Teaching American Sign Language to hearing adults using handshapes or semantic category groupings: which method will result in the most retention?

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TEACHING AMERICAN SIGN LANGUAGE TO HEARING ADULTS USING HANDSHAPES OR SEMANTIC CATEGORY GROUPINGS: WHICH METHOD WILL RESULT IN THE MOST RETENTION?

By
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B.A., Carleton University, 1979
Presented in partial fulfillment of the requirements for the degree of Master of Arts
University of Montana
1987

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ABSTRACT

Teaching American Sign Language (ASL) to hearing adults using handshape or semantic category grouping: Which method will result in the most retention. (63 pp.)

The purpose of the present study was to evaluate the effects of handshape (HS) grouping versus semantic category (SC) grouping of ASL signs on the short-term memory (STM) and long-term memory of signs by hearing adults. HS grouping refers to grouping signs according to the handshape used to form the sign, and SC grouping refers to grouping signs according to their meaning. One group of college undergraduates was instructed using signs grouped in HS and the other group received instruction with signs grouped in SC. Subjects were given two post-tests of their receptive recall of the signs. One test was given immediately following instruction, and a second unannounced test was given two weeks later. An analysis of variance (ANOVA) with repeated measures demonstrated significant differences for method of instruction (HS versus SC) and for the test scores immediately after instruction and two weeks after instruction. In both instances the HS group performed better than the SC group. A significant difference was found on the test given two weeks after instruction to assess long-term memory, indicative of a definite trend towards the HS group retaining more of the signs.
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CHAPTER ONE

Introduction

The auditory-linked acquisition of language is unique to humans, and is a time-locked function related to early maturational periods of the infant’s life. The longer auditory stimulation is delayed, the less efficient will be communication facility via the oral-aural mode (Hamilton, 1986). One primary reason for this is that a critical period exists for the development of language (Chomsky, 1966).

A hearing-impaired infant who is deprived of appropriate auditory language stimulation during the first three years of life may never fully attain his best potential language function, unless his impairment is recognized early and intervention is initiated. It has long been recognized by linguists and educators that language skills are paramount to success, both educationally and socially. Through spoken input, most children are able to master the formidable task of learning the language spoken by their community. However, for the hearing-impaired child, spoken input may be distorted, incomplete or missing completely (Northern and Downs, 1984).

For some hearing-impaired children, early amplification, aural rehabilitation and an enriched auditory environment will allow them to make up for some of the language exposure they missed prior to the identification of their hearing loss. Others may need the added input of
manual communication in order to learn language with any facility. For children with normal hearing, the spoken language input provided by primary caregivers is considered to be of critical importance to language development. Research studies have found this input to be highly grammatical and tailored to the child’s needs and linguistic abilities (Chomsky, 1966; McCormick & Schiefelbusch, 1984). Primary caregivers of hearing-impaired children may elect to use a manual communication system such as fingerspelling or American Sign Language (ASL), with the premise that visible linguistic input will enhance the oral input provided (Champie, 1984; Crittenden, 1974). The use and acceptance of manual communication has increased since the early 1960’s (Champie, 1984). This may be a result of the recognition that fragmented or incomplete acquisition of spoken and written language continues to persist in a segment of the hearing-impaired population, despite years of speech, language and auditory training in the oral/aural mode (Barnum, 1984; Klima & Bellugi, 1979; Mavilya & Mignone, 1977; Montanelli & Wilbur, 1976). Additional support for the use of manual communication with young hearing-impaired children is found in case studies of hearing-impaired children of hearing-impaired parents. These children received early exposure to sign language. They have been shown to perform significantly better on standardized tests of reading and writing than hearing-impaired children.
with identical audiograms who have hearing parents (Miller, Sherburn, Smith & Stotter, 1980; Schlesinger, 1972). Their improved performance on these tests may be related to the early sign language exposure provided by the hearing-impaired parent.

Hearing caregivers may decide to use a strictly manual communication method or a Total Communication (TC) system that includes signing among other inputs such as facial expression, body posture, auditory, speechreading and spoken English. Ideally, parents would learn the chosen system as rapidly and fluently as possible in order to most optimally model the signs to their child during the critical language learning period (Barnum, 1984; Birch & Stuckless, 1964).

The majority of hearing parents who elect to have their child trained in a manual communication system enroll in some form of sign language class (Goldin-Meadow, 1975; Goss, 1970). Unfortunately, many sign classes may not be teaching sign skills as efficiently as they could (Goss, 1970; Weddell-Manning & Weslerman, 1977) For example, hearing mothers who have attended sign classes for three years still have limited sign vocabularies. This indicates that the task of learning to sign fluently has been underestimated and methods for teaching sign need to be reevaluated (Greenberg, M. 1980; Swisher, M. & Thompson, 1985). The mothers in this study produced signed sentences that were shorter than their spoken ones, and the overall corpus of their
vocabulary was reduced when compared to the input provided to their hearing children, in both quality and quantity. These mothers signed approximately 40.5 of 100 utterances in their entirety. The remaining utterances in the sample were either partially signed, inaccurately signed, or not signed at all (Swisher & Thompson, 1985). This high rate of deletion occurred despite the fact that the average mean length of all of the mother’s signed utterances was only 3.89 morphemes. These mothers had attended up to five years of sign language classes, yet their signed sentences were still usually less than four morphemes in length.

Sign language classes are most frequently taught in a manner similar to other foreign languages, in that functional vocabulary is presented in semantic categories such as "food" or "animals" (Caccamise, Basile, Mitchell & Martini, 1978; Champie, 1984). This seems to make sense since studies of memory function indicate that presenting words auditorily in semantic groups enhances long-term retention (Baddeley, 1966; Baddeley, 1971; Dale, 1964; Glass, 1979). In general, associated information is retained longer than non-associated information (Runquist, 1986). However, it has been postulated that the retention of manual communication may be enhanced by a different grouping than semantic categories (Hamilton, 1986; Seals, 1984).
Cherology of Sign Language

According to numerous authors, the dominant organizational principle of signs involves the concurrent presence of a limited number of parameters that are unique to a manual communication system (Stokoe, 1960; Klima & Bellugi, 1979). The major parameters are handshape, place of articulation, and hand movement. These are considered similar to the phonological properties of spoken language, but have been described by Stokoe (1960) as the cherology of sign language.

Stokoe was the first researcher to attempt to language that serve as its "phonology". Other researchers such as Crittenden (1974) have added other parameters such as palm orientation that may or may not be "cheremic".

