The representation of foot/leg polysemy in the mind — Insights from Vietnamese body part extensions with chân

Annika Tjuka

1 Introduction

The human body is a semantic domain commonly used as a source for meaning extensions. Many languages have body part terms that reappear in other semantic domains, for example, emotions (e.g., Yu 2002; Kraska-Szlenk 2014), or knowledge and reasoning (e.g., Kraska-Szlenk 2014). In addition, body part terms occur in semantic domains with concrete referents such as objects (Kraska-Szlenk 2014; Tjuka 2019). The domain of objects has a number of names for parts that originate from the human body domain, for example, ear of the jug, foot of the mountain, trunk of the tree. Body part terms are also often extended within the same domain so that one term can refer to two separate body parts (finger/toenail). A frequent pattern across languages is the use of the same term for the body parts finger and hand (Brown 2013a) or hand and arm (Brown 2013b). The examples of body part extensions show that various body part terms have multiple meanings and are, therefore “polysemous.”

It is still an open question how polysemous words in general and polysemous body part terms, in particular, are represented in the mind. The two main opposing views with regard to the representation of polysemous words expect one complex representation with all meanings stored in a single entry (e.g., Ruhl 1989) or separate entries for each meaning (Klein and Murphy 2001). Between these two extreme cases stand frameworks that assume semantic primitives (e.g., Wierzbicka 2007) or a continuum between homonyms and polyseme (Klepousniotou and Baum 2007; Windisch Brown 2008). The differences in the processing of homonymy versus polysemy indicate that the representations of unrelated meanings compete with one another, whereas the related meanings are stored in a single mental representation which can be accessed more easily. Body part terms, however, are a special case of polysemous words in that we have knowledge of their external form and internal workings. Experimental studies investigating the mental representations of bodies showed that functional aspects of body parts are activated in implicit as well as explicit naming tasks (Morrison and Tversky 2005). In addition, Tversky & Hemenway (1984) found that important features for the categorization of everyday objects are perceptual salience and function. These findings suggest that we store perceptual and sensorimotor knowledge with a certain body part term.

The aim of the present study is to shed light on the discussion about how polysemous words are represented in the mind by examining the extensions of body part extensions with ‘leg’ and ‘foot’ across languages and the word chân ‘foot/leg’ to object parts in Vietnamese. The emerging patterns show that the features underlying the extensions correspond to different similarity dimensions between a particular body part and an object. The results indicate that Vietnamese speakers use the similarity dimensions function and spatial alignment to extend the word chân to other meanings. Therefore, the meanings of chân seem to be connected to the perceptual and
sensorimotor features of two body parts: foot and leg. The premise of this article is that multiple meanings are connected to a single word on the basis of different dimensions of similarity\(^1\).

In the following, I describe the representation of body parts in the mind and the variation in how the body is segmented into different parts across languages. The differences in segmentation are then illustrated on the basis of cross-linguistic naming patterns in general and cross-linguistic meaning extensions with the words for ‘leg’ and ‘foot’ in particular. Thereafter, body part extensions with \(chân\) are examined with regard to the similarity dimensions of function and spatial alignment. Lastly, the implications of the analysis are discussed.

2 Representation of body parts and their meanings in the mind

The representation of the body in the mind, as well as the representation of polysemous words, needs to be taken into account to understand the cognitive principles involved in the extension of body part terms to other domains. The experimental studies discussed in this section focus on both aspects. Long-standing claims that general principles are at work in the segmentation of the human body into parts is still widespread in the literature. However, some findings show a more nuanced illustration of how languages segment the body. Studies of polysemy in the mental lexicon also do not offer a univocal picture although recent studies suggest that differences in the representation of ambiguous words are due to the closeness between meanings. Nevertheless, both accounts offer some indications of how polysemous body part concepts may be represented in the mind.

2.1 Segmentation of the body into parts

The representation of the human body is associated with specific areas in the brain. The involved areas are often presented in a neurological map and give rise to the picture of a ‘homunculus’ (Penfield and Boldrey 1937). In this map, particular brain areas are labeled with a body part and certain body part areas show a stronger activation pattern (e.g., hand) than others (e.g., foot). Although vision is assumed to be our most important sense (cf. Majid et al. 2018; Hutmacher 2019), the representation of the body is exceptional because we have internal sensorimotor knowledge about most of our body parts as well as visual knowledge about the shape of the outer body parts. Thus, the question arises which knowledge plays the important role in the segmentation of the body into parts and their representation in the mind. Morrison and Tversky (2005) tested whether part size, distinctiveness, or significance provided better predictions for the patterns of response times in body part verification tasks. They performed experiments with visual stimuli of body parts (Experiment 1, 2, 4), in addition to an experiment with written stimuli of body part names as cues for the following visual stimuli (Experiment 3, see Morrison and Tversky 2005). Whereas theories focusing on part size and part distinctiveness predict visual features of body parts to be more important, part significance predicts verification time based on sensorimotor and

\(^1\) The term “similarity” in this article is interpreted according to a featural approach to the notion of similarity (Tversky 1977; for an overview of the different approaches, see Hahn 2014).
visual features of body parts. Their results showed that part distinctiveness best accounted for visual stimuli (pictures of body parts) in comparison to part significance which made better predictions when conceptual stimuli (names of body parts) were presented (Morrison and Tversky 2005). The findings indicate that knowledge about the function of a body part is evoked when a body part term is processed. The study was conducted with English speakers and the authors assumed a preconceived segmentation of the body based on cross-linguistic naming patterns found in Brown (1976) and Andersen (1978). Therefore, it is not clear whether the results could be replicated with speakers of other languages (i.e., non-Indo-European languages).

