

# Iconicity and Arbitrariness in Taiwan Sign Language: A Psycholinguistic Account

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## Abstract

The aim of the current study is to explore the comprehensibility of the lexical items in Taiwan Sign Language (TSL) by hearing subjects as a way of knowing more about the language-dependent factors and language-organizational principles that may influence the perception of lexical signs' iconicity and transparency. Grounded on the previous studies of American Sign Language (ASL) (Bellugi & Klima 1976) and Italian Sign Language (LIS) (Grosso 1993; Pizzuto & Volterra 2000), we pursued the issue by conducting two experiments (Exp. 1: free guessing task, Exp. 2: multiple choice task) based on 90 TSL signs from Digital Graphic Dictionary of TSL (Tai 2001-2005), but with a different criterion in material selection based on Su's (2004) categorization of TSL signs. The results obtained revealed that: First, most TSL signs are opaque (83% in Exp. 1 and 75% in Exp. 2) while only a small number of the signs are transparent. Second, the proportion of the signs that received correctly guessed meanings at least by one subject in either Exp. 1 or 2 was higher than that in ASL (Bellugi & Klima 1976) but the proportion from at least more than 50% of the subjects was smaller than LIS (17% for TSL; 24% for LIS). Third, looking into the proportion of correct answers given for different types of iconic signs, the proportion of correct answers in Exp. 1 patterned a downward tendency from image (95%), metonymy (30%), diagram (30%), to metaphor (18%), but not in Exp. 2. Drawn from the results, we argue for the necessity of re-examination of the materials used in previous studies since the possible imbalanced proportion of the iconic signs may lead to imprecise conclusions drawn from the cross-linguistic comparisons. In addition,

## 台灣手語像似性與任意性之心理語言學研究

Asian cross-linguistic or cross-cultural studies that focus on the role of the culture-related factors in comprehension of sign languages by hearing are more than welcome.

**Keywords :** TSL, iconicity, modality, transparency.

# 台灣手語像似性與 任意性之心理語言學研究

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## 摘 要

為瞭解語言依賴因素(language-dependent factors)與語言組織原則如何影響手語詞彙之像似性(iconicity)與透明度(transparency)之感知過程，同時也期與前人研究做跨語言間的對比(美國手語：Bellugi & Klima 1976；義大利手語：Grosso 1993; Pizzuto & Volterra 2000)，本文以具有正常聽力之受試者為對象進行二組心理語言學實驗來探討其對台灣手語(Taiwan Sign Language, TSL)詞彙之理解過程。二組實驗（實驗一：詞彙意義無提示猜謎作業(free guessing task)；實驗二：詞彙意義選擇題方式猜謎作業(multiple choice task)）所用的詞彙語料以蘇秀芬(2004)對台灣手語像似性所做的劃分標準為基礎，自台灣手語影像辭典(Tai 2001-2005)選用九十個詞彙。二組實驗結果顯示：(1)大多數台灣手語詞彙皆具模糊性(實驗一：83%；實驗二：75%)；(2)實驗一或實驗二中至少有一名受試者猜對的詞彙比例皆比美國手語研究(Bellugi & Klima 1976)的數據高，但至少有一半以上的受試者猜對的詞彙比例比義大利手語研究(Pizzuto & Volterra 2000)的數據低(台灣手語：17%；義大利手語：24%)；(3)從詞彙像似性種類來分析受試者答對比例可發現實驗一中答對的比例從映像(image: 95%)、轉喻象(metonymy: 30%)、擬象(diagram: 30%)至喻象(metaphor 18%)呈現下降趨勢，而實驗二中並未呈現此下降趨勢。綜合實驗結果，本研究提出以下二點建議：(1)前人研究所用之語料有其重新檢視的必要性，並建議以統一之劃分標準來選取手語詞彙以便跨語言之比較研究，以避免因採用熟悉度的判斷(familiarity judgment)所造成詞彙間像似性比例的不平均，進而影響研究結論；(2)可比照Pizzuto & Volterra (2000)所執行之歐洲地區跨語言研究，進行大規模亞洲地區之手語像似性感知度之研

## 台灣手語像似性與任意性之心理語言學研究

究，以期更瞭解語言依賴因素與語言組織原則對跨地區及不同文化背景下之手語像似性感知過程的影響為何。

**關鍵詞：**台灣手語、像似性、透明度、機制

## 1. Introduction

Over the past few decades of research on sign language, their focus was put on justifying both its status as *real* language just like spoken language and which features can be categorized as universal. Sign language has gained agreement upon its status as a real language by its several characteristics common to spoken language, such as creativity and productivity in lexical items, duality of patterning, systematic syntactic structure, and similar language acquisition process (Meier 2002). While sign language, expressed visual-gesturally, requires different articulators and perceptual systems from spoken language, the focus of sign language research has shifted to which features can be linked to sign language or spoken language only, due to their modality difference (see Emmorey 2002; Lillo-Martin 1999; Tai 2005; Taub 2001). Compared with spoken language, the visual-gestural modality of sign language is deemed as a greater source for iconic properties because signers can depict the shape, location, and dynamic relationship of the object in a relative larger space in front of their bodies. In addition, signs are expressed in a three-dimensional space while oral speech is expressed in one-dimensional space. Due to the difference in dimensional spaces, studies of spoken language mostly focus on iconicity of syn-

tax as utterance is expressed in this one-dimensional space in a sequential manner.

This is not to say, however, iconic relation between a sign and its referent could in any way determine the actual details of the form that individual signs have in different sign languages (Klima & Bellugi 1979: 21). As Klima and Bellugi pointed out, the iconic features taken from an even concrete object, e.g., “tree”, could vary to an extent in different sign languages. Take the three sign languages from different areas as examples, American Sign Language (ASL) picks up the trunk and branch as the iconic features of “tree”, represented by the forearm upright with the hand spread wide, and a twisting of the wrist respectively; Danish Sign Language (DSL) traces the shape of tree’s round top and its trunk with hands symmetrically; signers of Chinese Sign Language (CSL) symmetrically encompass the shape of a tree’s trunk and move up. Although “tree” is expressed distinctively in three different sign languages, the signs are still iconic anyway in the features and the manner how they are formed.