Handshape, Articulation and Movement: The Cherology

Handshapes are differentiated by the spatial configurations of the fingers and thumb. A vast array of configurations is physically possible. However, the formational system of the native language of the deaf population, American Sign Language (ASL), includes only a limited number of handshapes (Newkirk, Klima, Pederson & Bellugi, 1980). Over 70% of ASL signs are made using 19 handshapes. These 19 handshapes, presented in Figure 1,(Fromkin, 1980) have critical aspects of correct formation, such as proper placement of the thumb in relation to the index finger (Newkirk, Klima, Pederson &
FIGURE 1: THE NINETEEN MAJOR HANDSHAPES
The place of articulation is defined with respect to particular locations on and around the body, in a specific region called the signing space. The primary locations include the face, neck, trunk, arms and upper body. Some places of articulation carry a special significance. For example, "male" signs such as man, father, and boy are made near the forehead, while "female" signs are made near the chin (Stokoe, 1960). Other" places" may also have certain negative connotations, such as signs made near the nose. Some of these are the signs for "boring", "rat" and "silly" which are all made on or near the nose, and are considered negative.

Movement can either be towards or away from the body, up or down, or in a circular or repeating motion. Movement additionally can consist of directional movement, rotary action and interaction between the two hands. When the two hands are used, the movement of the two hands is almost always identical unless one hand remains stationary (Stokoe, 1960). Movement can also be used to replace adjectives or adverbs used in English. For example, in order to sign "run fast" the sign for run is made with a very quick movement, versus "run slow" where the same sign is made with a slower movement rather than utilizing separate signs for "fast" or "slow".

In summary, the three major parameters of a manual communication system are handshape, place of articulation
and hand movement (Stokoe, 1960). These parameters are labelled the "cherology" of sign language.

**Memory**

Auditory information is coded in short-term memory (STM) primarily in terms of its phonological properties, and in long-term memory (LTM) according to its semantic properties (Baddeley, 1966; Baddeley & Dale, 1966; Crowder, 1972). In contrast to auditorily presented information, memory coding of manually presented linguistic information by native signers appears to be related to the "cheremes" or "phonological" properties of sign language: the handshape, place of articulation and movement (Hoemann & Andrews, 1975). Evidence of the presence of these cheremes is found by analyzing errors made in signed responses. Signed errors are highly similar visually to target signs rather than being acoustically similar. The majority of signed errors preserve all but one of the three major "cheremes" (Klima & Bellugi, 1979). For example, a deaf signer is likely to replace "tea" with "vote" (see Figure 2) which is highly similar visually when signed but does not share the same spoken or semantic qualities.

Errors made in signed responses differ from errors made in spoken responses in the way they are similar to the target response. In conclusion, signed errors are similar visually, both for short and long-term memory tasks, while
spoken responses are similar acoustically for short-term tasks and similar in meaning for long-term tasks (Crowder, 1972).

FIGURE 2
The ASL signs for "Tea" and "Vote"
Hypothesis

Sign language training in the past often has not been adequate in helping parents build a flexible vocabulary that allows them to develop fluency and use it during their child’s optimal language learning period. Lindford (1980), among others, describes the critical period as being from ages 0 to 3. This leaves a minimal amount of time for the hearing-impaired child’s parents to learn and become proficient in sign language. Training efforts which promote a larger corpus of sign vocabulary, as well as a higher degree of retention, would potentially improve the signing knowledge of adult caregivers of the hearing-impaired. If hearing parents are provided instruction and information about the three major sign language parameters and presented with vocabulary grouped according to these parameters, long-term retention of the signs will presumably be greater than if signs are presented in groups of semantic categories.

Summary

If sign language vocabulary is presented in handshape groupings, short and long-term retention of these signs will be greater than if signs are presented in semantic categories.
CHAPTER TWO

LITERATURE REVIEW

The increasing awareness of the need to provide comprehensive speech and language training for the hearing-impaired population has prompted a growing number of researchers to investigate ways to improve one aspect of this training; sign language instruction (Caccamise, Basile, Mitchell & Martin, 1978). Recent studies focus on the way memory for linguistic information is organized, in order to organize instruction in a manner that will complement these organizational principles (Crittenden, 1974).

Several studies have demonstrated that for normal hearing people, acoustic similarity has a large and consistent effect on short-term memory (STM) for unrelated words. Semantic similarity also has an effect of similar magnitude for long-term memory (LTM) of acoustic information (Baddeley, 1966; Conrad, 1973; Dale, 1964; Luftig, 1985; Wickelgren, 1965). These studies found that the hearing subjects used almost exclusively a phonological, or acoustic coding system for short-term memory of word lists. This conclusion was based on "slips of the tongue" or error responses. For example, Fromkin (1983) found that when the stimulus was the word "vote", the error produced most frequently by hearing subjects was the acoustically similar "boat" and was never something from the same semantic
category such as "ballot" or "elect". However, the errors produced three weeks after presentation of the words were usually from the same semantic category. Thus, it appears that the salient features used to permanently code information auditorily are semantically based.

Crowder (1972) similarly found that when subjects were presented orally with English word lists and immediately tested for recall, their errors were phonologically related to the correct responses. The errors produced at a later date were semantically related to the targets.

Short-Term Memory for ASL Words by Hearing-Impaired and Hearing Subjects

Coding of manually presented linguistic information by native signers who are hearing-impaired appears to differ from the way hearing subjects code auditory information. A large number of errors made by hearing-impaired subjects when coding signs appear to be based on formational properties of the signs themselves (Bellugi, Siple & Klima, 1975; Seals, 1984).

Siple (1978) compared deaf subject's recall of randomly presented words in ASL to hearing subjects' recall of matched lists of spoken English words. She found that the short-term word span of signs by the deaf subjects was 4.9 items, approximately one item shorter than the short-term memory of spoken words by hearing subjects. Error analysis was used to infer the form in which these two groups stored
linguistic information in short-term memory. In this study, the hearing subjects made errors that were related to the acoustically available phonological properties of the words, as expected. This encoding method was not possible for the hearing-impaired subjects who were presented with manual communication. The intrusion errors in short-term memory for ASL signs indicated that deaf native signers encoded the signs on the basis of distinctive features particular to manual communication: handshape, place of articulation and movement. Of these three parameters, handshape proved to exert the most influence on errors.

