

Two-Handed Signs and Handedness: Phonological Implications for Sign Language Structure

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Introduction & Motivation

- A defining property of sign languages (SLs) is the availability of **two active manual articulators**. Across SLs, one-handed and two-handed signs are roughly equally represented in the lexicon (Crasborn 2011; McKee et al. 2024).
- Yet **handedness** – the structural choice between one and two hands – has not been systematically incorporated as a formal phonological parameter in existing hierarchical models.

This paper argues that handedness is a **core phonological parameter** that directly constrains the distribution of movement, handshape, location, and orientation across articulators. We propose an **adapted phonological dependency model** that explicitly encodes handedness within the hierarchical structure, with implications for both linguistic theory and sign language technology.

Phonological Parameters in Sign Languages

Following Stokoe (1980) and subsequent hierarchical accounts (Brentari 1998; Van der Kooij 2002; Sandler 2014), lexical signs are analysed across a small set of contrastive manual parameters:

Movement

Phonologically obligatory. Distinguishes *path movement* (PM — transition between two positions) and *local movement* (hand-internal change; orientation change). A syllable contains at most one instance of each type.

Handshape

Determined by *finger selection* (foregrounded vs. backgrounded) and *finger configuration* (curve, aperture, width). Simple/unmarked handshapes require minimal specification; complex/marked handshapes require multiple dependent features.

Orientation

Encodes palm facing relative to space, body, or another articulator. Three analytical approaches: handshape-linked, movement-linked, and contact-based orientation (Fenlon et al. 2017).

Location

The major area of articulation (head, torso, neutral space, non-dominant hand). Distinct from *setting*, which specifies finer positional distinctions within that area.

Handedness – our contribution

The present paper introduces **handedness** as a sixth parameter, arguing it belongs at the level of structural specification rather than post-lexical annotation.

Adapted Phonological Dependency Model

The proposed model extends prior hierarchical accounts (Van der Kooij 2002; Sandler 2014, 2017) in two principal ways:

1. Handedness as an explicit structural node

Handedness is introduced directly under the manual articulator node, forking into **One hand (Dominant)** and **Two hands (Non-dominant)**.

This makes articulatory asymmetry formally visible within the hierarchy

- In one-handed signs the non-dominant branch receives feature value **X** (unspecified)
- In two-handed signs it receives full specifications – either shared (symmetry) or independent (asymmetry, constrained by dominance condition).

2. Formalised feature distribution across articulators

Dashed dependency relations encode how phonological features (*orientation, handshape, location, setting*) are distributed across both hands, capturing symmetry and dominance conditions as *structural constraints* rather than stipulated rules.