Since iconic relation between the form and the object is prevailing in sign languages, we may want to ask how manifest the basis for such a relation is. We ask this question because the iconic relation between form and meaning in sign language would imply that hearing subjects who never learn

sign languages may more or less understand the meanings of the signs or can make a connection between the signs and the object, event, or action (Pizzuto & Volterra 2000). However, Bellugi and Klima (1976) and Klima and Bellugi (1979) pointed out the difficulty a naïve hearing individual encounters in even guessing the topic of a conversation, not to mention the meanings of individual lexical items signaled in sign languages. It thus appears that the paradoxical situation above indicates different degrees of iconicity in signs. While considerable attention has been paid to the paradoxical situation recently (e.g., Bellugi & Klima 1976; Grosso 1993; Pizzuto & Volterra 2000), their research targets are western sign languages, and studies on the same issue but based on Asian sign languages, such as Taiwan Sign Language (TSL) and CSL, to our knowledge do not currently exist. The present study thus bridges the gap and examines the comprehension of TSL by hearing subjects for cross-linguistic comparisons.

We have organized the rest of the paper in the following way: Section 2 is a review of the literature concerning the degree of iconicity in lexical signs. Section 3 describes the experiments: methodology and procedures for the collection of data, followed by the results and discussion. Finally, conclusions are presented, and suggestions are made for future research in the last sec-

tion.

## 2. Degree of Iconicity in Lexical Signs

Iconicity originates from the ways of defining the form-meaning relationship. Way back to Plato, words were categorized into those whose meanings are determined by nature and those whose meanings are agreed upon convention within a community. In the same line was the trichotomy in forms, i.e. icons, indexes, and symbols, proposed by Peirce (1955), who then further categorized icons into images, diagrams, and metaphors based on how they are related to the objects they represent, such as imitation, analogy, and parallelism. However, ever since Saussure (1959[1916]) argued the arbitrariness between the concept and the sound image and treated those onomatopoeic words as exceptions of language systems, the natural relationship between form and meaning has been regarded as peripheral phenomena that surface only in a limited number set of onomatopoeic words. Only recently when functional and cognitive linguistics bring more attention to the natural relationship between language structure and conceptual structure, there has been increasing interest for iconic features of speech in different structural levels such as syntax, morphology, and phonology (see Haiman 1985; Tai 1985, 1993).

The same interest also brings up systematic research on iconicity and transparency of lexical signs in sign languages, such as ASL (Mandel 1977; Taub 2001) and LIS (Pietrandrea 2002). These studies were conducted in order to know more about the language-dependent factors, language-organizational principles, and modality-specific effects that that may influence the perception of lexical signs' iconicity and transparency (e.g., Bellugi & Klima 1976; Grosso 1993; Pizzuto & Volterra 2000). Section 2.1 and 2.2 respectively present the studies of Bellugi and Klima (1976) on ASL and Grosso (1993) and Pizzuto and Volterra (2000) on LIS, followed by Su (2004) on TSL in Section 2.3.

## 2.1 Comprehension of ASL Signs by Hearing Observers

Bellugi and Klima (1976) explored whether iconicity could facilitate the comprehension of ASL lexical signs by native hearing subjects via a series of experiments. In the first experiment, ten hearing subjects, who were naïve to ASL, were shown ninety lexical signs that correspond to abstract and concrete common nouns in English. They were asked to write down the meanings they guessed for the ASL signs upon seeing them. The results of the first experiment revealed that only about 9-10% of the signs were given the appropriate meanings by at least one subject while other 81 signs were not. This

indicates the majority of the lexical signs is not purely transparent. In the following experiment where the same list of 90 signs was adopted again, a new set of 10 hearing naïve subjects was asked to do a multiple choice task, an easier one compared with the free guessing task. Each lexical sign was accompanied by one correct English translation and four choices from the answers given for each lexical sign in the previous experiment. The proportion of correct answers given by the participants was below chance level, i.e. 20%, and only 12 signs were given correct meanings by a majority of subjects while 36 signs were not given appropriate meanings even by a single subject. Bellugi and Klima argued that most ASL signs were opaque rather than transparent. In their last experiment, an association task was adopted where another new set of 10 hearing subjects were asked to describe the relation between the form of the sign and its corresponding English translation. The results indicated many ASL signs had a representational aspect and were *translucent*, that is, hearing subjects agreed on the basis for the relation between the sign and its meaning (Klima & Bellugi 1979: 24-26).

## 2.2 Comprehension of LIS Signs by Hearing Observers

The first study on iconicity and transparency of LIS signs was carried out by

Grosso (1993). This study was a replication of Bellugi and Klima's study (1976), but what differentiates Grosso (1993) from Bellugi and Klima (1976) is the gesture-prominent culture where both Italian hearing speakers and deaf LIS signers are immersed. Grosso used a set of 92 LIS signs (47 nouns, 28 verbs, 12 adjectives, 2 adverbs, and 3 spatial relation terms), selected based on the same criterion in Klima and Bellugi (1979: 22). That is, the materials were those commonly used by Italian deaf native signers. Following the same experimental procedure of Bellugi and Klima's Experiment 1, 24 subjects were asked to write down the meaning they felt to be the most possible for each lexical sign. Overall, the results showed a significant proportion of the LIS signs (76%) appeared to be entirely opaque or partially transparent, similar to that reported in ASL study (90%). Few signs constituted a small proportion (24%) of entirely or partially transparent signs which were guessed correctly more than 50% of the subjects. In addition, those treated as transparent signs exhibited either perceptual features that were conceived as physically similar to the action or object, or more culture-related features that were similar to or identical with conventional gestures commonly used by Italian hearing subjects. The results of the ASL study and LIS study differed in two ways: First, Italian hearers seemed to be