Klima and Bellugi (1979) completed a distinctive features matrix for ASL handshapes. They discovered that 6 handshapes are used to form 70% of all signs. These include the 5, B, C, O, A, and G handshape categories. (see Figure 3)

Figure 3: The Six Major Handshapes of ASL
Klima and Bellugi later compared the recall of word lists that were identical on only one of the three parameters (handshape, movement or place) with the recall of lists of signed words that were unrelated. For deaf college students, only the similarity of handshape improved the recall of lists of signed words, when compared to random word lists. Similarity of place actually produced a detriment in recall, while movement similarity had no effect.

Hamilton (1984) addressed the encoding of ASL by young deaf children with hearing parents. These children were not given formal training regarding the specific distinctive features of ASL. The 35 children in the study were tested for perception of the cheremes of ASL using a minimal pairs design. Some of the words were signed in pairs and were totally unrelated. Other words were similar on one of the three parameters of ASL. An analysis of the errors produced indicated that the children grouped the signs in short-term according to all three of the ASL parameters.

Short-Term Memory for ASL Vocabulary by Hearing Subjects

Luftig (1985) hypothesized that both the translucency (perceived relationship between a sign and the English gloss when both are provided) and the cheremic similarity of signs would affect hearing subjects’ retention of ASL signs. He postulated that translucency would improve retention while
cheremic similarity would retard it. He found that signs which are high in translucency were indeed processed more efficiently in short-term memory, but cheremic similarity had no measurable effect on short-term recall. This may have occurred because the subjects had not had any prior exposure to sign language, so they did not even perceive the cheremic similarity. Luftig did not teach his subjects the various cheremes before the experiment.

Crittenden (1974) found that hearing individuals do not readily perceive the cheremes that Luftig was examining, at least initially. Crittenden researched the relative importance of the three cheremes of ASL as perceived by hearing adults learning sign. He noted that although over 50% of speech therapy programs offered training in manual communication, instructors did not seem to organize sign vocabulary into cheremic categories. He suggested that the cheremes of ASL should be used to help new signers remember vocabulary. He reported that 58% of errors committed by new signers were accounted for by the handshape and movement cheremes. He concluded that teaching students these cheremes from the beginning of instruction would substantially reduce the number of errors made by new signers. Therefore, the handshape or movement features may be discerned by hearing subjects with little facility initially, but could be systematically taught to aid retention of ASL signs.
Long-Term Memory of ASL Signs by Hearing and Hearing-Impaired Subjects

Seals (1984) examined an approach to teaching signs to hearing children which incorporated the cheremes of ASL as well as the developmental sequence of sign learning and its impact on the instruction process. Seals noted that all languages are learned in a series of predictable steps and that there is a sequence of learning the handshapes of ASL, as evidenced by young deaf children. According to Seals and others (Hawes & Danhauer, 1978; Plumb, 1981) the formation of the signs requiring the 'A,' '5,' and 'S' handshapes are learned before the 'B' or 'T' handshapes. Seals divided a 6th grade class into two groups. One group followed the sequence of handshape learning evidenced by young hearing-impaired children. This group was taught words grouped according to handshapes that were presented in a developmental order. The second group was taught a similar, although not identical number of words, but their signs were grouped according to semantic categories such as "food" and "colors." Immediately following instruction and again three weeks later, both groups were tested for their ability to respond to the question "What is the sign for ___________?"

The results of the first testing immediately following instruction showed no clear difference between the two groups for short-term memory of the signs. However,
measurement of the long-term memory of the signs showed marked differences in retention between the two groups. Students who had been taught words according to semantic categories averaged a mean decline between the two tests of 38%, whereas those students instructed according to handshape averaged a decline of only 4%. Unfortunately, Seals did not match the number of signs taught to the two groups, nor did she control for extraneous factors such as the age of her subjects or their prior exposure to sign language. However, her findings suggest that grouping signs according to handshapes may enhance long-term memory of signs by hearing caregivers who are taught the salient features of ASL prior to instruction.

Siple, Fischer and Bellugi (1977) examined the long-term memory of nonsemantic attributes of ASL and English words by both deaf and hearing subjects. These authors speculated that since short-term dependence on phonological properties gives way to representation based on semantic organization for acoustic material by hearing subjects (Baddeley, 1966; Glass, 1979) there might also be semantic organization of signs in the LTM by deaf subjects. They found that the formational characteristics of the signs were still more important than semantics for recall of ASL words by deaf subjects. The hearing subjects in the study were presented with ASL signs without being told their meaning. They also encoded the signs on the basis of their formation, probably
because this was the only information available to them, since they did not know what the signs meant.

Long-term memory is of course a very important factor in teaching ASL to parents of hearing-impaired children. As their recall of new signs increases, they will have a larger repertoire of vocabulary words to sign to their hearing-impaired children. However, there remains a paucity of information addressing the most efficient way to teach ASL vocabulary to hearing adults.

Caccamise, Basile, Mitchell and Martin (1978) have discussed some general overall principles for manual communication instruction. These principles include teaching vocabulary in context, recognizing the communicative importance of non-verbal messages, and providing vocabulary which reflects the learner's needs. In addition, these authors suggested that mime and natural gestures should be reinforced.

The purpose of this study was to examine the effect of handshape in retention of ASL vocabulary by hearing adults. In an actual classroom situation parameters such as facial expression and mime would be used to maximize effectiveness of instruction. However, in order to examine only the effects of handshape versus semantic category grouping on signs, other variables such as context and facial expression were eliminated to control for variability imposed by these parameters (Harper, Wiens & Matarazzo, 1978; Rosenthal,
1979; Speer, 1972; Matazarro, 1978).
CHAPTER THREE
METHODS AND PROCEDURES

Introduction

The experimental questions were the following:

1. Will the memory for ASL signs by hearing adults be greater for words taught in handshape groupings or semantic category groupings? Specifically,
   A. Will the STM of signs by hearing adults be greater if words are taught in handshape groupings or semantic category groupings?
   B. Will LTM of signs be greater if adults are taught the cheremic dimension of handshape prior to learning sign vocabulary?

2. Will LTM of ASL signs be less than the STM for the signs?

The apparent critical dimension of "handshape" is perceived by deaf speakers and appears to be a method employed to help remember signs over time. Errors made by these subjects are highly similar visually and tend to preserve the basic handshape of the target word. Nearly all the signing errors made by deaf signers have no discernible semantic relationship to the target (e.g., replacing "tea" with "vote"). The dimension of handshape was found to be the most important of the three parameters of ASL for deaf subjects, and research indicates this may also prove true for hearing subjects, if they are made aware of the concept of handshape.
(Seals, 1984).