In an experimental study focusing on body part segmentation, de Vignemont et al. (2009) showed differences in the representation of boundaries between the body parts hand and arm. By testing parthood relations (mereology) with distance judgments, the authors found that visual discontinuities, such as joints (i.e., the wrist joint), are important to segment the body into parts. However, the visual segmentation effect was weakened when action with the body parts was performed. The study also tested whether there are differences in segmenting one’s own body versus a neutral object (Experiment 4) and found no segmentation effects in the experiment (de Vignemont et al. 2009). Thus, visual discontinuities may be more important in the segmentation of everyday objects than their function. It would be interesting to evaluate whether this hypothesis holds for objects which have corresponding functions similar to our body parts or with which we interact. The results also raise the question of whether perceived segmentation of the body is reflected in the naming patterns of body parts and follows general principles in the languages of the world.

Majid (2010) examined a three-dimensional hierarchical model of the human body and compared it with naming patterns across languages. She showed that perceptual cues, such as visual discontinuity, facilitate the categorization of the body into parts in that languages tend to name constrained spaces. However, language speakers need to learn which discontinuity is important in their language community (Majid 2010). The implications of this study are far-reaching because it highlights a crucial aspect in the study of body part naming: the universality of meaning. Therefore, Majid and van Staden (2015) aimed to answer the question of whether languages detect the same parts that are identified in perception or action systems. By conducting a coloring task (van Staden and Majid 2006), they compared lexical representations versus body structural representation across three languages (Dutch, Japanese, Indonesian). The authors found that the lexical representation does not need to correspond to the structural representation and concluded that the structure of our body is represented without the influence of linguistic entities (Majid and van Staden 2015).

The results of the experimental studies on the representation of the body in the mind illustrate that the segmentation of body parts is influenced by perception in general and visual discontinuities as well as function in particular. The presented studies illustrate that visual discontinuities are recognized in all languages, but particular languages choose different discontinuities for segmenting the body. In addition, action merges two separately perceived body
parts together. The discussion also highlights the importance of taking experimental evidence into account when studying cross-linguistic naming patterns.

2.2 Polysemy in the mental lexicon

Although an analysis that treats body parts as polysemous may not be accurate (Enfield, Majid, and van Staden 2006; Majid 2010), a closer look at the representation of polysemy in the mental lexicon adds a valuable perspective. The main question of psycholinguistic studies investigating polysemy is to which degree meanings of polysemous words are connected to single or multiple representations.

The findings of studies conducting experiments with polysemous versus homonymous words are heterogenous: Klein and Murphy (2001) proposed that polysemous senses (i.e., meanings) are stored in separate representations. Their results showed that there needs to be a reasonable number of senses stored in the mental lexicon even if senses are constructed spontaneously. Other studies demonstrated that related senses of polysemous words are stored together, whereas unrelated senses of homonyms are stored in separate entries (Klepousniotou 2002; Klepousniotou and Baum 2007). On the basis of reaction times for different word types, Klepousniotou and Baum (2007) suggested continuous processing spanning from polysemy (metonymy) over polysemy (metaphor) to homonymy. Similarly, Windisch Brown (2008) argued for a continuum with a linear progression of response time for the conditions same senses > closely related senses > distantly related senses > homonymy. On the one hand, the findings support aspects of theoretical models2 of the representation of polysemous words in the mental lexicon and indicate differences in the processing of homonymy versus polysemy. On the other hand, they contradict accounts that suggest the storage of a core meaning (as proposed by Wierzbicka 2007).

The experimental studies with polysemous words indicate a difference in how related meanings are represented in the mind. Although there are discrepancies in the results, the degree of relatedness between two meanings seems to be represented in the storage of word meanings in the mental lexicon.

