



# Noun-Verb Pairs in Taiwan Sign Language

Jane S. Tsay<sup>(✉)</sup>

Institute of Linguistics and Taiwan Center for Sign Linguistics, National Chung  
Cheng University, Chiayi, Taiwan  
Lngtsay15@gmail.com

**Abstract.** Nouns and verbs that are semantically and formationally related are called noun-verb pairs. Noun-verb pairs are found both in spoken and signed languages. A debate has been raised as to whether the noun and the verb in the pairs are distinguished by syntactic environments or they have a morphological (derivational) relation. Based on the Taiwan Sign Language data we have collected, it was found that nouns and verbs are distinguished more systematically by syntactic environments. Modality effects and non-effects in word formation in spoken versus signed languages are also discussed with a special focus on the role of iconicity.

**Keywords:** Noun-Verb pairs · Cross-modality · Taiwan sign language  
American sign language

## 1 Introduction

Compared with spoken languages, the history of research on signed languages is much shorter. Since the pioneering works of [1, 2], and many later works, e.g., [3], it has been demonstrated that human language can be produced in two modalities, i.e., the vocal-auditory modality for spoken languages and the gestural-visual modality for signed languages. It is expected that there will be differences (as modality effects) as well as similarities or parallels (as modality non-effects) between spoken and signed languages in all linguistic components. Thus signed languages are worth exploration and examination, especially with linguistic theories developed mainly on spoken languages.

Word classes are a major domain in the area of lexical semantics. Among the major word classes, nouns and verbs are the most fundamental natural word classes in human language. As has already been claimed more than half a century ago [4], nouns and verbs can be regarded as universal categories based on evidence in the formal analysis of language structures.

Although nouns and verbs can be formed independently of each other, some nouns and verbs are related both in form and meaning. For example, *water* in English could be a noun or a verb. These paired words that are related in form and meaning are called noun-verb pairs.

While noun-verb pairs in spoken language have been analyzed quite thoroughly, not much attention has been paid to the noun-verb pairs in signed languages. Therefore, this paper analyzes noun-verb pairs in Taiwan Sign Language (TSL), with reference to other sign languages including American Sign Language (ASL). Furthermore, by

comparing noun-verb pairs in spoken versus signed languages, the modality issue is also addressed, especially the role of iconicity in word formation.

### 1.1 Nouns and Verbs are Universal

Nouns and verbs are natural word classes in spoken (e.g., [4–6]) and sign languages [2, 7, 8].<sup>1</sup> Since nouns and verbs are so fundamental in human language, they have been the focus of linguistic analysis in almost all components, especially in morphology, semantics, and syntax.

The relation and contrast between nouns and verbs have also raised important issues in psycholinguistics and neurolinguistics. For example, there has long been a debate about whether children acquire nouns before verbs, or vice versa, i.e., noun-bias (noun-first) versus no-noun-bias (verb-first) in young children’s lexical development. Arguments have been drawn from grammatical structure (e.g., null subject), object and action contrast, entity vs. event, degree of concreteness, and imageability of the lexical items (e.g., [12–18]).

Nouns and verbs are also the major word classes to be dealt with in lexicography and computational linguistics, especially when nouns and verbs are identical in form as in noun-verb pairs and may cause problems in automatic language processing (e.g., [19–23]).

### 1.2 Noun-Verb Pairs

Nouns and verbs can be formed independently, especially with the arbitrariness in form-meaning mapping in spoken languages. For example, *chair* and *sit* in English are semantically related but do not share any formational characteristics. However, there are certain nouns and verbs that are related not only semantically, but also formationally. They are called noun-verb pairs. For example, in English *water* could be a noun that refers to the liquid substance composed of hydrogen and oxygen or a verb that refers to the action of putting water on plants. The word *hùà* 畫 in Mandarin is both a verb meaning “to draw” and a noun meaning “drawing” as the output of the action “to draw”.

Noun-verb pairs have also been reported in many signed languages around the world (e.g., [2, 24, 26–28]). A noun-verb pair in ASL is defined with two criteria [24]. First, the verb expresses the activity performed with or on the object named by the noun. For example, SIT in ASL expresses the activity performed on the object CHAIR.<sup>2</sup> Second, the noun and verb share formational characteristics. For example, CHAIR and SIT share formational characteristics in handshape, orientation, place of articulation, and movement. (The formational characteristics of words/signs in signed languages will be presented in more details in Sect. 2.)