Educators of the hearing-impaired child continue to search for ways to improve the vocabulary of these youngsters. Finding a way to more efficiently teach sign to the caregivers of these children may be an important step towards this goal, as better adult communicators would presumably aid in the language acquisition process by providing adequate language models.

Subjects

The subjects were 30 undergraduates from a Psychology 110 class, an introductory psychology class at the University of Montana. Each subject was selected according to the following criteria:

1. Minimal or no exposure to any form of manual communication, as assessed by a "Sign Language Exposure Rating" (see Appendix A). Respondents needed to select descriptors 1 or 2 on the rating scale in order to participate in the study.
2. Normal or corrected vision in each eye of 20/30 as assessed by a standard 'E' Snellen eye chart. The rationale of this measure was to ensure adequate vision to see signs being presented.
3. Only native English speakers were used, to ensure understanding of the English glosses being presented.
with the signs during instruction.

4. Subjects had attained a grade point average of at least 2.0 on a four point scale as determined by self-report, in order to obtain a rough measure of general academic soundness.

5. Subjects passed a pure-tone screening administered by the investigator at 20 dB HL at .5, 1, 2K Hz and 25 dB HL at 4K Hz (ASHA 1985). A GS 10 audiometer meeting 1969 ANSI calibration standards and a sound treated booth which met the ANSI 1977 ambient noise criteria standard were used. (ASHA 1985) revised screening guidelines were followed.

**Sign Presentation**

Individual ASL signs were produced by Patrice Tourne, a graduate student from the Department of Communication Sciences and Disorders at the University of Montana. All signs were videotaped and then presented on video to ensure uniform presentation to all groups. Videotaping was done using a Camero Panasonic WV 3240 camera. The signal was presented on a RCA Color Track 18" Lyceum television monitor with built-in speakers. The tape was played on a Sony VO-2600 Video Cassette KCA-60 recorder with a volume setting of 3 (on a scale of 0-5). The videotape used was Eastman Professional 3/4" KCA 60 U-matic tape.

There was a distance of 12 feet from the camera to
signer, and the signer produced the signs in front of a light blue background, so that there would be contrast between her hands and the environment. A 335 watt backlight and two 150 watt side lights were used, as well as a 100 watt light in front of the signer. The verbal gloss for each sign was taped using a male voice recorded 6" from a Panasonic K60 external microphone plugged into the video camera.

ASL was used rather than other forms of manual communication because there is ample evidence for ASL being a unique language, so standard texts are available to demonstrate the proper way to present and form words (Miller, Sherburn, Smith & Stotter, 1980). Other forms of manual communication are considered pidgin forms of English and are not as standard from text to text (Battison, 1974).

Accuracy of the videotaped signs were verified by a native signer of ASL who learned it as her primary language from deaf parents. Thirty signs were each signed twice, with a ten second pause between each new sign. The signer was shown from the top of her head to her waist, to include the important signing space of ASL (Stokoe, 1960). Each sign was presented using the same neutral facial expression, to minimize the effects of non-verbal communication other than the actual signs (Speer, 1972). Subjects were asked to rate the clarity of the signs presented after instruction. On a scale ranging from "very clear" to "extremely unclear", 100%
of the subjects rated the signs as "very clear".

**Training Method**

Subjects were randomly assigned to two groups of 15. The groups were further divided into subgroups with a maximum of 5 subjects, to ensure that all subjects could easily view the video monitor. Each subgroup was shown the target signs in different orders to minimize the effects of primacy or recency on test scores (Glass, 1972).

**Group One**

Subjects were presented with 30 signs grouped according to the following six semantic categories: **people, animals, colors, time, food, and school**. The order of presentation of categories was randomized for the three subgroups of subjects to minimize effects of order. The five words in a single category such as "people" all differed in handshape. Each sign was presented twice in a row, after the name of its semantic category had been provided. The verbal label for the sign as well as a written 3 1/2 " printed gloss on the screen simultaneously accompanied each sign. There was a ten second interval between each new sign.

The following general instructions were given orally prior to initial exposure to the videotaped signs.

"You will be seeing a person on videotape demonstrating American Sign Language signs. These signs will be presented in categories such as "food" and "animals." There will be both a verbal and written label that accompanies each sign, and each of 30 signs will be repeated twice in a row. Before each group of 5 signs you will be told the name of the category, such as "the next 5 signs are all "food" words."
Immediately after you have been shown a total of 30 words grouped in 6 categories, you will be shown a random selection of 10 of these 30 signs in random order without a verbal label. You will be asked to write down the meaning of these signs. You are urged to practice each sign as you see it during training, as well as writing down anything that may help you remember them. However, you will not be able to use notes during testing."

Immediately following presentation of the 30 signs, which lasted 15 minutes, subjects were given a 5 minute distractor task of counting backwards from 100 by 3’s. Following this, subjects were tested for receptive knowledge of 10 selected signs presented during the session. At least one sign, and not more than two signs from each semantic category, were included on the test.

Testing was conducted by presenting the test items via videotape with no accompanying label, and having subjects write down the meaning of the signs. Each sign on the test was repeated twice.

**Group Two**

These subjects were presented with a total of 30 signs to match the number of signs presented to the first group. The signs were presented in six handshape groupings: A,B,C,G,Y and "5." The Y handshape was chosen although it is not one of the six major handshapes because the more common "O" handshape is perceived as highly similar to the "C" handshape by hearing subjects (Stokoe,1960). The order of presentation of categories was randomized for the four
subgroups of subjects to minimize effects of order. The five words in a single category such as 'A' all differed in their semantic category. Each sign was presented twice in a row, after a demonstration of its particular handshape was provided on the videotape. A verbal and written 3 1/2" label of each handshape was provided while the handshape was being demonstrated. The following spoken instructions were provided "This is the ____ handshape. Your next five signs will all be made using the ____ handshape." Simultaneously with each sign, its verbal gloss and written 3 1/2" printed label was provided. Each sign was repeated once, then a new sign was presented 10 seconds later. Immediately following presentation of the 30 signs, which lasted 19 minutes (4 minutes longer than the tape shown to the semantic category group due to the presence of handshape demonstrations on the tape), subjects were given a 5 minute distractor task of counting backwards from 100 by 3's. Following this, subjects were tested for receptive knowledge of 10 selected signs presented during the session. At least one sign, and not more than two signs from each handshape category was included on the test.

