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ABSTRACT

To explore methods of visual communication as a supplement to bilingual education, 200 white male subjects were selected from a public school system in South Florida (100 from the first grade and 100 from the eighth grade) and were allowed to create visual statements from a standardized set of photos. Using primarily Latent Partition Analysis, the resultant visual statements were analyzed. The results indicated the existence of what might be termed a "visual syntax." The data further suggest that this "visual syntax" is relatively stable over students of the two grade levels. Implications of these and other findings, along with suggestions for future research, are also discussed. A description of Latent Partition Analysis is appended. (Author/SK)

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An Investigation of Visual Syntax
Among Children of Different Grade Levels

by

Joseph David Clement

ABSTRACT

In the present study, 200 white male Ss were selected from a public school system in South Florida (100 from first grade classes and 100 from eighth grade classes) and were allowed to create visual statements from a standardized set of photos.

Using primarily Latent Partition Analysis, the resultant visual statements were analyzed. The results of these analyses indicated the existence of what might be termed a "visual syntax". The date further suggests that this "visual syntax" is relatively stable over students of the two grade levels used in the present study. Implications of these and other findings, along with suggestions for future research, are also discussed.

In a well known letter to Jacques Hadamard, Albert Einstein said: "The words or the languages as they are written or spoken do not seem to play any role in my mechanism of throught. The psychical entities which seem to serve as elements in throught are certain signs and more or less clear images which can be 'voluntarily' reproduced and combined." And, further, "The above mentioned elements are, in my case, of visual and some muscular type. Conventional words, or other signs, have to be sought for more laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be reproduced at will." If Einstein's procedure is representative of intelligent reasoning, we may be strangling the potential of our brainpower systematically by forcing our youth to think primarily with verbal and numerical signs.

(Arnheim, 1965, p. 12)

CHAPTER 1

Introduction

Origin of Problem

In contemporary United States education there is a growing movement toward the incorporation of a visual communication system into the curriculum. Studies have been reported and theories developed - all favorable toward this movement. Yet, despite all the published accounts, certain basic and essential information regarding the visual language is lacking (at least from the empirical standpoint).

If visual communication is to be taught, used, and evaluated in the classroom, it is imperative that the visual language upon which visual communication is based, be understood. This understanding cannot be based solely on theoretical insights that individuals may develop. Rather, this understanding must evolve from objective evaluations of the characteristics of the visual language. Once the understanding of the visual language is accomplised, then, and only then, may visual communication realize its full potential in the classroom.

In a rather extensive evaluation of bilingual schooling in the United States, Andersson and Boyer (1970, p. 73) contend that, ".... language is the bedrock of American elementary education." This contention poses a severe handicap to the three-four million children from non-English speaking homes.

"The non-English speaking child who has typically lived the critical first five years of his life

> in a language and a culture different from those he encounters as he enters school inevitably suffers a culture shock. To be sure, most administrators and teachers try their best - in English - to make such a child feel comfortable and welcome.. However, to the extent that English is the only medium of communication and the child language is banned from the classroom and playground, he inevitably feels himself to be a stranger. Only as he succeeds in suppressing his language and natural way of behaving and in assuming a new and unaccustomed role does he feel the full warmth of approval. In subtle and not so subtle ways he is made to think he is inferior to the English speaking children and that his parents are inferior to English speakers in the community.
> (Andersson and Boyer, 1970, pp. 43-44)

Similar statements have also been made with specific concern for the native children (Indian, Eskimo, and Aleut) of the United States (Salisbury, 1967).

In investigating the linguistic characteristics of Negro ghetto children, Baratz (1969, p. 199) concludes, "The Negro child is speaking a significantly different language from that of his middle class teachers." Thus, the children of Baratz' work quite logically can be combined with the children of Andersson and Boyer's study. This combination tends to intensify the magnitude of the difficulties imposed by the use of English as the sole medium of communication within the classroom.

One solution to these difficulties is the approach advocated by Andersson and Boyer (1970), i.e., development of more and better bilingual programs. While there is much evidence to support the bilingual position, there are also some questions that can be raised.

Andersson and Boyer (1970), Salisbury (1967), and Baratz (1969) seem to be saying that there are many children who, because of their cultural backgrounds, have difficulty in communicating within the classroom. Further, they maintain, these difficulties arise primarily because English is used exclusively. However, LaPolt (1968) notes that many children (without specifying cultural backgrounds) have difficulty in developing writing skills because of faulty language patterns (not necessarily English) they have developed. Thus, problems of communication in the classroom are not simply restricted to children from non-English speaking homes. While communality of language may be a prerequisite for communication, it does not necessarily follow that a common language will automatically lead to effective communication. As Galloway observes:

> Communication is successful when the teacher and the pupil agree on the interpretation that should be put on the message. Perfect communication is rarely achieved, however, because words are at best mediating symbols between the expressed intent of an inner state of being and the achieved affect they elicit.
>
> (Galloway, 1970, p. 234)

In looking at restrictions in communication brought about through linguistic modes, Schwalm notes that:

> Differences in language, customs, religions,

> and technological development can be a formidable barrier for a linguistic system of communication. As we develop and utilize visual communication as an instrument of cultural penetration and assimilation, the barriers can be eased to allow communication between all levels of culture to all races.
> (Schwalm, 1970, p. 49)

Thus, Schwalm would maintain that the communication difficulties encountered in the classroom can be resolved, at least, in part, through the use of "visual communication".

How this resolution is to be accomplished is more theoretical than empirical in nature. Due in large part to the lack of empirical data, three rather distinct positions have emerged with regard to the concept of visual communication. One of these positions is that visuals can and should be used as a primary mode of communication. This contention is epitomized by Drefuss (1969) when he states:

> As airplanes become faster and the world grows smaller, the need for nations to communicate easily among themselves becomes increasingly acute. Esperanto and other artificial languages have, so far, failed to bridge this global communications gap. But symbols may ultimately provide the answer. I say ultimately because there is still resistance in our highly verbal society to abandoning words for pictures even when we know the words will not be understood.
> (Dreyfuss, 1969, p. 16)

In the same article, Dreyfuss goes on to provide evidence, albeit non-qualitative, that visual symbols have been used as communication successfully across various cultures.

Another popular position is that visuals should be used as a learning tool in the acquisition of verbal skills.

> Poor communication skills in the 'culturally deprived' student can be remedied when a 'visual language' is emphasized through the use of camera and pictures. Such experiences, when accompanied by verbal and language interaction, make it possible for the inner-city child to 'move toward the abstract level of symbolic reality and, thus, toward verbal literacy.'
>
> (Thelen, 1969, Abstract)

Similar statements can be found elsewhere in the literature (Jaromin, 1970; Wallace, 1971).

The third position with regard to visual communication could be labeled as "cautionary". An example of this position is found in the writing of Dworkin. In discussing the numerous occasions where claims of a major breakthrough in education had been more closely associated with commercial publishers than with factual data, Dworkin (1970) warns:

> If visual literacy is the sound and imagery of a new bandwagon and no more, maybe, we should wait for the next one - which surely is on its way: perhaps, 'olfactory literacy' is next, duly heralded by committees and letterheads, with conferences supported by manufacturers of perfume or glue or fertilizer.
>
> (Dworkin, 1970, p. 28)

Whichever of the three positions will eventually be proven to be the most valid, one point can definitely be made - there is a trend in American education toward more and more incorporation of visual communication into the classroom. This point is substantiated by: (1) the growing number of proposed curriculums built around visual communication (Smith, 1971; Culhane, 1970; Flynn, 1970; Robinson, 1970; Kehoe, 1970; Knudson, 1970; Link, 1970; Hanosek, 1970, and; Ashmead, 1970); (2) the well respected Journal of Typographic Research changing its name to Visible Language in order to reflect what the editor feels is the current trend, and; (3) the formation of a national organization to study and disperse information about educational implications of visual communication.

However, if visual communication is to realize its full potential, it becomes necessary to understand the nature of the visual language — a language which must exist if communication with visuals exists. Without such an understanding, a teacher trying to evaluate a student produced film would be like a teacher trying to evaluate a written composition and not knowing the language in which the composition is written.

Despite the fact that LaDue (1967) and Rifkin (1968) used the term "visual language" in the titles of their dissertations, neither one of them defined "visual language" except in a limited operational sense. This lack of definition is quite understandable when one considers that no standard of delineation on the characteristics of the visual language has ever been agreed upon. What does exist are various theoretical positions - the more popular of which shall now be considered.

> If you wonder how some communication act might be managed visually, think of the verbal mode and ask yourself if there is a useful parallel. Over and over again, I myself have found useful parallels and I know there are visual rhymes, visual puns, visual metaphors, and, in fact, perhaps a visual counterpart for nearly every aspect of the verbal model.
> (Debes, 1969, p. 5)

The position of Debes that the visual language is the same in form as the verbal language is the most popular position found in the relevant literature. Some of the reasons for this popularity would appear to stem from three rather diverse sources - structural linguistics, transformational grammar, and the philosophical work of Turbayne.

Structural linguistics, as posited by Fries (1962), maintains that almost any word can assume any grammatical role. By adapting this position to visuals, it becomes unnecessary to identify visual "verbs", "objects", or "subjects" - the role of a particular visual element being determined by the use for which the visual is intended.

One particular aspect of the transformational grammar position, developed by Chomsky (1957), is also of particular importance. Essentially, the transformational position maintains that there exists within a language various categories of grammatical structure (e.g., negative sentences, interrogative sentences) and that these categories form the basis for rules which make it possible to generate sentences. Menyuk (1963) provides empirical support for this argument. In applying this position to visuals, it could be argued that children, having once learned the basic visual "categories" presumably at a young age, are capable of generating various types of visual statements.