<sup>1</sup> The universality of nouns and verbs has been challenged in some languages, e.g., [9–11].

<sup>2</sup> Following the convention in sign language linguistics, English glosses or equivalents of the lexemes in signed languages are given in capital letters.

### 1.3 Cross-Modality Study

There are two modalities in human language, the vocal-auditory modality for spoken languages and the gestural-visual modality for signed languages. The similarities and parallels between spoken and signed languages are called modality non-effects, while differences between spoken and signed languages are called modality effects [29].

Based on the design features proposed by [5] for distinguishing human language from the communication systems of other animals, [29] proposes several design features as the shared properties of signed and spoken language, including conventional vocabularies, duality of patterning, productivity in vocabulary, syntactic structure, time course of child language acquisition, and brain lateralization, and claims that these are non-effects of modality (see Table 1)<sup>3</sup>.

**Table 1.** Non-effects of Modality: Some shared properties between signed and spoken languages (Meier 2002:2, [29])

- 
- Conventional vocabularies: learned pairings of form and meaning.
  - Duality of patterning: meaningful units built of meaningless sublexical units, whether units of sound or of gesture:
    - Slips of the tongue/Slips of the hand demonstrate the importance of sublexical units in adult processing.
  - Productivity: new vocabulary may be added to signed and spoken languages:
    - Derivational morphology;
    - Compounding;
    - Borrowing.
  - Syntactic Structure:
    - Same parts of speech: nouns, verbs, and adjectives;
    - Embedding to form relative and complement clauses;
    - Trade-offs between word order and verb agreement in how grammatical relations are marked: rich agreement licenses null arguments and freedom in word order.
  - Acquisition: similar timetables for acquisition.
  - Lateralization: aphasia data point to crucial role for left hemisphere.
- 

Regarding conventional vocabularies, like spoken languages, signed languages can expand their vocabularies through derivational processes, compounding, and borrowing (e.g., [3, 24, 30]).

On the other hand, there are also modality effects resulting in the structural differences between signed and spoken languages in the lexicon, phonology, morphology,

<sup>3</sup> Before [1], human language was thought to be only possible in the oral-aural modality [32, 33].

semantics, and syntax. While sound symbolism is rare in spoken languages [31], iconicity in sign language is overwhelmingly common and is a crucial word formation motivation. In this paper, we will address the issue of iconic motivation in word formation in spoken versus signed languages, as will be illustrated in the relation between nouns and verbs.

## 2 Some Background for Signed Languages

### 2.1 Formational Characteristics of Signs

Signs (words) in signed languages can be described in terms of phonemic contrasts in manual features (i.e., handshape, location, movement, hand orientation) and non-manual features (e.g., [2, 34] for ASL; [35] for TSL). These features are the constructing elements of signs in signed languages. Considering the scope and the relevance to the theme of this paper, only manual features are introduced in this section. TSL minimal pairs that contrast in the manual features are given as examples [35].<sup>4</sup>

TOMORROW and DOCTOR (PhD) form a minimal pair of signs that contrast only in handshape. Handshape 1 is used in TOMORROW, while handshape Curved-Middle is used in DOCTOR (PhD) with the rest of the features (location, movement, and hand orientation) being the same. (See [36] for a complete list of handshapes in TSL) (Fig. 1).



**Fig. 1.** Phonemic contrast in handshape (1 vs. Curved-Middle)

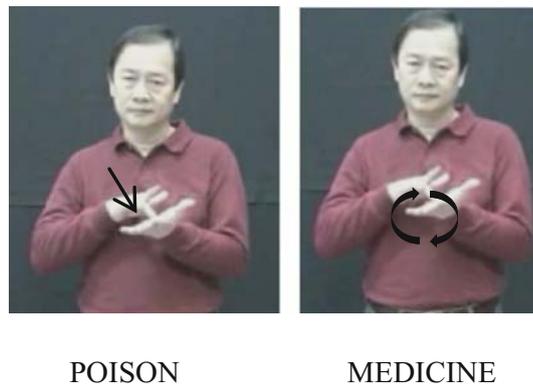
PLEASE and YES (confirmation) is a pair of signs that contrast only in location. They both use the handshape B and have the same hand orientation, except that the hand in PLEASE makes contact on the forehead, while the hand in YES touches the chin (Fig. 2).

