Section VII

CULTURE, EDUCATION, AND COMMUNICATIONS THEORY

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Introduction

The present paper is an effort to develop a frame of reference suited to the study of education as a social process. When one confronts the avalanche of stimuli that strikes the child as he struggles up the Himalayas of classroom learning experience, one becomes aware that the aids that have been developed in the laboratories of learning theory require supplements that might ease the transition from the relatively simple choices of preliminary experiments to the relatively complex ones of the classroom. This is not to say that learning theory as developed by Thorndike, Hull, Tolman, Skinner, Miller, Dollard, and others may not be applicable in some respects to classroom learning. Rather the point is that a conceptual scheme must be found for the social transactions of learning also. I have tried therefore to make suggestions, some of them drawn *as metaphors* from communications theory, about what such theoretical supplements might be.

I said that I have found the frame of reference of communications theory suggestive, and useful in a metaphorical sense, in attempting to understand learning in social situations. When I say "metaphorical sense," I mean that it is helpful to me to think about social events in terms of communications theory, bearing in mind always that society is not an energy system like a working telegraph line or an electronic computer. As long as we remember this, we avoid the errors of those social thinkers who imagined they could apply literally the laws of mechanics or physiology to society.

With these reservations in mind, I have attempted an examination, partly within the framework of communications theory, of the storage of information in social systems.

Although in communications theory information is a mathematical measure of order (Wiener, 1950, p. 18),[1] it does not do too much damage

[1] I believe that the idea of attempting to apply communications theory to the analysis of classroom transactions came to me because of the discussions between myself and the other members of the Committee for a Unified Theory of Human

to that definition to use the word here to mean *that which is learned*;[2] for in society one important goal (though not always a consequence) of learning is the maintenance of social order (level of organization). In this paper I shall be concerned only with the *process* of storage of information in social systems, and not with content; nor will there be space for discussion of the important problem of the efficiency of the process. What I have to say derives in considerable part from observations made by my graduate students and me in elementary school classrooms in the United States in 1954. The conceptual scheme, therefore, while inspired in part by communications theory, is also empirically derived.

As a final note to this introduction, I would like to add that while the data used here place teachers in an inglorious light at times, I intend no fundamental criticism of teachers. I am a teacher myself, and though I am aware of many of our shortcomings, I am conscious also of the degree to which our profession has become the scapegoat of those who would place the blame for our contemporary desperation on teachers. Teachers, parents, and children can rarely be better than the total social system of which they are part.

A Note on Dichotomies[3]

In the following sections I set up a number of dichotomous categories, and since American scientific culture hates dichotomies, I do not imagine that mine will fare any better than anybody else's unless I point out that mine are formal models (Rosenbleuth and Wiener, 1945) which seem useful as organizing points for a great deal of previously unorganized empirical material. Thus I do not assume that my models cover all possibilities or are even found in the "pure" state in the data. In discussing their own work, Rosenbleuth, Wiener, and Bigelow (1943) point out that

> It is apparent that each of the dichotomies established singles out arbitrarily one feature, deemed interesting, leaving an amorphous remainder: the nonclass. It is also apparent that the criteria for the several dichotomies are heterogeneous. It is obvious, therefore, that many lines of classification are available, which are independent of that developed above.

These remarks apply, without alteration, to the present paper.

Nature of general problems in the behavioral sciences. Naturally Wiener's (1948, 1950) books have been especially provocative; but in addition Deutsch's (1951, 1951, and 1952) attempts to extend communications theory to the social sciences have been very stimulating to me. A valuable summary of communications theory is contained in Cherry's (1952) paper.

[2] Thus I am not concerned with the intake of isolated "facts" like the date of the discovery of America, or the Australian word for puddle, but with the general problem of those configurations of knowledge and/or awareness that form the basis for human social life.

[3] This note is written because Dr. Coladarci, in discussing my original paper, observed that I seemed to have set up a dichotomous world that did not account for the facts.