Perhaps, the single most influential work with regard to a verbal model for the visual langua e has been the theoretical writings of Turbayne (1969). Turbayne has developed a rather comprehensive argument for the evolution of the visual language from the verbal model. The complexity of Turbayne's theory precludes any short, fair discussion. Suffice to say that Turbayne provides theoretical support for the following hypothesis:

> ....the visible world is a script, presented in alphabetical form, which we have to learn to read. In looking at the ancient problem of how we see, we must first consider the conflict of common sense vs. illusion in our interpretation of what we see. Man learns to decode a complex code of vision, which includes bridging the gulf between a written language and a spoken language (both called, for example, "English") as well as between visuals and tactiles. Seeing is modeled upon reading; painting, sculpture, and photography are modeled on writing - and are forms of writing in visual language.
> (Turbayne, 1969, p. 345)

One of the contentions of Turbayne is that visuals are signs not reality. Since words are also not reality, it logically follows that the verbal model provides one of the best ways to examine visual signs. Guerin (1970) modifies this contention when he states:

> .....here is where verbal literacy and visual literacy part company and the analogy breaks down. The reason for the divergence is that they work differently. They stand for reality in different ways - the verbal is arbitrary and must be learned.
>
> (Guerin, 1970, p. 56)

Guerin goes on to note, however,

> If the visual symbol's cues are very obscure, it begins to fall into the very same category as the verbal mode. We must learn it as we learn a word. The verbal mode works by agreement and by associations and certain visuals work pretty much the same way.
>
> (Guerin, 1970, p. 57)

Thus, when a visual is what Knowlton (1966) might classify as an analogical picture, Guerin would seem to agree with Turbayne. However, when the visual is a realistic visual, Guerin believes that the visual-verbal parallel breaks down - contrary to the position maintained by Turbayne.

Not everyone totally agrees that the verbal model fits the visual language. For example, Traver (1964) notes that:

> [illegible] are made in terms of hunches and intuition rather than in terms of a set of well-defined

> production principles....To refer to this (learning from visual stimuli) as a language hardly seems useful....and may obscure an important difference between linguistic an non-linguistic learning when otherwise defined.
>
> (Travers, 1964, pp. 1.15, 1.21-22)

In developing a theory of multiple-image communication, Perrin (1969) suggests that, while visuals can and have been used in ways analogous to the verbal mode, there are ways in which visuals can be used for which there are no verbal counterparts. Chen (1972, p. 24), in comparing visual and verbal symbols in relation to thirteen design features shared by all spoken languages of the world, concludes that, "It is possible that visual symbols have design features which are unique to them and are not shared by verbal symbols."

Along a similar line of thought, Pryluck states:

> Proponents of the aesthetic approach attempted to develop the idea that film was a unique language, but they narrowed their view unnecessarily by attempting a rule-bound grammatical approach; in their search for the 'correct' way of using film, they evolved normative statements which were quickly negated by example. It would appear that a more useful orientation could be borrowed from the descriptive linguists as they begin to describe any new (to them) language. They first accumulate all of the distinctions that they discriminate, and only then evolve from a language as it is used a set of categories which are susceptible to some kind of test. The use of pre-existing categories designed for other purposes can obscure the categorical discrepancies that exist between symbol systems.
>
> (Pryluck, 1968, pp. 375-76)

Pryluck then goes on to develop a rather comprehensive model to find ways in which filmic communication can be studied. Since film can be interpreted as a sequence of photographs, Pryluck devotes quite a bit of time in examining sequencing characteristics. While what Pryluck proposes pertains to groups of photographs, what of individual pictures?

Barley (1969) has suggested that the processes involved with interpreting and creating visual sequences may be different from those involved with single visual units such as a single photograph. If this is the case, then it would not be too incredulous to speculate that the "visual language" of a single photograph may be different from the "visual language" of a series of photographs. Thus, it is that, while Pryluck searches for syntax in the sequence of visuals, Narasimhan (1965) uses the computer to search for syntax within individual photographs.

The exact characteristics of the visual language, in short, are not clearly established. If the visual language is an artificial language, then, perhaps, the expressed theoretical differences are not too important - since all that would be required would be a set of arbitrary rules which visual communication must follow in order to be valid. If, on the other hand, the visual language is a natural language, then the rules governing the use of visuals cannot be arbitrarily established, but must be sought after.

Definition of Terms

Within the context of the present paper, certain terms are used which have many possible interpretations. These terms, along with definitions used in the formative stages of the present study, are listed below.

Language

Operationally, a language is identified by the presence of:

1. A vocabulary (a group of symbols)
2. A syntax (the manner in which the vocabulary may be arranged) (Hodgkinson, 1970)

Visual Language

Operationally, a visual language is identified by the presence of:

1. A visual vocabulary (a group of photographs and/or paintings)
2. A visual syntax (the manner in which the visual vocabulary may be arranged)

Syntax

Operationally, a syntax is identified by the existence of two components:

1. Relatedness (e.g., elements of the vocabulary which tend to appear together)
2. Operators (e.g., arrangement or order of elements) (Bolinger, 1968)

Visual Syntax

Operationally, a visual syntax is identified when:

1. Given a set of photos and the instruction to create visual stories, certain common subsets of photos occur together.

2. For each subset of photos, certain orders will occur whose frequencies of occurrence are not accountable by chance.

It cannot be overstated that visual language is percieved as being quite distinct from verbal language. Similarly, visual syntax (as defined above) is distinct from verbal syntax. It should be noted that this position is contrary to that taken by Debes (see previous section). Simply by prefacing linguistic terms (e.g., syntax, metaphors, and puns) with the word "visuals" does not make a visual syntax, visual metaphor, and visual puns synonymous with syntax, metaphors, and puns. One of the major reasons why "visual syntax" should not be considered the same as "syntax" lies in the inherent differences between a picture unit and a word unit. Turbayne (see previous section) maintains that pictures and words are similar in that they are both representations of reality. However, Turbayne fails to distinguish the sign characteristics of photos from the symbolic characteristics of words. It is basically this distinction that leads Chen and Guerin (see previous section) to conclude that there are significant differences between the elements and characteristics of the visual language and the elements and characteristics of the verbal language.

Scope of the Present Study

The present study was designed specifically to investigate visual syntax as operationally defined above. Consequently, generalizations would not be justified with regard to broader topics such as visual language, visual communication, and visual literacy. In addition, attempts to make comparisons between visual syntax and syntax (and other similar verbal indices) would not be appropriate.

Strandberg and Griffith (1969) provide evidence which indicates that how an individual responds to a visual is related to the degree to which the individual can identify with the visual. Since the photos in the instrument used in the present study do not include females and minority group members, it was decided to restrict the sample to white males so as to reduce possible confounding. This sample restriction prohibits generalizations to groups other than white males.

The photos selected by the publisher to make up the instrument used, were chosen on the basis of common underlying themes. Therefore, the findings of the present study can only be generalized to sets of photos similarly constructed and not to sets of photos created by another procedure such as randomization.

The Specific Problem

The validity and ultimate usefulness of communication with visuals is dependent on whether there exists a visual language. An examination of the research on children's art reveals that there is much similarity between the art of children from all over the world. This would tend to argue for the existence of a common visual vocabulary among children of various cultural backgrounds (Kellogg and O'Dell, 1967). Having ascertained that there is at least a core of visual vocabulary, the existence of a visual language would seem to be dependent on the existence of a visual syntax.

The notion of a single visual syntax is confounded by the findings of Travers (1970). Essentially, Travers found that children of higher grades (e.g., 6th grade) tend to differ from children of lower grades (e.g., 1st grade) in their response to visuals. Thus, what might be identified as a visual syntax exhibited by children of higher grades may differ from the visual syntax of children of lower grades - given the same visual elements.

Questions to be Investigated

In the present study, a methodology will be developed to assess the visual syntactical characteristics of sequentially composed visual statements. In addition, the study will examine the stability of the visual syntax across two different grade levels by looking at similarities and differences of the visual syntax from two grade levels. Specifically, the present study will:

1. Test for the existence of a visual syntax (as operationally defined above) by means of a Latent Partition Analysis (Miller, et al, 1967) and a chi-square test.

2. Examine the stability of visual syntax across grade levels by looking at similarities and differences of the visual syntax exhibited by students from two difference grade levels.

CHAPTER 2

Method

Subjects

The subjects used in the present study were 100 white male first grade students and 100 white male eighth grade students selected from the Broward County Public School System of Florida. The subjects were selected on the basis of availability and, thus, should not be regarded as a truly random sample.

Instrument

Photo Discovery Set 2, developed by Eastman Kodak, was used in the present study. This set consists of twenty-six, three and one-half inch by three and one-half inch, black and white photographs whose contents vary from children fishing to a child blowing up a balloon.

Photo identification numbers were written (in a random fashion) on the back of each photo for facilitation in data recording. A copy of the Photo Set, displayed as it was before the <u>Ss</u>, along with each photo's I.D. number is found in Figure 1.

Procedure

Each <u>S</u> was tested individually. The <u>S</u> was seated at a table and shown by the <u>E</u> (via example) how to make a story with pictures. The photos used in the example were not used in the actual study (see

Figure 2). The example was the same for all Ss. The subject was then told that he would be shown some pictures and that he was to make "picture stories" with them. The S was also told that he could make each story as long or as short as he wanted. In connection with this point, it was stressed that there were no wrong stories - that any story the S made would be correct. The E also explained that each picture could only be used once and that it would not be necessary to use all of the pictures.

After answering any questions regarding the task, the E placed the pictures from the Photo Discovery Set on the table in the pattern shown in Figure 1. After ascertaining that the S could see each of the pictures, the S was told to start making "picture stories" and to tell the E when each story was completed. When a story was completed, the E removed the story from the table in such a way as to retain the order of the photos within the story. This procedure continued until the S stated that there were no more stories he wished to make or until all the photographs had been used (for a verbatim account of the procedure, see Appendix A).

After the S had left the experimental setting, the E recorded the S's stories by recording each photo's I.D. number on a response sheet. The format of the response sheet was such that it was possible to determine the order in which the stories were created, the order of photos within each story, and the photos that were not used (for an example of the response sheet, see Appendix B).

