TWO FACES OF SIGN: ICONIC AND ABSTRACT

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INTRODUCTION

What would be the nature of a language which has developed in the absence of auditory input? There are numerous possible channels in which a language may develop. In the human species, we might expect that language—in the absence of hearing—would develop using the most important of the remaining senses: vision. The language that has been the object of our research at The Salk Institute for Biological Studies has in fact developed as a visual language—using the hands, rather than the vocal apparatus, as articulators. This visual-gestural language is called American Sign Language (ASL) or Ameslan. It is the language developed in large part by deaf people themselves and passed down from one generation to the next in deaf families. American Sign Language is entirely distinct from English and from other spoken languages. It is a language in its own right with its own set of lexical items; its own way of incorporating semantic information into those items; and its own grammatical rules. That is, American Sign Language (ASL) is not a form of English rendered visually on the hands.

When we first began our studies in the nature of the language used by deaf people of deaf parents, there were hardly any linguistic studies of sign language in this country (aside from the important and sophisticated contributions made by William Stokoe and Stokoe et al. Reading through the scanty literature about signs and signing, we found that what earlier observers invariably stressed was their impression of the language as being "pictorial," "pantomimic," "concrete," "iconic"—"a loose collection of pictorial gestures," as one observer put it. These impressions would make American Sign Language appear essentially different from spoken language, for there is a long tradition in linguistics that characterizes the lexical items of language as essentially arbitrary: the form of a morpheme having no part-for-part relationship to the form of what it denotes.

FROM MIMETIC REPRESENTATION TO SIGN

Not only does pantomimic representation seem a likely candidate as the historical source for many ASL signs, it also plays a very important role in the total range of

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devices currently used when the deaf communicate among themselves; that is, signing is interspersed with other gestures, including pantomime.

When we analyze a typical conversation or narrative among deaf signers, we find that nearly all of the manual gestures that are made are ASL signs. Actual ASL signs are a rich set of conventional symbols that conform to a specific set of systematic formation constraints that distinguish American Sign Language, from other sign languages and from gestures in general. Those gestures in deaf communication which are not actual ASL signs will be the focus of the first part of this paper.

We shall call a certain set of nonsigning gestures that occur in deaf communication “mimetic representation.” The amount of such mimetic representation varies, of course, from individual to individual and from situation to situation. It is significant that in deaf communication, the sign-symbolic (i.e., the “linguistic”) and the mimetic are in the same channel. Deaf signers, however, have a very strong sense of the difference between the extremes: between what counts as an ASL sign and what is clearly pantomime.

![Image of three signers performing gestures: "cinnamon roll", "sand crab", "milk shake"]

Figure 1. Nonse signs invented by young deaf children.

We can make some distinctions among varieties of mimetic representation; gestures that are not actual ASL signs. Full pantomime means reenactment where one assumes the role of the agent in the event portrayed and acts in realistic fashion. Gestural delineation, usually with the hands, is describing the shape or other salient characteristics of an object, e.g. the moon, or designing the sail to represent a boat. (A more detailed classification of similar phenomena may be found in Schlesinger, et al., in press.) Yet another category of mimetic representation consists of creations which, while not actual ASL signs, nonetheless conform to the systematic formation constraints of actual signs: these are nonce signs and neologisms and may well be a rich source of new signs in the language.

In deaf communication, mimetic aspects are very much alive, and the “signs,” for example, that children create are clearly mimetic in form. We have observed many cases of the creation of nonce signs among the young deaf children of deaf parents learning ASL as a native language in our longitudinal study of the acquisition of sign language. We note that some of these invented signs are not only mimetic, they also share in the restricted parameters of the language; that is, they conform to the systematic formation constraints of the adult language. For example, one three-year-old deaf child invented a nonce sign for “cinnamon roll” which she made with a cupped hand representing the roll, and an active pointing hand indicating the swirls of cinnamon sugar on the top of the roll (Figure 1). This invented neologism has a base...
hand like the regular ASL sign for GROW or SEAT; an active hand like the ASL sign for WHAT or PAY; a movement like the ASL sign for TEA or WHO. In our studies of the acquisition of ASL, we have seen other signs invented by deaf children which have this same kind of dual aspect; they are clearly mimetic representations while at the same time sharing in the specific properties of ASL signs. For the purposes of illustration we have selected two additional nonce-signs created by young deaf children: a sign for "sand crabs" and a sign for "milk shake". (See Figure 1).

Among deaf adults, mimetic aspects are also very much alive as a source for new signs in the language. One example is provided by deaf researchers within our laboratory. There was no regular sign in ASL for "video tape recorder." In referring to the machine, our deaf researchers first used the index fingers of both hands moving clockwise to indicate the tape moving from one reel to another. The reels themselves, of course, also both move in a clockwise direction. We noticed, however, that in a short period of time, some of the realism of the representation was lost. Now the neologism is made with the index fingers describing circles that both move inward; not the way the reels of a video tape recorder actually move, but in a way that is easier to perform and, in fact, more sign-like. (See Figure 2).

![Figure 2. A recent neologism in ASL.](image)

It is important to note that in addition to using mimetic representation in the creation of new signs, adult signers may also subject actual ASL signs to mimetic elaboration, thus extending the modulations on a sign beyond the boundaries of regular grammatical processes and into the realm of depiction. (Some of the regular grammatical processes are described later in this paper.) For example, one signer made the sign BUTTERFLY in a narrative, and then made the hands flutter around as a butterfly would move, but still using as a basis the particular handshape and other formational characteristics of the ASL sign for BUTTERFLY.9

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†We have adopted some notational conventions for the purposes of this paper. Whenever a regular ASL sign is referred to, the sign is represented by an English gloss presented in capital letters: EGG. The form of the sign need not, of course, have any relationship to the form of the English word used to represent it. Whenever two words are required to translate a single ASL sign, the two words are joined with a hyphen, as in VIDEO-TAPE RECORDER or TOTAL COMMUNICATION. When two signs are joined in a compound relation, the glosses for the two signs are connected with "", as in EAT NOON, meaning "lunch."
We now turn to some examples of pure mimetic representation in deaf communication and the distinctions between such gestures and regular ASL signs.