Testing was conducted by presenting the test items via videotape with no accompanying label, and having subjects write down the meaning of the signs. Each sign on the test was repeated once.

The following instructions were presented to this group
prior to instruction:

"You will be seeing a person on videotape demonstrating American Sign Language signs. These signs will be grouped according to their handshapes, which refers to the way the hand is formed when making the sign. The handshapes are labeled using letter or number names. There will be both a verbal and written label that accompanies each sign, and each of the 30 signs will be repeated twice in a row. Before each group of 5 signs you will be shown the handshape that will be common for all the signs in that group, and told the name of the category, such as the next 5 signs are all made with the 'A' handshape.

Immediately after you have seen a total of 30 words grouped in 6 handshape categories, you will be shown a random selection of 10 of these 30 signs in random order without a verbal label. You will be asked to write down the meaning of these signs. You are urged to practice the signs as you see it during training, as well as writing down anything that may help you remember them. However, you will not be able to use notes during testing."

Selection of Sign Vocabulary Taught

Signs were chosen in two ways. The first was the ability of selected signs to fit into a category for both the semantic grouping and the handshape grouping. For example, the word "father" was chosen because it fits the semantic category of "people" and also the handshape category "5" so it could be trained for both groups of subjects (see Table 1). The second way words were chosen was according to their presence in the average vocabulary of a hearing-impaired 5 year old (Silverman-Dresner and Guilfoyle, 1972).
Table 1. SIGNS THAT WERE TAUGHT

<table>
<thead>
<tr>
<th>People</th>
<th>Food</th>
<th>Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>girl</td>
<td>nut</td>
<td>blue</td>
</tr>
<tr>
<td>boy</td>
<td>cheese</td>
<td>white</td>
</tr>
<tr>
<td>father</td>
<td>hungry</td>
<td>green</td>
</tr>
<tr>
<td>cousin</td>
<td>apple</td>
<td>yellow</td>
</tr>
<tr>
<td>uncle</td>
<td>meat</td>
<td>orange</td>
</tr>
<tr>
<td>Animals</td>
<td>Time</td>
<td>School</td>
</tr>
<tr>
<td>pig</td>
<td>yesterday</td>
<td>study</td>
</tr>
<tr>
<td>fish</td>
<td>tomorrow</td>
<td>flag</td>
</tr>
<tr>
<td>turkey</td>
<td>long ago</td>
<td>teach</td>
</tr>
<tr>
<td>cow</td>
<td>minute</td>
<td>desk</td>
</tr>
<tr>
<td>lion</td>
<td>later</td>
<td>play</td>
</tr>
</tbody>
</table>

GROUP 2: HANDSHAPE CATEGORIES

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>girl</td>
<td>fish</td>
<td>turkey</td>
</tr>
<tr>
<td>nut</td>
<td>blue</td>
<td>minute</td>
</tr>
<tr>
<td>tomorrow</td>
<td>cheese</td>
<td>green</td>
</tr>
<tr>
<td>yes</td>
<td>please</td>
<td>sour</td>
</tr>
<tr>
<td>orange</td>
<td>flag</td>
<td>summer</td>
</tr>
<tr>
<td>cousin</td>
<td>V</td>
<td>5</td>
</tr>
<tr>
<td>hungry</td>
<td>play</td>
<td>father</td>
</tr>
<tr>
<td>policeman</td>
<td>yesterday</td>
<td>study</td>
</tr>
<tr>
<td>photo</td>
<td>yellow</td>
<td>pig</td>
</tr>
<tr>
<td>lion</td>
<td>stay</td>
<td>long ago</td>
</tr>
</tbody>
</table>
The entire corpus of vocabulary was not identical for both groups, however 20 of the 30 signs were identical. All signs were judged regarding their iconicity by 10 non-signers that were not part of this study. Any sign that was guessed correctly by more than one of these people was judged iconic and was not used in this study. The 20 words trained that were the same for both groups were used for test purposes (Tables 2 and 3).
Table 2. SIGNS ASSESSED ON TEST ONE

| girl, turkey, cheese, yesterday, blue, |
| study, hungry, father, yellow, lion   |
Table 3. SIGNS ASSESSED ON TEST TWO

nut, flag, green, minute, pig

cousin, cow, long ago, play, orange
Assessment of Short and Long-Term Memory of the Signs

Ten of the signs were used to assess the short-term memory immediately following presentation of the signs (Table 2). Two weeks after the training session and initial test, subjects returned under the guise of filling out a survey and were given a second unannounced test of their receptive knowledge of the signs taught. Test items were once again 10 different items that had been taught to both groups (Table 3). At least one word from each semantic category and handshape was included on both tests. The tests differed between test 1 and 2 in order to control for the effect of testing on the forgetting of items (Runquist, 1986).

Statistical Analysis of Results

A 2 by 2 analysis of variance (ANOVA) with repeated measures was employed to compare groups by tests, on the two tests. Receptive response mode scores were used rather than expressive scores as the receptive response is less open to bias or variability.

Additionally, t-test scores were computed to compare differences between the two groups on the initial test as well as differences between groups at the second testing.

One subject from each group did not return for the second test, so the scores of these two subjects were not used. However, as a precaution, a total of 16 subjects in each
group were initially assessed on Test 1, resulting in a total of 15 data points for both tests 1 and 2 for both groups.
CHAPTER FOUR

RESULTS

The purpose of this study was to systematically evaluate the effects of handshape grouping versus semantic organization of ASL signs on the short-term memory (STM) and long-term memory (LTM) of signs by hearing adults. Preliminary investigations by Crittenden (1974) and Seals (1984) have indicated that grouping signs according to their handshapes may enhance retention of the signs by hearing people. They concluded that teaching students specifics about these parameters would reduce signing errors.

In this study it was hypothesized that handshape grouping would indeed improve the recall of ASL signs by hearing people. The measurement of scores on two post-tests given to two groups of 15 college undergraduates after viewing videotaped sign demonstration, was utilized to observe differences in short-term and long-term memory of signs. In order to assess the short-term memory, one test was given immediately following instruction and a five minute interrupter task. The second test was administered exactly two weeks later, to assess long-term memory of the signs. The second test was not announced in order to control for variable study time. The subjects were required to return two weeks after the first session under the guise of filling out a survey (see Appendix B). After being tested
the second time, subjects actually did fill out the survey, which was designed to gather further information related to the study. Subjects were asked to indicate what they thought the purpose of the research was. Twenty eight subjects believed the purpose was simply to "test people's memory for sign language." Two subjects indicated they did not know the purpose of the research. None of the subjects indicated that the purpose was to examine semantic categories versus handshape groupings on short and long-term retention of ASL by hearing adults.