able to guess the meaning of a larger number of LIS signs (24%, compared with 10% in ASL); second, strictly speaking, none of the ASL signs examined was transparent for all or most American hearing subjects while the Italian study exhibited varying degrees of transparency for individual LIS signs (10 signs guessed correctly by 83%-100% of the subjects, 12 signs by 54%-71%, 15 signs by 25-50%, and 21 by 4%-21%). More research questions were raised, e.g., whether the better performance of the Italian subjects in the guessing task was due to the common gestural culture in Italian community, or whether LIS signs were generally more transparent than ASL signs. These questions were clarified by a recent cross-linguistic study in terms of perceptual and the cultural factors (Pizzuto & Volterra 2000). Pizzuto and Volterra concluded based on their results that: first, some LIS signs were universally iconic that were comprehended by non-Italian hearing and deaf subjects; second, the performance of non-Italian hearers was poorer than that of Italian hearers particularly for those signs common in the Italian culture.

The pioneering study led by Bellugi and Klima way back to 20 years ago has paved the way for insightful research on the intricate interrelation between iconic and arbitrary features in ASL as well as for the later studies such as those on LIS. However,



only one recent study on iconicity of TSL signs was reported (Su 2004), and no experimental study on degrees of transparency in iconicity of the TSL lexical signs is found up to date.

### 2.3 Iconicity in TSL

Su (2004) examined about 1,500 TSL lexical items from *Digital Graphic Diction-*

The interactional relationship among types of iconicity and parameters is illustrated through examples below.

First, Images are iconic in that they take parts of the simple qualities of the objects they signify, and the way it is manifested in languages of different modalities is different. Spoken languages, being produced orally and perceived auditorily, feature lin-

Table 1. Sample Categorization of TSL Iconic Signs (Su 2004).

PARAMETER	ICONIC TYPE		
	Image	Diagram	Metaphor
Hand Shape (e.g., /二/ 'two' )	SCISSOR (Fig. 2a) TOOTHBRUSH (Fig. 2b)	CHANGE PART TIME	VOICE
Location (e.g., Head)	HEAD MOUTH	INVENT (Fig. 3a) THINK (Fig. 3b) REMEMBER (Fig. 3c)	KNOWLEDGE FORGET
Movement (e.g. Move apart/together) SEPARATE	SEPARATE TOGETHER	KNOWLEDGE COPY	MARRY (Fig.4a) DIVORCE (Fig. 4b)

ary of TSL (Tai 2001-2005) based on three phonemic parameters, i.e. hand shape, location, and movement (Stokoe 1960), and three types of icons by Peirce, i.e. image, diagram, and metaphor as discussed earlier. A total of nine possible ways (3 types of iconicity x 3 parameters) of analyzing iconic motivations of TSL signs was shown in Table 1 below:

earity in a single dimension span. Due to the limit of uni-dimensional channel, iconicity of objects or events is mapped into serial auditory signals. The most common imagic iconicity in spoken languages is symbolized by onomatopoeic words. For example, the word “cuckoo” in English, imitating the bleat of the animal, is used to refer to the animal that makes the bleat of such. In visual-oriented

sign languages, however, imagic iconicity is manifested by hands instead, either in the forms of hand shape, movement or their location. The manifestation of direct simultaneous representation of objects and events in the three-dimensional world allows lexicon and syntax in sign languages to be more iconic than spoken languages (Tai 2005). Take “CHICKEN” in TSL as the example (Fig. 1), the extended thumb and index of one hand are open and close repeatedly in front of the mouth, indicating the beak of a chicken and its movement. In this case, iconic relationship between the signified and

the signifier is expressed by the shape and location of the hand. Take the TSL lexical signs “SCISSOR” and “TOOTHBRUSH” in Table 1 as another example whose imagic iconicity is based on its hand shape. The hand shape /二/ ‘two’ in TSL with index and middle finger being extended can be used as an imagic icon to signify the shape of scissors, shown in Fig. 2a, while the hand shape /一/ ‘one’ with index finger being extended back and forth in front of the mouth is used as an imagic shape to signify the toothbrush, shown in Fig. 2b.



Fig. 1. The TSL lexical sign for “CHICKEN”.



Fig. 2a. The TSL lexical sign for “SCISSOR”.

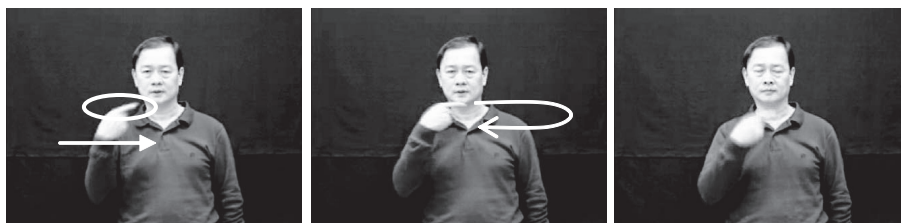


Fig. 2b. The TSL lexical sign for “TOOTHBRUSH”.