*Mimetic Representation in the Absence of an ASL Sign*

In order to study the distinction between mimetic representation and ASL signs, we have used signed narratives from a study of paraphrase in ASL. Deaf signers were asked to sign a story by James Thurber called "The Unicorn in the Garden." In the course of the narrative we found that occasional pantomimic representations were interspersed into the flow of regular ASL signs. We discovered, for example, that there is no commonly accepted sign for "strait-jacket" or for "unicorn." Since these concepts figure in the story several times, this gave us an opportunity to study the invention of nonsign representation by different signers and enabled us to observe the changes in the representation of these concepts as the narrative progressed. We shall consider here the representations of "strait-jacket": we noted that each signer produced a different pantomime, focusing on different aspects of a strait-jacket and/or the act of getting into one, and most renditions involved several steps (a series of different actions).

These pantomimes for strait-jacket involved activities like putting the arms into the two sleeves, fastening the cords, crossing the arms, tying different kinds of knots in various ways, pulling tight, constraining the wrists, depicting a jacket, clothing, sleeves, straps from shoulders, and so on. For each signer, it was the initial introduction of his representation of "strait-jacket" into the narrative that was the most elaborate, involving as many as five activities in sequence. At later points in the story, individual representations could reduce to two or even one activity. Extracting from different performances, one deaf researcher gave her interpretation of the step-by-step progression from highly pantomimic rendition to abbreviated, more sign-like rendition, finally having the restricted form of a possible sign. (See Figure 3).

The signer first pantomimed putting her arms straight out, one after the other, as if they were being forced into the sleeves of an outstretched jacket. The arms were wrapped, again one after the other, across her body, each ending on the other side of the opposite elbow. She held her arms in this awkward position for a brief interval; then her hands relaxed. Then, as if becoming the hands of someone else, her own hands went through an elaborate tying motion at the center line of the body, knotting and pulling tight in a realistic if convoluted fashion. The impression one has in watching the rendition is that the signer has been put into the jacket, the action occurring to her arms and body as a passive agent; and then switching roles, the signer violently ties the straps that hold the jacket in place in an elaborate knot, which involves curves and twists of motion, and considerable physical effort (Figure 3).

At the other extreme, the simplified final sign-like version was reduced to two steps and was highly abbreviated, with no trace remaining of the original physical effort depicted. The final two parts of the representation had been reduced and simplified to something that had characteristics of a single ASL compound sign. In the reduced sign-like version, the arms no longer wrapped around the body but instead contacted the torso one above the other without crossing; immediately following this, and very close in space (as is typical of the parts of a compound in

§The form of compound signs in American Sign Language is discussed in the section Grammatical Processes and the Suppression of Iconicity.
ASL) was an abbreviated straightened version of what originally represented the elaborate "tying," which now simply involved moving the hands apart a short distance. The preliminary activities were not now even represented in the reduced sign-like version. What was created was a nonce sign. Although sign-like in form, note, however, that the final shortened representation is still iconic; i.e., aspects of its form are directly related to what is represented. Thus this example presents a typical change from highly pantomimic (elaborate, many steps, actual "acting out") to highly sign-like (condensed, shortened, stylized), in a mimetic representation occurring where there is no corresponding sign. (See Figure 3).
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Comparison of Pantomime and ASL Sign

In the case of "strait-jacket" we studied the invention of a pantomimic representation of something for which there is no regular ASL sign. As another way of examining differences between mimetic representation and sign, we asked ten nonsigners to convey in gestures the meanings of the individual English words for which actual ASL signs exist. One of the words was "egg," and this was rendered in many different ways. In most cases the pantomime involved a number of steps; and there were "thematic" elements common to many of the renditions. The common elements included the following: picking up a small oval-shaped object; hitting it against the edge of a real or imaginary surface; breaking it open and emptying the contents of the shell; putting the two halves of the shell into one hand and throwing them away. But the way these general thematic elements were realized varied enormously from subject to subject. For all intents and purposes, the details of each rendition were absolutely different (FIGURE 4).

By contrast, let us consider what is involved in signing EGG in American Sign Language. As FIGURE 4 indicates, the ASL sign EGG is clearly related to one step within the complex pantomimed sequence of actions: namely, the breaking open of the eggshell so that the contents run out. But the relation between the sign itself and the action is a highly stylized, conventionalized one. The movement proper to the ASL sign involves a repetition; the "corresponding" motion of emptying the shell was, of course, never repeated in the pantomime. The sign is stylized in that the two fingers of one hand cross the same two fingers of the other hand in a way that would not occur if one were actually holding an egg; in pantomime, holding an egg is depicted realistically. Thus, while the sign is iconic and suggestive of an aspect of the pantomime, the two performances—pantomime and ASL sign—are distinctly different. (See FIGURE 4).

Although the pantomimes portraying "egg" varied enormously from one person to the next, the various renditions of the ASL sign for EGG are recognizably the same across signers. Note, for example, that the ASL sign for EGG requires a particular handshape and that handshape only. We have seen a deaf mother correct her deaf child's signing when the sign was made in the same way but the hands were

Pantomime of "egg"  ASL Sign EGG

FIGURE 4. Comparison of pantomime and ASL sign—(1).
held with four fingers outstretched instead of two. That there is a recognizably appropriate way to form the sign EGG—that there are, in fact, conditions of well-formedness in ASL—is indicated by the mother's correction of the child's "misprounciation." In the pantomime, it matters not at all how the hands are shaped in holding an imaginary egg, nor how many fingers are straight or curved; what counts in the pantomime rendition is that the hands are held as if surrounding or holding an egg-shaped object. In the final analysis, the distinction is between well-formedness in the sign and effectiveness in the pantomime.

