Poznań Studies in Contemporary Linguistics 44(1), March 2008, pp. 103–119

doi:10.2478/v10010-008-0005-z

LOOKING AT SIGN LANGUAGE AS A VISUAL AND GESTURAL SHORTHAND

YISHAI TOBIN
Ben-Gurion University of the Negev, Be'er Sheva
yishai@bgu.ac.il

ABSTRACT

In this paper I will compare and contrast sign language (used by the deaf community) and spoken language from the point of view of semiotics and linguistics. Both signed and spoken languages can be defined as: a system of systems – revolving around the notion of the linguistic sign – used by human beings to communicate. Both languages also share a common goal: to achieve maximum communication with minimal effort. Where they differ, however, is in the way they produce the meaningful signs to create an efficient system of communication and in the nature of these meaningful signs regarding arbitrariness versus iconicity. Spoken language is based on phonemes that are in opposition to each other which are arbitrary and possess no meaning of their own – but combine into larger meaningful units such as morphemes, words, etc. Thus spoken language is fundamentally auditory and arbitrary (Tobin 1990, 1997, 2007a, b). Sign language is based on units that represent a combination of hand-shapes and gestures which have an orientation and movement to various parts of the body – all of which not only possess meaning – but are iconic rather than arbitrary in nature. Thus sign language is fundamentally visual and iconic (Fuks 2008; Fuks and Tobin 2008). Therefore it is our contention that the traditional concepts of spoken language are neither appropriate nor suitable for sign language and a different approach to analyze sign language will be suggested in this paper.

KEYWORDS: Spoken versus signed languages; auditory versus visual; arbitrary versus iconic.

1. Introduction[1]

In this paper, I will compare and contrast sign language (used by the deaf community) versus spoken language from the point of view of semiotics and linguistics (Tobin 1990, 1994, 2007a, b). Both signed and spoken languages can be defined as: a system of systems − revolving around the notion of the linguistic sign − used by human beings to

[1] This article is an extended and upgraded version of the paper read at the 38th Poznań Linguistic Meeting, Gniezno 2007. All the pictures courtesy of Orit Fuks.

communicate, i.e. a symbolic tool whose structure is shaped both by its communicative function and by the characteristics of its users. Both languages also share a common purpose and goal: to achieve maximum communication with minimal effort. Where they differ, however, is in the way that they create the meaningful signs they use to fulfill this goal of creating an efficient system of communication. Spoken language is based on the concept of sounds which are in opposition to each other − as phonemes − which are arbitrary and possess no meaning of their own − but combine into larger meaningful units such as morphemes, words, etc. Thus spoken language is fundamentally *auditory* and *arbitrary* (Tobin 1997). Sign language, on the other hand, is based on a combination of hand-shapes and gestures which have an orientation and movement to various parts of the body – which not only possess meaning but are iconic rather than arbitrary in nature. Thus sign language is fundamentally *visual* – rather than auditory – and *iconic* – rather than arbitrary (Fuks 2008; Fuks and Tobin 2008). It is our contention that the traditional concepts of spoken language are therefore not always appropriate as a means to analyze sign language and a different approach to analyze sign language will be suggested in this paper.

Israeli Sign Language (ISL) is a relatively young language that developed in Israel in the1930s, parallel to the development of the deaf community in the former British Mandate of Palestine, or what is today the State of Israel. ISL, like other sign languages in the world, is produced manually (with the hands) and perceived visually (with the eyes). The hand is primarily composed of bones and joints. Physiologically, this anatomical structure and its accompanying flexibility allow the hands to create different geometrical shapes and to move in space in alternative ways and in various directions with diverse orientations. The eyes are capable of perceiving several stimuli simultaneously: hand shapes, hand movements, hand-movement orientations and facial expressions. This variable manual flexibility paired with complex and multifarious visual perception are important tools for the creation of signs inherently based on (metonymic) iconic analogies that are indeed exploited for this explicit purpose by users of sign language. These metaphorical, metonymical analogies are created by the choice of a specific image that represents the entire concept. Each language chooses the specific image that can be representative of the larger concept within the medium of communication that it uses: *kukuriku* for example, is the acoustic image of the rooster in Hebrew while the rooster's crest is the visual image in Israeli Sign Language.