The signs POISON and MEDICINE contrast only in movement. Both signs use the same handshape Open-8. In POISON, the middle finger touches the palm of the other hand, while in MEDICINE the middle finger makes small circles in the palm of the other hand (Fig. 3).

<sup>4</sup> The use of all the pictures in TSL in this paper has received the approval from the signers.



**Fig. 2.** Phonemic contrast in location (Forehead vs. Chin)



**Fig. 3.** Phonemic contrast in movement (Touch vs. Circle)

The signs NOW and CALM-DOWN contrast only in hand orientation. They both use handshape Open-B with downward movement. They only differ in the direction that the fingertips are pointing to. That is, while the fingertips in NOW are pointing forward, they are pointing towards each other in CALM-DOWN (Fig. 4).



**Fig. 4.** Phonemic contrast in orientation (Pointing forward vs. Pointing to each other)

## 2.2 A Brief Introduction to Taiwan Sign Language

Compared to ASL which has been investigated since [1], linguistic research on TSL has a much shorter history, with [37] being the first linguistic study on TSL. TSL is the native language of the deaf in Taiwan. It is historically related to Japanese Sign Language (JSL) and is considered a branch of JSL [36, 38–40]. The history of TSL can be dated back to when the first school for the deaf was established in 1915 in southern Taiwan by Japanese educators during the period of Japanese occupation of Taiwan (1895–1945). Therefore, TSL is based on JSL with a mixed lexicon of JSL words and locally developed vocabulary. TSL vocabulary was also influenced through language contact with Chinese Sign Language (CSL) after 1949 when some deaf teachers from Nanjing and Shanghai came to Taiwan. Hence there are also borrowing words from CSL.

In this paper, we report TSL data of noun-verb pairs collected for comparison with other signed languages, in particular, ASL.

## 2.3 Noun Verb Pairs in Signed Languages

Noun-verb pairs are more common in signed languages than in spoken languages ([24] on ASL; [26] on Australian Sign Language; [27] on Austrian Sign Language; [41] on German Sign Language (DGS) and Sign Language of the Netherlands (NGT)).

In sign languages, noun-verb pairs are mostly concrete object nouns and their related action verbs, such as CHAIR (noun) and SIT (verb). Examples of noun-verb pairs are abundant. In Fig. 5 are some from the 100 pairs listed in [24] for ASL.

AIRPLANE – GO-BY-AIRPLANE (i.e., FLY)  
 MATCH – STRIKE-MATCH  
 CIGARETTE – SMOKE  
 TOOTHBRUSH – BRUSH-TEETH  
 CLIP – CLIP-FINGERNAIL  
 BROOM – SWEEP  
 STAPLER – STAPLE  
 HAMMER – HAMMER  
 COMB – COMB

**Fig. 5.** Some noun-verb pairs listed in Supalla and Newport (1978) [24]

As can be seen from the above examples, these are concrete objects nouns and their related action verbs. These semantically related noun-verb pairs have been reported to share formational characteristics in phonemic features such as handshape, location, and movement.

## 2.4 A Debate About Noun-Verb Pairs in ASL

It is claimed that noun and verb in noun-verb pairs in ASL are identical in form. That is, they have the same handshape, location, and movement [2]. They can only be distinguished by context or syntactic environments. For example, both CHAIR and SIT are signed by putting two bent fingers (index and middle, i.e., handshape Curved-V) on the index and middle fingers of the other hand. They cannot be distinguished in isolation unless they are in context. That is, the word in phrase “two \_\_\_” refers to CHAIR because only nouns can be modified by a quantifier.

However, they argue that the noun and the verb in a noun-verb pair are structurally distinct and that there is a derivational relation between the noun and the verb in the noun-verb pairs [24]. In the CHAIR—SIT pair, both signs use handshape Curved-V and have the same location. But they differ in the movement. In SIT, the movement is larger, while in CHAIR the movement is smaller (restrained) and, more importantly, repeated. See Fig. 6 for the illustration of CHAIR—SIT in ASL.