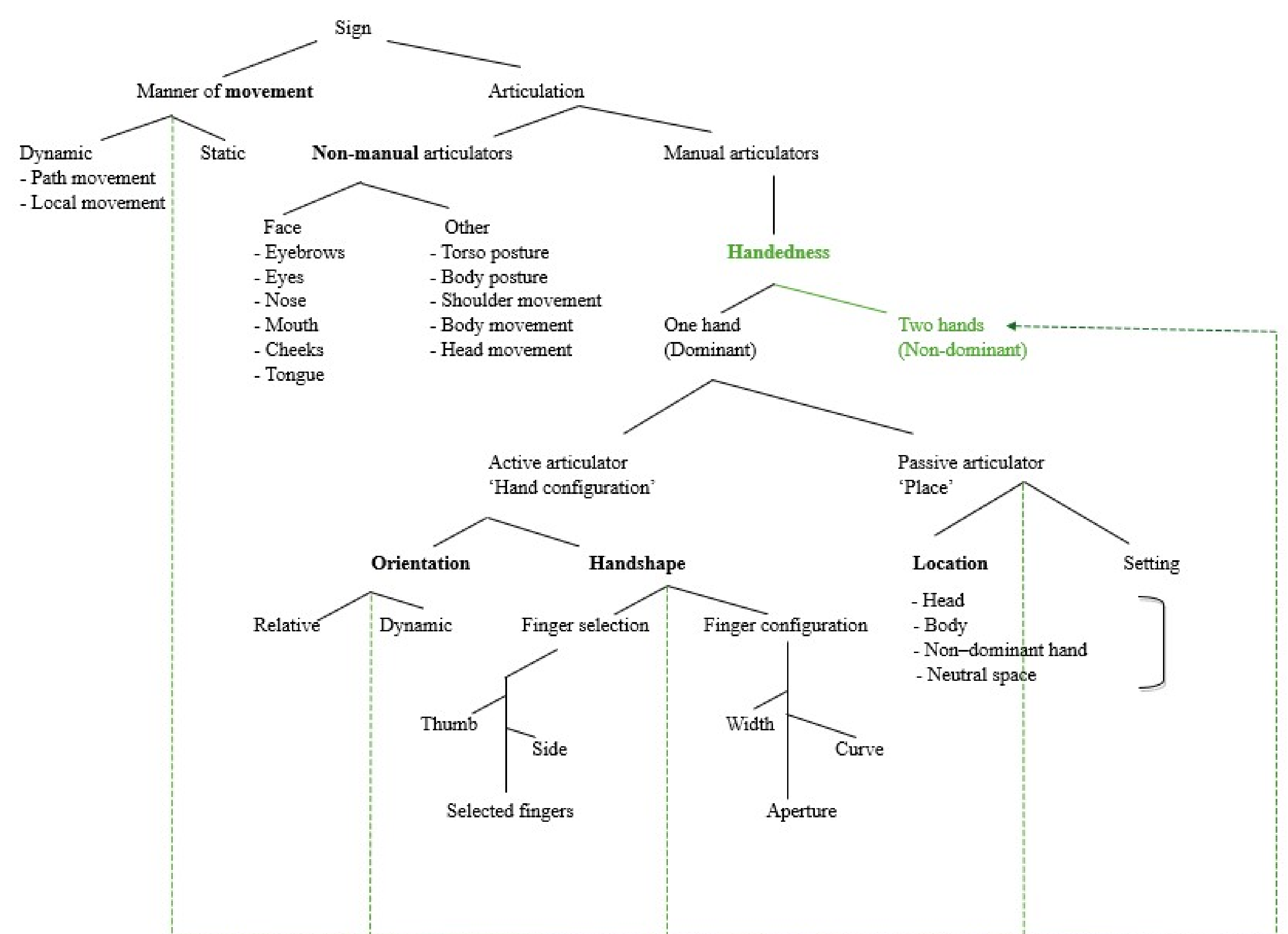


Figure: Adapted phonological hierarchy dependency model

Theoretical & Computational Implications

Bidirectional interpretation

- Bottom-up (production):** movement patterns and articulators together formalise the sign's linguistic content during lexical access
- Top-down (comprehension):** recognition begins with finger selection and handshape — the earliest and most salient cues for lexical access (Brentari 1998; Emmorey & Corina 1990) — which then supports reconstruction of the full hierarchical structure

Theoretical

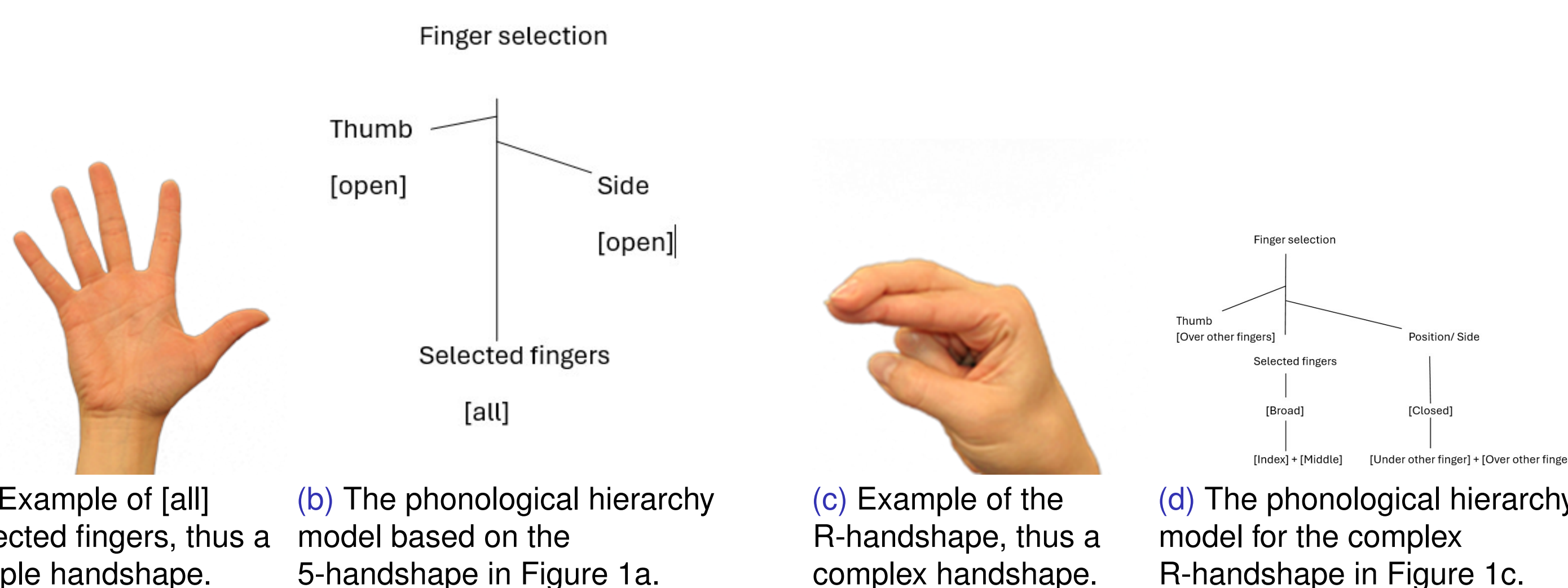
- Enables **cross-linguistic variation** analysis in one- vs. two-handed signs
- Captures dominance, symmetry, and constraint interactions
- Accounts for variation phenomena as structurally constrained adjustments
- Reduced representational ambiguity and improved empirical testability