Analysis

By placing certain photos together, the S is sorting the photographs on the basis of some subjective component which presumably could be labeled "theme". This is analogous to an F-sorting procedure and, therefore, can be analyzed by a Latent Partition Analysis (for a description of the Latent Partition Analysis, see Appendix C). The Latent Partition Analysis (LPA), when used over all Ss, establishes:

1. the number of common underlying themes within the Photo Discovery Set,
2. the internal consistencies of these themes,
3. the degree to which these themes are confused with each other,

then can be used to evaluate which photographs were put together (Bolinger, 1968).

Pryluck (1968) provides the concept that was utilized to evaluate the order aspect of visual syntax. Pryluck suggests that the ordering of pictures is best evaluated through probability. Thus, for example, while three pictures may occur together, there are six possible combinations of the three pictures. Only certain of these combunations are expected to occur more than by chance. In the verbal model, this would be analogous to having three elements (for example, "bird-eats-cat") and recording the ways in which the elements go together. With the elements, "bird-eats-cat", certain combinations tend to occur more frequently than others. For example, "cat-eats-bird" will probably occur more frequently than "eats-cat-bird". If certain orders occur more than chance would allow, then it can be concluded that specific relationships exist between the elements, thus, satisfying the order requirement for visual syntax.

It should be noted that the Latent Partition Analysis does not evaluate order. It thus became necessary to do an additional analysis to examine order characteristics. This was to be accomplished by first taking those pictures which, by the results of the Latent Partition Analysis, occurred together; and, then, examining, via a Chi-Square test, the probabilities of the observed orders of the pictures. If clear latent structures emerged from the Latent Partition Analysis, and, if the Chi-Square analysis yielded significant orders, it was to be concluded that a visual syntax does exist at least for the photos used. However, because of certain circumstances described in Chapter 3, the Chi-Square test was subsequently eliminated.

By dividing the sample according to grade levels (i.e., first and eighth grades), and examining the data from each group in the above described fashion, it was possible to compare the differences and similarities of the groups in relation to the visual syntactical characteristics of the observed visual statements.

CHAPTER 3

Results

First Grade Relatedness

Latent Partition Analyses were conducted on the picture stories for both the first grade group and the eighth grade group. The latent structure matrix (Phi) for the first grade group is found in Table 1. The number of latent categories was calculated by using an eigenvalue of 1.00 as a cutoff level.

While the loadings in the Phi matrix are theoretical probabilities of occurrence, the Phi matrix can be interpreted as being analogous to a factor structure matrix. Thus, the matrix in Table 1 indicates that six latent categories (or factors) were the basic structures used by first graders to create their visual statements. The photos constituting each of the latent categories are found in Table 2 (these are photos that loaded .40 or higher on the respective category). It should be noted that the orders of the latent structures as they appear in Tables 1 and 2 are of no interpretive importance.

An additional item of potential value to be found in Table 1 is the concept of ambiguity. Ambiguity in Latent Partition Analysis refers to an item (or in the present study - a photo) which does not have a high loading on one particular category, but rather, tends to have moderate to high loadings on two or more categories (Miller, et al, 1967).

TABLE 1

Latent Structure Matrix for First Grade

Photo I. D.	1	2	3	4	5	6
16	.88	.02	.04	.02	.08	.05
15	.80	.09	.02	-.00	.11	.00
23	.76	.04	.02	.00	.19	.01
26	.71	.08	.03	.02	.09	.03
22	.71	.02	.02	.05	.07	.00
25	.69	.02	.03	-.01	.24	.04
7	.00	1.01	.08	-.02	.01	-.00
11	.00	.98	.07	.04	-.03	.05
17	-.05	.97	.04	-.04	.13	-.00
21	.04	.95	.02	-.01	-.04	-.01
12	.08	.67	.05	.02	.10	-.01
2	.12	.57	.05	.05	.05	-.00
19	.05	.55	.12	.06	.04	.07
6	.02	.11	.90	.01	-.02	.06
24	.05	.15	.86	.05	.03	-.02
9	.06	.03	.73	.08	-.02	.03
18	-.01	.06	.72	.06	.05	.00
4	.03	.12	.62	.07	.05	.08
13	.05	.04	.14	.65	.02	.08
1	.03	.10	.20	.62	.03	.07
10	.26	.05	.02	.01	.55	.06
5	.22	.12	.05	.08	.50	.05
14	.36	.13	.03	-.01	.48	.04
3	.37	.11	.03	-.03	.45	.14
8	.11	.06	.13	.14	.14	.44
20	.10	.07	.10	.09	.17	.42

e data in Table 1 thus indicates that, for the first grade group, e photos were not ambiguous - with the photos 10, 5, 14, and 3 proaching what might be termed ambiguous.

In Latent Partition Analysis, the concept of confusion pertains o the probability, averaged over Ss, that any two distinct items hotos) from any pair of latent categories will be placed together n a future sorting. Table 3 indicates the confusion between latent tegories for the first grade group. The diagonal entries can be in-rpreted as an index of cohesion for each latent category - the higher e value, the more cohesive the category. The off-diagonal entries e the probabilities of confusion between the latent categories. (The ssible range for entries in this table is .00 - 1.00.) It can be en from Table 3 that the chances for confusion between categories are n-existent.

It should be noted that the index of confusion is mathematically dependent from the index of ambiguity. Conceptually, however, the o indices would seem to be related. For example, if a latent cate-ry is composed of several items that are ambiguous, then it would em to follow that that category would have a high probability of ing confused with other categories composed of a number of the same ems.

TABLE 3

Confusion Matrix for First Grade

	1	2	3	4	5	6
1	.83	.00	.00	.00	.00	.00
2	.00	.75	.00	.00	.00	.00
3	.00	.00	.98	.00	.00	.00
4	.00	.00	.00	1.01	.00	.00
5	.00	.00	.00	.00	.97	.00
6	.00	.00	.00	.00	.00	.93

First Grade Operators (Order)

In examining the order effect, it should be kept in mind that the loadings in the Latent Category Matrix (Table 1) are theoretical probabilities of future occurrence. It thus becomes possible to have a latent category clearly defined by five or six items (photos) and yet have relatively few Ss that used all of the items together.

As previously stated, the order effect was to be examined by means of a Chi-Square test. However, the unpredictable length (unpredictable prior to the LPA) of a number of the resultant latent categories would have made the results of a Chi-Square test meaningless. In calculating the Chi-Square, evaluations are made on the difference between theoretical frequencies of occurrence and observed frequencies of occurrence. In calculating the theoretical frequency, the formula is:

$$\frac{1}{\text{the number of items }!} \times \text{the number of observations}$$

In the case of Latent Category 2:

$$\frac{1}{7!} \times 36 \text{ (number of Ss using all 7 items together)}$$

or

$$.007 = \text{theoretical frequency}$$

With such a low theoretical frequency, any order would prove to be statistically significant using a Chi-Square test, even if the

Consequently, it was decided to handle the orders in a descriptive fashion. Figures 3 - 8 present graphic representations of the various orders for each latent category. The rankings of orders in these figures was determined by simply examining the data of Ss who had used all the photos and recording the orders as they occurred. Thus, Order 1 represents the order used by the first S found using all photos in a given category.

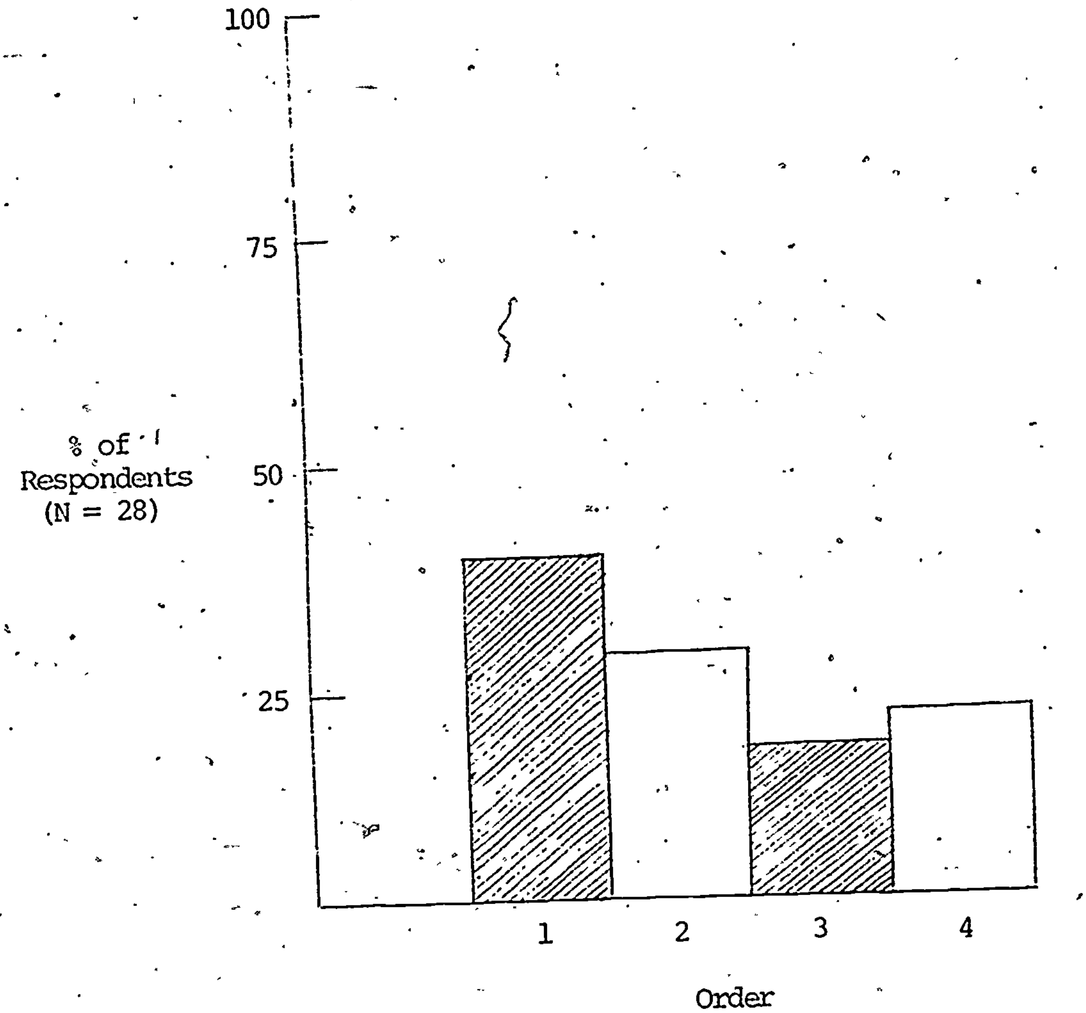
Eighth Grade Relatedness

The data from the eighth grade group was analyzed in the same fashion as the first grade group. The latent structure matrix is found in Table 4. While the latent structure matrix reflects four latent categories (using an eigenvalue of 1.00 as a cutoff), an examination of Category 4 indicates that Category 4 is composed of photos with only moderate loadings. Using a .40 cutoff level, only three categories remain. These three categories - along with the photos which loaded .40 or higher on them - are found in Table 5. In further examination of Table 4, it should be noted that photos 1, 8, 13, and 20 were ambiguous (as previously defined).