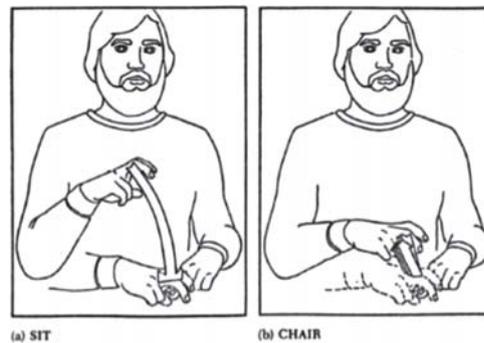


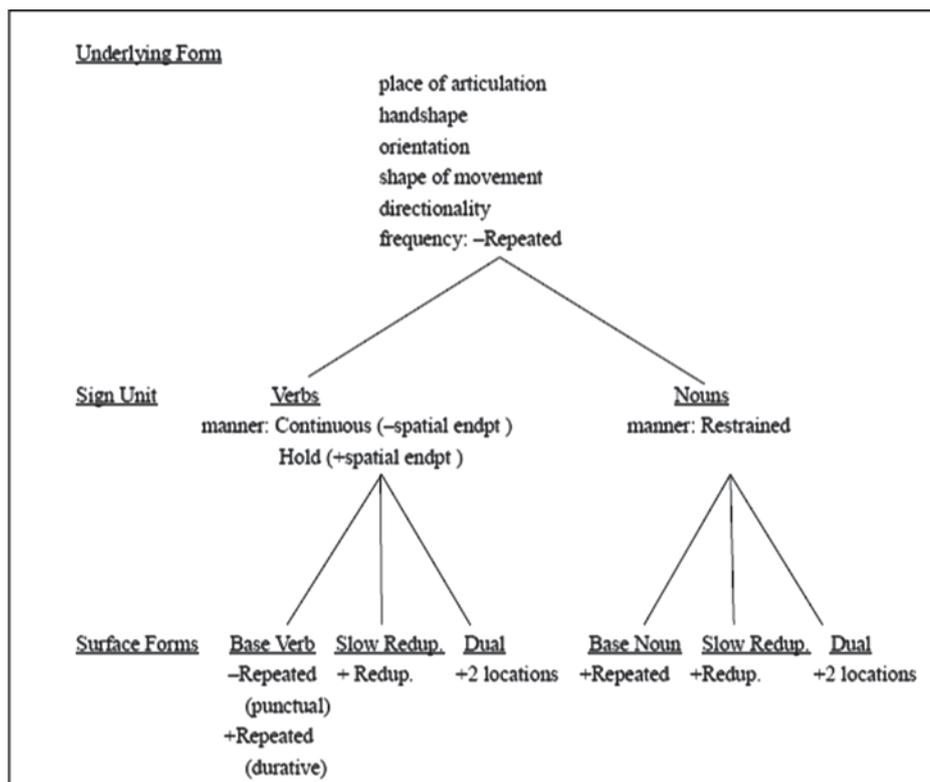
Figure 4.4. One noun-verb pair.

**Fig. 6.** SIT and CHAIR in ASL (Supalla and Newport 1978:102 [24])

A formal model was proposed to derive the noun-verb pairs from an underlying base form [24]. They argue that noun and verb in the noun-verb pairs are structurally distinct in manner of movement. Although the location, handshape, and orientation of the noun and the verb are basically the same, there is a difference in the manner of movement. They analyze movement in more detailed features such as continuous, hold, restrained (the muscles are tightened, movement is small, quick, and stiff), and frequency ([+repeated]).

The derivational relation for related nouns and verbs is illustrated in Fig. 7. Both the noun form and the verb form are derived from an underlying base form. Regarding the CHAIR—SIT pair, specifically, the manner and frequency in SIT are [continuous] and [-repeated], while in CHAIR they are [restrained] and [+repeated].

It was further claimed that, while most verbs are formed with a single movement, referring to single punctual or perfective actions, all the nouns have “restrained” manner of movement and the movement is always repeated [24]. In the following section, we test this claim with noun-verb pairs in TSL.