3 Cross-linguistic patterns of polysemous body part terms

In lexical semantics, the domain of the human body is one of the most prominent examples (besides color or kinship terminology) used to illustrate naming patterns across languages (Koptjevskaja-Tamm, Vanhove, and Koch 2007; Koptjevskaja-Tamm 2008). Detailed descriptions for body part nomenclature are available for individual language families such as Indo-European (Buck 1949) or Austronesian (Blust 2013) as well as cross-linguistic language samples (Witkowski and Brown 1985). On the basis of a comparison of body part naming patterns, the assumption was that universal principles for the categorization of the body would emerge (Brown 1976; Andersen

2 The theoretical accounts under investigation in the experimental studies are not discussed in detail here (see Apresjan 1974; Pustejovsky 1996; Geeraerts 1993; Tuggy 1993).
The proposals of universal principles by early studies on naming patterns are often disproportionate to their language sample. Although the studies included to some extent a genealogical diverse language sample, universals were based on observations of not more than about 100 languages which is around 1.4% of the world’s languages (assuming 7,000 spoken languages in the world). Recent studies are based on a more representative sample (e.g., Brown 2013a, 2013b; Pattillo 2014) or examine patterns in neglected language varieties such as South American languages (Pattillo 2018). Thus, most of the universals that were proposed at the beginning of cross-linguistic comparisons in body part nomenclature did not stand the test of time. For example, the claim that all languages have a term for ‘face’ or ‘mouth’ was disproven (Andersen 1978; cf. Enfield, Majid, and van Staden 2006).

Nevertheless, the studies showed that a number of diverse languages use a single term for parts that English speakers commonly distinguish and refer to as *foot* and *leg*. Witkowski and Brown (1985) found that this pattern occurred more frequently in languages spoken near the equator than in colder climates. Their explanation for the pattern was that the use of mittens and boots in colder climates highlights the separation between the body parts leg and foot. This observation indicates that perceptual salience plays a role in distinguishing the two body parts. Interestingly, studies using a body coloring task showed that visual discontinuities are important but which boundary is expressed with separate terms is language-specific (Majid and van Staden 2015). It is therefore not clear whether languages extend body part terms to other domains, such as objects, on the basis of language-independent or language-specific principles.

Body part terms are a special semantic domain in various ways. For example, many body parts can refer to objects or landscape features in the natural environment of humans, as in *table leg* or *foot of the mountain*. Some body parts are the target domain for figurative names such as *belly button* (for further examples, see Brown and Witkowski 1981). They are also important for the study of semantic change (e.g., Brown and Witkowski 1983; Hilpert 2007; Urban 2011). In addition, body part terms seem to have a communication advantage (Dingemanse 2009). This study focuses on the extension of body part terms to everyday objects.³ Kraska-Szlenk (2014) stated, “domains of the metaphoric mapping of body part terms are practically unlimited and may include plants and their parts, landmarks, human-made artifacts, foods and various other objects.” In contrast, Lakoff and Johnson (1980: 54) stated that expressions like *leg of the table* or *foot of the mountain* are idiosyncratic in that they are not systematic in our language or thought. Thus, most studies in cognitive linguistics concentrate on the mapping of a concrete domain to an abstract domain. As a result, there are few studies that have examined extensions of body part terms to the concrete domain of objects across languages. Some studies illustrate body part extensions in individual languages, for example, Persson (2005) listed several expressions that use body part terms for technical artifacts. In addition, Levinson (1994) found that the Mayan language Tzeltal uses body part terms productively according to a geometrical analysis of shape properties of objects. The results of an experimental study showed that speakers of two Mesoamerican

³ Based on the assumption that the representation of objects includes certain aspects, the psychological notion of similarity is established by the appearance of an object (Hahn 2014).
languages (Juchitán Zapotec and Tzeltal) tend to group objects according to the shape of one of their parts in contrast to English speakers who used function (Tilbe 2017). A systematic typological study of body part extensions across 13 diverse languages demonstrated that there are cross-linguistic differences in the frequency of body part extensions (Tjuka 2019). The existing body part extensions in a given language were not due to a particular preference for one of the dimensions (shape, spatial alignment, function); instead, there appeared to be an overarching pattern that body part extensions relating to multiple dimensions, i.e. *leg of the table/chair*, were more common across languages (Tjuka 2019).

Using the semantic domain of the human body as a source for meaning extensions seems to be an independent invention across languages. Although there may be tendencies to use body part terms more productively across different domains in one language (e.g., Tzeltal) than in others (e.g., English), all languages are likely to extend the meanings of some body part terms to object or landscape features. In addition, the cross-linguistic evidence indicates that body part terms can be mapped to everyday objects on the basis of similarity in the dimensions of *shape, spatial alignment,* and *function.* The next sections discuss patterns of meaning extensions of words for the concepts *LEG* and *FOOT* across a variety of the world’s languages.

### 3.1 Colexifications of the concept *LEG* across languages

In a cross-linguistic comparison of naming patterns of body parts in 109 languages, Witkowski and Brown (1985) showed that 42 diverse languages had a single term for the meanings ‘foot’ and ‘leg.’ Based on their findings, they claimed that 39% of the world’s languages have this pattern of foot/leg polysemy. Fortunately, more data have become available in recent years from large compilations of dictionaries (e.g., Key and Comrie 2016) and fieldwork that documents languages of remote communities (e.g., Bowern et al. 2020). The Concepticon project stores those word lists in a cross-linguistic data format and maps the elicitation glosses to concepts (for information on the database, see List, Cysouw, and Forkel 2016; List et al. 2020; for information on the data format, see Forkel et al. 2018). In its current version, the Concepticon comprises 353 word lists mapped to 3,743 concepts (List et al. 2020). The standardized data format and the mapping to “comparative concepts” (Haspelmath 2010; for a critical discussion, see Newmeyer 2010) makes a cross-linguistic comparison possible. The Concepticon is a reference catalog for other databases that combine the available data in an innovative way.