Table 6 is the confusion matrix for the eighth grade group. It can be seen from Table 6 that Category 4 does tend to be confused with other categories (although the literature seems to regard confusion indices of less than 10 to be not significant). If Category 4 is dropped from Table 6, the remaining categories are not confused with each other.

FIGURE 3

Frequency of orders for Category 1
(items loading greater than .40) for First Grade

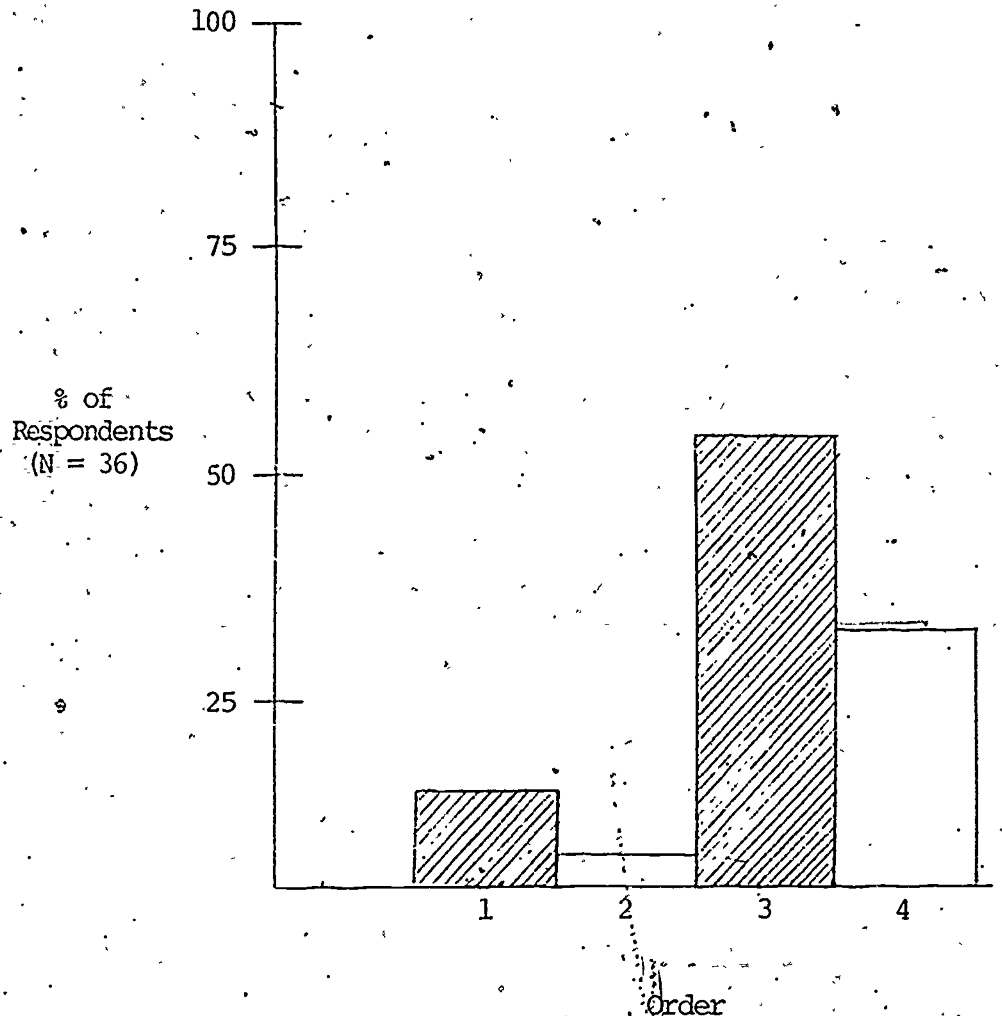


Order 1-

(Con't.)

FIGURE 4

Frequency of orders for Category 2
(items loading greater than .40) for First Grade

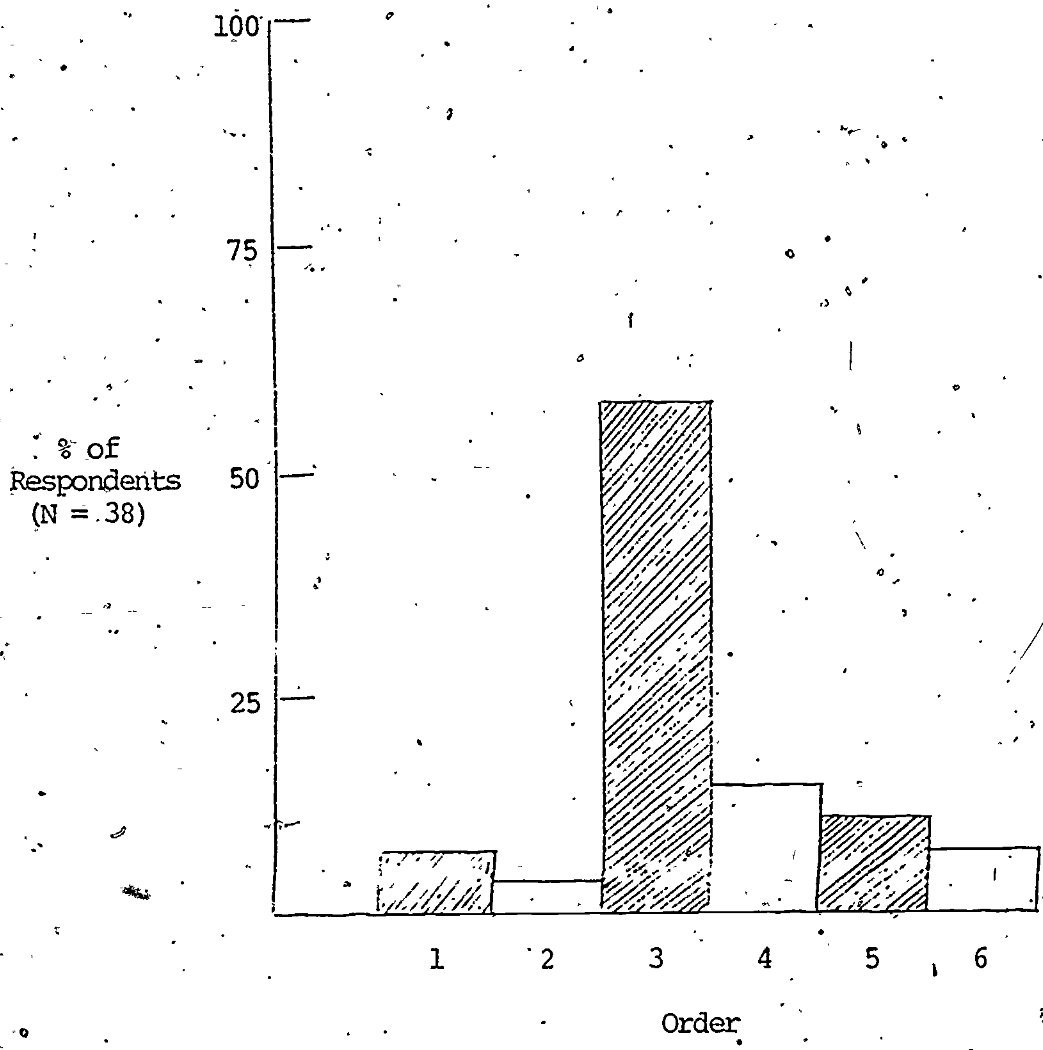


- Order 1 -

(Con't.)