**Fig. 7.** The derivational system for related nouns and verbs (Supalla and Newport 1978: 119 [24])

### 3 Noun-Verb Pairs in Taiwan Sign Languages

#### 3.1 TSL Noun-Verb Pairs in Citation Form

Noun-verb pairs in TSL have been studied by [25], focusing on the iconic strategies in word formation. It was found that manipulation property was the most frequently used, followed by action property, position property, and appearance property. It was also found that the noun and the verb in a noun-verb pair are identical in form and can only be distinguished by their syntactic position in context [25].

Since the goals of [25] were different from our current study, TSL noun-verb pairs were collected with more elaborated methods. TSL data discussed in this paper are part of the database, in which 73 pictures of objects and 73 pictures of actions corresponding to 73 noun-verb pairs were used to elicit data from three male deaf signers aged 72 (YS), 60 (JM), and 22 (MJ), respectively.<sup>5</sup> Some pairs also appeared in sentences to verify their forms in syntactic environments. Nouns and verbs were videotaped separately. Unrelated pictures were used as foils. The following two figures are pictures for eliciting CHAIR—SIT and TOOTHBRUSH-BRUSH-TEETH in citation form.<sup>6</sup>

<sup>5</sup> This list of 73 noun-verb pairs was adapted from [25] with reference to [24].

<sup>6</sup> To avoid copyright and portrait right issues, some pictures for actions that involve people were hand-drawn by our research assistants.

The generalizations proposed in [24], in particular, a derivational relation between the noun and the verb in a noun-verb pair, are not fully supported based on the TSL data we have collected. Instead, our data are more in support of [2] in that the noun and the verb in noun-verb pairs tend to be identical in form and are mainly distinguished by syntactic environments (Figs. 8 and 9).



**Fig. 8.** Pictures for eliciting CHAIR and SIT



**Fig. 9.** Pictures for eliciting TOOTHBRUSH and BRUSH-TEETH

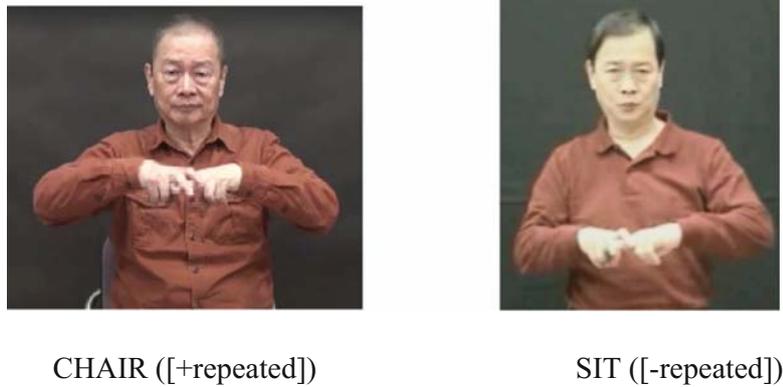
Five TSL noun-verb pairs in citation form by the three deaf signers are given in Table 2 below.

In the five pairs presented, only CHAIR—SIT shows a contrast between the noun and the verb. It is also the only pair that shows discrepancies among the signers.

**Table 2.** TSL noun-verb pairs in citation form

N-V pair	Not Identical (Supalla and Newport 1978)		Identical (Stokoe et al. 1965)
	Nouns	Verbs	
	[+repeated]	[-repeated]	
CHAIR-SIT	✓(YS)		✓ (JM)
AIRPLANE-GO-BY-AIRPLANE			✓
MATCH-STRIKE-MATCH			✓
CIGARETTE-SMOKE			✓
TOOTHBRUSH-BRUSH-TEETH			✓

Signer YS has a contrast of CHAIR [+repeated] vs. SIT [-repeated], consistent with [24], while signer JM has an identical form for both CHAIR and SIT, both being [+repeated], consistent with [2] argument, as shown in Figs. 10 and 11, respectively.



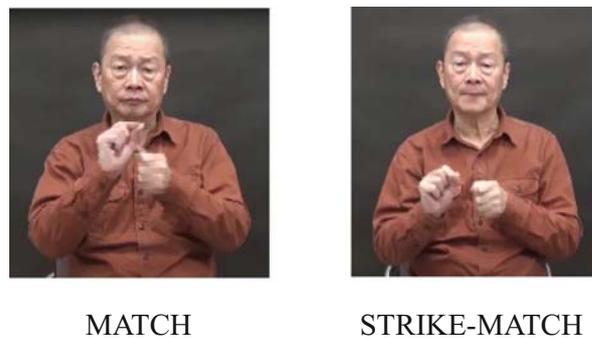
**Fig. 10.** CHAIR-SIT pair by YS



**Fig. 11.** CHAIR-SIT pair by JM

The other four pairs showed identical forms between the noun and the verb in the pair consistently among the three signers. Demonstrations of the pair MATCH—STRIKE-MATCH by the three signers are given in Figs. 12, 13 and 14.