Second, diagrammatical iconicity depicts the systematic relations of signs that are analogous to those of their referents. In spoken languages, such diagrammatical relationship can be seen in certain initial consonant clusters. For example, many derivationally unrelated *fl*- initial words share a common theme of linear motion, e.g., “flow”, “flutter”, and “fly”, or words with the initial cluster of *gl*- share a common theme of sight/light, e.g., “glance”, “glimpse”, and “glory”. In sign languages, the systematic relations among referents are signaled by diagrammatical location, shape, and movement of hands. Take the lexical signs “INVENT”, “THINK”, and “REMEMBER” in TSL as an example to illustrate a group of lexical signs that are systematically centered on their diagrammatical

and wiggling it slightly (Fig. 3b). As to the sign “REMEMBER”, it is expressed by putting the fist on one side of the head with the palm touching the head (Fig. 3c). All the three lexical signs are diagrammatically linked by their location parameter, *head*. Head or brain is the place that mainly deals with human reasoning or any cognition-related activities; as such, the above lexical items are signed around head, which in turn links a diagrammatical-location group of lexical signs.

Third, metaphorical iconicity signifies objects by pointing to a parallelism between objects and something else (Hiraga 1994, as cited in Su 2004). This parallelism-based conceptual mapping device is used to express abstract concepts. Take the words “up” and “down” in spoken languages as



Fig. 3a. “INVENT”



Fig. 3b. “THINK”

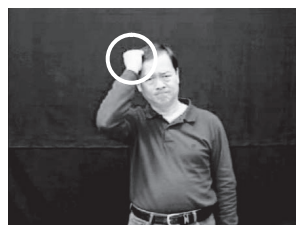


Fig. 3c. “REMEMBER”.

location. The sign “INVENT” is expressed by the index finger of one hand touching the side of the head with the other fingers starting together and then opening up suddenly (Fig. 3a). The sign “THINK” is expressed by pointing the index finger to the temple

an example, they both literally indicate orientational concepts, but such a physical spatial relationship is used to map into more abstract relationships, e.g. *happy* vs. *sad* in emotion, *more* vs. *few* in quantity, and *good* vs. *bad* in quality. Example phrases

of such in English include “cheer up”, “fall ill”, or “drop dead” (Su 2004: 60). The same metaphorical mapping device is also used in sign languages. For example, TSL uses the thumb to express “MALE” (Fig. 4a), and the pinky to express “FEMALE” (Fig. 4b). The sign for “MARRY” is then expressed by putting these two fingers together (Fig. 5a)



Fig. 4a. “MALE”.



Fig. 4b. “FEMALE”

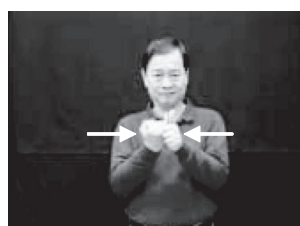


Fig. 5a. “MARRY”



Fig. 5b. “DIVORCE”

while the sign for “DIVORCE” is to move these two fingers away from each other (Fig. 5b) (Tai 2005: 13). The source domain of the current mapping is hand movement, i.e., hands being put together or apart, and its target domain is “being together” or “being separate”.

Su’s study on iconicity in TSL has done a comprehensive, though not exhaustive, survey of literature regarding iconicity in sign languages as well as discussion on ico-

nicity in TSL signs. She concluded that 39% of the TSL vocabulary can be categorized as images, most of which are content words, while only 9% of the TSL lexical items are symbols, which are function words or those representing the Chinese characters. Though TSL appears to have a large number of iconic lexical signs, the proportion (39%) based

on Su’s theoretical analysis has not yet been supported psycho-linguistically to the extent that all these signs are actually fully transparent. In addition, early studies on ASL and LIS have seen either a very small proportion of correct guesses for the lexical signs (10% in ASL & 24% in LIS) or varying degrees of transparency in their studies. As a result, to understand why there is such disparity regarding the degree of iconicity between TSL and ASL or LIS, it is necessary to examine

the TSL signs analyzed as iconic in Su's study by means of a psycholinguistic approach to testing how hearing observers can comprehend TSL signs for cross-linguistic comparisons.

### 3. THE CURRENT STUDY

The aim of the study is to explore the comprehensibility of TSL lexical items in terms of iconicity degree by hearing subjects. For the sake of cross-linguistic comparisons between TSL and ASL or LIS, we follow the same experimental procedure in Bellugi and Klima (1976), but we propose different criteria in material selection for the following reason: In the previous studies, the materials were selected based on the familiarity judgment of the deaf participants; however, it could be possible that arbitrary or less iconic lexical signs occupied the majority of the materials already. Accordingly, this confound might have led to the false comparison between ASL and LIS and consequently a faulty conclusion that none of the ASL signs being transparent but translucent (at least in Bellugi & Klima's first experiment). To avoid the confound mentioned above, we selected the experimental materials based on Su's iconicity framework (2004) in TSL signs to make sure that these materials are theoretically iconic and that there is no imbalanced proportion of *arbitrary* signs

to iconic ones.

In the two experiments reported below, we want to test the general hypotheses drawing on the indications provided by the previous works:

1) Only a small number of the signs in TSL are transparent while most are less iconic or translucent (cf. 90% for ASL and 76% for LIS).

2) Due to our different criterion in material selection, the proportion of the signs given correct guessed meanings at least by one subject in both the guessing task (Exp. 1) and multiple choice task (Exp. 2) would be higher than ASL (Bellugi & Klima 1976), but the proportion might be lower than LIS (Grosso 1993) owing to the culture-specific factors in the Italian culture (Pizzuto & Volterra 2000);

3) The proportion of given correct responses may pattern a downward tendency from image-based to association or analogous based iconic signs (e.g., metonymy, diagram, and metaphor).

#### 3.1 Experiment 1: Free Guessing Task

##### *Subject*

Ten hearing subjects, 5 males and 5 females, joined the current experiment. All of them, naïve in TSL, were educated at college level in Taiwan aged between 19 and 21 years (mean age = 20 years).

### Material

Along with an answer sheet with numbered lines, the materials consisted of 90 videotaped clips of TSL lexical signs extracted from *Digital Graphic Dictionary of TSL* (Tai 2001-2005), available on line at <http://tsl.ccu.edu.tw/htmltext/browser.htm> (Tsay, Tai, Lee, Chen, and Liu 2008) containing the most frequent 1000 TSL lexical items. The selection criterion is based on the classification of iconicity in TSL by Su

parameter, i.e. *action*.