One of those databases is CLICS which offers cross-linguistic colexification patterns (List, Terhalle, and Urban 2013; List et al. 2018; Rzymski et al. 2020). The third version of CLICS comprehends colexifications of 2,906 concepts across 3,156 language varieties (Rzymski et al. 2020). Within the database, one can search for the colexification between the concepts *LEG* and *FOOT* to test whether the claim by Witkowski and Brown (1985) still holds. As shown in Table 1, the concepts *LEG* and *FOOT* colexify in 358 languages which accounts for about 12.8% of the languages.

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4 The term “colexification” was established as an umbrella term for the phenomena polysemy, homonymy, and vagueness (François 2008).
in the CLICS\textsuperscript{3} database. Thus, although foot/leg polysemy cannot be confined to a specific area, the pattern is not as common as originally thought.

<table>
<thead>
<tr>
<th>Colexified concept</th>
<th>Number of language varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOT</td>
<td>358</td>
</tr>
<tr>
<td>THIGH</td>
<td>53</td>
</tr>
<tr>
<td>SHIN</td>
<td>33</td>
</tr>
<tr>
<td>BONE</td>
<td>30</td>
</tr>
<tr>
<td>LOWER LEG</td>
<td>24</td>
</tr>
<tr>
<td>CALF OF LEG</td>
<td>9</td>
</tr>
<tr>
<td>PAW</td>
<td>9</td>
</tr>
<tr>
<td>TREE</td>
<td>7</td>
</tr>
<tr>
<td>FOOTPRINT</td>
<td>6</td>
</tr>
<tr>
<td>CLAW</td>
<td>5</td>
</tr>
<tr>
<td>LIVER</td>
<td>4</td>
</tr>
<tr>
<td>TOE</td>
<td>4</td>
</tr>
<tr>
<td>EGG</td>
<td>3</td>
</tr>
<tr>
<td>HEEL</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1: Colexifications with the concept LEG in the CLICS\textsuperscript{3} database (Rzymski et al. 2020).

The colexifications between the concept LEG with other concepts in Table 1 show interesting patterns. For example, LEG colexifies frequently with other body parts in various languages which have specific terms in English (i.e., \textit{thigh}, \textit{shin}, \textit{bone}). Although the data do not reveal clear boundaries that speakers draw between specific parts (see Majid and van Staden 2015), it is evident that languages differ in which body part terms can be colexified. For the extension of meanings to other objects, there are only a few examples of colexifications in the database: TREE in 7 languages (e.g., Hindi, Oodoodee (Hesif Dialect), Wandamen) and EGG in 3 languages (Wichí, Suboo, Fayu). The colexification between LEG and TREE indicates that the similarity in shape (length) or function (holding up the crown) of the body part leg can give rise to leg/tree polysemy across diverse languages. The small number of examples for body part and object colexifications may be due to the algorithm that combines elements from the original Concepticon resource and integrates only single lexemes in the CLICS database. Thus, as of yet, partial colexifications like \textit{table leg} are not listed in the database.

The connections between colexifications can be additionally visualized in a semantic network. The subgraph of the colexifications of the concept LEG is shown in Figure 1. The graph illustrates further connections between the concepts that are colexified with the concept LEG. The frequency of each colexification pattern of two concepts across languages is shown by weights (i.e., the thickness of the line) between the nodes (i.e., the concepts). Colexifications between other body parts such as CALF OF LEG and HEEL become apparent with the graphical interface.
New approaches in the storage and representation of cross-linguistic data make it possible to get a more accurate picture of common patterns and language variations. The data in this section showed that assumptions about general principles of cross-linguistic body part nomenclature need to be revisited. In addition, more robust statements can be made about the cognitive principles and influence of similarity dimensions that lead to colexification independent of a particular language.