FIGURE 5

Frequency of orders for Category 3
(items loading greater than .40) for First Grade



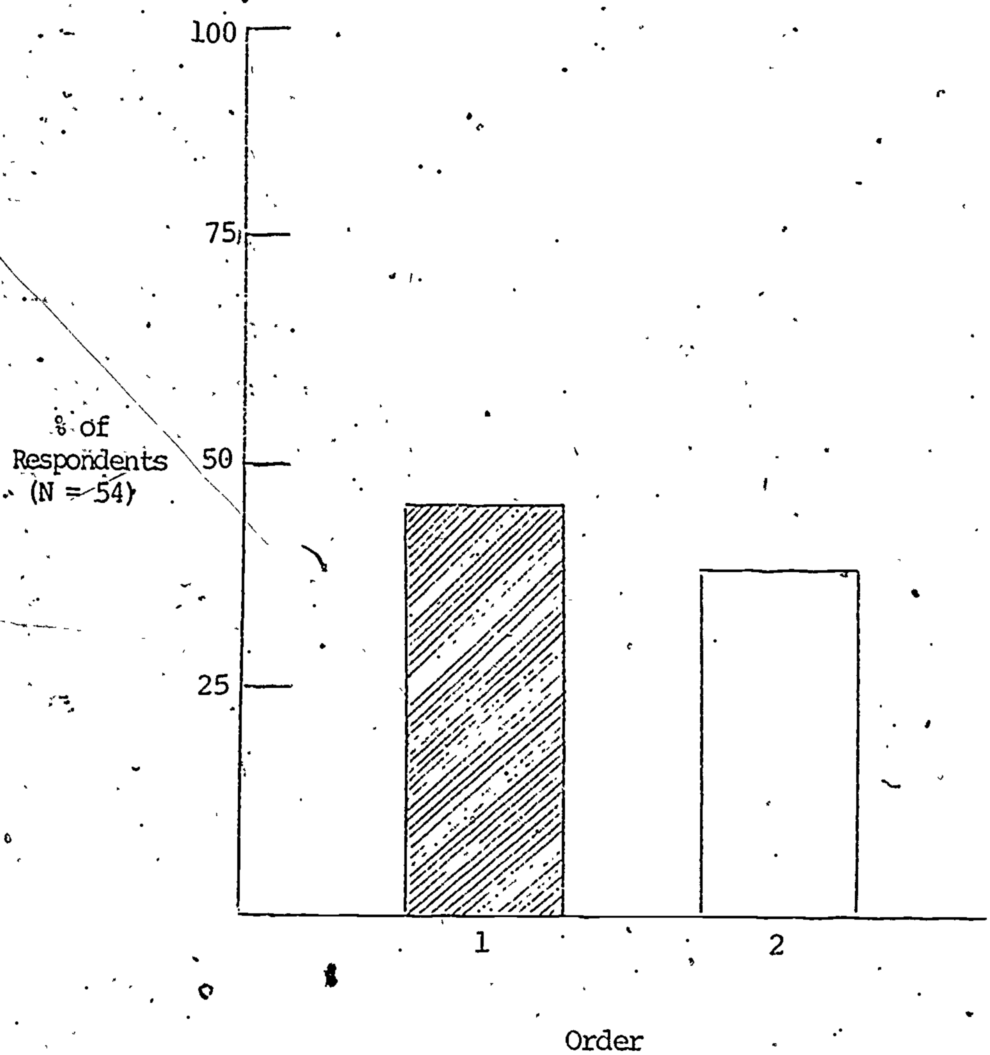
Order 1

Order 2

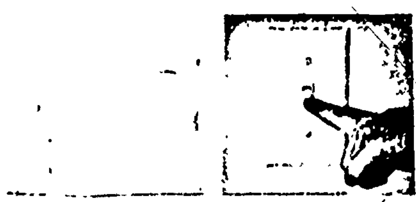
(Con't.)

FIGURE 6

Frequency of orders for Category 4
(items loading greater than .40) for First Grade



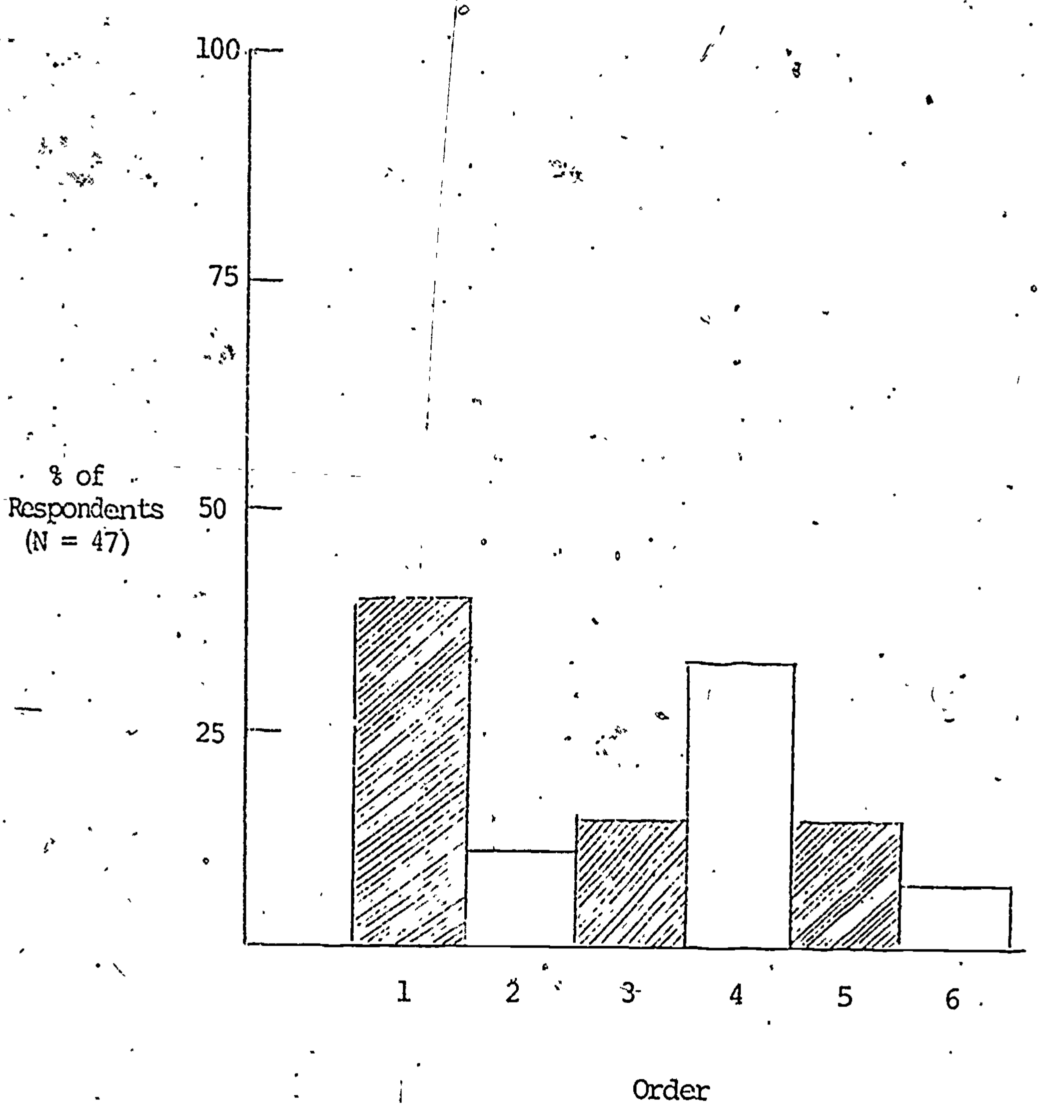
Order 1-



Order 2-

FIGURE 7

Frequency of orders for Category 5
(items loading greater than .40) for First Grade



Order 1-

Order 2-

FIGURE 8

Frequency of orders for Category 6
(items loading greater than .40) for First Grade