Some Principles of Process[4]

Target-seeking and diffuse learning.—Target-seeking learning is the expression I use for learning in which the child is taught to seek directly a human "target," which will deliver negative feedback. Here the child seeks out a teacher (as a parent, or the teacher in a classroom) who will correct errors or give goal-correcting signals. Diffuse-learning occurs where emphasis is not placed on the single target that constantly reflects corrective signals, but where, rather, *many* individuals correct behavior, and where the correction is frequently not sought directly. In target-seeking learning the individual is imagined to have, already built into him, a magnetic compass which automatically responds to the external magnetism of a single correcting source; in diffuse learning the individual is conceived of as wandering about in a random way, but pushed in the correct direction eventually by many impulses which he elicits by accidental "bumping." Target-seeking learning, so it seems to me, is so well known from our own culture as to be self-evident without examples. Since diffuse learning is not, perhaps, so well understood, I give below some examples from observations of the Pilagá Indians of Argentina.[5]

Darotoyi (male, probably in fifth year of life) is screaming because of a quarrel with an age-mate, Yorodaikolik. Adults in the village (not his parents, for they are not present) call out to Darotoyi, "Make your revenge." Yorodaikolik picks up two sticks and swings them at Darotoyi in a threatening way. Then Darotoyi is told by the adults to go home, and does so.

When Matakaná (female, probably in fourth year of life) is about to eat pig meat, two little boys yell at her, "It will bewitch you!"

A small boy is shooting at birds with a pellet-bow, and the men and boys around call directions.

Ethnologists give Deniki (male, in the second year of life) a small piece of biscuit. He immediately turns away from our tent and goes toward his house, where his mother and three adult female housemates (Nenarachi, Nagete, Araná) are sitting outside. As soon as he gets there . . . Nenarachi says, "Give me some!" and Nagete says, "Give some to me your grandmother, give some to grandmother!" Araná also holds out her extended hand. Deniki gives nothing to anybody. Then his brother Yorodaikolik (male, probably in fifth year of life) . . . comes to our door with Deniki and says, pointing to Deniki, "He's a stingy fellow."

One of the disadvantages in permitting many individuals to give signals is the confusion that may arise. The following is another sequence of diffuse learning events in which Deniki took part:

He goes toward Nenarachi. She shakes her fist at him. He smiles and moves away toward her husband. Then back to Nenarachi. She pulls him over on her lap in nursing position (her breasts are dry) and he reaches for her breast. "It is torn," she says, referring to her blouse. He reaches again, and she sets him on his feet. Deniki is on his way back to his mother, when she asks Nenarachi for a pin. Nenarachi calls him, but he keeps on toward his mother. Then his mother sends him to Nenarachi, and Piyarasaina (ancient female housemate) turns him around by hand, he goes, gets pin, takes it to mother, who uses it to extract thorn from his foot. . . .

[4] In this connection—different learning techniques used in different cultures—see Bateson (1947).

[5] The writer and his wife lived with these Indians for a year. See J. Henry (1949 and 1951); J. and Z. Henry (1944); Schachtel and Henry (1942). All verbalizations were recorded in the native language, which was spoken by the ethnologists.

Situations such as these, in which the child is expected to be sensitive to signals from many sources at once, probably call for a different kind of alertness from those in which there is only one source of signals. Diffuse learning calls for a multiple awareness—an awareness on several levels at once—probably with a corresponding easy breaking of contact; target-seeking learning seems to require "single-mindedness," "concentration," and *high contact intensity*. People exposed to much tarket-seeking learning are good concentrators but may find rapid shifts of attention difficult.[6]

It is likely that both target-seeking and diffuse learning occur in all human societies; but it seems also that one method or the other is emphasized more in one society than in another. It is likely also that one or the other process is used in different degrees at different age levels and in different contexts. For example, on the one hand Dorothy Eggan (1953, pp. 283, 285) says of the Hopi:

From birth, a child in this extended family normally slept in a room with . . . his mother, father, mother's mother, father, or siblings. . . . All of these individuals . . . indulged, cared for, and disciplined him as he became older and required it, although he perhaps had most to fear in this regard from his mother's brothers.

Not only were there often several mother's brothers who divided the responsibility for the child's discipline somewhat, but in any case one of these was never the sole disciplinarian. . . . All persons . . . agreed that ceremonial parents, adopted relatives and paternal uncles, could and did scold them severely upon occasion. . . .

On the other hand F. Eggan (1950, pp. 31–32) says of Hopi fathers and sons:

. . . he [the father] is mainly responsible for preparing them to make a living. He teaches them to farm and herd sheep. . . . The position of father in relationship to his son is something like that of an older comrade and teacher. . . . The "ceremonial father" has the special duty of seeing his "son" through the various initiations. . . .