In order to study more carefully some of the diagnostic characteristics of ASL sign and pantomime (when presented in citation form), we chose a set of signs that retain a high degree of iconicity; that is, ASL signs that were close in form to some plausible pantomimic representation (like ZIPPER, BED, BOOK, DIG, STEAL). Bernard Bragg, a deaf actor and mime artist from The National Theater of the Deaf, produced for us on video tape some pairs of representations: pantomimes and corresponding ASL signs. We asked him to keep the renditions similar to one another but yet each natural to its own mode of communication, in order to illuminate the diagnostic characteristics of pantomime as opposed to ASL sign. In general, we found, as before, that there were a varied number of thematic images in the pantomime and only one in the regular ASL sign, and that the pantomimes were much longer and more varied in duration. The individual pantomimes ranged from 3 to 12 seconds; the individual ASL signs were all far shorter and more uniform in duration, most of them around one second. In the discussion which follows, it should be kept in mind that these are signs in their citation form, presented individually and carefully; signs are much shorter in duration in connected discourse. D. Newkirk from our laboratory has made a detailed comparison of the set of pantomimes and signs.\

Each sign always had a well-defined beginning and end. Since the signs were presented as separate individual signs, i.e., not in a sequence, the initial position (or beginning) of a sign was always characterized in the following way: the hands always started from a resting position and a relaxed, nonspecific shape; then there was a transitional movement to the start of the sign, by which time the hand had taken on the specific handshape of the sign to be made. Thus one could recognize the beginning of a sign by the brief temporal holding—observable in slow-motion playback—of the specific handshape in an initial position. In pantomime, no such hold was required; the hand could move directly from the rest position through the series of motions into the pantomime itself.

We chose one pair of representations for illustration in this paper to reveal some of the fine distinctions between pantomime and sign—distinctions that also reveal criterial attributes of ASL signs. This is the pantomime and sign for "steal," as performed by Bragg (see Figure 5). Actual tracings from the video tape were made at selected intervals. We intentionally chose a pantomime that was simple in terms of the activities represented, in order to have a more direct basis for comparison. In this particular pantomime (Figure 5), the first five drawings (fields 1 through 227) constitute a preamble representing a person furtively looking to one side and then reaching over in preparation of the actual "swiping" of an object. The last seven drawings (fields 228–338) represent the act of stealing—and here, the thematic image is the same as in the sign. Bragg's total pantomime sequence takes 338 fields (over 5½ seconds); his ASL version of the sign STEAL requires only 34 fields (about ½

†Individual fields on the video tape (60 fields per second) were numbered with the aid of a Video Numbers Generator (Data Systems Design, Model no. 44-2) for ease of counting.
second). Even if we omit the preamble sequence and count only the shared thematic image, the pantomime is three times as long as the sign.

The eyes provide one differentiating clue to separate sign from pantomime. In producing signs in citation form, Bragg makes direct eye contact with the camera (or addressee) throughout the sign. When he is producing the corresponding pantomime, he makes direct eye contact only after the sign is completed.

Bernard Bragg's Pantomime of "steal"

The ASL Sign STEAL

Figure 5. Comparison of pantomime and ASL sign—(2).
mimes; his eyes instead participate in the action, sometimes anticipating, sometimes following the hands. In this pantomime for "steal," the hands are not held in one of the specific handshapes of ASL, whereas the sign starts with a specific well-defined ASL handshape; two fingers spread as in "V for victory." The pantomime involves reaching all the way across the body to the contralateral side beyond the elbow, and then making a large sweeping motion back to the other side; the movement of the sign is short, precise, and well specified, the two fingers bending as the hand moves upward and to the right. The movement of the two hands differs in the pantomime; only one hand moves in the sign. One hand moves in a large sweeping motion from one side, across in front of the face, around to the other side, in the pantomime; whereas the movement in the sign is along a single vertical plane parallel to the torso. The shoulders, body, and head moved during the pantomime, whereas in the sign only the hand moved.

To sum up: the signs were condensed, restricted in the space used, the action transferred to the hands alone. The action occurred along a limited plane of movement, with a restricted well-specified handshape, location, movement. The pantomimes, by contrast, were realistic in time, duration, size, and direction of movement; in signing, all dimensions were altered: condensed, compressed, reoriented, and conventionalized.

The progressions we have observed from complicated pantomime to simple sign-like units that are consistent with the formational constraints of ASL are far from unique to the particular situations discussed above. In fact, it has been demonstrated that similar tendencies have characterized the actual historical development of American Sign Language. N. Frishberg has undertaken a study of historical change in American Sign Language and has found that there is a consistent direction to observed changes in the form of signs within the past 100 years. The general direction of historical change in the form of signs is from what was in the past more iconic and more representational to what is now more arbitrary and more constrained, conforming to a tighter system.\textsuperscript{11,12} The historical trend includes: concentrating the lexical content in the hands rather than in facial or bodily movements, moving from outside to within the "signing space," centering, simplifying movement. The result of this change in the form of signs is not that they have lost all traces of iconicity, only that their iconicity is less transparent.

\textbf{THE DEGREE OF ICONICITY OF ASL SIGNS}

Although, as pointed out above, there is a definite distinction between regular ASL signs and the sort of spontaneous mimetic representation characteristic of pantomime, many regular ASL signs clearly have mimetic properties—constrained, to be sure, more and more through historical change by the systematic-formational system of the language. Furthermore, it has often been noted that the vocabulary of American Sign Language—and, to our knowledge, of other primary sign languages as well—undeniably is a great deal more iconic than are the morphemes of spoken languages.

Of course, to claim that there is an iconic relationship—that aspects of the form of a sign are related to aspects of the form of what is denoted—does not determine to any degree the actual details of the form of that sign. As an example, consider the sign for TREE in American Sign Language. It is made with the forearm upright, the hand spread wide, and a twisting of the wrist and forearm. As Figure 6 shows, it can be said that the upright forearm represents the trunk of a tree, the outstretched hand represents the branches, and the twisting motion represents the movement of the
wind through the branches of a tree. The sign for TREE in Danish Sign Language is also iconic, and yet it differs in all details from the ASL sign: the two hands symmetrically outline the rounded shape of the outer perimeter of a tree and then outline the shape of the trunk. The sign for TREE in Chinese Sign Language is yet again different, but still iconic: the two hands symmetrically encompass the shape of

![Figure 6. Sign for TREE in three different sign languages.](image-url)
the trunk of a tree and indicate its extent. (FIGURE 6 represents the sign TREE in American Sign Language, Danish Sign Language, and Chinese Sign Language. The drawings to the right indicate the relation of each sign to some representation of a tree.) Thus, the sign TREE in each of three different sign languages is iconic, and yet the three signs are entirely distinct, both in what they represent and in the way in which this is expressed in forming the sign.