All the sign languages that have been studied (in the world) have been defined as natural – but iconic – languages. Signers throughout the world exploit the unique features of the communication channel to create analogies for phenomena found outside the reality of language. However, the lexical signs of sign languages differ from each other on the level of motivation and the type of iconicity they portray. Some of the signs are direct, obvious, mimetic pictures; for example, in the sign for *bird*, the index finger and the thumb represent the beak – a mimetic picture). Others are indirect iconic signs that are only semi-transparent; for example, in the sign for *economics*, the shape of the hand in the sign is the iconic of parallel of the form for handling bills of cash and the partial

rounding of the hands is the metaphorical equivalent of 'merchants exchanging cash'. There are also signs that have been classified in the literature as "opaque – not transparent signs" because it is more difficult to detect their iconicity, i.e. the iconic elements do not give direct clues to the abstract elements of the concept. For example, in the sign for *mistake* – the palms of both hands face the shoulders − the hands change places; the pinkie and the thumb remain straight and the other fingers are bent. It is the "crossing" of the hands with the straight + bent hand shape that clues a 'mistake' − one possibility in the place of another . The strong presence of obvious and transparent iconicity in the signs found across sign languages led to the unfortunate fact that until the late seventies, the full linguistic status of sign languages remained in doubt in the literature. Until the end of the 1970s, American Sign Language (ASL) was considered by many educators and by the hearing community alike as a mere pantomimic language of gestures.

The 1960s and 1970s became an important turning point in the research of sign languages. At this time a number of research centers in the United States showed that the lexical sign in sign languages was controlled by linguistic laws in the same way as lexical signs in spoken languages. The classic studies of Stokoe (1960) were the first indicators of this trend. His research showed that the lexical sign in sign language was more than a mere pantomimic gesture, but rather a complex structure composed of a number of parameters (hand shape, orientation, location and movement) which are joined together according to internal syntagmatic and combinatory rules. Thus, through this new revelation, the researchers persuaded the hearing community that sign language was indeed a bona fide natural language in every sense of the word and in all of its aspects.

Ironically, however, the research perspective on iconicity marched in opposite directions in the fields of sign language versus spoken language. Even though it was openly recognized that linguistic iconicity also existed in spoken languages and was exploited as an economic and efficient tool to support and induce memory, a great deal of effort was invested by generative grammarians to show that iconicity played no role in sign language, and they further claimed and supposedly "showed" that iconicity did not provide an advantage to the language acquisition of deaf children (Kantor 1980; Newport and Meier 1987).

The search for universal phonological features led the same linguists to adopt all the concepts, tools and tests available at the time for phonological research in spoken languages to sign language. The parameters for sign language (hand shape, location, movement and orientation) were described in terms of their distinctive articulatory and visual features. The test for minimal pairs used to discover phonemes in spoken language was adopted (by the definition of *noblesse oblige*) to the study of sign language phonology in order to determine which features (of arbitrary abstract phonemes) were "distinctive" and created differences in meaning, and which features were "secondary" or allophonic and did not change meaning.

Despite these attempts to adopt the theoretical and methodological concepts of spoken language to sign language, the few studies that studied the influence of iconicity on the phonology of sign languages revealed that what suited the phonology of an arbitrary

language, or a spoken language grounded in arbitrariness, was not necessarily suitable for a figurative language, or a language based on figurative iconicity. In spoken language, the phonemes are arbitrary, and their distinctive features signal "mere otherness" (Sangster 1982: 4; Jakobson and Waugh 1987: 285–286). Alternatively, Boyes-Bream (1981) showed that hand shape in ASL had a specific iconic meaning that influenced its distribution in the lexicon. For example, arched hand shapes always appear in lexical items that refer to entities that are either visually arched-shaped or round: a glass/cup, a grapefruit, an egg). Boyes-Bream claimed that the articulatory and visual features were not sufficient to describe hand shape, and therefore she added another dimension of features that were essentially more semantic-perceptual: grasping, linearity, pairedness, etc.

Brennan (1990, 2005) reported that in British Sign Language (BSL) not only did the feature of hand shape have iconic or metaphorical meaning, but so did all the other parameters of the lexical sign. For example, their location on the body – such as the temple and the heart – are almost always perceptually connected with intelligence and feelings, respectively, and tend to appear in lexical signs related to, or associated with, these areas. Brennan further showed that users of BSL exploit the isomorphism that exists between the phonemic and the morphemic levels in order to create new signs and/or to make creative additions on already existing signs. For Brennan, the sign in sign language is the comprehension of the cognitive reality. The ways in which signers exploit the morphophonemic units to produce new metaphors and signs in the language reflect the ways in which they perceive and interpret the world.