3.2 Colexifications of the concept FOOT across languages

The cross-linguistic comparison of colexifications with the concept FOOT presented in the CLICS$^3$ database (Rzymski et al. 2020) gives further insights into naming patterns and meaning extensions of body parts. Similar to the colexifications with LEG, the concept FOOT tends to commonly colexify with other body part concepts that have a particular lexeme in English (i.e., heel, toe, thigh). In addition, the concept FOOT is colexified with the spatial concept CORNER in three languages (Nung-Fengshan, Bulang, Mandarin Chinese). The most frequent colexification after the already established foot/leg polysemy is a colexification with the concept HEEL across 14 languages (e.g., Godoberi, Hinuq, Lezgian, Gawwada). A closer look at the languages in which this colexification exists reveals that it seems to be a pattern common in one language family: ten out of 14 languages with this colexification belong to the Nakh-Daghestanian languages. In the case of meaning extensions to everyday objects, the data show only one extension of FOOT to WHEEL which is an areal pattern in South American languages (for further discussion, see Mayer et al. 2014; List et al. 2018). The colexification seems to be based on a similarity in function or spatial alignment. In another analysis by Hilpert (2007), the same colexification was found in 6
languages based on a comparison of 76 languages taken from data in descriptive grammars (Bybee, Perkins, and Pagliuca 1997).

<table>
<thead>
<tr>
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<th>Number of language varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEG</td>
<td>358</td>
</tr>
<tr>
<td>HEEL</td>
<td>14</td>
</tr>
<tr>
<td>FOOTPRINT</td>
<td>13</td>
</tr>
<tr>
<td>CLAW</td>
<td>9</td>
</tr>
<tr>
<td>WHEEL</td>
<td>5</td>
</tr>
<tr>
<td>TOE</td>
<td>5</td>
</tr>
<tr>
<td>THIGH</td>
<td>4</td>
</tr>
<tr>
<td>CALF OF LEG</td>
<td>4</td>
</tr>
<tr>
<td>ANKLE</td>
<td>4</td>
</tr>
<tr>
<td>BONE</td>
<td>4</td>
</tr>
<tr>
<td>PAW</td>
<td>4</td>
</tr>
<tr>
<td>CORNER</td>
<td>3</td>
</tr>
<tr>
<td>SKIN</td>
<td>3</td>
</tr>
<tr>
<td>CALF</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 2: Colexifications with the concept FOOT in the CLICS³ database (Rzymski et al. 2020).

The graphical representation of the colexification network centered around the concept FOOT illustrates that most body part concepts colexify with at least one other body part concept, whereas the colexifications with WHEEL and CORNER connect only to FOOT.

![Network structure of the concept FOOT in the CLICS³ database (Rzymski et al. 2020).](image)

Figure 2: Network structure of the concept FOOT in the CLICS³ database (Rzymski et al. 2020). The nodes represent the colexified concepts and the edges represent the weighted connection between them.

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Note that these cases may be homonyms based on transliteration.
The comparison between the colexifications with the concepts LEG and FOOT shows similarities in the concepts that are expressed with one of the body part concepts. Both colexify with concepts representing adjacent human body parts, corresponding animal body parts, and a few object concepts. The total number of colexifications for both concepts is the same, but most colexifications with LEG are more frequent across languages. An interesting pattern occurs when looking at colexifications with upper versus lower body part concepts. The concept LEG is more frequently colexified with concepts denoting parts of the leg (SHIN, CALF OF LEG, LOWER LEG) that receive particular terms in English. In contrast, the concept FOOT more often colexifies with concepts of lower body parts connected to the foot (HEEL, TOE, ANKLE). Only three concepts in the domain of objects (EGG and TREE; WHEEL) were found to colexify with the body part concepts LEG and FOOT, respectively. Thus, in order to obtain more examples of meaning extensions to other semantic domains, additional data need to be considered.

The patterns of colexifications with the concepts LEG and FOOT demonstrate the different associations that relate to the two visually distinct parts leg and foot. Although most languages have two separate terms for the two concepts, this does not imply that languages with a foot/leg polysemy cannot distinguish the two parts.

4. The use of chân in Vietnamese

The Vietnamese language belongs to the Mon-Khmer language family which branches off the Austro-Asiatic phylum. There are three varieties spoken in Vietnam: Southern, Northern, and Central dialects. Vietnamese is an isolating language with no marking of case, number, or gender and the majority of semantic units are single morphemes. Content words in Vietnamese are often realized as compounds with a reversed order compared to the English head-first order (leg table instead of table leg). Furthermore, Vietnamese has an elaborate sound system consisting of six lexical tones.

By comparing the use of đầu and chân in Vietnamese and head and foot/leg in English in a corpus study, V. H. Nguyen (2014) found that chân ‘foot/leg’ can be metaphorically transferred to:

1. a quarter of four-leg animals, as a source of foods (a pig is divided into 4 equal parts)
2. legs of pig, including thigh and shin, nails, as a food source (boiled pig’s leg)
3. the bottom part of some furniture (the bed/furniture, tripod / column...)
4. the bottom portion adjacent to the surface (foot mountain / wall/teeth...)

In addition, chân ‘foot/leg’ can be metonymically transferred to (V. H. Nguyen 2014):

5. the travel by foot of people (vui chân đi chơi ‘people who feel happy when they go out,’ trú chân ‘reside temporarily’)

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3. the bottom part of some furniture (the bed/furniture, tripod / column...)
4. the bottom portion adjacent to the surface (foot mountain / wall/teeth...)