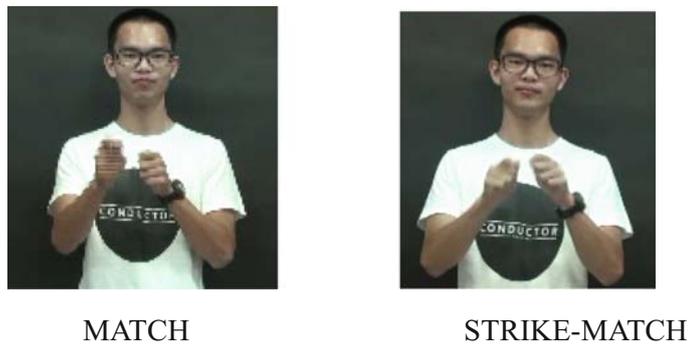
If the claim in [24] was correct, as parallel to the CHAIR-SIT pair, we would expect the noun MATCH to be signed with restrained and [+repeated] movement and the verb



**Fig. 12.** MATCH—STRIKE-MATCH by YS



**Fig. 13.** MATCH—STRIKE-MATCH by JM



**Fig. 14.** MATCH—STRIKE-MATCH by MJ

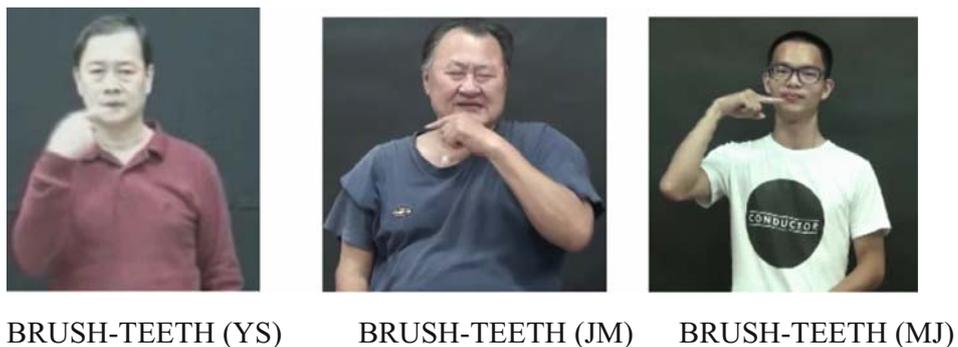
STRIKE-MATCH with larger and [–repeated] movement. However, all three signers signed the noun MATCH and the verb STRIKE-MATCH identically with restrained and [+repeated] movement. Therefore, the results do not support the hypothesis proposed in [24].

### 3.2 TSL Noun-Verb Pairs in Context

We further examined the noun-verb pairs in sentences. The pair TOOTHBRUSH-BRUSH-TEETH in citation were signed with identical form with [+repeated] movement by all three signers, as shown in Figs. 15 and 16.



**Fig. 15.** TOOTHBRUSH



**Fig. 16.** BRUSH-TEETH



**Fig. 17.** TSL “I have three toothbrushes”

When appearing in sentences, both TOOTHBRUSH and BRUSH-TEETH were still signed identically. The only difference is in the syntactic environments they appeared. TOOTHBRUSH, as a noun, was modified by a quantifier “three” in “I have three toothbrushes” (Fig. 17), while BRUSH-TEETH, as a verb, was modified by a modal “should/need” in “One should brush the teeth after meals” (Fig. 18).



**Fig. 18.** TSL “One should brush the teeth after meals”

## 4 Discussion

### 4.1 Noun-Verb Pairs in Other Sign Languages

It was reported in [41] that the ASL pattern described in [24] cannot be established in German Sign Language (DGS) and Sign Language of the Netherlands (NGT).