Van der Kooij (2002), who researched the structure of Dutch Sign Language (DSL), also claimed that the "phonological" parameters of the lexical sign in DSL are not without meaning. More importantly, and contrary to the popularly held claim that iconicity did not influence the deep phonological rules of the lexical sign, van der Kooij found that iconic motivation neutralized phonological rules, e.g. the possibility of dropping the use of the second hand in symmetrical signs.

Despite all of the above, most of all phonological research on sign language was, and still is influenced by the idea that language is composed of independent and autonomous levels prevalent in formal generative and other linguistic approaches. This view includes the idea that the fundamental impact of iconicity in sign language is dwarfed by phonological rules and the building blocks of lexical signs are without meaning like the phoneme, the arbitrary building blocks of the lexeme in spoken language (Sandler and Lilo-Martin 2006).

The present research presents an alternative theoretical and methodological framework of phonology to analyze the structure of ISL: the semiotic or sign-oriented linguistic approach which includes the theory of Phonology as Human Behavior (PHB) developed by William Diver (1979) and applied to the speech and hearing clinic by Yishai Tobin (1997) of the Columbia School (CS). The sign-oriented approach is based on the integrity of the linguistic sign where form and meaning are interlocked together, and, therefore, this approach is holistic in its point of view, and rejects the idea of separate and autonomous linguistic levels inherent in other theories. Thus, this approach is

especially suitable for the study of sign language where, as we claim, the fundamental unit of language is the sign which integrally combines a visual signal and a meaning. Furthermore, because the basic unit in sign language is visual, it makes sense that the role of iconicity, which economically and efficiently connects form and meaning, will dominate the use of sign language.

2. Research methodology

A stratified sample was randomly selected from the index of the Dictionary of ISL. A random stratified sample preserves the relative weight of the various content word classes in the dictionary and also assures that even the smallest category will have at least 50 lexical signs. A minimum of lexical signs even for the smallest category assures the possibility of carrying out quantitative statistic analyses which will be significant within and across all lexical categories. As a result of this, the category of noun includes 356 lexical signs, the category of action words includes 96 lexical signs, the general category includes 57 lexical signs and the category for features includes 51 lexical signs. The total number of lexical signs in the random stratified sample in our research is 560 lexical signs.

An adult deaf male, the son of two deaf parents, whose native language is ISL, was asked to sign the lexical signs in the sample which was then recorded and filmed on video. The Liddle and Johnson (1989) phonetic transcription system, which has been used to transcribe sign languages throughout the world, was used as the basis of the transcription of the internal structure of the lexical signs in our study. Three deaf advisers, the children of deaf parents, whose native language is ISL, accompanied our research and aided us with various content questions.

3. Results

(1) All of the parameters of the lexical sign in ISL have meaning.

(2) The distribution of the sub-parameters in the lexicon was not random but rather motivated by the iconic meanings connected to them. The following are examples of the metaphoric iconic motivation of lexical units.

Examples

A. Hand Shape

Hand Shape 1 (fist).
1.1. Firm GRASP.

Figure 1. "Grasp" hand shape – FIST; meaning: 'firm'.

This hand shape appears in signs that represent their parameters through firm GRASPING:

Pot = HEAVY 2 HANDLES; Motorcycle = REVVING UP + HANDLEBARS; Row Boat = ROWING CIRCULAR; Suitcase = HEAVY + HANDLE; Car = STEERING WHEEL – CIRCULAR DRIVING; Clothes Iron = GRASPING IRON + TABLE.

1.2. This hand shape is exploited for passing on a metaphorical message of power/strength/stability = MAKING A FIST LIKE A CHILD – in signs:

Religion = BREAST BEATING; Government = FIST FORCING YOU; Synagogue = LIKE RELIGION; Official = BOTH HANDS DOWNWARD MOVEMENT ALSO LIKE PRAYER; as well as signs such as: Security, Certainty, Support, Strong, Work, Democracy.

1.3. This hand shape is used to express a metaphorical message of 'hardness/difficulty' (Firm = Hard):

To Make Difficult,/Difficult, Regret, Sadness, Miserable, Poor, Complain, Stubborn, Stupid.