Incidentally, it should be noted that deaf people are especially aware of the potential of the iconic aspect of signs when teaching signs to hearing adults. In this situation, deaf people very often assign some iconic interpretation for mnemonic purposes. Handbooks of signs often contain information on how to form the sign, and then specify some representational aspects of signs: "YEAR; the earth revolving around the sun," or "WEEK; one row of dates on the calendar." Disregarding the problem of which and how many of there are "true" etymologies, it is a fact that a great many signs of American Sign Language and probably other primary sign languages invite iconic interpretation.

As a first step toward assessing the degree of general iconicity of ASL signs, we designed two pilot studies which approach this problem from different angles. One study asks the question: how obvious is the basis for the relationship between a sign and its meaning? That is, given a sign and its meaning, to what extent do nonsigners agree on the basis for the relationship between the two? The other study asks: how transparent or self-evident are ASL signs? That is, given a sign, to what extent can a nonsigner—in the absence of any prior knowledge—guess its meaning? It is important to note that in these first approaches to the degree of iconicity of signs, we ask how non signers can make the connections between the form of the sign and what it denotes. Of course, a more important question from the point of view of the structure of the language—and one to which we shall address our attention later in this paper—is the significance of the iconicity of signs for deaf people whose native language is sign language.

The Relationship of the Form of a Sign and Its Meaning

To a group of ten hearing people who had no prior knowledge of sign language, we presented a collection of ASL signs along with the English translation-equivalent of each sign. In the instructions for the task, we told subjects that ASL signs are often said to be representational and we gave an example of an iconic sign that was not on the list, presenting the ASL sign CAR paired with its meaning and suggesting as a possible response that it represents "turning the steering wheel of a car." Subjects were thus instructed to describe what they considered to be the basis for the relationship between the form of each sign and its meaning in terms of the corresponding English word. We used as stimuli a set of 90 different signs that had been previously chosen for use in a memory experiment—chosen because they were commonly known among the deaf and had fairly direct translations into English nouns. Each sign was presented on video tape (by a native signer) followed by a spoken presentation of its meaning. The signs were made in citation form and with a neutral facial expression. The subjects were told to provide some written response for each sign-meaning pair. The 90 signs included items like APPLE, BIRD, BOY, CANDY, EARTH, FRIDAY, GRAVY, IDEA, MEAT, SCIENCE, SENTENCE, TREE, WEEK, and so on—i.e., both abstract and concrete nouns, including a few proper nouns.

A corresponding task for a spoken language might be to ask English-speaking subjects who know no German what it is about the sound of the German word pronounced [hʊnt] (i.e., Hund) that suggests a dog, or about the sound of the German word [braʊn] (i.e., Bein) that suggests a leg. With most common German
words, there would, of course, be no obvious answer to the question. On the other hand, this small informal study supports the notion that for many ASL signs there is a representational aspect.

For more than half of the 90 signs presented, the responses of the subjects showed overall agreement on the basis for the connection between the shape of a sign and its meaning. For example, when the sign produced was the one we gloss here as VOTE and the subjects were told that it means "vote," there was general agreement among the responses. Subjects wrote: "putting a ballot in a ballot box," "placing vote in a ballot box," "motion of placing ballot in container," "ballot in a box," and other equivalent responses. For the sign WOOD, they responded: "sawing a board," "motion of sawing as in sawing pieces of wood," "sawing motion on board," "sawing action," "sawing a log," and other equivalent responses. Extracting from the responses on which there was agreement of a similar nature, we find the following:

<table>
<thead>
<tr>
<th>Sign Presented</th>
<th>Agreed-upon Relationship of Sign and Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD</td>
<td>Sawing</td>
</tr>
<tr>
<td>TRAFFIC</td>
<td>Cars passing each other</td>
</tr>
<tr>
<td>TENT</td>
<td>The poles of a tent</td>
</tr>
<tr>
<td>QUEEN</td>
<td>Sash worn across the shoulder</td>
</tr>
<tr>
<td>GRAVY</td>
<td>Drippings from a piece of meat</td>
</tr>
<tr>
<td>GIRL</td>
<td>The soft cheek of a girl</td>
</tr>
<tr>
<td>TREE</td>
<td>Trunk and branches of a tree</td>
</tr>
<tr>
<td>WEEK</td>
<td>One line across the calendar</td>
</tr>
<tr>
<td>TICKET</td>
<td>Punching a ticket</td>
</tr>
<tr>
<td>MELON</td>
<td>Thumping for ripeness</td>
</tr>
<tr>
<td>LETTER</td>
<td>Placing a stamp</td>
</tr>
</tbody>
</table>

The results of this small study support the notion that many ASL signs have a representational aspect. Specifically, such signs are what we call translucent; i.e., nonsigners tend to see essentially the same basis for the relationship between the sign and its meaning. This need not, of course, mean that the agreed basis corresponds to historical fact. The ASL sign GIRL, for example, did not in fact originate from a representation of "the soft cheek of a girl" as our nonsigning subjects said, but rather, according to historical sources, the sign GIRL originally represented either the bonnet strings of hats worn by young girls or the curls that lay along girls' cheeks.

For some of the signs, there was not overall agreement in responses; in these the basis described ranged widely from subject to subject. For example, for the sign CANADA, subjects responded "close neighbor," "fine woolens," "someone proud of what he is," "sounds like collar," "you need a coat because winters are colder than in the U.S.," et cetera. Other signs for which there was a wide variety of responses included AMERICA, APPLE, COLOR, EARTH, FATHER, HOME, SCIENCE.

Nonetheless, the subjects did agree on specifying the relationship between form and meaning in what was to us a surprising number of instances—certainly far higher than we would predict if the items presented were spoken words in an unknown language.