“In NGT, for instance, a comparable systematic relation between nouns and verbs cannot be established. The manual part of the signs for SIT and CHAIR, which are both signed with a  $f <$ -handshape, thus looks identical in some signers. Others perform CHAIR with a turn of the wrist which is not found in SIT. The two-handed noun BICYCLE is usually signed with a single alternating circular movement while the related verb CYCLE has multiple repetitions - exactly the opposite of the ASL pattern described above.”

(Baker, et al. 2016:101 [41])

Interestingly, [28] investigated two young sign languages, Israeli Sign Language (ISL) and Al-Sayyid Bedouin Sign Language (ABSL), to determine whether they have developed a distinction in the formation of noun-verb pairs. They found reliable formational distinctions between nouns and related verbs in ISL, but not in ABSL. They suggested that a formal distinction in noun-verb pairs in sign languages is not necessarily present from the beginning, but may develop gradually. More studies on noun-verb pairs in signed languages might shed light on how human language has evolved.

### 4.2 Noun-Verb Pairs in Spoken Languages

Words that can function as both nouns and verbs are very common in spoken languages. In addition to English and Mandarin, more than 60 languages are discussed as having this phenomenon [6], including Paiute, Chukchee, Ponapean, Nahuatl, Mende, Turkish, French, Indonesian, Malay, Hungarian, Bemba, Spanish, German, Hausa, Portuguese, Finnish, Akan, Yoruba, Igbo, Hindi, Russian, Maori, Tamil, Palestinian, Arabic, Zulu, Rukai, Nootkan, and Salishan.

In English, the substance “water” (noun) is converted to the action verb as in “water the garden” and the tool “hammer” (noun) is converted to the action of using the tool upon something as in “hammer a nail”. This process is called *denominalization* or *verbalization* in the literature. On the other hand, *nominalization* is also a common word formation mechanism in spoken languages and is much more productive than verbalization, known as an *asymmetry* in the literature (e.g., [6, 42]).

Hopper and Thompson (1984:745) state that “...a nominalization names an event taken as an entity; however, a ‘verbalization’ does not name an ‘entity taken as an event’, but simply names an event associated with some entity [6:745].”

Since this has been a well-known and well-studied topic in spoken languages with a long list in the literature, in consideration of space limitation and the focus of this paper we will not discuss it further. Detailed discussions on related issues, e.g., zero derivation, regarding the derivational relation in the noun-verb pairs in spoken languages can be found in the literature (e.g., [42–44]). The so-called Chinese multi-class words *hànyǔ jiānlèi* (漢語兼類) phenomenon has been discussed widely since [45] and followed by many others (e.g., [46–51]).

Syntactic functions and distribution are crucial in distinguishing nouns and verbs in these pairs. If the word is located in a subject or an object position, it is a noun, as in Fig. 19(a). It is a verb if located in a predicate structure, as in Fig. 19(b).

- (a) The plants in the garden need *water*.  
 (b) I will *water* the plants.

**Fig. 19.** An English noun-verb pair in syntactic contexts

Derivational morphology is also a common mechanism used in English noun-verb pairs. For example, suffixes such as *-er*, *-al*, are added to a verb to make a semantically related noun, as in the following noun-verb pairs *write* (v.) – *writer* (n.) and *propose* (v.) – *proposal* (n.).

Syntactic functions and distribution for noun-verb pairs are similar in Mandarin, as shown in Fig. 20, where the cross-class word *huà* 畫 “draw/drawing” appears in the same sentence as both a verb (“draw”) and a noun (“drawing”). In addition to syntactic environments, nouns in Mandarin can also be identified by modifiers such as number (*sān* “three”) and classifiers (*fú* CLS), and verbs by aspect markers (*le* ASP).<sup>7</sup>

- (a) 他 昨天 畫 畫 了。  
 tā zuótiān huà huà le  
 he yesterday draw drawing Asp.  
 “He drew drawings yesterday.”
- (b) 他 昨天 畫 了 三 幅 畫。  
 tā zuótiān huà le sān fú huà  
 he yesterday draw Asp. three CLS. drawings  
 “He drew three drawings yesterday.”

**Fig. 20.** A Mandarin noun-verb pair in syntactic contexts

Thus in English and Mandarin, the syntactic environments are most crucial for distinguishing the noun and the verb in noun-verb pairs.