Thus it would appear that for different functions and at different times in the child's life among the Hopi, different methods of teaching are used. Specifically, in the case of four kinds of knowledge—values, interpersonal relations, subsistence techniques, ceremonial—the learning process and

[6] A comparison of these remarks with Riesman's (1950) statement of the difference between the *tradition-directed* and the *other-directed* shows areas of overlap and also subtle difference.

the person or group of persons who teach are different. Thus the first two categories are taught by a broad group of blood and ceremonial kin, and the process is diffuse learning. The third and fourth categories are taught by blood and ceremonial parents and the process is target-seeking. Hence what is learned, who teaches it, and the process employed are related to the underlying socioeconomic and ceremonial structure of Hopi culture. Meanwhile we may note that the Pilagá and Hopi observations of many people teaching the same child at the same time would be difficult to duplicate in our own culture. As a matter of fact, the effort by several adults to teach a child at the same time often creates tension in the group in our culture, and under such circumstances, "One at a time—he'll get confused," is quickly heard. Since traditional China and the United States seem to be cultures in which target-seeking learning is closely related to a compact nuclear family organization, while diffuse learning is related to cultures where the family organization is broader—where responsibility and authority are distributed among a relatively extensive group—these two models are seen to be associated with types of societies with different steady-state processes, and different internal boundary configurations.

Another consideration important to the difference between target-seeking and other types of learning is whether the culture's goals are in the past or in the future. Where, as in China, for example, or among American "upper-uppers," the culture is thought of as anchored in the past, then feedback is constantly available to enable individuals to steer their course, for all one needs to do to find one's bearings is to refer to past models. For instance, Chiang Yee tells us in his *A Chinese Childhood* (1952, pp. 11, 13) how, in the presence of the clan books, his father would talk about the family ancestors of two thousand years ago, and once pointed out

> . . . how one of the fifty-first generation who did not follow the family rule as laid down by the first ancestor brought the family into disgrace. He was the youngest son, and being neglected, was always getting into difficulties.

In such situations there is no question of what to do about what: if the family history is contained in books that go back two thousand years, a precedent can always be found, somebody always has the answer, and target-seeking learning is feasible. On the other hand, where, as in our culture, goals are in the future and often not known, target-seeking becomes an increasingly difficult kind of learning to institutionalize, because nobody knows where the target should be anchored or, if it is moving, what its locus is. Hence, for a culture like the American ever since the settlement, it has become increasingly difficult to adhere to the more ancient forms of target-seeking learning. Thus boundaries are important determinants of the kinds of storage processes that are used: China's traditional culture has been bounded by a clearly defined past, so that targets—such as tutors, parents, and grandparents—could serve as excellent teachers of all things; but in contemporary America nobody knows where the boundaries are, so that children who begin by scoffing at their parents end by ridiculing their teachers.

Additive and spiraling learning.—Spiraling learning is said to occur when to the teacher's out-put the student is expected to respond with one that touches off a new response in the teacher, which in turn leads often to more information being forthcoming from the student, which then triggers another response in the teacher, and so on. The ultimate expression of this is the Socratic method, which fixes no limit to the discussion, but which theoretically can lead anywhere. Additive learning, on the other hand, occurs when the teacher simply adds one bit of information to another. An important difference between spiraling and additive learning is that the former requires spontaneous expansion of or response to an idea by the learner, while in additive learning this is generally not required. The following example of spiraling learning is taken from the protocol of an observation in a second-grade classroom:

Teacher: What would you think would be one of the *first things* to do for our play?
Students: Get scenery and conversation. Get kids who can memorize it. Tell the name and speak with expression.
Teacher nods head and replies affirmatively to each answer.
Teacher: But what is *the most important thing*?
Student: The characters.
Teacher: Name them.
Students: Billy Goat, Gray Pony, Red Cow, Calf, Jolly Pig, Mrs. Pig.
Teacher: What else?
Student: Scenery.
Teacher: Have you ever been in a play?
Student: No, but I've seen one.
Teacher: He's *using his head*; he's got *ideas*. Now what kind of scenery do we need?
Student: Apple tree, pies, house, sky, fence, ground.
Teacher: Would you have the outside and the inside of the house in one part? What do you call it when you divide a play?