Also on the survey, subjects were asked why they were interested in participating in the study, and whether they would prefer to learn signs via videotape, live presentation or from a book.

Twenty six of the subjects indicated they participated because it was a class requirement for their introductory psychology class. Four subjects stated that they wanted to learn some sign language. Interestingly, these four subjects were all in the Semantic Category group and all obtained low scores on both tests. For example, their scores on Test 2 were 1, 2, 3 and 3.

All 30 subjects indicated they would prefer to learn sign language either via live presentation or a combination of live presentation and videotaped instruction. Subjects provided reasons for this preference, and the majority stated they would prefer a live instructor because of the
availability of feedback. Other items on the survey are discussed elsewhere in this document.

Both tests consisted of 10 of the 30 words that had been instructed via videotape. The following predictions were made:

1. The short-term memory of signs would be greater than the long-term memory of signs for both groups.
2. Scores on the test given immediately after instruction would be higher for the group taught according to handshape groupings than for the group taught according to semantic categories.
3. Scores on the test given two weeks later would also be higher for the handshape group.
Research Findings

An analysis of variance (ANOVA) with repeated measures procedure was performed on the test scores of the two groups.

Table 4 lists the actual scores of all subjects on the two tests. The overall means for both groups at each test period are depicted in Table 5.

ANOVA for Tests

An ANOVA with repeated measures was performed for the independent variable 'tests', specifically Test 1 versus Test 2 (see Table 6). Scores of both groups on the immediate test were compared to both groups' scores on the delayed test given two weeks later. A significant difference was found for this variable at the 0.05 alpha level. The overall mean for Test 1, when both groups scores were used was 8.97 out of a possible 10, and the overall mean for Test 2 was 4.97 out of a possible 10. As hypothesized, the overall score on the immediate test was significantly higher than the score on the delayed test.

T-Test for Each Group, Test 1 Versus Test 2

In addition, each group's score on the immediate test were compared to that group's scores on the delayed test given two weeks later via paired t-tests. A significant difference was found for the scores for each group at the .05 alpha level between test 1 and test 2 (see Table 7). As hypothesized, the scores on the immediate test were
significantly higher than the scores on the delayed test for both groups.

An ANOVA with repeated measures was performed for the independent variable "methods". However, the data comparing the semantic category versus handshape grouping contrasts will instead be discussed via t-test comparisons. The t-tests were used in order that specific information regarding the contrast at test 1 and test 2 between the groups could be more clearly demonstrated.

Handshape vs. Semantic Category Group on Test 1, and Handshape vs. Semantic Category Group Scores on Test 2

An unpaired t-statistic was employed to analyze statistical differences between the Semantic Category and Handshape groups on test scores at each test period (see Table 8). The arithmetic mean on Test 1 was 8.47 for the Semantic Category group and 9.47 for the Handshape group. Using the t-statistic, results show a significant difference at the .05 alpha level for the scores on Test 1 for the two groups. Significantly higher scores were obtained by the Handshape group on Test 1.

The unpaired t-statistic was also used to assess statistical differences between scores obtained on Test 2 by the Semantic Category group versus the Handshape group (see Table 8). The arithmetic mean on Test 2 was 4.13 for the
Semantic Category group and 5.80 for the Handshape group. Results also reached a one-sided significance level of .05, indicating there was a significant difference between the two groups' scores on the long-term memory test. Again, significantly higher scores were obtained by the Handshape group.

ANOVA for Methods by Tests

Although the Handshape group did retain a higher percentage of signs over time, both groups demonstrated a high level of forgetting over time. As a result, interaction of the independent variables 'methods by tests' did not reach the .05 alpha level of significance. This indicates that the scores of both groups followed roughly the same pattern, of being high on Test 1 and much lower on Test 2 (see Table 9).
Table 4. Actual Scores of Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>TEST 1</th>
<th></th>
<th></th>
<th>TEST 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic Categories (Group 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>7</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>10</td>
<td></td>
<td></td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>8</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>9</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>7</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>7</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>10</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>6</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>9</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>10</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>10</td>
<td></td>
<td></td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>7</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>10</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>8</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>9</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEST 1</th>
<th>TEST 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handshape Group (Group 2)</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>9</td>
</tr>
<tr>
<td>7.</td>
<td>10</td>
</tr>
<tr>
<td>8.</td>
<td>8</td>
</tr>
<tr>
<td>9.</td>
<td>9</td>
</tr>
<tr>
<td>10.</td>
<td>8</td>
</tr>
<tr>
<td>11.</td>
<td>8</td>
</tr>
<tr>
<td>12.</td>
<td>10</td>
</tr>
<tr>
<td>13.</td>
<td>10</td>
</tr>
<tr>
<td>14.</td>
<td>10</td>
</tr>
<tr>
<td>15.</td>
<td>10</td>
</tr>
</tbody>
</table>
Table 5. Means and Standard Deviations of Test Scores Across Groups and Across Tests

<table>
<thead>
<tr>
<th>Group</th>
<th>Test 1</th>
<th>Test 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic Category Group</td>
<td>x = 8.47</td>
<td>x = 4.13</td>
</tr>
<tr>
<td>(n=15)</td>
<td>S.D. = 1.35</td>
<td>S.D. = 2.57</td>
</tr>
<tr>
<td>Handshape Group</td>
<td>x = 9.47</td>
<td>x = 5.80</td>
</tr>
<tr>
<td>(n=15)</td>
<td>S.D. = 0.81</td>
<td>S.D. = 2.54</td>
</tr>
</tbody>
</table>
### Table 6. Analysis of Variance With Repeated Measures for the Independent Variable "Tests"

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>ms</th>
<th>f ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests</td>
<td>240.00</td>
<td>1</td>
<td>240.00</td>
<td>81.62 *</td>
</tr>
</tbody>
</table>