Metonymy, usually known as synecdoche, is an association of contiguity, which usually refers to an entity by taking a salient part of it. For example, in TSL, the hand shape representing “red cross” is used to signify “NURSE”, as shown in Fig. 6.

The TSL signs for “HUNGRY” and “FULL” take their location as the metonymic source. For instance, “HUNGRY” is to use both hands to press the signer's stomach



Fig. 6. The TSL lexical sign for “NURSE”.

(2004) as earlier discussed in Table 1 in Section 2.3.

We hereby make some modification by adding one more subtype under image, i.e., *metonymy*, and one more type of phonemic

lightly (Fig. 7a), while the sign for “FULL” is to move both hands out from the signer's stomach (Fig. 7b). The semantics of the two lexical signs are associated with the location where the hands are put, i.e., stomach.



Fig. 7a. “HUNGRY”



Fig. 7b. “FULL”.

(Taken from Tai 2005: 12)

*Action*, also called “mime” (Mandel 1977), refers to those signs that require signers to present the physical action such as “EAT” in TSL (Fig. 8a), or to those signs that require signers to exhibit the actions interacting with the signified objects, e.g., “CAMERA” in TSL (Fig. 8b). In Fig. 8a, the signer’s five fingertips touch as if the signer

both hands, and he repeatedly presses down on the button with his index finger as if he is taking pictures.

Adding one more type of iconicity and one more parameter, our criteria now consist of four types of iconicity, *image*, *metonymy*, *diagram*, and *metaphor*; and four phonemes, *hand shape*, *location*, *movement*, and *action*



Fig. 8a. The TSL lexical sign for “EAT”.



Fig. 8b. The TSL lexical sign for “CAMERA”.

is holding food and then move to the mouth, accompanied by chewing, as if he is eating something. In Fig. 8b, the signer pretends to hold a camera with his index and thumb of

The full-fledged combination of categorization for TSL iconic signs is shown in Table 2 below:



Table 2. Modified Categorization of TSL Iconic Signs Based on Su (2004).

PARAMETER	ICONIC TYPE			
	Image	Metonymy	Diagram	Metaphor
Hand Shape	SCISSOR TOOTHBRUSH	NURSE (Fig. 6)	CHANGE PART TIME	VOICE
Location	HEAD MOUTH	HUNGRY (Fig. 7a) FULL (Fig. 7b)	INVENT THINK REMEMBER	KNOWLEDGE FORGET
Movement	SEPARATE TOGETHER	MINISTER	KNOWLEDGE COPY	MARRY DIVORCE
Action	EAT (Fig. 8a) CAMERA (Fig. 8b)	FARMER	CHILD	FEMALE

The complete set of detailed TSL stimuli is summarized as follows and can be referred to Appendix I:

1) The set of the iconic signs based on image type consists of 30 signs in total, 10 of which belong to the subtype of metonymy. There are 20 in diagram and 22 in metaphor;

2) The set of the arbitrary symbols consists of 18 signs;

3) The final set of 90 TSL stimuli varies in their grammatical categories: concrete and abstract nouns (n=36), verbs (n=38), and adjectives (n=16).

### Procedure

The experimental procedure follows Bellugi and Klima (1976) in ASL. The clips

of TSL signs were presented individually to each subject in a randomized order. Before starting, the experimenter gave experimental instructions to subjects that they had to guess the meaning for what they saw in the monitor and write it down on the answer sheet, shown in (1):

(1) Example item “MALE” in Exp. 1



Answer: \_\_\_\_\_

There was no time restriction, and subjects could see any sign they were uncertain



about as many times as they liked. All the subjects run through a set of warm-up examples before the main experiment started.

### *Scoring Criteria*

Following Grosso (1993), we treat any answer written down by subjects as broadly correct when the answer given meets the following two conditions: first, the word provided for a given lexical sign is exactly corresponding to the gloss that Taiwan signers used for the same lexical sign; second, the word provided is close in meaning to the gloss, including synonym or near-synonym, e.g., the answer ‘to rise’ for the sign “RAISE A FLAG”, shown in Fig. 9, or the answer “to take pictures (verb phrase)” for the sign

“CAMERA (noun)”, as previously shown in Fig. 8b. Any answer is considered incorrect when the given answer by the subjects was significantly different or unrelated to the sign gloss, e.g., “there” or “here” given by the subjects for the lexical sign “TOOTHBRUSH”, shown in Fig. 10. We also follow Grosso’s assessing standard on degrees of transparency by calculating the number of subjects providing correct or incorrect responses. Those which receive correct responses from 80%-100% of the subjects are considered as most transparent, those from 50%-79% as transparent, those from 30%-49% less transparent, those from 10%-29% as opaque, and the rest as non-transparent (arbitrary).



Fig. 9. The TSL lexical sign for “RASIE A FLAG”.



Fig. 10. The TSL lexical sign for “TOOTHBRUSH”.

## Results & Discussion

The results appear to support our hypothesis according to the following observations. First, only a small number of the TSL signs (15 signs or 17%) received correct guesses from all or more than 50% of the subjects. The consistent findings with Bellugi and Klima (1976) and Grosso (1993) thus supported the first hypothesis. Second, due to our different criterion in material selection, the proportion of the signs in the list (37%, 33 out of 90; 19 from image, 3 from metonymy, 6 from diagram,

culture-specific factors in the Italian culture thus confirmed the second hypothesis. The results are summarized in Table 3:

Among the 15 signs (deemed as most transparent according to Grosso (1993)) that received correct guesses from all or at least 50% of the subjects, 11 signs (73%) belong to the image type, 1 (7%) to the metonymy, 3 (20%) to the diagram, and none to either metaphor or arbitrary (0%). If we lump the responses to the image and metonymy together, the downward pattern of correct-

Table 3. Summary of distribution of correctly-guessed answers according to Grosso's assessing-standard (1993).