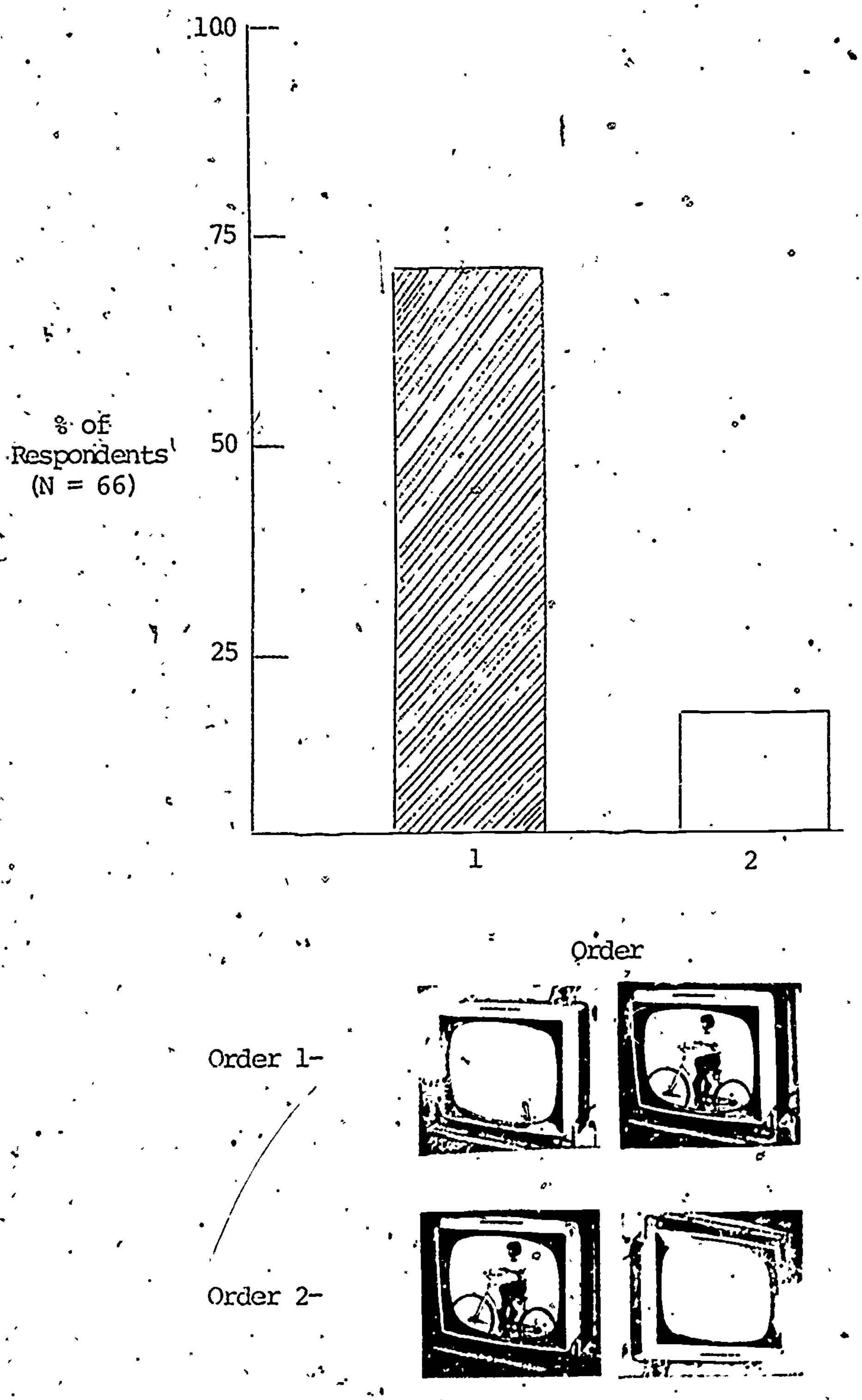


TABLE 4

Latent Structure Matrix for Eighth Grade

Photo I. D.	1	2	3	4
26	.73	.05	.12	.06
16	.73	.06	.11	.05
22	.70	.07	.13	.06
25	.69	.05	.09	.08
23	.67	.04	.10	.09
15	.65	.07	.06	.08
14	.56	.23	.08	.14
5	.52	.26	.23	.21
10	.51	.16	.23	.27
3	.41	.11	.18	.29
11	.09	.78	.17	.07
17	.07	.75	.17	.10
7	.11	.72	.08	.01
21	.07	.70	.13	.16
12	-.00	.65	.08	.13
2	.14	.52	.11	.26
19	.11	.50	.19	.05
20	.17	.27	.19	.26
18	.22	.14	.68	.06
6	.20	.08	.65	.07
24	.14	.17	.61	.14
9	.02	.14	.48	.11
4	.12	.22	.45	.17
13	.23	.12	.30	.28
1	.13	.21	.26	.33
8	.26	.25	.25	.27

TABLE 6

Confusion Matrix for Eighth Grade

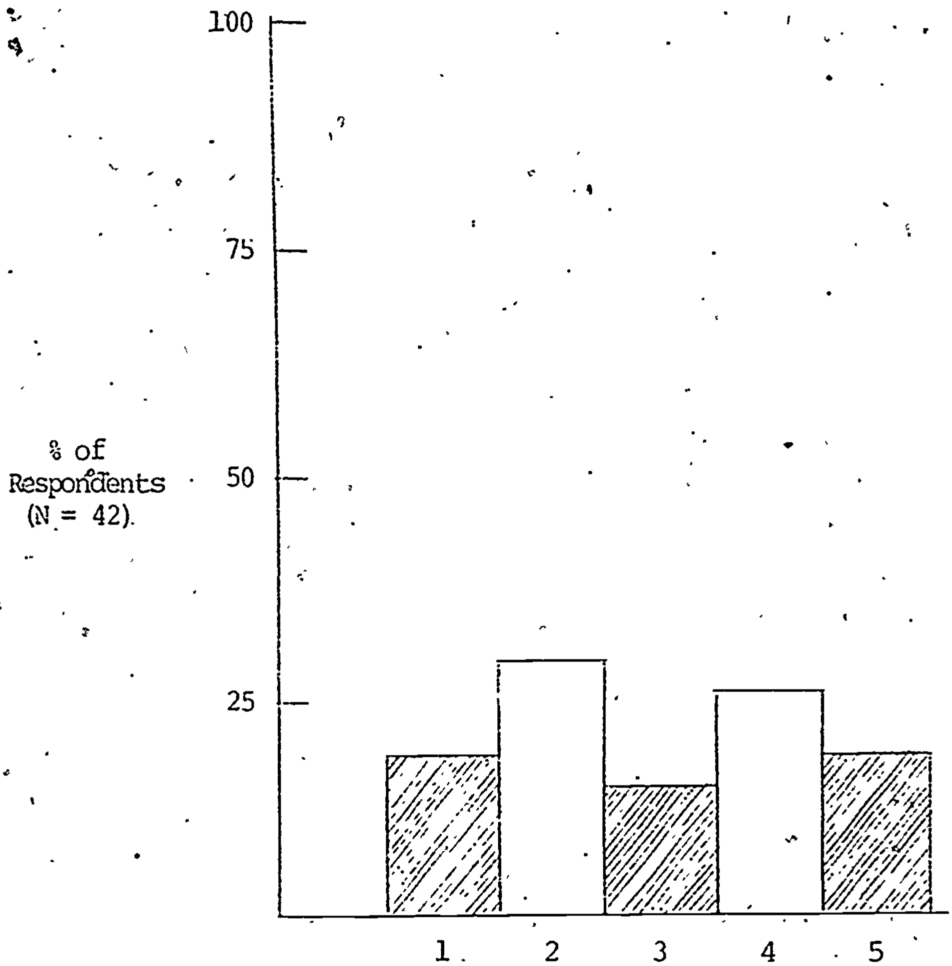
	1	2	3	4
1	.89	.00	.00	.03
2	.00	.81	.00	.01
3	.00	.00	.77	-.05
4	.03	.01	-.05	.52

Eighth Grade Operators

Once again the length of the latent categories made statistical analysis, via the Chi-Square test, meaningless. The graphic frequency distributions of orders for each latent category (ignoring Category 4 for previously described reasons) are found in Figures 9 - 11.

FIGURE 9

Frequency of orders for Category 1
(items loading greater than .40) for Eighth Grade



Order

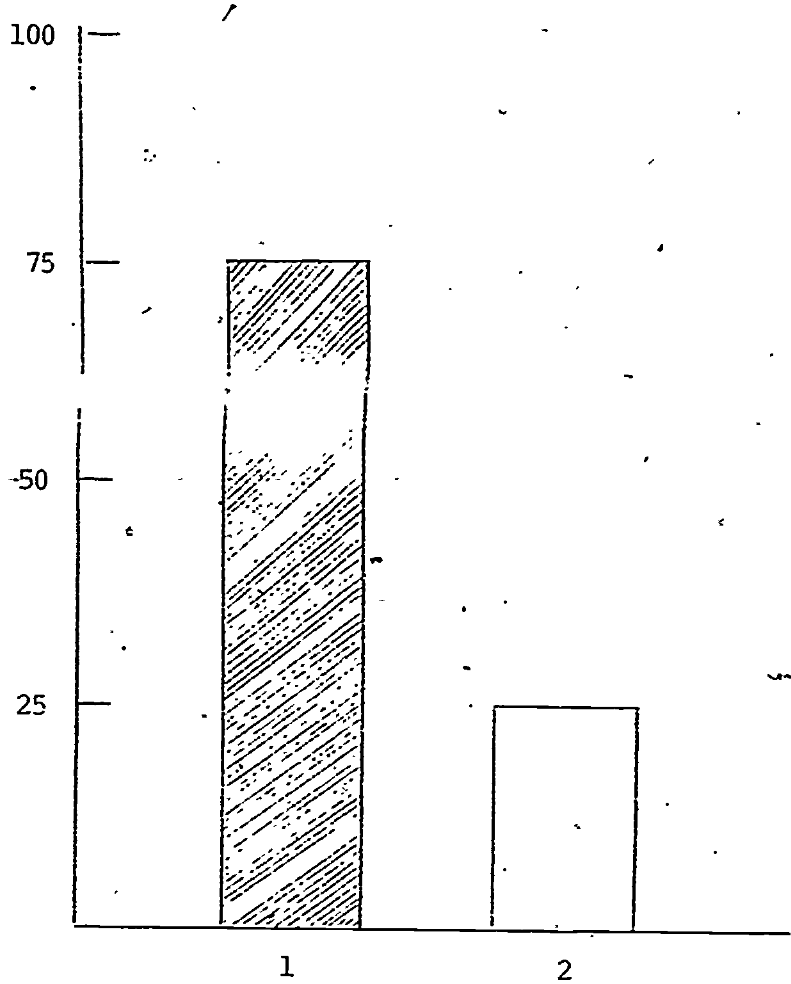
Order 1-

(Con't.)

FIGURE 10

Frequency of orders for Category 2
(items loading greater than .40) for Eighth Grade

% of
Respondents
(N = 53)