Corpus & annotation

- Motivates encoding hands as **distinct articulators** with separate feature specifications
- An additional ELAN tier could encode whether the non-dominant hand carries independent specifications, and which parameters are specified independently
- Facilitates more precise corpus searches and improved dataset interoperability

Computational

- Reduced representational ambiguity benefits automated SL recognition and generation
- Hierarchical articulator structure supports feature geometry models



Handedness: Asymmetry & Phonological Constraints

A functional asymmetry between the **dominant (strong) hand** and the **non-dominant (weak) hand**:

Two well-established constraints (Battison 1978)

- Symmetry constraint:** if both hands are active, they must share handshape, movement, and location
- Dominance constraint:** if the non-dominant hand is passive, it must bear either an unmarked handshape or the same handshape as the dominant hand

These are difficult to explain if handedness is merely a surface realisation choice.

Prior Approaches to Handedness

- Van der Kooij (2002) asks whether handedness should receive a structural position in the phonological hierarchy. Crasborn & Van der Kooij (2023) propose a **three-level architecture** which implies handedness is not marginal or purely phonetic.
- Prior accounts treat it as an *architectural* issue rather than a formal parameter; the present proposal integrates it directly into the phonological hierarchy.

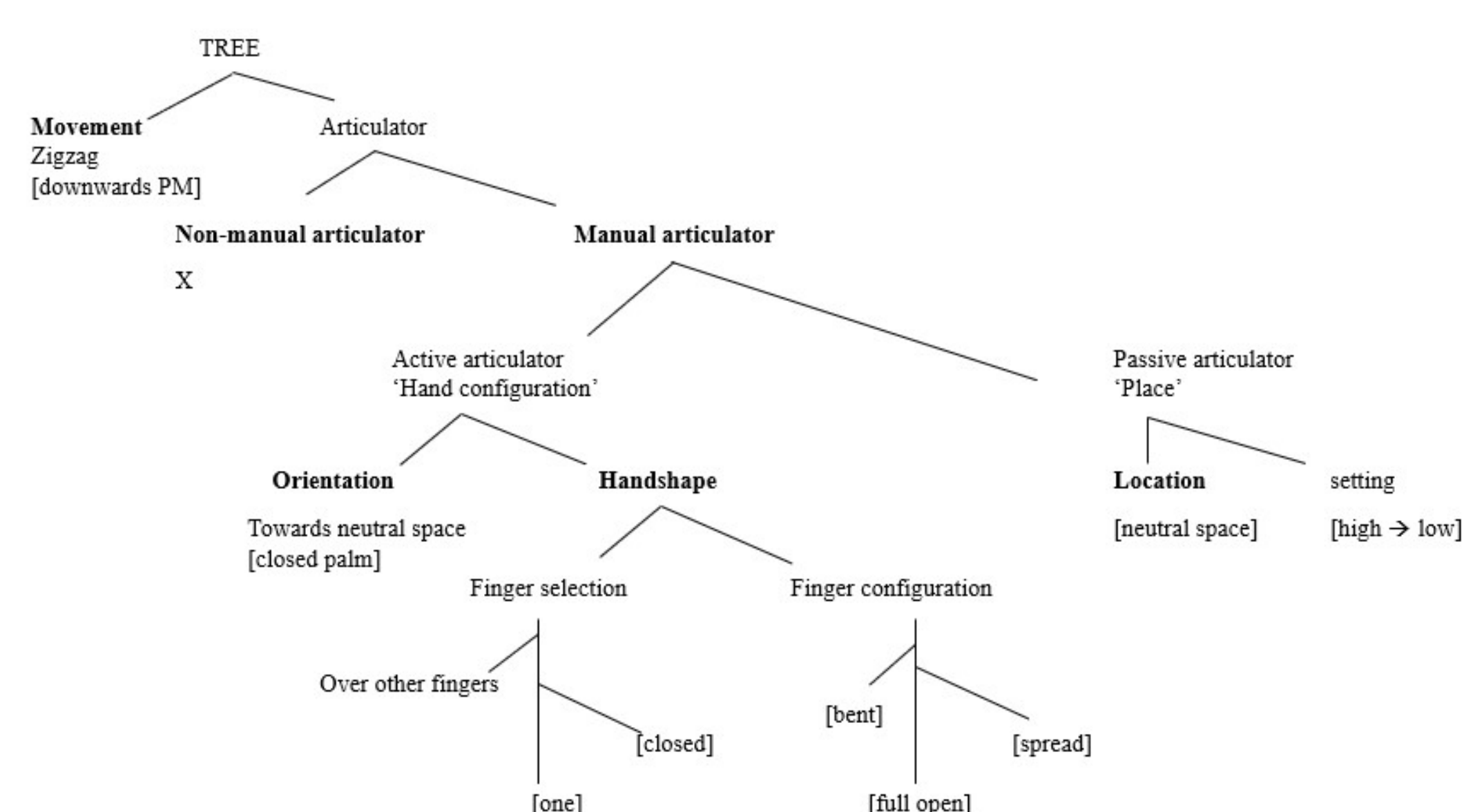


Figure: The old phonological hierarchy dependency model for the one-handed sign TREE

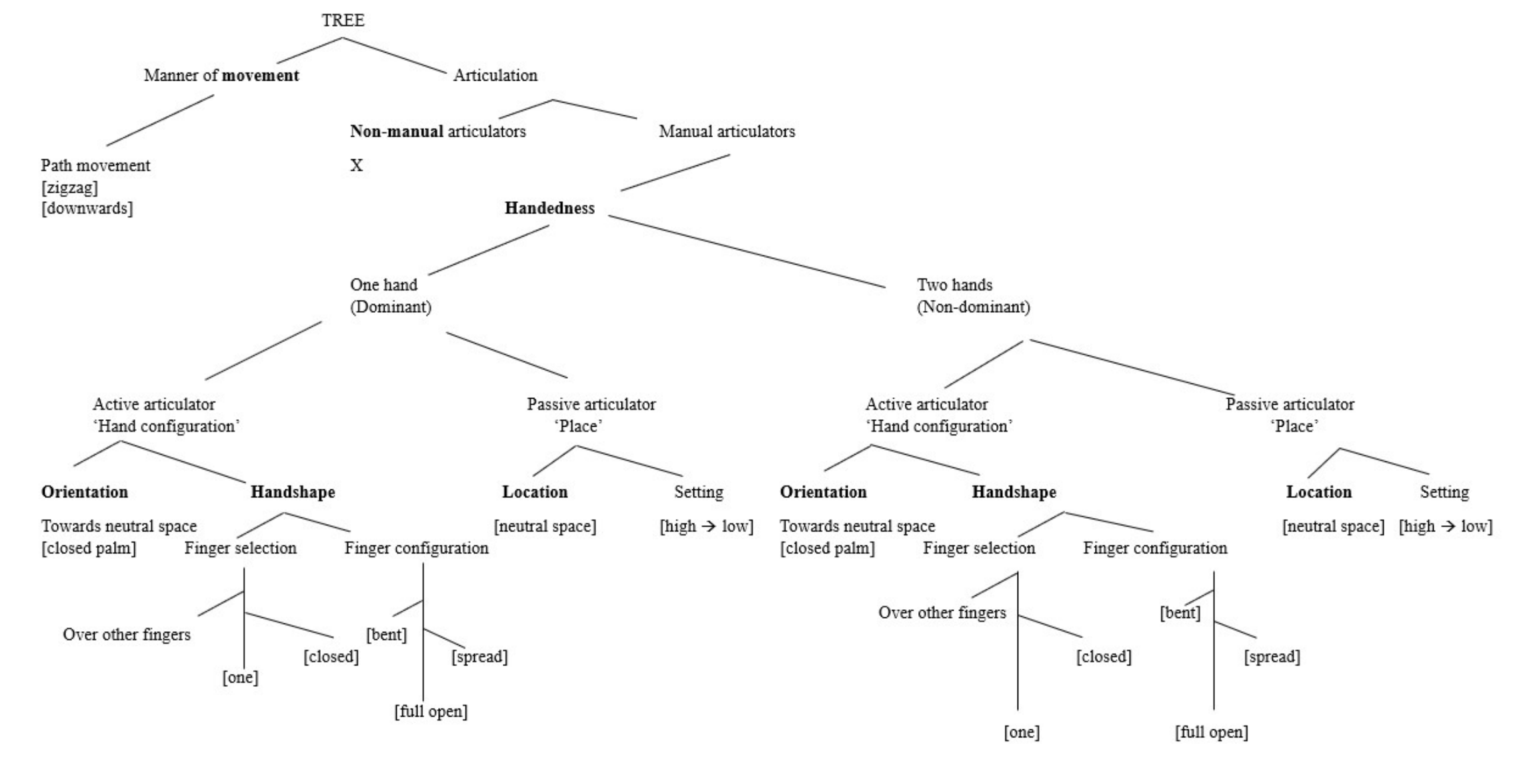


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