The Transparency of Signs

We decided next to investigate the degree of iconicity of signs in a more demanding way: given an ASL sign, and no other information, could a nonsigner correctly ascertain its meaning? To the extent that this is possible, a sign would be considered transparent. If we were presenting successful pantomime, which has the
aim of being self-evident from its form alone, we would expect that uninitiated subjects would be able correctly to interpret the pantomime; i.e., successful pantomime is by definition transparent. The comparable question concerning sign language is: to what extent is the meaning of a sign self-evident from its form alone? We used the same set of 90 signs as in the previous study and asked another group of hearing people with no knowledge of sign language to view each of the signs and to guess—under conditions of free choice—the meaning of that sign in American Sign Language. Except in the case of a mere handful of signs (9 out of the 90), not a single subject was able to guess the meaning of the signs presented. The few signs from our list that were transparent to any one of the hearing subjects in this special sense were: BED, BUTTON, EAR, EYES, MARBLE, MILK, OPERATION, PIE, SURPRISE. But for each of these there were also many responses that were not acceptable translations as well. For the other 81 signs, the subjects made only incorrect, and highly varied, guesses. Thus it is obvious that according to this criteria, the ASL signs are not at all transparent; that is, their meaning is not self-evident from their form.

We then constructed a multiple-choice test in which the correct English translation and four other possible meanings were listed for each ASL sign. The alternatives were selected from the responses given to the sign by the subjects in the free-choice test, with some filler items added in. Thus some of the alternatives were “likely,” though incorrect, meanings. This gave us a five-item multiple choice test that we could use with hearing nonsigners to determine a more limited degree of transparency of signs. As an example, for the sign glossed as HOME, the choices listed were:

kiss _______ home _______ math _______ comprehend _______ orange

On the multiple choice test, a new group of ten hearing subjects—again with no knowledge of sign language—viewed the signs and marked the response that corresponded to what they thought the sign meant in American Sign Language. These subjects did no better than chance at choosing the correct meaning for a sign—there were 18.2% correct responses on the five-item, multiple-choice test. Thus, given a situation in which one must select the correct meaning of a sign from among five choices, our subjects were not successful. The ASL signs were opaque, according to this narrow criterion of iconicity.

For only a few of the signs (12 out of 90) did a majority of subjects select the correct meanings. The twelve non-opaque signs were BED, BLOSSOM, BODY, BOTH, BUTTON, DAY, EAR, EYES, ODOR, OPERATION, SURPRISE, and YEAR. Note that six of these were the same signs that had generated at least one correct response on the free-choice test. For a large number of signs on the multiple-choice test (36 of the 90), not one of the subjects selected a correct meaning. Among the opaque signs whose meaning was never correctly selected from the five choices provided were: APPLE, BOY, CANADA, COLOR, EARTH, GIRL, GRAVY, HOME, IDEA, SCIENCE, SUGAR, SUMMER, and WEEK.

For a few of the signs (nine) most subjects (eight or more) agreed in their selection of a particular incorrect response. For example, for the sign HOME, all ten subjects chose the meaning “comprehend.” For these nine signs, the response chosen was always a “likely” alternative provided by subjects in the free-choice situation, and apparently was a compelling alternative. Thus, while such signs are not transparent—i.e., their actual meaning in ASL is not self-evident from their form—nonetheless, their form is highly suggestive of “meaning.”* The incorrect meanings selected in common by most of the subjects for the nine signs are noted below.

** For similar results and a further discussion of transparency of ASL Signs, see Ref. 13.
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Sign Presented | Incorrect Meaning
HOME | comprehend
COLOR | conversation
SENTENCE | unravel
EARTH | hinge
WEDDING | gather
TREE | unsteady
PIE | divide
SWEETHEART | imitate
PENNY | think

So far, we have shown that aspects of the form of many signs in ASL may have a direct relation to aspects of their meaning, although the signs are not in themselves so unambiguously representational that a nonsigner can guess the correct meaning—not even when that meaning is presented as one of several possible meanings.

However, the more relevant and important question is not how transparent are signs for a nonsigner; it is, rather, what is the role of the iconicity of signs for deaf people who are native users of the language. As we mentioned before, we have found that deaf people are definitely aware of the representational aspects of signs, and bring these out (or sometimes fabricate them) in teaching signs to hearing people who are nonsigners.

That the deaf are aware of the undertones and overtones of iconicity can also be shown in other more significant ways. In communicating among themselves, or in narrative, we find considerable mimetic extension, enhancing or exaggerating the mimetic character of individual signs. We have made a collection of plays on signs, studying the properties that deaf people use to create new or additional meanings in "colorful" signing. One facet of playing with signs may involve exaggerations of their mimetic character. We have collected numerous instances of such exaggerations, two of which we will illustrate here. In a film made in 1913 of an elderly deaf signer with an eloquent signing style we found the following finale: the deaf man signed that he hoped it would not be "long before we meet again." The ASL sign LONG is made with the index finger of one hand moving along the back of the wrist of the other hand, part way up the forearm. As shown in Figure 7, the signer expressed himself instead in an exaggerated rendition of the sign, elongating it from his left toe up across the body and ending above his right shoulder. The ASL sign LONG became as long as it could possibly be made on the human body!

The other example we have chosen illustrates two aspects of playing on signs: blending of one sign into another, and in addition, an exaggeration of iconic aspects of the signs. There is an ASL sign TOTAL-COMMUNICATION, which is the term educators use for signing and speaking at the same time, thus providing deaf students with information from the lips and from signs. According to one story current among the deaf, a visitor to a deaf school asked why all the students looked so happy. A deaf student responded by making the sign TOTAL-COMMUNICATION, a nontransparent sign which has a back and forth movement (See Figure 8). He continued making the sign, moving his hands alternately back and forth, but each time coming closer to his mouth, until the sign TOTAL-COMMUNICATION had become (i.e., been reanalyzed as) the alternating highly iconic signs DRINKING and SMOKING. The original sign had blended into two other signs, giving the response a double meaning. Furthermore, the latter two signs were enhanced by playing on their iconic aspects: inhaling as if enjoying a smoke and throwing the head back as if emptying a glass. Thus, the response indicated that the students were happy because of the total
The ASL sign LONG is normally made on the back of the wrist and forearm. In this sign-play, it has been greatly elongated.