In addition, chân ‘foot/leg’ can be metonymically transferred to (V. H. Nguyen 2014):

5. the travel by foot of people (vui chân đi chơi ‘people who feel happy when they go out,’ trú chân ‘reside temporarily’)

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The Vietnamese language belongs to the Mon-Khmer language family which branches off the Austro-Asiatic phylum. There are three varieties spoken in Vietnam: Southern, Northern, and Central dialects. Vietnamese is an isolating language with no marking of case, number, or gender and the majority of semantic units are single morphemes. Content words in Vietnamese are often realized as compounds with a reversed order compared to the English head-first order (leg table instead of table leg). Furthermore, Vietnamese has an elaborate sound system consisting of six lexical tones.

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6. position, duty of a member of an organization (as a member of Council, a player in card game using a deck of 120 cards and played by five persons)
7. mediate, brokers work in the black affairs (wooden leg)
8. the sources supplying (the clue)

The words đầ‘head’ and chân ‘foot/leg’ occurred more often in close proximity to each other in the Vietnamese corpus than head and foot/leg in the English corpus, indicating that the former is more closely related (V. H. Nguyen 2014).

Based on an analysis in the framework of Conceptual Metaphor Theory (Lakoff and Johnson 1980), the study by N. V. Nguyen (2016) showed that body part terms occur in three types of conceptual metaphors in Vietnamese idioms:

1. personalities referred to as material
2. personalities referred to as the shape of the eyes
3. whether the hands being clean or dirty indication personalities

The third type included idioms that used a combination of the body part terms chân ‘foot/leg’ and tay ‘hand’ (e.g., chân làm tay bàn ‘to have dotted legs and dirty hands’, lit. ‘dirty hands symbolize assiduousness and painstakingness’).

In a study investigating the four limb terms (arm, hand, thigh, foot/leg) in the Thai language, a minority language in Vietnam, Thanh (2019) found that the meaning of the word tìn in Thai (corresponding to chân ‘foot/leg’, bàn chân ‘foot’ in Vietnamese) is transferred to:

1. [the lower extremity of human or animal body] to express the lower extremity of things:
   a. chân bàn ‘leg of the table’
   b. chân ghế ‘leg of the chair’
   c. chân thang ‘foot of the ladder’
2. [used to walk, stand, run, or jump, etc.] to express human activities:
   i. thay chân ‘replace’
   ii. chân nâng ‘support’
   b. things’ names:
      i. đường chân (đường bô) ‘foot walk’
3. [from the ankle to the tip of the longest toe] to express things with foot position:
   a. chân núi ‘foot of the mountain’
   b. chân chai ‘the support of the casting-net’
   c. chân rừng ‘fringe of the fores’
   d. chân áo (gậu áo) ‘fringe of the shirt’
   e. chân váy (gậu váy) ‘fringe of the dress’

The examples in all three studies indicate the following patterns of meaning extensions of the word
chân into the domain of objects: chân refers to parts of objects that are expressed with the term leg in English and additionally, refers to lower parts which would be denoted with the term foot in English. Thus, Vietnamese seems to have a foot/leg polysemy from an English perspective. Interestingly, only one study included the more specific term bàn chân ‘foot’ (Thanh 2019). In line with the analysis of Brown (1976), Vietnamese is still at stage 3 in that the speakers have a more specific term for ‘foot’ (bàn chân) at the same time as a more general term chân ‘leg (and foot).’ However, the term for ‘foot’ is conceptualized but not lexicalized and the semantic change may continue so that a separate name for the meaning ‘foot’ may be established in the future (as proposed by Brown 1976). This means that Vietnamese speakers are aware of the difference between the body parts leg and foot, but in compound words such as chân núi ‘foot of the mountain’ the specifier bàn is omitted and in everyday language chân can refer to either ‘foot’ or ‘leg.’ In the following, I relate the observations of the use of chân in Vietnamese to body part extensions that are based on the similarity dimensions of function and spatial alignment.

4.1 Extensions with chân on the basis of similarity in function

The following analysis is based on data collected through conversations with Vietnamese native speakers, elicitation (Tjuka 2019), and the data from dictionaries (Key and Comrie 2016). The examples in (1) illustrate the use of chân in expressions that refer to parts of everyday objects.

(1) a. chân bàn
‘leg of the table’

b. chân ghế
‘leg of the chair’

c. chân giường
‘leg of the bed’

d. chân thang
‘ladder side rail’

e. chân cầu
‘pier of the bridge’

In example (1a-c), factors that lead to the extension of the body part term chân could be the similarity in shape, spatial alignment, and/or function. The Vietnamese translations of chân bàn/ghế/giường correspond to the English expressions ‘leg of the table/chair/bed.’ In contrast,
examples (1d-e) show differences in the translations between the Vietnamese and English expressions in that Vietnamese uses the body part term chân whereas English has an abstract term for the object parts. Nevertheless, the extension of chân to a ladder side rail or pier of a bridge is transparent for non-Vietnamese speakers. The similarities that the object part share in each of the objects in (1) give rise to the body part term extensions with chân.