*significant difference

alpha=0.05, df=1
<table>
<thead>
<tr>
<th>Source</th>
<th>Mean Diff</th>
<th>t-score</th>
<th>1 sided sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semantic</td>
<td>4.33</td>
<td>5.89</td>
<td>0.0001 *</td>
</tr>
<tr>
<td>Pre vs. Post</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handshape</td>
<td>3.67</td>
<td>3.92</td>
<td>0.0008 *</td>
</tr>
<tr>
<td>Pre vs. Post</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

alpha = 0.05, df = 14
* significant difference
Table 8. T-Scores for Semantic Category Group Versus Handshape Group on Test 1, Test 2

<table>
<thead>
<tr>
<th>Source</th>
<th>Diff. of Means</th>
<th>t-score</th>
<th>1 sided sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>1.00</td>
<td>2.37</td>
<td>.0125 *</td>
</tr>
<tr>
<td>Test 2</td>
<td>1.67</td>
<td>1.72</td>
<td>.0478 *</td>
</tr>
</tbody>
</table>

alpha=0.05
* significant difference
Table 9. Analysis of Variance With Repeated Measures for the Interaction Methods by Tests

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>ms</th>
<th>f ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods by Tests</td>
<td>1.67</td>
<td>1</td>
<td>1.67</td>
<td>.57</td>
</tr>
</tbody>
</table>

**alpha= 0.05**
Percent Decline in Scores

The average decline in scores for the HS group was 37% and for the SC group was 46%, further indicating a trend for the HS group to retain a greater number of signs over time. The mean decline was 41.5% for all subjects. These percent declines were computed by subtracting each subjects' score on Test One from the score they obtained on Test 2, then computing the average decline in scores.
CHAPTER FIVE
DISCUSSION

The purpose of the present study was to systematically evaluate the effect of grouping ASL signs according to either their handshape (HS) or semantic category (SC) and subsequently evaluate the retention of the signs by hearing adults. The underlying objective of the experiment was to evaluate two different methods of teaching ASL vocabulary in order to provide guidelines for future ASL instruction for hearing adults. Although there is evidence from past studies that grouping vocabulary according to handshape may enhance retention, the majority of sign classes continue to use the more traditional semantic category grouping. The present experiment evaluated 30 hearing adults' retention of ASL signs that were demonstrated on a 15 minute videotape. Half of the group was shown signs grouped in semantic categories, and the other half was shown signs grouped according to handshapes.

Previous investigations that found benefit in using handshape categories during sign language training have been discussed and the rationale for investigating this topic delineated. In general, prior investigations in this area have not used adult subjects, nor have they controlled for various extraneous variables. However, there is ample data to support the notion that for native signers, handshape plays the important role in organizing sign vocabulary in
short-term and long-term memory. There is less scientific
evidence regarding the effect of handshape grouping on sign
retention by hearing adults. This population is of
particular interest because adult caregivers are critical in
providing signed input to their hearing-impaired offspring.
This research involved investigation of the items that
follow.

1. Immediate recall of ASL signs by the HS group and the
   SC Group - it was hypothesized that the group taught signs
grouped according to handshape would obtain significantly
higher scores on a test of receptive recall of signs given
immediately after instruction.

2. Long-term recall of the ASL signs by the Handshape
group and Semantic Category Group - it was hypothesized that
the handshape group would retain more of the signs and would
obtain significantly higher scores on an unannounced test of
receptive recall given two weeks after instruction.

3. Decline in recall of ASL signs - it was hypothesized that
short-term recall of the signs would be significantly
higher than long-term recall of the signs by both groups of
subjects.
Summary of Results

From the statistical analyses of data generated from the present experiment, the following findings were demonstrated:

1. Hearing adults who learned the concept of "handshape" and were shown ASL vocabulary grouped in handshape categories performed significantly better than those trained using semantic category groupings on a test of receptive recall of ASL given immediately after training.

2. Hearing adults shown ASL vocabulary using handshape groupings performed significantly better than adults shown ASL grouped in semantic category grouping on an unannounced test of receptive recall given two weeks after training.

3. The handshape group had a lower percentage of decline in scores from Test 1 to Test 2 than the semantic category group.

4. Both the HS and the SC group scored significantly higher on the immediate test than on the delayed test, averaging a decline of 41.5%.

5. The interaction of methods by tests was not found to be significant, indicating both groups followed a similar pattern of high scores on the first test and low scores on the second one.
Hypotheses Tested

Immediate Recall Variable

Statistical analysis demonstrated that the group taught words grouped in handshapes achieved significantly higher scores on the test immediately following training. Not only did this group perform statistically better, the number of perfect scores is notable. Ten of the 15 subjects in the handshape group received a score of 10/10, remembering 100% of the signs tested. Only five of the subjects in the semantic category group received a score of 100%, indicating a trend for the HS group to remember all the signs immediately after instruction. The range of scores on this test was small for both groups, specifically 8 to 10 for the handshape group and 6 to 10 for the semantic category group. This indicates that both groups were able to recall most of the signs on the immediate test, although the handshape group recalled a larger percentage of the tested signs.

The high scores obtained on the first test may be due to the fact that subjects were tested only five minutes after instruction so there was little time to forget. It also indicates that the videotape of the signs was clear enough for 67% of the subjects (20/30) to achieve scores of 90% or higher. Indeed, all 30 subjects rated the videotaped signs as "very clear" on a survey given following the second test (see Appendix B).

Another possible reason for such high scores with a
restricted range is the limited number of signs tested. If the test had included more items, a greater variability across all subjects may have been demonstrated. The findings described above suggest that teaching hearing adults ASL signs grouped in handshapes is more efficient than teaching these signs grouped in semantic categories in terms of short-term recall. Since long-term recall of information can never be greater than short-term memory of that information (Glass, 1977) subjects who learn more signs initially will at least have the advantage of a greater repertoire of signs to begin with.

**Long-Term Recall Variable**

The handshape group in this study also achieved significantly higher scores than the semantic category group on a test given two weeks after instruction. This finding is more important than the fact that handshape grouping resulted in greater short-term retention, because greater long-term memory of signs would allow parents and educators to recall more signs, and thus pass on more signed vocabulary to hearing-impaired children. The following explanations are offered as potential reasons for this finding:

Subjects were able to use handshape groupings to chunk signs into groups, thus enabling themselves to recall a greater number of signs over time. Appendix B asked what methods subjects employed to remember the signs while instruction was taking place. Those subjects in both groups...
who said they wrote down the category (i.e., the handshape or the semantic group) and then listed the signs in that group, had higher scores on the second test than those who had not listed signs in this manner. The scores of the 16 subjects who said they had made such lists and used some type of grouping was higher than the overall mean of scores exhibited by subjects who indicated they did not formally group the signs. Of these 16 subjects, 9 were in the handshape group. It is possible that those who indicated they did not write down the categories were not using handshape or semantic category grouping as efficiently as they could have in helping them organize and recall the signs. If all subjects had used grouping it is possible that an even greater advantage of handshape grouping may have been noted.