**FIGURE 7.** The iconic elaboration of an ASL sign.

communication used at the school, but at the same time, their joy was evident in the pleasures of drinking and smoking.

We also find an exaggeration of iconic aspects of signs and their meaning in poetic or art-sign presentations: the ASL sign SLOW in one poem about the creeping pace of summer was made with such exaggerated slowness that it took twice as long as any other sign in the verse. Or the sign SUMMER ("wiping perspiration from the brow") in the same verse was made in such an intensified manner that it brought out the sense of the heat and perspiration of summer, at the same time that it indicated the particular season of the year. (For further examples, see Ref. 15.)

So far, these examples of the role of iconicity in the signing of deaf people refer to the extent to which mimetic or iconic aspects of signs are brought out in special

**FIGURE 8.** Iconicity in a play on signs.
linguistic activities such as plays on signs, poetic signing, or in teaching signs to hearing people. These are, of course, quite special activities, and may not reflect what happens in normal, everyday communication. We now want to turn to a completely different question: what is the role of iconicity in the rapid processing that takes place when deaf people are engaged in everyday conversation?

Let us begin by suggesting something about the rate at which such processing must take place. In one of our early studies, we examined some aspects of the rate of producing signs, and observed that signs in a narrative were produced at around 2½ signs per second by three native signers.‡‡ In processing (i.e., encoding) signs at such a rate, what is the role of the iconic or representational aspect of signs? Of course we have no direct way of measuring this, but we can ask a related question: how are signs coded in short-term memory? We will presume that the encoding of signs in short-term memory bears some relationship to what goes on in processing signs in conversation.

THE INSIGNIFICANCE OF ICONICITY IN MEMORY PROCESSING

We have completed a series of experiments in short-term memory processing of ASL signs by fluent deaf signers. We presented random strings of signs in list lengths from three items to nine items; we compared ordered recall and free recall; we compared recall in signs with recall in the written English translation-equivalents of the signs; we compared memory for random lists with memory for partially structured and highly structured lists of signs. In all these studies, one result emerges strikingly across all conditions of presentation and all conditions of ordered recall. The multiply occurring intrusion errors‡‡ made by deaf signers are consistent in a special respect, and these errors reveal something significant about the way in which fluent deaf signers process signs in short-term memory.‡‡

Because signs are so much more iconic in general than words, it would not be unreasonable to expect that deaf people might encode them differently from the way in which hearing people encode the highly abstract, arbitrary words of spoken language. We might expect that signs would somehow be encoded basically in terms of their iconic or representational qualities—in terms of, let us say, some more general pictorial images. Let us try to imagine what kind of evidence would support some sort of basic iconic encoding. Consider the example of the sign for BIRD, which by the opening and closing of the thumb and index finger at the lips "represents a bird opening and closing its beak." If the errors which were made for the sign BIRD included "feathers," "wing," "claws," "song," "cage," "beak," or even "pecking," we might posit some sort of iconic storage of the sign. But the errors that were made to signs were not of that sort at all; nor, of course were they errors based on the visual or phonetic properties of the English words corresponding to the ASL signs.

We found, in fact, that the multiply occurring errors were predominately and consistently signs that were close in systematic-formational aspects—rather than in...

‡‡In the Bellugi and Fischer study, we compiled the mean rates of narrative signing for three native signers, eliminating pauses whenever possible. The rate of about 2½ signs per second represents the rate of signing in connected discourse, and thus is considerably faster than the rate cited earlier for single signs which are presented in citation form.

‡‡ By intrusion error, we mean any response given in a particular serial position that was an incorrect response and at the same time was not a repetition of an item in that list or an item from the immediately prior list.
semantic or iconic aspects—to the sign presented on the test. Typically, the errors were similar in form to the sign presented in all but one respect. For example, a common error for BIRD was NEWSPAPER; and the signs representing BIRD and NEWSPAPER are exactly alike in form in all respects except for the place of articulation. A common error for CANDY was JEALOUS; the signs representing CANDY and JEALOUS are alike in all respects except for the configuration of the hand. A common error for the sign EGG was NAME; the signs representing EGG and NAME are alike in all respects except for movement. The examples given here are representative of the predominant type of intrusion error made in short-term memory, and these errors were similar in form according to specific recurring formalional parameters of American Sign Language. (For further details, see Ref. 8.) In fact, the parameters are essentially those originally suggested by Stokoe in his seminal early work on the linguistic description of signs: place of articulation, configuration of the hand, and movement.\(^{12}\)

Thus we see that the evidence from memory experiments supports the theory that deaf people do not encode signs in terms of their iconic representational properties. Even the iconic aspects of signs that are “alive” to deaf people are entirely disregarded when deaf signers encode signs in our experiments. What counts, instead, are certain systematic-formational properties of the signs (analogous to the phonological properties of words).

It is important to point out that these recurring systematic-formational properties themselves are—like the phonemes of spoken language—in general arbitrary in terms of meaning (even in signs which are themselves iconic). If one knows that a sign has the particular hand configuration proper to the ASL sign EGG, this would predict little or nothing about the meaning of that sign. The same hand configuration occurs not only in EGG but also in many other ASL signs, some of which have representational aspects and some of which do not. The particular distinctive handsign of EGG also occurs in the ASL signs NAME, UNCLE, TRAIN, SHORT, WEIGH, STAMP, BUILDING, FUN, HORSE, SUGAR, NATION, BUTTER, CATHOLIC, CHAIR, as well as many others. For some of the signs listed—when considered as a whole—representational aspects have been suggested: the form of the sign HORSE as representing the ears of a horse; the form of the sign BUILDING as representing piling bricks one on top of another; the form of the sign BUTTER as representing spreading butter on bread, and so forth. The vast majority of ASL signs that have the same handsign as EGG, we note, have little or nothing in common except for the formalional fact of that shared handsign.