Figure 2. Hand shape "C"; meaning: 'arch-like'.

Hand Shape: "C".
Meaning: Arch-like.

This is an iconic hand shape with a very specific meaning that appears only in lexical signs that represent referents with arch-shaped visual features: Egg = BREAKING; Grapefruit = CIRCULAR HAND MOVEMENT OF EXTRACTING JUICE; Lemon = THE ACT OF SQUEEZING BY PUTTING THE HANDS TOGETHER; Tomato = PLACING THE ARCH NEXT TO RED CHEEK; Flashlight = SWEEPING MOVEMENT; Banana = IN THE SHAPE OF PEELING; Bag of Cocoa = SQUEEZING A PLASTIC BAG OF CHOCOLATE MILK CLOSE TO THE MOUTH; A Person Who Talks a Lot (the hand shape represents the mouth) = A SLOW MOVEMENT FROM THE MOUTH; Tea = REVERSE BACKWARDS CUP + DRINKING TEA BY DIPPING (A TEA BAG) IN THE CUP.

Hand shape 4 ('paying').
Meaning: Functional holding.

This hand shape which is extremely problematic for traditional linguists because it has a highly marked structure but it also appears very frequently in sign languages throughout the world (because of its functional iconic meaning).

Figure 3. Hand shape 4; meaning: 'paying' (prototype for signs involving economics/money).

In all of the lexical signs in which this hand shape appears it represents 'holding on to something' = CLOSE HAND INDEX FINGER ON THUMB: Gardener = holding tools = BOTH HANDS HOLDING TOOLS = RAKING; Tennis = holding the racquet = IN THE FORM OF MAKING A SERVE; Tear = holding a piece of paper = LITERALLY TEARING AWAY FROM YOU; Brush = holding a hair brush = NEXT TO HAIR; Money – holding a bill. In ISL, as in other sign languages in the world, a whole paradigm of lexical items related to 'money' has developed around the image of holding a bill: *buy*, *sell*, *be extravagant*, *waste money*, *cash*, *economy*, *sell*, *expensive*. The common denominator for all of these lexical items is the appearance of hand shape: T representing the image of holding on to a bill of paper money.

B. Locations

An iconic meaning that motivates the distribution of the feature of Locations was found in ISL just as it was for the feature of hand shape. The following are a few examples.

Figure 4. REMEMBER.

1. The temple
   Meaning: Representing mental activities:

   Remember = WHOLE HAND NEXT TO TEMPLE; Know = INDEX FINGER NEXT TO TEMPLE – ONE MOVEMENT; Genius = C-SHAPE MOVEMENT FROM TEMPLE; Knowing a Person = WHOLE HAND TAPPING THE TEMPLE; Not Knowing a Person = TAKE HAND AWAY FROM EYES WITH THE PALM FACING YOU; Idea = CROSS SECOND + THIRD FINGERS MOVE AWAY FROM TEMPLE; Invent = LIKE *IDEA* BUT ONE FINGER ONLY; Dream = MOVING FINGERS = MOVING HAND FROM TEMPLE LIKE A BOAT; Learn = TAP YOUR HEAD SEVERAL TIMES; Forget = ERASE MOVEMENT ACROSS ENTIRE FOREHEAD; Think = PLACE INDEX FINGER ON TEMPLE; Worry = LIKE *IDEA* BUT RUB YOUR TEMPLE WITH FINGER.

2. Mouth/ears/eyes.
   Meaning: Sensory activities:

   Mouth: Eating and communication: Eat = GRASPING FOOD SHAPE TO MOUTH.

Figure 5. EATING.

Swallow = PUTTING FOOD SHAPE AS IF HAND IS ENTERING THE MOUTH AND THROAT; Vomit = OPPOSITE OF EATING – PALM UP FROM THROAT UPWARDS; Say/Tell = INDEX FINGER UNDER BOTTOM LIP – STRAIGHT OUTWARD MOVEMENT – DEICTIC: STRAIGHT MOVEMENT = YOU (*I TELL YOU*), MOVEMENT TO THE SIDE = THIRD PERSON (*I TELL HIM, HER, THEM*), *SHE TOLD HIM* = ONE SIDE TO MOUTH TO OTHER SIDE; Ask, Answer/Respond, Reply, Communication = INDEX – THUMB CIRCLE – SAME MOVEMENT WITH ARCH – SAME DIRECTIONS.