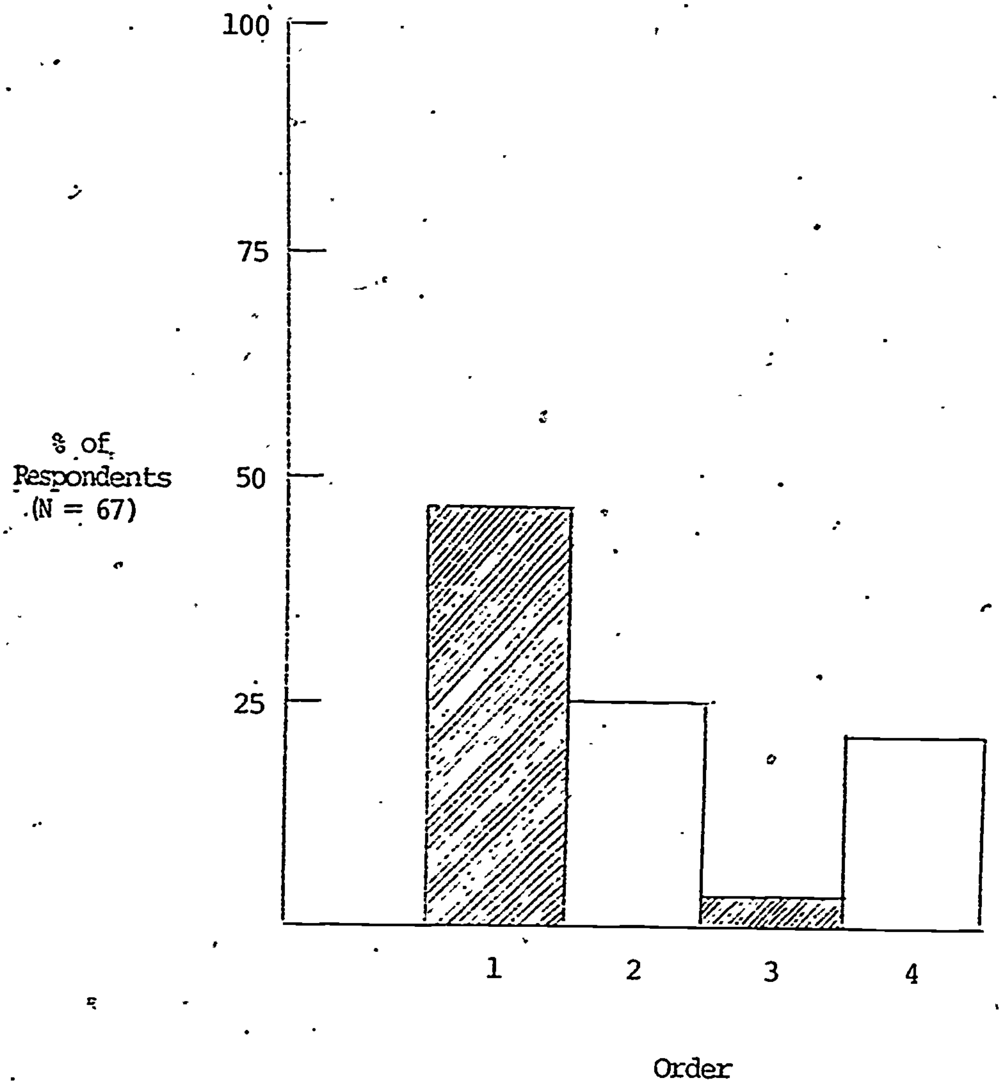


Order

-Order 1-

FIGURE 11

Frequency of orders for Category 3
(items loading greater than .40) for Eighth Grade



Order 1-

CHAPTER 4

Discussion and Conclusions

The two major purposes of the present study were: (1) to explore the possible existence of a visual syntax, and; (2) to examine the stability of such a syntax over two grade levels.

Limitations of the Study

In order to gain the proper perspective on the following conclusions with regard to these purposes, the limitations of the present study should be made explicit. Specifically, there were a number of *a priori* restrictions built into the study. These restrictions, along with their implications, are found in Chapter 1, under the heading, "Scope of Study", and will not be reiterated at this point. Often, in conducting research, certain unanticipated methodological problems arise which could have an influence on the data that is collected. Prior to the present study, a pilot study was conducted which served to eliminate these methodological problems, with one notable exception.

At the time the study was initiated, there was confusion within the local Board of Education with regard to classroom research. As a consequence, it became necessary to obtain Ss whenever and wherever possible. For example, a number of Ss were tested in a city park during their Spring vacation. This lack of truly random selection procedure limits, in the strictest statistical sense, generalizations that can be made beyond the sample used in the present study. Aside from this sampling restriction, no other methodological difficulties were encountered which, at least to the investigator, would have affected the results.

Visual Syntax

The existence of a visual syntax was to be identified by two characteristics:

1. Given a set of photos and the instruction to create visual stories, certain common subsets of photos will occur together.

2. That for each subset of photos, certain orders will occur whose frequencies of occurrence are not accountable by chance.

The results of the Latent Partition Analyses (LPA) found in the previous section indicate that there are certain subsets of photos that are commonly used together - in the case of the first grade group, there were three such subsets. The confusion matrices of these analyses indicated that the subsets for both grade levels were cohesive and did not tend to become confused with each other.

The fact that LPA could be used successfully to identify the subsets of photos offers an interesting insight into the nature of visual statements. The probability estimates of LPA are based on the assumption that the basis for the sorting was similarity between items. If the basis for sorting is a complimentary relationship between items, then the resultant LPA probabilities would not make sense. For example, in constructing an English sentence, words are chosen which compliment one another (i.e., a noun, a verb, and an object). Using Latent Partition Analysis to analyze English sentences would result in latent categories which would make no sense. Because the latent categories in the present study would appear to be logical in nature (at least to the author), it can then be deduced that visual statements (such as those created in the present study) are not analogous to linguistic sentences. If linguistic paragraphs can be viewed as groupings of sentences with similar content, then it might be argued that visual statements such as those created by the Ss in the present study are most like linguistic paragraphs.

As previously noted, a statistical test of the orders of photos for each latent category would have proven trivial. However, when several hundred orders are possible and only a few of these orders are used (as in the present study), it logically follows that something other than chance is operating.

The only questionable category, with regard to order, would appear to be Category 4 in the first grade group. This category consisted of two photos - one, a picture of a light switch being turned on; the other, a picture of a light switch being turned off. Thus, there were only two orders possible. One order occurred approximately

52% of the time, while the other order occurred approximately 48% of the time. This would indicate that, for these two photos, the first grade Ss failed to demonstrate a meaningfully significant order preference. This conclusion is confounded, however, by the nature of these particular photos. One of the cues an individual can use to determine if the light switch is being turned on or off is to read the words "on" and "off" found on the switch in the photos. Unfortunately, these words may not be obvious at an initial glance and, therefore, it is possible that some Ss simply did not notice the labeling in the photos. The above discussion would seem to provide an answer to the first major question - there is a visual syntax which has general characteristics ascribed to verbal syntax by Bolinger (1968).

Stability of Visual Syntax

In examining the latent categories for the first grade and the eighth grade groups, a number of similarities are found. For example, in the three interpretable categories of the eighth grade Ss, two are ide cal (in terms of the photos loading .40 or higher) to two categories of the first grade group (Category 2 of the first grade; and Category 3 of the eighth grade is identical to Category 3 of the first grade). The most frequently occurring order of the photos in Category 2 of the eighth grade group is the same as the most frequently used order found in Category 2 of the first grade group. Similarly, the most frequently used order of the photos in Category 3 of the eighth grade group is the same as the most frequently occurring order in Category 3 of the first grade group.

A careful examination of Category 1 of the eighth grade Ss reveals that this category is a composite of Categories 1 and 5 of the first grade Ss. This finding leads to interesting speculation. Perhaps, the first graders perceive riding a bicycle as a complete activity, whereas, eighth graders perceive bicycle riding primarily as a means of transportation - a way of getting from one situation to another. Another possible explanation is that the first graders did not attend to the bicycles found in the photos, where the major activity of the primary subjects was fishing (e.g., Photo 25).

Two categories (4 and 6) of the first grade group do not appear to have counterparts in the results of the eighth grade group. It should be recalled that Category 4 consisted of two pictures of a light switch being turned either on or off; while Category 6 consisted of two pictures - one of a television set being turned either on or off, and the other, a photo of a television set with a picture on the screen. It is interesting to note that, these four photos were ambiguous in the eighth grade group. This would tend to indicate that these photos, while regarded by the first grade Ss as being sufficient as complete statements, were used by the eighth grade Ss as supplementary elements in larger visual statements.

While the above statements tend to point out differences between the first and eighth grade groups, these statements should not overshadow the similarities which exist in the data. In general, the data tends to support the concept that certain characteristics of the visual syntax (as previously described) are utilized in similar fashion both by first graders and eighth graders - thus, indicating the stability of visual syntax over grade levels and the potential efficiency of visual communication.

Summary

The data obtained in the present study provides evidence for the existence and stability of a visual syntax (as operationally defined). There will be those who will reject the concept of visual syntax as defined in the present study. Hopefully, these individuals will become sufficiently motivated to develop their own definitions of visual syntax, with precision enough to allow for empirical examinations.

No matter what definition is eventually agree upon, it should be evident from the data that the structures underlying how photographs are put together is distinct from the verbal notion of syntax. It was suggested that a visual statement is like a paragraph, but this does not mean that a single photograph is necessarily like a sentence. Searching for a one to one correspondence between the visual mode and the verbal mode would seem, at this point, to be an exercise in futility.

Implications for Future Research

As is the case with most research, the limitations of the present study provide the most obvious guidelines for future research. It should be remembered that white males were selected on the theoretical grounds that, how a person relates to a series of photos would affect how he uses those photos to create statements. One logical extension of the present study would be to test that theoretical assumption by using the same set of photos with members of both sexes and members of various ethnic groups.

The photo set used in the present study suggests further areas of research. As noted in the first chapter, the photos comprising the set were selected by the publishers primarily because the pictures centered around certain themes. The question might then be raised, what effect would there be if Ss were asked to create visual statements from a random selection of photos that did not center around a particular theme? In examining the characters in the photo set, it should be noted that they are white males. A further question then arises, what effect would there be if the characters in the photos were females, or black, or Chinese?

In addition to questions arising from variations in the content of the photos, the physical properties and mode of presentation of the photos provide another broad area for research. What effect would there be if the photos were in color as opposed to black and white? What would happen if the photos were presented one at a time? What would be the effect of projecting the photos? Variations along these themes are almost infinite in number and, yet, such variations would add considerable insight into the nature of visual communications. A further area of research could be centered around the possible sociological and psychological meanings of the visual statements.

Does it mean anything when one child creates a story in which the character begins by reading a story book and falls asleep; and another child, using the same photos, has the character wake up and start reading? Is there a relationship between the visual statement a child makes and his personality? These questions fall beyond the scope of the present study and would seem to be a potentially exciting area for future research.

In individual testing, such as was done in the present study, certain observations are often made which, because of the spontaneity involved, defy careful documentation. Yet, such observations often provide lines for potentially exciting new research. Such was the case in the present study. While the Ss in the present study were not required to verbalize their visual stories, many Ss persisted in verbalizing a story to supplement their visual statements. In six such cases, within the eighth grade group, Ss were describing visual statements that they had made in which the photos of the light switch had been used in a rather curious fashion (i.e., in the middle of visual statements and, apparently, out of context). When it came to verbalizing the photos of the light switch, these six Ss made statements such as, "He's turning off," "He's turning on," "The T.V. show turned him off...." Thus, these Ss were using a symbolic interpretation despite the non-symbolic elements of the photo. This potentially is a significant finding, since most theories of visual communication have tended to emphasize the realistic or symbolic nature of the visual and de-emphasize the interpretation of the viewer (Knowlton, 1966).