This is not to say that there is nothing parallel to sound symbolism in American Sign Language; indeed there are such phenomena, in which “families” of signs are related at the same time in both formalional and semantic aspects. In fact, according to our observations, the ASL analogue to “sound symbolism” is undoubtedly more widespread in sign language than that process is in spoken language (see Ref. 17).

Nonetheless, the general point remains. No matter whether the signs presented on the memory test were transparent, translucent, or opaque—i.e., whether they had representational aspects or not—there was no difference in the nature of the intrusion errors that occurred. In fact, in terms of general principles of encoding, none of our results indicate that signs are encoded differently from words, despite the fact that signs are, in general, surely more iconic than words.

**Grammatical Processes and the Suppression of Iconicity**

Until now we have been discussing the basic form of the sign, analogous to what Jespersen calls “the naked word”—the kernel without any formatives either before or
after—the free morpheme abstracted from its combinations with other morphemes in derivational and inflectional morphology. But how is modulation of meaning accomplished in a visual language like American Sign Language? In spoken language, such modifications of meaning of the naked word are typically (but by no means exclusively) expressed by the addition of affixes before, within, or after the sequence of segments constituting the word, although some spoken languages also modulate meaning through certain nonsegmental modifications such as tone or stress.

In American Sign Language, there is no tendency to modify the basic units of the language—the signs—with the addition of segmental prefixes or suffixes; in fact, there seems to be a great resistance to segmental affixation. (There are only two segmental suffixes that appear in handbooks of American Sign Language, and these are clearly borrowed from the English comparative and agitative; and we find that in colloquial ASL even these are not used.)

On the other hand, our observations indicate that American Sign Language has other kinds of processes that operate on signs to change their form class or to modulate their meaning. These processes basically are modulations of some aspect of the inherent movement of the sign; i.e., instead of adding a segment before or after the sign, typically some special type of movement is superimposed onto the basic movement of the sign. In fact, the parameter of movement seems to be the parameter most frequently affected in such modulations.

In our studies of ASL, we are now at the point where we know what kinds of dimensions to look for in the modulation of meaning of signs, although our analysis is far from complete. (Incidentally, while it may be relatively easy for hearing people to learn the unembellished form of signs, it is certainly very difficult for the inexperienced eye and hand to learn the fine distinctions in movement that mark modulations of meaning.) American Sign Language is a language in which a slight but specific elongation of movement, a slight but specific difference in tempo, a minor but specific variation in the form of a repetition, may signal a critical but regular difference in meaning. In function, indeed the dimensions that are marked by such superimposed variations in the ASL sign are similar to those marked by other languages. But the form of the modulations on signs—superimposed changes in movement—is radically different from segmental suffixation in speech, and in our opinion, also differs basically from the ablaut, umlaut, stress, and tonal variation in spoken languages, in that classes of modulations in ASL involve formational properties not characteristic of base forms of lexical items.

One of the most striking effects caused by grammatical operations on signs is the distortion of the signs to such an extent that the original iconicism of the base form is overridden and submerged. This is an important point for the general theme of our argument: grammatical processes—which may themselves incidentally have some degree of iconic associations—operate on the basic form of signs. Often the result is an obfuscation of the representational aspects of the original sign.

The modulations we will discuss here are those which operate on the basic form of the sign to change its meaning. In our laboratory, we have only begun to unravel the mutations on the form of signs that give clues to the underlying regularities of the language: S. Fischer and B. Gough have described a set of operations on verbs of American Sign Language, and T. Supalla is currently working on modulations of meaning affecting nouns, as well as the derivation of nouns from verbs.

Let us consider what happens to the form of a sign when it undergoes certain regular modulations. Consider first the sign WEEK (Figure 9a), which, according to one handbook of signs (and according to hearing subjects in one of our studies on transparency described earlier), indicates “one row of dates on the calendar.” The basic unembellished movement characteristic of the sign WEEK is made once only,
with the active hand brushing along the palm. If the sign is made with the movement repeating several times quickly, the meaning is changed to "every week" or "weekly." If, instead, the movement is changed so that the brushing is lost and is replaced by a contact at the base of the palm, a slow arc forward, and another contact at the fingertips, the meaning is changed to "all week long." If the sign is made with slow repetition—a slow brushing movement that extends beyond the palm of the hand, a slow arc-like movement back to the original position, another brushing movement, but so that the movement is continuous—the meaning is changed to "for weeks and weeks." There are many other modulations that can occur superimposed on the basic sign WEEK, but we will limit our discussion to this small set for now. (See Figure 9a).

**Figure 9.** The submerging of iconicity through grammatical operations—(1).
These same general types of repetitions—a fast repetition in the same place of articulation, a slow movement between two end contact points, a slow repeated movement in which there is an arc-like return—operate on “time” signs in general, but are by no means limited to that narrow category of signs. The sign YEAR, according to our handbook and our hearing subjects “indicates the earth revolving around the sun.” One hand in a fist remains stationary; the other hand contacts it, makes a full revolution around it, and returns to contact again (Figure 9b). For a meaning equivalent to “all year long,” the first contact is lost and one hand moves around the other in a slightly modulated circle. To modulate the sign for the meaning “for years and years” or the meaning “yearly,” it is no longer the case that one hand moves around the other. For the continuous meaning, the active hand moves above the base-hand in a circle and contacts only at the top of the hand; for the habitual meaning, the active hand moves along the top of the base hand in a brushing forward motion which is repeated quickly. In both cases, the original iconic value of “the earth revolving around the sun” is completely lost, since one hand no longer revolves around the other. (See Figure 9b.)

This is a way of illustrating our general point. The form of modulations in themselves may have some iconic basis to indicate that an event (or state or action) occurs regularly, habitually, one can superimpose a rapid repetition of movement on the basic movement of the sign. To indicate that an event (or state or action) continues for a long period of time, one adds a slow drawn-out repetition to the motion of the sign, which usually entails a slow circular or arc-like motion (since not only is the movement of the sign affected, but the transition between movements is also involved). In many cases, the superimposition of movement or type of repetition suppresses the representational aspects of the basic sign.