Due to the different shapes of the objects (table/chair/bed versus ladder/pier) and their perceived spatial alignment to a human body, the predominant similarity in all cases seems to be function. The leg as the part on which a structure stands and that supports an object is similar to the function of our own body part which holds up the upper body. Although it is often assumed that shape (especially length) is the main aspect associated with the concept of the body part leg (e.g., Andersen 1978), example (1e) indicates that even a part that varies in its length can also be denoted with chân which points to the dominance of similarity in function.

4.2 Extensions with chân on the basis of similarity in spatial alignment

The body part term chân can also be extended to other parts of objects, as in example (2). In comparison to the above-mentioned examples, here the extension of chân seems to be based on the similarity in spatial alignment between the lowest part of the human body and the object part. The term chân in the expressions chân cầu thang and chân mộ is translated with the English term ‘bottom/lower part’, respectively. However, more literal translations would be chân cầu thang ‘foot of the staircase’ and chân mộ ‘foot of the grave’ indicating that the expressions refer to the part of the object that spatially aligns with the body part foot. Again, the transfer is transparent and can be understood without knowledge of the Vietnamese language. Note that I used ‘foot’ in the literal translation on purpose. Although Vietnamese does not differentiate between bàn chân ‘foot’ and chân ‘leg’ in compounds, the reference to a spatially lower part suggests that the body part foot is implied rather than leg as the whole lower limb.

(2) a. chân cầu thang
   foot/leg staircase
   ‘bottom step of the staircase’

b. chân mộ
   foot/leg grave
   ‘lower part of the grave’

The underlying similarity in spatial alignment illustrated by these cases is supported by the use of chân referring to landscape features, as in example (3). As shown by the English translation ‘foot of the mountain’ for chân núi, the term chân in this case refers to the part of the body that is denoted by the term foot in English. Although it could be argued that the function of a foot as the

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6 Note that bàn chân literally means ‘table of the leg.’
supporting part of the body plays a role, the example in (3b) chân trời lit. ‘foot of the sky’ shows that the spatial alignment is the main driving force behind these extensions.

(3)  
a. chân núi
    foot/leg  mountain
    ‘foot of the mountain’

  b. chân trời
    foot/leg  sky
    ‘horizon’

The examples in Vietnamese are relevant for understanding meaning extensions and the representation of foot/leg polysemy in two ways: First, they illustrate that Vietnamese speakers extend the body part term chân to various everyday objects and some landscape features. Second, the analysis of the different similarity dimensions (function and spatial alignment) that are the basis for each of the body part extensions shows that chân may be segmented into two different body part representations for the meanings ‘foot’ and ‘leg’ although, on the surface, the word seems polysemous. The final discussion in the next section will explore the latter point in more detail.

5 Discussion

Body part terms are used in a wide variety of contexts. They are persuasive in everyday language when we talk about our emotions and social relationships, and they serve as a template for categorizing objects into parts. The present article focused on the latter use to explore the representation of body part terms and their polysemous meanings in the mind. The question of how the meanings of polysemous body part terms are represented in the mental lexicon was examined on the basis of cross-linguistic naming patterns and the use of the body part term chân ‘foot/leg’ in Vietnamese. The results indicate that the meanings of chân are connected to perceptual features on the one hand and sensorimotor features on the other hand. This leads to the interpretation that chân is represented in two different entries with the meaning ‘foot’ and ‘leg.’ However, the following discussion presents a more nuanced view on the implications of the analysis.

Since the body is important for humans, its representation has been the subject of research for a long time and the brain has different areas where specific body parts are processed (Penfield and Boldrey 1937). Furthermore, the segmentation of the body into parts is primarily based on distinctiveness (visual features) and significance (sensorimotor and visual features). The former is shown to predict visual processing of body part pictures whereas the latter accounts for conceptual processing of body part terms (Morrison & Tversky 2005). Sensorimotor features play an additional role when performed in a distance judgment task between two body parts in that the parts feel closer together after an action is performed with them (de Vignemont et al. 2009). As of yet, most studies in the area of body part segmentation (and cognitive science in general) are
conducted predominantly with English speakers rather than non-WEIRD participants (Henrich, Heine, and Norenzayan 2010). Thus, it is still an open question whether the same results hold across different populations.

In recent years, targeted investigations in semantic typology have brought forward findings of language variation in the semantic domain of human body parts (e.g., Enfield, Majid, and van Staden 2006; Majid 2010; Majid and van Staden 2015). The results of coloring tasks propose that speakers have different segmentation patterns across languages and within the same language. Interestingly, all languages seem to rely on discontinuities while segmenting the body into linguistic units, but which discontinuity is chosen differs (Majid 2010). In addition, it is assumed that speakers of a language without distinct names for hand and arm ground the lexical entries in the motor system instead of the visual system (Majid and van Staden 2015). The importance of perception, especially vision, with respect to patterns of body part nomenclature is reiterated in the literature, whereas sensorimotor features, such as function, have been considered less important. Although we see parts of our body with our eyes, there is also an intrinsic experience of body parts. For some body parts, this experience is subtle (e.g., the beating of our hearts), whereas for others, it is intentional (e.g., writing with your fingers on a keyboard). The representation of the body in the mind therefore seems to be associated with both perceptual and sensorimotor features.

