki nado [On changes in the uses of the word "head"]. *Kokugogaku* 94. 1–15.

Miyaji, Atsuko. 1982. Shintaigoi no rekishi [On the history of body part terms]. In Kenji Morioka, Yutaka Miyaji, Hideo Teramura & Yoshiaki Kawabata (eds.), *Koza Nihongogaku 4: Goishi*. Tokyo: Meiji Shoin.

Miyara, Toso. 1980. *Miyara Toso Zenshu [complete works of Toso Miyara]*. Tokyo: Daiichi Shobo.

Moseley, Christopher. 2010. *Atlas of the world's languages in danger*. Paris: UNESCO Publishing.

National Institute for Japanese Language and Linguistics. 1968. *Nihon Gengo Chizu [Linguistic Atlas of Japan]*, 3. Tachikawa: National Institute for Japanese Language and Linguistics.

Nerbonne, John, Rinke Colen, Charlotte Gooskens, Kleiweg Peter & Therese Leinonen. 2011. Gabmap-a web application for dialectology. *Dialectologia: Revista Electrònica* (Special Issue II). 65–89.

O'Meara, Carolyn & Asifa Majid. 2020. Anger stinks in Seri: Olfactory metaphor in a lesser-described language. *Cognitive Linguistics* 31(3). 367–391.

Palmer, Gary B. & Lawrence Nicodemus. 1985. Coeur d'Alene exceptions to proposed universals of anatomical nomenclature. *American Ethnologist* 12(2). 341–359.

Pellard, Thomas. 2015. The linguistic archeology of the Ryukyu Islands. In Patrick Heinrich, Shinsho Miyara & Mhimoji Shimoji (eds.), *Handbook of the Ryukyuan languages. History, structure, and use*, 13–38. De Gruyter Mouton.

Ponsonnet, Maïa. 2011. Body-parts in Dalabon and Barunga Kriol: Matches and mismatches. In 42nd Australian Linguistic Society Conference-2011 (Canberra, 1–4 Dec 2011). Canberra: ANU Research Repository.

R Core Team. 2020. *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing.

San Roque, Lila, Kobin H. Kendrick, Elisabeth Norcliffe & Asifa Majid. 2018. Universal meaning extensions of perception verbs are grounded in interaction. *Cognitive Linguistics* 29(3). 371–406.

Shibatani, Masayoshi. 1990. *The languages of Japan*. Cambridge: Cambridge University Press.

Svorou, Soteria. 1993. *The grammar of space*. Amsterdam/Philadelphia: John Benjamins.

Swadesh, Morris. 1952. Lexico-statistic dating of prehistoric ethnic contacts: With special reference to North American Indians and Eskimos. *Proceedings of the American Philosophical Society* 96(4). 452–463.

Swanson, Richard A. & Stanley Witkowski. 1977. Hopi ethnoanatomy: A comparative treatment. *Proceedings of the American Philosophical Society* 121(4). 320–337.

Sweester, Eve. 1990. *From etymology to pragmatics: The mind-body metaphor in semantic structure and semantic change*. Cambridge: Cambridge University Press.

Tadmor, Uri. 2009. Loanwords in the world's languages: Findings and results. In Martin Haspelmath & Uri Tadmor (eds.), *Loanwords in the world's languages: A comparative handbook*, 55–75. Berlin: Walter de Gruyter.

Terrill, Angela. 2006. Body part terms in Lavukaleve, a Papuan language of the Solomon Islands. *Language Sciences* 28(2–3). 304–322.

Van Staden, Miriam. 2006. The body and its parts in Tidore, a Papuan language of Eastern Indonesia. *Language Sciences* 28(2-3). 323–343.

Van Staden, Miriam & Asifa Majid. 2006. Body colouring task. *Language Sciences* 28(2–3). 158–161.

Ward, Joe H. 1963. Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association* 58(301). 236–244.

Wegener, Claudia. 2006. Savosavo body part terminology. *Language Sciences* 28(2–3). 344–359.

Wierzbicka, Anna. 2007. Bodies and their parts: An NSM approach to semantic typology. *Language Sciences* 29(1). 14–65.

Wild, Fridolin. 2015. *lsa: Latent semantic analysis*. R Package Version 0.73.

Wilkins, David P. 1981. *Towards a theory of semantic change*. Australian National University (Honours Thesis).

Wilkins, David P. 1996. Semantic change and the search for cognates. In Mark Durie & Malcolm D. Ross (eds.), *The comparative method reviewed: Regularity and irregularity in language change*, 264–304. Oxford: Oxford University Press.

Wnuk, Ewelina & Yuma Ito. 2021. The heart's downward path to happiness: Cross-cultural diversity in spatial metaphors of affect. *Cognitive Linguistics* 32(2). 195–218.

Wulff, Dirk U., Simon De Deyne, Michael N. Jones, Rui Mata & The Aging Lexicon Consortium. 2019. New perspectives on the aging lexicon. *Trends in Cognitive Sciences* 23(8). 686–698.

Yamada, Masahiro, Yukinori Takubi, Shoichi Iwasaki, Celik Kenan, Soichiro Harada, Nobuko Kibe, Tyler Lau, Natsuko Nakagawa, Yuto Niinaga, Tomoyo Otsuki, Manami Sato, Rihito Shirata, Gijs van der Lubben & Akiko Yokoyama. 2020. Experimental study of inter-language and inter-generational intelligibility: Methodology and case studies of Ryukyuan languages. *Japanese/Korean Linguistics* 26. 249–260.

Zlatev, Jordan. 2010. Phenomenology and cognitive linguistics. In *Handbook of phenomenology and cognitive science*, 415–443. Berlin: Springer.