The sign QUIET is made with two hands on the mouth, which then separate as they move downward (as one informant said, “it indicates a smoothing down, or a calming”), (see Figure 10). If the sign is repeated slowly with a circular or elliptical motion superimposed, the meaning changes to “quiet for a long time.” If the sign is repeated quickly, the meaning changes to “habitually quiet” or “quiet by nature.”

With the rapid, repeated movement superimposed on the basic single movement of the sign, any sense of smoothing, quiet, or calming in the form of the sign is suppressed completely. Again, an iconically based modulation on a sign—which itself has representational aspects—can obscure or totally submerge the iconicity of the original sign (see Figure 10).

One can observe the lessening of iconicity also under the grammatical processes by which nouns can be derived from verbs, or predicates from nouns. T. Sepalla, from our laboratory, has shown that there is a regular process by which nouns can be derived from many action verbs in American Sign Language. If the verb has a single nonrepeated movement, the derived noun will have a small repeated movement. The sign SIT (Figure 11) is made with two fingers of one hand (representing legs) moving down once onto the two fingers of the other hand, as if “sitting.” The sign CHAIR is just the same in form except that it has a small repeated movement; this entails some loss of iconicity—unless one wanted to argue that a chair is something you sit on, get up again, and sit on again. The same relation holds (single movement in the verb, repeated movement in the noun) for a large number of noun-verb pairs, and represents a productive pattern.

Still another process changes a noun sign to a predicate sign, with the special meaning of “to act like an X” or “X-ish.” The ASL sign BABY clearly derives from the pantomimic act of holding a baby; the arms are crossed and sway back and forth with some remnant of the act of rocking a baby (Figure 12). But to sign “act like a baby” or “baby-lish,” a different type of movement is superimposed. The sideways
rocking motion disappears, the hands are moved closer together, and the motion is changed: it is an intense movement, the overlapped hands jerk downward repeatedly in a way that would be most inappropriate for the meaning of the original sign. The modulation, again has completely submerged the iconicity of the base form of the underlying sign BABY. (FIGURE 12 shows the progression from a pantomime to a citation form sign BABY and from the latter to the modulated sign meaning "babyish".)
The mutations presented here are only a very small part of what constitutes a rich system of modulations on signs of American Sign Language. In our view, the form of these modulations is one of the most distinctive aspects of American Sign Language as a human language.

Finally, let us consider one other historical process in American Sign Language. Creating a sign for a new concept in ASL, as in other languages, is sometimes accomplished by compounding: two signs that exist as independent units in the language are combined to create a new lexical unit which can then itself undergo grammatical modulations. In this respect American Sign Language utilizes an essentially sequential process; however, we have found that historically the two once-separate signs tend to become merged in various ways into the form of a single sign.

We have studied several hundred ASL compounds, and discovered their special properties. In the process of combining two lexical items in a single unit, we find that there is a special rhythm to compounds: the two signs are made closer together and reduced in temporal length so that their combined duration is only slightly longer than that of a single sign. In particular, the first member of a compound is
drastically shortened, thus affecting its formational properties—in particular, its movement. In terms of the historical development of American Sign Language, compound signs tend to reduce over time until in fact they have the properties of single signs; that is, they tend to merge into single signs. Under this kind of temporal reduction and merging, the iconic properties of the original signs may again be totally submerged.

A classical case of this is illustrated in the current ASL sign HOME (Figure 13). The current form of the sign HOME turns out to be opaque in both of our studies of iconicity discussed in the paper. Hearing nonsigners when presented with the sign HOME guessed "comprehend," "orange," "whisper," and other meanings, but never "home" or any related meaning. Even when the meaning was given along with the sign, there was no agreement on the basis for the relationship between the two: our subjects responded with "familiar," "touch base," "close to a person," "feminine and masculine," "moves backwards like going home," "where I speak the most," et cetera. Not one of our subjects guessed that the sign HOME is directly related to eating and sleeping. But in fact, the current opaque sign HOME is historically a merged compound, deriving from the two highly transparent ASL signs EAT and SLEEP: the ASL sign EAT represents bringing something to the mouth; the ASL sign SLEEP involves one hand at the side of the head as if laying the head on the cheek. Over time, there were distinct changes in the form of the compound signs EAT and SLEEP: the same handsplace prevailed throughout the sign; then the contact points were brought closer together so that instead of one contact on the mouth and one on the cheek, there are now two contacts on the cheek alone (See Figure 13). As a consequence of these changes, there is a complete loss of the iconicity of the original two signs, and the sign HOME has now become one of the more opaque signs of ASL.

Through the historical process of merging, many other compound signs of American Sign Language have undergone similar mutations of form and loss of iconicity. Thus both current grammatical processes operating in the language and historical processes result in diminished iconicity.

Summary

In this paper, we show that the total range of the communication system of the deaf is considerably enriched but at the same time rendered more difficult to analyze, because pantomime and other spontaneous nonsign representations occur in the same mode as regular ASL signs in deaf discourse. We note that the rarification of what was originally nonsign depiction is clearly an important source of regular ASL signs. We show that criteria can be established that would distinguish the clear cases of pantomime from the regular ASL signs. Nonetheless, there remain a sizable number of regular ASL signs which, although they are neither pantomimic nor otherwise freely mimetic, still appear to retain an iconic cast. We show that very few ASL signs are actually transparent; that is, a nonsigner cannot guess the meaning of a sign in the absence of further information. On the other hand, many signs are iconic in the sense that nonsigners, when given the sign and its meaning, show considerable agreement in how the two are related.

More important in terms of language and its users is the significance of iconicity for deaf signers themselves. This paper shows that while in special circumstances the deaf do play on iconic elements of certain signs for special effects, iconicity plays no observable role in the coding of signs in short-term memory. The abstract formi-
ional parameters definitely dominate. We further note that it is the abstract system and not purely iconic aspects that have determined observed historical change in the form of ASL signs. We interpret this as indicating the deeper structural significance of the abstract formational level. Finally, we show that very widespread and productive grammatical processes, especially suited for a visual-gestural language, override the iconic aspects of signs also at the synchronic structural level.
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