It will be observed that even in this relatively simple situation, response to and elaboration of certain ideas take place. For example, in the teacher's requirement that the children state "first things" and "the most important thing" there is the cultural emphasis on hierarchy and order. The idea of order and arrangement is also carried through in the teacher's question about how the stage and the play are to be divided. She seems to be emphasizing the motto, "Each thing in its proper place." Thus, while superficially this protocol might seem to be an account of adding facts, important reasoning processes are taking place too.

The following examples of additive learning in China are among the "purest" examples I could find in a culture other than our own.

If the boys are beginners, they are brought up in a line before the desk, holding San-tsz' King, or "Trimetrical Classic," in their hands, and taught to read off the first lines after the teacher until they can repeat them without help. He calls off the first four lines as follows:

Jin chi tsu, sing pun shen;
Sing siang kin, sih siang yuen;

when his pupils simultaneously cry out:

Jin chi tsu, sing pun shen;
Sing siang kin, sih siang yuen.

Mispronunciations are corrected until each child can read the lesson accurately; they are then sent to their seats to commit the sounds to memory (Williams, 1883, Vol. I, pp. 526–27). Lessons of this sort are not accompanied by discussion of meaning, but all that is required is that the material be committed to memory.

No effort is made to facilitate the acquisition of the characters by the boys in school by arranging them according to their component parts; they are learned one by one, as boys are taught the names and appearance of minerals in a cabinet [p. 541].

Another example is Chiang Yee's description of how he learned to paint:

I do not remember that I ever had any proper lessons in painting from my father. He told me to watch him as closely as possible. I was allowed to try to paint what I liked and never given a subject or told which stroke to begin with for a bird or flower. I remember that after watching my father painting a few times I thought I knew just how to paint, but when I actually began I found I was mistaken. . . . I asked father to help, but he only smiled and told me to watch him again. He never pointed out where I was wrong and until I was about twelve did not attempt to correct my efforts. But from then on, when I produced something for him to see, he told me which part I must watch still more carefully [p. 58].

While all cultures employ additive learning, it is not yet clear that all use the spiraling type. Here a reasonable hypothesis is that the additive type is related to cultures that emphasize stability, while spiraling is related to cultures in a process of rapid autogenous change. Traditional China was a culture in which additive learning was emphasized in order to form a rigid, durable system. In China education was aimed at keeping information at the same level. In contemporary American culture a typical classroom routine is the brief informal discussion, in which the teacher, starting from the child's personal experience, so structures the interchange between himself and the child that he and the child mutually stimulate each other to higher and higher levels of awareness. But American culture is rapidly changing, particularly in the fields of aesthetics and pure science. American culture uses the additive type of storage too, but in terms of all existing accounts of Chinese education the latter did not use the spiraling type. Our storage processes generate a constantly increasing supply of information. *The storage process itself is such as to make of the information stored a source of new inquiry.* In this way the character of the in-put process determines in part whether the stored content shall remain stable or change by new increments.

The problem of out-put implicit in in-put.—In human learning it is generally assumed that the person's out-put is implicit in his in-put. Thus when a child is taught to spell cat *c-a-t* it is implied that the child, having learned that cat is *c-a-t*, will soon be able to reproduce the correct spelling. This is true of all formal school learning, and much of it is of this *simple, uninterpreted* learning. Another kind of storage in which out-put is implied in in-put is that in which the child, on a given signal like "Readers," uttered by the teacher, is supposed to perform a specific act, such as distributing the reading books to the other children in the class. Here the out-put, what the child does, is not the same as the in-put, but rather the signal calls forth a consequence which has been previously learned. I call this *simple consequent* learning. However, when a fourth-grade American child reads *The Wizard of Villeville* (Gray, 1947) and is asked to tell how one "wins people," he is presumably putting together complex past experiences into an interpretive system expressive of himself. This is therefore *complex interpretive expressive* learning.

The Wizard of Villeville is a story of a wizard who transforms himself into a rabbit and confers magical powers on Auntie Grumble, an old woman and the most unpleasant person in Villeville. Through the events brought about by these powers Auntie Grumble ceases to be "unhappy" and a "most unpleasant person." The following from a lesson on *The Wizard of Villeville* illustrates the problem of *complex interpretive expressive* learning, and also the process of *spiraling*:

Teacher (to class): Why wasn't Auntie Grumble happy?
Pupil: Because she was grumbly and grouchy. People avoided her.
Pupil: She was mean.
Teacher: How did she win the people?
Pupil: She was happy.
Teacher: What did she do?
Pupil: She danced and laughed.
Teacher (to all the children): Be Auntie Grumble. You know what a pantomime is—you've seen it on TV?
Children indicate they know what a pantomime is.
Teacher: Do a pantomime to show how she is going to be happy after being grumbly.
Children put on long faces, and then gradually change to a smile, and bounce around in their seats.