Eyes: Look = INDEX + THIRD FINGER LIKE EYES-V SHAPE – EYE LEVEL SWEEPING MOVEMENT / UP + DOWN MOVEMENT = LOOK SOMETHING/SOMEONE OVER; Visit = TWO EYE MOVEMENTS MEETING TOGETHER (*TWO PEOPLE SEEING EACH OTHER TOGETHER*); Cry = INDEX FINGER IN FRONT OF EYES + UP + DOWN MOVEMENT.

Ears: Deaf = INDEX FINGER FROM EAR TO MOUTH = STIGMATIZED *DEAF* + *DUMB*; Hear = INDEX GINGER TO EAR; Noise = BRISK HAND MOVEMENTS NEXT TO BOTH EARS; Hearing Loss = CLOSE HAND (MEANS LOSS/LOWERING) NEXT TO EAR; Telephone = USED TO BE RECEIVER SHAPE NEXT TO EAR – BEFORE CELLULAR PHONES – NOW COMPACT PINKY + THUMB EXTENDED = CELLULAR PHONE.

Figure 6. LOVE.

3. Torso – Locus of emotional and individual experience:

   Love = CROSS ARMS LIKE AN X ACROSS CHEST.

   Happiness = HANDS UP = UP IS GOOD = ACROSS CHEST – BRISK MOVEMENT; Become Excited = LIKE HAPPINESS BUT WITH MORE BRISK, ABRUPT MOVEMENT; as well as Be Insulted, Want, Regret, Hurt, Be Patient, Comfort/Feel Comfortable, Alone.

C. Path movement

Movement and its associated features like location and hand shape were also found to have meaning in our study.

Direction of Movement: Each direction of the movement of the hand in space had a different specific meaning, e.g.:

1.1. Upward Movement – Up Is Good: Promotion, Rehabilitation, Director, New, Education, Success.

Figure 7. UP IS GOOD.

1.2. Downward Movement: Down Is Bad: Failure, Loss, Lazy, Weak, Rude, Inferior.

2. The shape of the movement:

2.1. Convex Arch; meaning: Passage To, Passing X Over, To Pass, Wander, Postpone, Beginning, To/Towards…, Next Year, Ask, Help, Give, To Move = CONVEX ARCH BOTH HANDS MOVE FROM ONE PLACE TO ANOTHER; Beduin = REPEATED MOVEMENT OF SIGN TO MOVE = NOMAD.

2.2. Repeated Circular Movement; meaning: an activity which lasts a long time or a continuing situation: Look For, Lonely/Isolated, Nothing, Lecture, Tradition, Trips, Arrangements, Used, Complicated.

REPEATED CIRCULAR MOVEMENT WITH INDEX FINGER:
TORSO = LONELY
MOUTH = LECTURE

4. Additional results

(1) Iconicity was responsible for the appearance of irregular hand shapes and locations that cannot be represented or described by means of the standard features of the language. The appearance of irregular units is generally limited to one or two lexical signs.

For example, location – lateral space near the arm pit. An infrequently used location that appears only in two signs: to gossip and to steal. The location also receives the meaning of 'from the side/behind one's back' on the semiotic level.

(2) These irregular features are problematic for traditional linguists who have to deal with the questions: (a) How should one explain these irregular units? And (b) Should the phonological model be able to represent them? The traditional generative phonological model could not adopt specific features to explain each irregularity individually

(3) In abstract lexical signs basic units with a wide and neutral iconic meaning were generally used. Units with very specific iconic meanings like the various arch shapes never appeared in abstract lexical signs.

(4) Iconicity was more dominant than the human factor (ease of production) for explaining the phenomenon of specific units such as "B-Bent" (see Figure 8 overleaf).

There is disagreement regarding the status of the hand shape B-Bent in the literature. Some researchers (such as van der Kooij 2002) claim that it is a phonetic allophone of the Hand shape "B" (see Figure 9 overleaf), that appears in phonetic articulatory environments where the wrist joints at the root of the palm of the hand has to be bent. The argument is that instead of bending the wrist joints that requires much effort, the bending is passed on to the first knuckle of the fingers (metacarpophalangeal joints). Alternatively, there are other researches (such as Pizzuto et al. 1995) who claim that this hand shape has a more narrow and specific meaning that the Hand shape "B", and this is the marking of boundaries or delimitations; our research supports this latter claim. In 43% of the cases, this B-Bent hand shape delimits its boundaries: AMOUNT, A RAISE/RISE, A STOREY/FLOOR, TALL/HIGH, EARLY/LATE, PROCEED, EXPAND, MAKE SMALLER. In 36% of the cases it iconically represents the visual appearance of the lexical referent (e.g., *camel*). In the remaining 21% of the cases, one can explain the appearance of the B-Bent hand shape by the human factor as an attempt to limit the bending of the wrist joints which is more difficult than to bend than the knuckle.