	Image	Metonymy	Diagram	Metaphor	Arbitrary	Total (%)
80-100%	7	0	1	0	0	8 (9%)
50-79%	4	1	2	0	0	7 (8%)
30-49%	3	0	1	0	0	4 (4%)
10-29%	5	2	2	4	1	14 (16%)
0%	1	7	14	18	17	57 (63%)

4 from metaphor, 1 from arbitrary symbols) that were given the appropriate meanings by at least one subject was larger than that (9-10%) reported in Bellugi & Klima (1976). However, compared with LIS, the proportion of the signs that received correct guesses from at least more than 50% of the subjects is smaller (17% for TSL; 24% for LIS). The difference which might owe to the

guess percentage across different types of lexical signs is more obvious.

The same downward tendency can be observed as well if we look into the proportion of correct answers given for different types of iconic signs. The proportion of the signs that received correct responses from at least one subject is 95% (19 out of 20) within the image type, 30% (3 out of 10)

within the metonymy type, 30% within the diagram type, 18% (4 out of 22) within the metaphor type, and finally 6% (1 out of 18), summarized in Table 4. Again, if we lump the responses to both image and metonymy together, the downward tendency is more

and metaphor types shows that most of the image-type signs that are theoretically and perceptually categorized as most transparent have more or less direct relation of physical resemblance to the action or object they represented. These signs include body

Table 4. Summary of proportions of correctly-guessed answers by at least one participant under each iconic type.

Image	Metonymy	Diagram	Metaphor	Arbitrary
95% (19/20)	30% (3/10)	30% (6/20)	18% (4/22)	6%(1/18)
70% (22/30)				

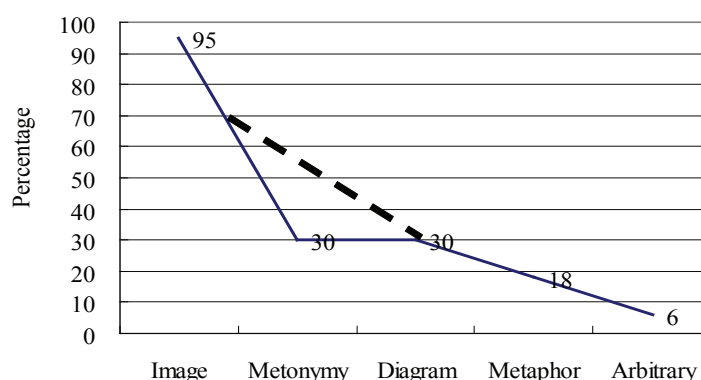


Fig. 11. Tendency of correct responses within each type of lexical signs.

obvious, shown in Fig. 11. This supports the third hypothesis that the proportion of given correct responses may pattern a downward tendency from image-based to association or analogous based iconic signs.

A closer examination on the proportions of correct guesses for the lexical signs across the image, metonymy, diagram,

parts, e.g., MOUTH (50%), HEAD (50%), EAR (80%), TOOTH, and HEART, concrete objects, e.g., SCISSOR (100%), and CAMERA (100%), and actions, e.g., COME (50%), STUDY (70%), SEPARATE (80%), and EAT (90%). DROOL (70%) is the only sign falling in the metonymy type that particularly received more correct answers from

the subjects (70%). This sign actually can be categorized into image-movement type since the signer traced how saliva drools around the corner of the mouth. The physical resemblance to the action could possibly explain why the particular sign among other metonymous signs received higher percentage of correct answers.

As to the iconic signs falling in the diagram types, we found the signs rated as the most transparent are related to emotions, such as HAPPY (90%), SAD (50%), and related to action, i.e., FIGHT (50%). Based on the deaf and hearing subjects' responses to the signed stories, Corazza and Volterra (1988)

and SAD that receive more correct guesses conform to the observation because HAPPY, signed with two open hands waving up and down in opposite directions against the chest, and SAD, signed with one hand opened up in front of the chest and then moving downward, both are accompanied with facial expressions of joy and depression, shown in Fig. 12a and 12b respectively.

The sign FIGHT, though categorized as a diagram where two fists punch each other repeatedly in front of the chest seeming to represent two parties hitting each other, also involves the image-like actions and facial



Fig. 12a. The TSL lexical sign for “HAPPY”.



Fig. 12b. The TSL lexical sign for “SAD”.

observed that the highly iconic signs well understood by the subjects often involve pantomimic elements, e.g., body postures and facial expressions. The signs HAPPY

expression of anger, as shown in Fig. 13. Again, the two elements seemed to jointly facilitate the hearing subjects to guess the meaning for the lexical sign.

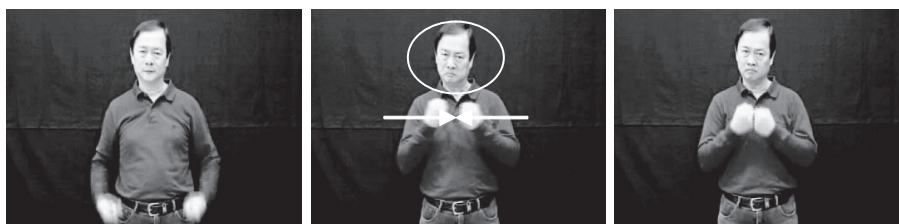


Fig. 13. The TSL lexical sign for “FIGHT”.