The different body part extensions with chân in Vietnamese support these observations. While Vietnamese speakers have a distinct term for ‘foot’ (bàn chân) it is not yet lexicalized and the word chân commonly refers to ‘leg (and foot)’ in everyday language. From an English perspective, this is a case of foot/leg polysemy, but Vietnamese speakers seem to have a clear grasp on the differences between the two body parts. This becomes apparent in the body part extensions with chân to objects (e.g., chân bàn/ghế/giường ‘leg of the table/chair/bed’) compared to landscape features (e.g., chân núi ‘foot of the mountain’). The same term can be extended on the basis of a similarity in function (sensorimotor) or spatial alignment (perceptual). An explanation for this observation may be that chân is represented in two different entries in the mental lexicon, one with the meaning ‘leg’ and its extensions and the other with the meaning ‘foot’ and its extensions. But this view is not compatible with the findings that polysemy is represented in a continuum (Klepousniotou and Baum 2007; Windisch Brown 2008) rather than separate entries (Klein and Murphy 2001). Therefore, I argue for a third possibility and suggest that the same term can be connected to multiple meanings that are associated with perceptual and sensorimotor features. The representation of meanings in the mental lexicon should be considered as a network, similar to the graphic representation in the CLICS³ database (Rzymski et al. 2020) with varying strength/closeness between meanings and connections on the basis of perceptual and sensorimotor features. A particular context or a previously performed action may activate one of these features, adding another meaning to a term. Thus, perceptual and sensorimotor features are the basis for the connection between two meanings. This interpretation could also explain some of the cross-linguistic patterns of colexifications.

The analysis of the colexifications with the concepts leg and foot in the CLICS³ database showed that a number of languages use the same term for both concepts. In addition, the
colexification between body part concepts and objects supports the findings of body part extensions with \textit{chân} in that the basis for a given colexification is a shared similarity. The colexification between \textit{LEG} and \textit{TREE} seems to be based on a similarity in function (holding up the crown) or shape (length), whereas the colexification between \textit{FOOT} and \textit{WHEEL} arises from a similarity in function (locomotion) or spatial alignment (lowest part). The analysis of the CLICS\textsuperscript{3} data also showed that the concept \textit{LEG} colexified more often with specific parts of the \textit{leg}, namely \textit{thigh}, \textit{shin}, \textit{lower leg}, and \textit{calf of the leg}. These colexifications could be depicting a phase in a semantic change from terms with the original meaning ‘thigh’ or ‘shin, calf’ to ‘leg’, which can be observed in several languages (Wilkins 1996). In contrast, the concept \textit{FOOT} is colexified more frequently with parts belonging to the \textit{foot}, such as \textit{heel} and \textit{toe}. These patterns illustrate that metonymy plays a role in the categorization of the human body into linguistic units. The transfer of \textit{chân} on the basis of metonymy was also illustrated by the different uses of \textit{chân} standing for people or activities like walking (V. H. Nguyen 2014; N. V. Nguyen 2016; Thanh 2019).

To learn more about the cognitive principles of body part extensions, we need to better understand how body part terms can be extended to objects on the basis of a shared similarity in perceptual and sensorimotor features. In the future, more detailed studies across a variety of languages need to be conducted with coloring tasks or other experimental methods. These studies will be able to differentiate whether a term labeled \textit{leg} has the meaning ‘limb between hip and foot’ or ‘lower limb including hip and foot’ and provide more insights into the cultural influence on the similarity of meaning across languages (see also Thompson, Roberts, and Lupyan 2020).

In sum, the dimensions of \textit{shape}, \textit{spatial alignment}, and \textit{function} seem to play a role in the extension of body part terms to object and landscape features across various languages. Although preferences for one particular dimension in a single language were not found (as opposed to Levinson 1994; Tilbe 2017; but similar to Majid et al. 2018), the strength of similarity\textsuperscript{7} (referred to by Ullmann 1963 as “obvious similarity”) increases the frequency of certain body part extensions in different languages (Tjuka 2019). The analysis suggests a general principle of extending body part terms that are salient in a language to objects on the basis of similarities in perceptual and sensorimotor features.

The investigation of polysemous words offers many new insights into human cognition and our understanding of language diversity. The present study has shown that polysemy is a multifaceted phenomenon that needs to be further investigated with a combination of cross-linguistic and experimental data to understand the structure of the mental lexicon.

References


\textsuperscript{7} Here, the strength of similarity is defined as the number of dimensions that can lead to a certain body part extension (see also Tjuka 2019).


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