### 4.3 The Role of Iconicity in Lexical Semantics

Conventional vocabularies are listed as the first of the shared properties (i.e., non-effects of modality) between signed and spoken languages [29] (see Table 1 above in

<sup>7</sup> Diminutive affixes such as *-zi* 子 and *-er* 兒 to the end of the word is also an identification nouns. The noun form of *huà* 畫 in the above example can hence appear as *huà-er* 畫兒 and makes the distinction between this noun-verb pair more clearly.

Sect. 1.3). However, there is a difference in the role of iconicity in word formation in spoken versus signed languages.

Words are conventional pairings of form (be it sound or sign) and meaning. As pointed out by [52:287]: “Although conventionality of pairing between form and meaning holds true to both modalities, iconic motivations are much more pervasive in signed languages at both lexical and syntactic levels. In contrast, arbitrary association is the general rule for spoken languages, although iconicity in syntax [53, 54], and onomatopoeia and sound symbolism in phonology have been documented for spoken languages [31].”

Noun-verb pairs in signed languages can be formed with concrete object nouns and their related action verbs. Concrete objects have shapes, sizes, and materials that can be visual motivations for naming the objects. On the other hand, actions can also be a visual motivation for nouns. Signed languages as visual languages thus can maximize the advantages of the visual modality.

Therefore, an object can be named with reference to its entity or to an action or event that this object is acted upon. For example, in the noun-verb pair WATERMELON– EAT-WATERMELON in TSL, the object WATERMELON is named by the way that watermelons are eaten and hence is identical in form to the verb EAT-WATERMELON. The pictures used for eliciting WATERMELON—EAT-WATERMELON are given in Fig. 21.



Fig. 21. Pictures for eliciting WATERMELON-EAT-WATERMELON

WATER and WATERMELON by three signers are shown in Figs. 22 and 23.



Fig. 22. WATERMELON



EAT-WATERMELON (YS) EAT-WATERMELON (JM) EAT-WATERMELON (MJ)

**Fig. 23.** EAT-WATERMELON

Although iconicity plays a more important role in word formation in signed languages than in spoken languages due to the visual modality effect, it is not necessarily true that iconicity leads to uniformity in word forms. Abstractness and arbitrariness in form-meaning coupling also exist as a general property of human language. That is, signing is not equal to gesture and iconicity is not equal to uniformity.

For example, HORSE is signed differently in different signed languages, although it is a concrete object name with clear visual properties (Fig. 24). While TSL focuses on the action of riding a horse, ASL, CSL, and JSL all highlight the ears of the horse. Sources of the pictures in Fig. 24 are: [55] for TSL, [56] for ASL, [57] for CSL, and [58] for JSL.

Another concrete object name CHAIR also shows varieties among different signed languages (Fig. 25). Pictures in Fig. 25 are from [59].



HORSE (TSL) HORSE (ASL) HORSE (CSL) HORSE (JSL)

**Fig. 24.** HORSE in TSL, ASL, CSL, and JSL



CHAIR (Spanish SL) CHAIR (German SL) CHAIR (Turkish SL) CHAIR (Russian SL)

**Fig. 25.** CHAIR in Spanish SL, German SL, Turkish SL, and Russian SL

## 5 Conclusion

Based on the TSL noun-verb pairs that we have collected, it was found that the nouns and verbs in noun-verb pairs are mainly identical in form, consistent to the pattern found in [2, 41]. Syntactic environments are crucial in distinguishing the nouns and the verbs in the noun-verb pairs. Morphological (derivational) mechanism does not play as an important role as claimed in [24]. These findings are similar to spoken languages and can be considered non-effects of modality.

Differences are found in the role of iconicity in word formation. In spoken languages, form-meaning patterning is more arbitrary, while in signed language form-meaning patterning shows higher iconic motivations. With the advantages of the gestural-visual modality, noun-verb pairs in sign languages are very often concrete object nouns and their related action verbs, although it is also common for nouns to be named by actions in word formation.

The role of iconicity in sign languages, especially the iconic motivations in word formation, is worth further exploration ([60–62] for TSL). These iconic word formation strategies have significant implications on sign language typology and child language acquisition of sign languages.

Another line for further research is the non-manual features in sign languages. It has been pointed out that in NGT there is a frequent use of mouthings that accompany the two manually identical signs to be distinguished [41].

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