All subjects were given a questionnaire following administration the second test. One question asked whether the subject was aware there would be a second test and if so whether they had studied (see Appendix B). All subjects except two in the SC group said they were not expecting a second test and had not studied. Of the two in the SC group who had studied, one had a score of 10 and the other scored 9 of a possible 10. If those two scores are not included the are highest score was 7/10, and the average decline would have been 49%. This indicates that for the subjects in the semantic group who did not study, almost one half the signs
assessed were forgotten over time. If none of the subjects had studied, there would have been even greater variability between the handshape and semantic category group.

There were larger standard deviations in scores on Test 2 than on Test 1 for both groups. Scores on this test for the HS group ranged from 1 to 9, and for the SC group from 1 to 10. This supports the notion that perhaps one grouping method does not aid long-term retention for all subjects, and perhaps handshape or semantic grouping is helpful for some learners and of negligible help to others.

The results obtained suggest that hearing subjects are able to use the concept of handshape in a way similar to native signers, to help them organize sign vocabulary. The results presented above confirm the hypothesis that at least for receptive recall by this study's hearing adults, grouping signs according to handshapes results in greater short and long-term retention than grouping signs in semantic categories.

Crittenden (1986) speculated that the reasons for the apparent critical importance of the cheremic dimension "handshape" may be that it is hard to discern for hearing adults until it is specifically taught. He postulated that recognition of various common hand configurations would lessen the confusion surrounding this dimension because learners would be able to recognize the minute distinctions between similar signs. The results of this study appear to
support Crittenden’s hypothesis. Those who had handshapes demonstrated to them and were shown signs grouped in handshapes retained more. The handshape group retained more signs over time even though semantic category grouping is a much more familiar instruction method for hearing subjects.

**Decline in Recall Variable**

In this study, a decline in scores between Test 1 and 2 was anticipated, and was indeed found to be statistically significant. This decline was expected because the second test was not announced so subjects did not study the signs between tests. Rather subjects were simply told to return to fill out a questionnaire. However, it is worth noting that those subjects who reported writing down the categories and those who said they had studied showed less decline on the second test. Presumably, adult caregivers studying and grouping the signs would have better retention of the material if they grouped the signs into handshape categories rather than semantic categories.

**Considerations for Further Research**

The definition of forgetting as "the loss of recallability over time" may be operationally defined as the difference between the number of items recalled on an initial test and those recalled on a later test (Runquist, 1983). These difference scores provide the basis for description of results. Scores obtained during this
investigation indicated a definite trend toward subjects remembering more ASL signs when they were grouped according to handshape than when they were grouped according to semantic categories. Although the HS group’s scores were significantly higher on Test 1, and on Test 2 they may have been even better if subjects had been informed of a second test and told to study during the two week interval between tests. The study time would give subjects more time to note the handshape groupings and use them to store the signs in long-term memory. Future investigation may want to incorporate this into research design. Presumably, variable study time could be addressed simply by the fact that subjects are randomly assigned to groups. Also, greater variability may be obtained if this research is duplicated using a larger number of subjects. This would presumably decrease in the amount of variability within groups on the second test. Also, subjects were only given one 15 minute instructional session. Repeated exposure to handshape groupings might potentially demonstrate its utility over time.

An underlying objective of the present investigation was to provide information that would allow sign language instructors to organize vocabulary in the most effective manner. Results of this study suggest that handshape groupings do indeed enhance the long-term recall of ASL signs. Future investigation must be undertaken using parents
of hearing-impaired children, where repeated exposure to handshape categories is compared to repeated exposure to semantic categories. These parents would be good subjects because they would benefit from learning ASL and would have a specific use for the knowledge. The problem in using the general population of college undergraduates is that they do not generally have a desire to learn the material. On the survey given to subjects in this study, most indicated they were only participating in the research because it was a course requirement.

Results also indicate an alarmingly high rate of forgetting signs by all subjects, indicating the need to frequently review signs in ASL classes. Analysis of error on both tests indicated that some subjects responded only to the perceived iconicity of the sign rather than its semantic category. For example, several subjects replaced "cow" with "martian" because the sign resembles antenna. Thirty-two percent of the errors involved replacing a sign with another sign in the same handshape category. This indicates handshape may not always enhance retention when separated from the other cheremes of "movement" and "place". Further investigation is needed whereby all three cheremes, handshape, place and movement, are described to hearing adults, as it is possible that teaching all three combined could significantly improve sign language learning.

The findings of this study have a degree of
generalizable information. By using handshape groupings, sign language teachers may expect greater retention over time by their students than if semantic category grouping is used. Writing down groupings is likely to improve recall, as is studying signs. Further research using large groups of hearing subjects is needed to ascertain the amount of probable improvement possible, as well as to identify and describe all of the critical variables that may enhance the learning of manual communication.
APPENDIX A

RATING SCALE FOR EXPOSURE TO SIGN LANGUAGE

Please circle the number that best describes your experience with sign language.

1. I have never had the opportunity to be exposed to any sign language. I have not seen it being used by deaf people and I have never used it myself. This includes fingerspelling and any other forms of manual communication.

2. I have had minimal exposure to sign language. I have seen it being used on television, in a movie, or by deaf people, but I have never learned to use any form of manual communication myself.

3. I have had some training in sign language at the beginning level and I have some knowledge of the deaf culture.

4. I have had several sign language courses and I have had the opportunity to interact with the deaf community.

5. I am an interpreter for deaf people and my knowledge of sign language is extensive.

6. I am a hearing-impaired person and I use sign language on a daily basis.
APPENDIX B

POST-TEST QUESTIONS

1. What strategies did you use to help you remember the signs during instruction? (e.g., writing down the categories, practicing the signs)

2. Would you prefer to learn signs via videotape, live presentation or from a book? Why?

3. Did you know you would be retested today? If so, did you study the signs?

4. In your opinion, what is the purpose of this research?

5. Why were you interested in participating in this research?

6. How would you rate the clarity of the signs on the videotape? Circle the appropriate description.
   very clear  moderately clear  somewhat unclear  unclear
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