The appearance of the hand shape B-Bent also appeared in phonetic environments where according to the hypothesis of "allophones" it should not have appeared since the bending of the wrist joints was not required: in the lateral dimension (right – left). Finally, a minimal pair was found for the hand shape B versus the hand shape B-Bent for the signs: WIDE/EXPANSION and TALL (HIGH)/TERRIBLE.

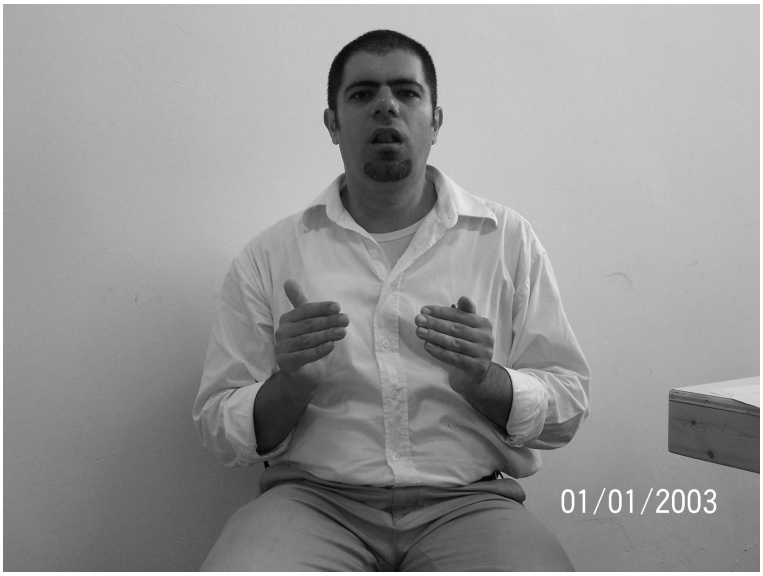

Figure 8. "B-bent" = EXPANSION.

Fig. 9. Hand shape "B" − WIDE (minimal pair with B-Bent).

5. Summary and conclusions

The results of our research reject the separation of semantics and phonology in ISL. Iconicity is the basis for all aspects of ISL including phonology. Arbitrariness, on the other hand, used only in those cases when iconicity – direct or indirect – metaphoric – cannot be used to describe the characteristics of the abstract concept. Paradoxically speaking, in the tension between arbitrariness and iconicity sign language is quite similar to spoken language. In both cases the human factor is striving for maximum economy and minimal effort.

Spoken language strives for maximum communication with minimal effort through the auditory channel/auditorially –through hearing – thus, arbitrariness reigns supreme in spoken language. Sign language, on the other hand strives for maximum communication with minimal effort through the visual channel/visually – through sight – thus, iconicity reigns supreme in sign language. The synergetic principle for the search for maximum communication with minimal effort is the common denominator for both language systems and it is the different channel of communication which provides the source for their individual preference for either arbitrariness or iconicity.

Linguistic research in sign language has to pay more attention to the influence of the channel of communication to the structure of the language. Instead of using theoretical and methodological tools adopted from an arbitrary auditory based system that only partially contributes to the understanding the linguistic phenomena, research in sign language should develop tools that are more suitable for a visual language. In the last few years more research has reported that the iconic meanings of the basic units of sign language are psychologically real for language signers and these iconic meanings are used to productively produce new metaphorical signs in the lexicon.

This means that signers are aware of the basic iconic meanings of the various components of the sign and exploit them when constructing new signs (especially in abstract signs where they create metaphorical parallels between the concrete iconic meaning of the unit and the metaphorical meaning: for example, in the sign for INFORMING, the hand shape is composed of all the fingers that are bent and touch the tip of the thumb. Iconically, this hand shape directly indicates grasping or having something at the tip of your fingers. Therefore the sign for INFORMING implies the metaphoric message that ideas–information–thoughts–knowledge are objects that can be grasped or held on to physically and passed on to others. Today, there are researchers like Taub (2001) who analyze the iconicity of sign language and the metaphoric use of the basic units of the sign in the theoretical framework that began with Lakoff and Johnson (1980) in metaphor and cognitive linguistics. Future research that will further increase our knowledge on the metaphorical exploitation of basic units in the process of building new signs will even further contribute to our understanding of how a visual language is realized in space.