### 3.2 Experiment 2: Multiple Choice Task

Recall in Bellugi and Klima's (1976) second experiment, they constructed a multiple choice test where every lexical sign had, in addition to its corresponding translation in English, four more alternative choices. The alternatives were based on the likely correct answers given in the free guessing task by the subjects. The subjects were shown the 90 ASL signs together with their correct translation and alternatives. They were then asked to circle one of the alternatives that they thought to be the possible meaning for the corresponding lexical sign. Their results showed that very few signs (12 out of 90, 13%) could receive correct responses from a majority of the subjects, and like what was reported in Exp. 1, a large number of signs (36 out of 90, 40%) could not receive correct responses from even one single subject. The results thus replicated Exp. 1 and confirmed Bellugi and Klima's conclusion that most of the ASL signs were not transparent but opaque.

In Experiment 2, we followed Bellugi and Klima's (1976) experimental design

for the convenience of comparison between their results and ours. In addition, we want to examine whether the hypotheses still hold even in a less demanding task.

#### Subject

A new group of ten hearing subjects, 5 males and 5 females, who did not join the previous experiment, were recruited in the current experiment. All of them were educated at college level in Taiwan, aged between 19 and 21 years (mean age = 20 years), and naïve in TSL.

#### Material

The same set of 90 videotaped TSL signs used in Exp. 1 was adopted to construct a multiple choice test. Each TSL sign has its corresponding translation in Chinese and four more alternatives extracted from the answers given by the subjects in Exp. 1.

#### Procedure

The same experimental procedure in Bellugi and Klima (1976) described earlier was adopted. The subjects were presented

with the clips of TSL signs individually together with their corresponding correct translation and four more alternatives in an

from 10%-29% as opaque, and the rest as arbitrary.

(2) Example item of “TOOTHBRUSH” in Exp. 2



\_\_\_\_\_ (a) 拆開 (b) 驚嚇 (c) 碰 (d) 破 (e) 折斷

answer sheet based on the likely correct answers given by the subjects in Experiment 1, as shown in (2):

There was no time restriction, and subjects could see any sign they were uncertain about as many times as they liked before they circled one of the alternatives that they thought to be the possible meaning for the corresponding lexical sign.

### *Scoring Criteria*

We adopted the same assessing standard in Exp. 1 on degrees of transparency by calculating the number of subjects providing correct or incorrect responses. Those which receive correct responses from 80%-100% of the subjects are considered as most transparent, those from 50%-79% as transparent, those from 30%-49% less transparent, those

### *Results & Discussion*

The results in Exp. 2 replicated Exp. 1 and confirmed our first hypothesis that even in a less demanding task, still only a small number of the TSL signs (22 signs or 25%) received correct answers from all or more than 50% of the subjects; however, the proportion is larger than that in Exp. 1 (15 signs or 17%). In addition, the proportion of the signs for which at least one subject picked up the correct meaning was larger than what was reported in Bellugi and Klima (1976) (68 out of 90, 76% in TSL; 54 out of 90, 60% in ASL), which also confirmed our second hypothesis. The results are summarized in Table 5:

Table 5. Summary of distribution of correctly-chosen answers according to Grosso's assessing standard (1993).

	Image	Metonymy	Diagram	Metaphor	Arbitrary	Total (%)
80-100%	5	0	2	0	0	7(8%)
50-79%	5	2	4	4	0	15 (17%)
30-49%	4	1	2	6	2	15 (17%)
10-29%	6	3	5	7	10	31 (34%)
0%	0	4	7	5	6	22 (24%)

Among the 22 signs that received correct guesses from all or at least 50% of the subjects, 10 signs (45%) belong to the image type, 2 (9%) to the metonymy, 6 (28%) to the diagram, 4 (18%) to the metaphor, and none to the arbitrary (0%). If we lump the responses to the image and metonymy together, the downward pattern of correctly-chosen percentage across different types of lexical signs is again more obvious: 12 (55%), 6 (28%), 4 (18%), and 0%. The results based on the most transparent lexical signs support the third hypothesis that the proportion of given correct responses may pattern a downward tendency from image-based to association or analogous based iconic signs.

By contrast, the downward tendency was not observed if we look into the proportion of the correct answers given for each iconic type. The proportion of the signs that received correct responses from at least one subject remained high at 100% (20 out of 20) within the image type, 60% (6 out of 10) within the metonymy type (87% if we lump the image and metonymy together), while the percentage for the diagram, metaphor, and arbitrary rose from 30% to 65% (13 out of 20), from 18% to 77% (17 out of 22), and from 6% to 61% (11 out of 18) respectively. The correctly-chosen percentage lowered from 100% in the image-type to level between 61% and 77%. These numbers are summarized in Table 6.

Table 6. Summary of proportions of correctly-chosen answers by at least one participant under each iconic type.

Image	Metonymy	Diagram	Metaphor	Arbitrary
100% (20/20 )	60% (6/10)	65% (13/20)	77% (17/22)	61%(11/18)
87% (26/30)				



Compared with Exp. 1, the better performance in both the most transparent lexical signs and the signs receiving correct responses from at least one subject seemingly can owe to the less demanding requirement in the current experiment. Since about 80% of the TSL signs are theoretically categorized as iconic signs, the iconic nature of most of the signs more or less could help the subjects to make their intuitive judgment and guesses upon seeing the meanings listed as choices. These choices could serve as cues to facilitate the association or analogy between form and meaning. As to the performance difference between our study and Bellugi and Klima (1976), since we are not sure about the proportion the iconic signs may occupy in Bellugi and Klima's stimuli, the better performance in the current study might have been due to the proportional difference of the iconic signs used in their experimental stimuli.