It is interesting to note that such behavior was not observed in the first grade group, however, since verbalization was not systematically collected, it is impossible to know if such symbolic interpretation was totally devoid in the first grade Ss and, for that matter, how many more eighth grade Ss made similar interpretations, but did not verbalize.

The present data from this study indicated the existence of what can be termed "visual syntax". However, if the present study has succeeded in raising a number of questions - questions which must be explored and answered before the nature of the visual language can be truly comprehended.

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APPENDIX A

Verbatim Description of Procedure

"Hi, my name is Joe Clement and I wonder if you have a few minutes to try out a new game?"

(AFFIRMATION BY SUBJECT)

"Good. Sit down and let me show you how the game is played. What you have to do is make stories just using pictures. Watch....."

(AT THIS POINT, THE E TOOK THE PHOTOS FOUND IN FIGURE 2 AND DEMONSTRATED HOW FOUR DIFFERENT STORIES COULD BE MADE.)

"Did you see how some of the stories were long and some were short, and, sometimes, I didn't use all the pictures? That's one of the fun things about this game - any story you make is right. The only rule in the game is that you can only use a picture one time. Do you understand?"

(ANY QUESTIONS ASKED BY THE S AT THIS TIME WERE ANSWERED.)

"Okay, now I'm going to put out the pictures you're going to get to use to make your stories."

(FIGURE 1 SHOWS HOW THE PHOTOS WERE DISPLAYED.)

"Can you see all the pictures? Good. Now, remember, you can make long stories or short stories. You don;t have to use all the pictures. There's no time limit; you can take as much time as you want. You can only use a picture one time. When yo finish a story, let me know and I'll pick it up to get it out of your way. If you run out of stories you want to make, let me know. Now, do you have any questions? Okay, start."

APPENDIX B

Data Summary Sheet

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				

Name ______________

Sex-M ________ Sex-F ________

Age (Nearest year) ________

Bl ________ Wh ________

Time to complete set
(to nearest minute ________

Comments:

Do Not Write Below

#S ________

#PNU ________

$\overline{X}L$ ________

$\sigma^2 L$ ________

APPENDIX C

Latent Partition Analysis
(LPA)

From: Miller, D., Fawlkes, J. & Lampert, P. (Eds.), Elementary Teachers' viewpoints of classroom teaching and learning. University of Wisconsin, 1967, Research Report to U.S. Office of Education, Project No. 5-1015-2-12-1.

The data from a sorting experiment consist of several categorizations of a constant set of content units. Such data are the input for latent partition analysis (LPA). The major objective of the analysis is to summarize the data in such a way that the major similarities and differences in the categorizations are made apparent. The first summarizations of the data for LPA are in the form of a matrix called S.

S = the joint proportion matrix

This is a rescaling of the kind of matrix illustrated in Chapter 1. An S matrix has as many rows and columns as there are content units. All the diagonal entries equal 1.0. An S matrix is symmetric; each entry below the diagonal equals the corresponding entry above the diagonal. A number in an S matrix corresponds to a pair of content units, and that the number is the proportion of sorters in whose categorizations that pair of content units appeared in the same manifest category. An S matrix is a summary or reduction of the data or sorting experiment because the complete information about the manifest categories cannot, in general, be reconstructed from S.

The rest of this section is devoted to explaining the features and computations of LPA and, in particular, to showing the relationships between the features of the latent partition model and the features of the hypothesized psychology of the sorting experiment as presented in the previous section. The latent partition model and its computations are detailed in Appendix G. No claim is made for the exact correspondence between the latent partition and the psychological model, and, in fact, no claim is made that the latent partition model is accurate or even reasonable. Like all mathematical models, the latent partition model is on its face inadequate. The latent partition model ignores the effect of order of presentation of content units and the consequent differential information-processing applications; it specifies unusual constraints on agreement of percept assignment; it specifies that the major sources of variations are random and independent. But the latent partition model has not been proposed to provide profound understanding of the sorting behavior. Rather, it has been proposed and implemented to provide an analysis of the data of the sorting experiment, to provide automatic reduction and summarizations of an S matrix, to provide a clearer picture of several sorters' categorizations.

Latent Categories

If there were two manifest categorizations of a set of content units, then one might consider looking at the refinement categorization defined by them - that is, at the intersections of the categories of two sets. If there are five content units:

A, B, C, D, E

and the two categorizations are:

(AB) (CDE)

(ABC) (DE)

then the refinement categorization is:

(AB) (C) (DE)

The refinement categories consist of the content units that both sorters found similar. In LPA terminology, the refinement categories are called latent categories. The latent categorization is sufficient to explain each of the manifest categories in the sense that each manifest category is either a latent category or a union of latent categories. The content unit discriminations between the latent categories include all discriminations between content units in both manifest categorizations.

The mathematical representation of the latent categorization is in the form of a matrix called Φ (Phi):

Φ = the latent category matrix

Phi has as many rows as there are content units and as many columns as there are latent categories. Each row of Phi corresponds to a content unit and indicates which of the latent categories the content unit belongs to. The row has a 1 in the column corresponding to that latent category and 0's in the other columns. Note that the latent categorization is assumed to have the same property as the manifest categorizations: each content unit must belong to one and only one latent category. The latent categories are the features of the latent partition model which correspond to commonality of perception. It is assumed that the sorters, as a group, recognize the latent categories as defining the essential discriminations among the content units.

If there are many sorters and hence many different manifest categories, the simple concept of refinement is not sufficient to describe latent categories. With even a moderate sample of sorters, it is usual that no one pair of items are always together in the manifest categorizations, and consequently and reduction, the number of latent categories must be less than the number of content units. This motivates defining a probabalistic notion of category similarity.

Probability Transformation

For larger numbers of sorters, as noted, the latent categorization cannot assume all the discriminations made by all the sorters. As a data analytic resolution of this problem, some further specification is made about the relationship between the latent categories and the manifest categories. In particular, a probabalistic model is defined for the sorting process. This model is structured with re- [illegible] gories represent probabalistic blends of latent categories. That is, not only may a sorter combine several latent categories, but he may blend several latent categories, combining their items independently but with fixed probabilities. Thus a sorter may have discriminations in his manifest categories which are not made in the latent categories, but such discriminations are assumed to result from random assignment with probabilities which depend on the latent categories.

The individual characteristics of a sorter are assumed to reside in the distinctive probability patterns and levels with which he merges and splits latent categories. In the latent partition model it is assumed that each sorter's sorting process is characterized by a matrix ¶ (Pi).

¶ = a sorter's probability transformation matrix

This matrix is assumed to have as many rows as there are latent categories. The number of columns in Pi is distinctive for a sorter and is the number of manifest categories in the model of the sorter. The entries of Pi define the probabilities for the sorter's random process. For a given content unit, the sorter is assumed to recognize the latent category of the content unit and then to assign it randomly to one of the manifest categories according to the probabilities given in the row of Pi corresponding to the latent category of which the content unit is a member. The assignment of content units is assumed to be made independently.

It is difficult to put a substantive interpretation on the matrices. However, another matrix is definable from the matrices; it is called Ω (Omega).

Ω = the confusion matrix

Omega is formally defined as the average over sorters of ¶¶'. It has as many rows and columns as there are latent categories. It is symmetric; each number above the diagonal is equal to the corresponding number below the main diagonal. It can be shown that a number in Omega which corresponds to a pair of latent categories, is the probability, averaged over sorters, of the latent categories being merged. More exactly, it is the probability that any particular pair of content units from the latent category will be put in the same manifest category. These probabilities are called the confusion probabilities.

The probability transformations in the model are features which correspond in two ways to features in the psychological mode. First, the notion that a content unit ultimately belongs to a latent category, that a sorter recognizes that fact and then assigns the item according to his particular probabalistic warp of the latent category, corresponds to the psychological notion that a sorter forms a percept of a content unit in a generally similar manner to the other sorters, and then behaves according to the percept identification. Second, the notion of confusion corresponds to individual perceptual differences in the psychology. There are many perceptual reasons for a sorter's tending to confuse or merge two latent categories. There might be experimental error; perhaps some sorters understood the instructions differently and formed oversimplified categories. There might be experimental differences; a primary teacher does not need all the discriminations an intermediate teacher does, and vice versa. The term "confusion" is not intended to be pejorative, but rather to indicate individual differences with respect to group norms.

LPA Computations

The input to the LPA computations is an S matrix derived from the results of a sorting experiment. The objective is to estimate the latent partition parameters: the number of latent categories, Phi, and Omega. The details of the computations are presented in Appendix G, but the following notes give a general outline.[1]

Fundamental theorem. In Appendix G it is proved that under the assumptions of the LPA model

$$S - \Delta^2 = \Phi\Omega\Phi'$$

where Δ^2 is an unknown diagonal matrix called the diversity matrix. This theorem is true only in expectation but by the law of large numbers is assumed to be approximately true with real data.

Estimation of the number of latent categories. The number, L, of latent categories is estimated as the number of roots of S which are greater than 1.0.

Estimation of the diversity matrix. The diversity matrix is estimated by an iterative procedure in which the initial estimate is

[1]In the text of the report, no rotational differentiation is made between parameters and estimates.

equal to the complement of the diagonal matrix of the highest off-diagonal entries in S and in which the successive approximations are derived by reproducing $S - \hat{\Delta}^2$ with its L largest roots and vectors and extracting the complement of the diagonal.

Factorization. Given the final estimate of the diversity matrix, a eigenroot and vector decomposition is performed:

$$S - \Delta^2 = \Gamma\Lambda^2\Gamma',$$

where the columns of Γ are eigenvectors and the diagonal entries of the diagonal matrix Λ^2 are eigenroots.

Rotation. The first L columns of Γ are rotated by raw transvarimax rotation yielding $\Gamma\Theta$. The diagonal matrix Ψ is computed as the column sums of $\Gamma\Theta$, and the final estimates for interpretation are:

$$\Phi = \Gamma\Theta\Psi \text{ and } \Omega = \Psi^{-1}\Theta'\Lambda^2\Theta\Psi^{-1}.$$