REFERENCES

Aaronson, D. and P. Reiber (eds.). 1979. *Psycholinguistic research: Implications and applications*. Hillside, NJ: L. Erlbaum.

Boyes-Braem, P. 1981. Features of the handshape in American Sign Language. [Unpublished PhD dissertation, University of California, Berkeley.]

Brennan, M. 1990. *World formation in British Sign Language.* Stockholm: University of Stockholm.

Diver, W. 1979. "Phonology as human behavior". In Aaronson, D. and P. Reiber (eds.). 161-186.

Fuks, O. 2008. Israeli Sign Language (ISL) according to the Sign-Oriented Approach of the Columbia School and the Theory of Phonology as Human Behavior. [Unpublished PhD dissertation, Ben-Gurion University of the Negev.]

Fuks, O. and Y. Tobin. 2008. "The signs B- and B-bent in Israeli Sign Language according to the theory of Phonology as Human Behavior". *International Journal of Clinical Linguistics and Phonetics* 38. (In press.)

Jakobson, R and L. Waugh. 1987. *The sound shape of language*. Berlin: Mouton de Gruyter.

Kantor, R. 1980. "The acquisition of classifiers in American Sign Language". *Sign Language Studies* 28. 193–208.

Kooij, E. van der. 2002. *Phonological categories in sign language of The Netherlands: The role of phonetic implementation and iconicity.* [Unpublished Ph.D. dissertation,
Leiden University].

Lakoff, G. and M. Johnson. 1980. *Metaphors we live by*. Chicago: University of Chicago Press.

Liddell, S. and R. Johnson. 1989. "American Sign Language: the phonological base. *Sign Language Studies* 64. 195–277.

Newport, E.L. and R.P. Meier. 1987. "The acquisition of American Sign Language". In: Slobin, D. (ed.). 881–938.

Pizzuto, E., E. Cameracnna, S. Corazza and V. Volterra. 1995. "Terms for spatio-temporal relations in Italian Sign Language". In Simone, R. (ed.). 237–256.

Miyares, R., A. Muñoz Alvarado, and C. Alvarez Moreno (eds.). 2007. *Actas-1 del X Simposio Internacional de Comunicación Social, Santiago de Cuba 2007.* Santiago de Cuba: Centro de Lingüistica Aplicada.

Sandler, W. and D. Lillo-Martin. 2006. *Sign language and linguistic universals.* Cambridge: Cambridge University Press.

Sangster, R.B. 1982. *Roman Jakobson and beyond: Language as a system of signs, the quest of the ulimate invariants in language.* Berlin: Mouton

Simone, R. (ed.). 1995. *Iconicity in language.* Amsterdam: John Benjamins.

Slobin, D. (ed.). 1987. *The cross-linguistic study of language acquisition.* (Vol. 1. *The data.*) Hillsdale: Erlbaum.

Stokoe, W. [1960] 1993. *Sign language structure: An outline of the visual communication systems of the American Deaf.* Silver Spring: Linstok Press.

Taub, S.F. 2001. *Language from the body: Iconicity and metaphor in American Sign Language.* Cambridge: Cambridge University Press.

Tobin, Y. 1990. *Semiotics and linguistics*. London: Longman.

Tobin, Y. 1994. *Invariance, markedness and distinctive feature analysis: A contrastive study of sign systems in English and Hebrew*. Amsterdam: John Benjamins.

Tobin, Y. 1997. *Phonology as Human Behavior: Theoretical implications and clinical applications*. Durham, NC: Duke University Press.

Tobin, Y. 2007a. "A semiotic view of signed versus spoken language". In Ruiz Miyares et al. (eds.). 428–432.

Tobin, Y. 2007b. "Arbitrariness versus iconicity in signed and spoken languages". *Memorias de la Conferencia Linguistica Internacional 2007*. El Instituto de Linguistics y Literatura, La Habana, Cuba. 2007. (CD ROM.)