We then look closer into the proportion distribution of the correctly guessed items across the image, metonymy, diagram, and metaphor types. In image type, there were 10 signs that we found to be transparent (guessed correctly by 50% or more of the subjects) for the hearing Taiwanese subjects, including BOWL (50%), HEAD (50%), SCISSOR (60%), HOUSE (70%), SEPARATE (70%), HEART (80%), TOOTH (80%), EAT (80%), STUDY (90%),

and CAMERA (100%). In metonymy type, there were only two lexical items that were guessed correctly more than 50%, namely DROOL (70%) and CHRIST (70%). In diagram type, there were 6 items, CHEEKY (50%), FIGHT (50%), KNOWLEDGE (50%), WONDER (70%), HAPPY (100%), and TELL (100%). In metaphor type, they were MIXED UP (50%), WORRIED (50%), CALM DOWN (60%), and ANGRY (70%). Excluding the image-type iconic signs, there were 12 lexical signs left. Among the 12, 6 involve facial expressions of emotions, e.g., WONDER, HAPPY, FIGHT, WORRIED, ANGRY, and CALM-DOWN. Overall, these iconic signs together with the image-type signs share the following characteristics in common:

- 1) These signs have more or less direct relation of physical resemblance to the action or object they represented;
- 2) They would involve facial expressions;
- 3) Some of them might be similar to or identical with the conventional gestures used in that particular culture or even universal across different cultures, e.g., CALM-DOWN and CAMERA.

## 4. Conclusion

The results we obtained in the two experiments confirm the three hypotheses



made earlier:

1) *Only a small number of the signs in TSL are transparent while most are less iconic or translucent (cf. 90% for ASL and 76% for LIS).*

Yes, we found that most TSL signs are opaque (83% in Exp. 1 and 75% in Exp. 2) while only a small number of the signs are transparent.

2) *Due to our different criterion in material selection, the proportion of the signs given correct guessed meanings at least by one subject in both the guessing task (Exp. 1) and multiple choice task (Exp. 2) would be higher than ASL (Bellugi & Klima 1976), but the proportion might be lower than LIS (Grosso 1993) owing to the culture-specific factors in the Italian culture (Pizzuto & Volterra 2000).*

Yes, due to our different criteria in material selection, the proportion of the signs that received correctly guessed meanings at least by one subject in either Exp. 1 or 2 is higher than that in ASL (Bellugi & Klima 1976). By contrast, the proportion of the signs that received correct guesses from at least more than 50% of the subjects is smaller than LIS (17% for TSL; 24% for LIS). The difference between TSL and LIS can be owed to the cultural difference, that is, Italian culture is a “gesture-prominent” culture (Kendon, 1995).

3) The proportion of given correct re-

sponses may pattern a downward tendency from image-based to association or analogous based iconic signs (e.g., metonymy, diagram, and metaphor).

Yes, looking into the proportion of correct answers given for different types of iconic signs, we found the proportion of correct answers for iconic signs in Exp. 1 patterns a downward tendency from image (95%), metonymy (30%), diagram (30%), to metaphor (18%).

Overall, this study replicates the pioneering study on ASL by Bellugi and Klima (1976) and Grosso on LIS (1993). However, we do not conclude with either the greater ability of Taiwanese in guessing TSL lexical signs or the higher degree of transparency in TSL iconic signs. Instead, the results only suggest the strong existence of degrees of transparency in iconic signs, which are reflected by subjects’ performances on guessing different types of lexical signs, and it is the iconic nature that boosted up the performance in Exp. 2 where subjects were cued with the multiple choices upon seeing each lexical sign. Such high degrees of transparency should be taken as fundamental property for sign languages, a property resulted from their unique visual-gestural modality (Tai 2005).

Methodological implications can be drawn from the results above. As mentioned earlier, the logic of Bellugi and Klima’s

material selection might have led to an abrupt conclusion that almost all the ASL signs were opaque based on the results in the experiments where only 10% of the lexical items in Exp. 1 and 40% in Exp. 2 received the correct answers from at least one subject. The low performance reported in their study could just be owed to the imbalanced proportion of iconic signs to arbitrary lexical signs in their materials. Later cross-linguistic comparisons based on these studies might be made imprecisely due to the differences in focus, methodology, and even the criteria for material selections (Pizzuto & Volterra 2000). Accordingly, it is worth re-examining their experimental materials based on Su's (2004) iconicity framework, and the pattern and proportion of opaque ASL signs might present a different picture; in addition, future research on this issue could be directed toward an Asian cross-linguistic/cross-cultural study focusing on the role of the culture-related factors in interpreting lexical signs.

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APPENDIX I: Materials for Experiment on Iconicity of TSL

Type Parameter	Image	Metonymy	Diagram	Metaphor	Arbitrary
Hand-shape Noun: 10 Adjective: 5 Verb: 5	SCISSORS TOOTHBRUSH HOUSE FISH BOWL	NURSE CHRIST GUARD	COVET BANK BUY CHANGE CHEEKY BRAVE	ASK MIXED-UP	YU (SURNAME) WHATEVER CULTURE SKILLFUL
Location Noun: 11 Adjective: 5 Verb: 10	MOUTH EAR HEART HEAD TOOTH	SOUND SAY THINK DROOL SODA-POP	INVENT REMEMBER WONDER SAD HAPPY FIGHT DISCUSS	TRANSLATE BECOME-DEAF WORRIED NERVOUS	WU (SURNAME) CHIAYI SUFFICIENT NORMAL UNIVERSITY STRANGE
Movement Noun: 9 Adjective: 6 Verb: 15	SEPARATE RAISE-A- FLAG COME TAPE RACE	MINISTER	TELL FLOWER SUN KNOWLEDGE COPY HISTORY STORY	DIVORCE EXPENSIVE CHEAP PROGRESS VICTORY FAIL ANGRY CALM-DOWN EARN-MONEY SUFFER-LOSES COMMUNICATION YEAR	DON' T KNOW KNOW UNABLE ABLE
Action Verb: 8 Noun: 6	BREAK EAT SKI CAMERA STUDY	FARMER		CHILD START FIREWORK NEWSPAPER	FEMALE VACATION CLEAN CRITIQUE TEST
Total number	N= 20	N= 10	N=20	N=22	N= 18