Cultures vary in the degree to which they emphasize one or the other of these forms of storage processes. In the last case the degree to which the child is really expressing himself rather than a generalized "other" is a problem related to the storage process also. For it is evident that in the American classroom the degree to which one is expected to or permitted to express one's self is strictly limited. When we reach the fourth grade, *complex interpretive expressive* learning is already the product of simpler forms of learning, whereby the child learns what his "self" has got to be in order that he may get along in society.

Since this example illustrates spiraling learning also, we ought to have a brief look at it from that point of view. In spiraling learning the question arises, *Where shall the "cut-off point" be?* That is to say, where

shall the teacher stop asking questions, and when shall he cut off the students' questions? For example, in the present case the teacher could have asked, "What do you suppose makes people unhappy?" "What is happiness?" "Is happiness the best thing in the world?" "What does one mean by 'winning' people; and is this the finest thing in life?" Socrates was forced to drink hemlock for asking such questions, and thus we conclude that *spiraling learning is the most explosive form of education.* For not only may some teachers fail, as did Socrates, to set any cut-off point, but also the spiraling process may be internalized, so that the child begins to play question-and-answer with *himself.* Such "play," if engaged in by many people, can be threatening to the status quo. On the other hand what one observes in classrooms in our own educational system is that teachers—university as well as kindergarten—have *internalized the acceptable cut-off points*; for they know when to stop asking questions, and when to give no response to the questions asked them. Thus an interesting problem for students of education in all cultures is to discover where the cut-off points are in question-answer interchange.

Mono- and polyphasic learning.—Monophasic learning is the hypothetical case in which an organism learns one thing at a time. Possibly such learning occurs only in machines. In human beings, so it seems to me, the class of events in which only one thing is learned at a time would seem to have no members, but it is often helpful to imagine such a class, especially in connection with the human inability to learn only one thing at a time. On the other hand, just because human beings cannot learn only one thing at a time it does not follow that efforts have not been made to teach them as if they could. Let us look again at some examples. The first is from Williams' account of learning the characters of the Chinese language in traditional China (1888, Vol. I, p. 543). The first step involved simply committing to memory the characters themselves:

> The tedium of memorizing these unmeaning sounds is relieved by writing the characters on thin paper placed over copy slips. The writing and reading lessons are the same, and both are continued for a year or two until the forms and sounds of a few thousand characters are made familiar, but no particular effort is made to teach their meanings. . . . It is not usual for the beginner to attend much to the meaning of what he is learning to read and write, and *where the labor of committing arbitrary characters is so great and irksome, experience has probably shown that it is not wise to attempt too many things at once.* No effort is made to facilitate the acquisition of the characters by the boys in school by arranging them according to their component parts; they are learned one by one. . . . [Italics supplied.]

Obviously this is not "pure" monophasic learning, for the children are not only being taught to recognize the characters by their shape; they are also being taught to associate specific sounds to them, and how to write them. However, the focus is on the single goal—the characters—detached from meaning or from any connection with the complexities of religion, the economic system, geography, etc. We shall presently see how different this is from polyphasic learning in a contemporary American

classroom. Meanwhile let us look at a fourth-grade class being taught fractions in an American school:

> Teacher goes to board: What is a fraction?
> Tom: A piece of something.
> Teacher sends Jim to board to draw "a piece of something."
> Hands are up now.
> Bill: A clock has sixty seconds.
> Teacher: Each minute is what part of the whole clock?
> Bill got confused here, apparently trying to divide a five-minute period into intervals.
> Teacher: Can you help him? What part?
> Child: One-sixtieth.
> Bill explains his dilemma.
> Teacher: Count them, honey.
> Bill counts, and finds what part of an hour five minutes is.
> Jim is drawing a rectangle at the board.
> Teacher: Are other fractions possible?
> Linda: The window [i.e., one of the window panes].
> Teacher: Point out part of the window. . . . Let us see what Jim has for us. What is it, Jimmie?
> Jim: It's a cake. [He has drawn a rectangle divided into four parts.]
> Teacher: What do we do to change 3/4 to 6/8? Who remembers that? Good, which is which, James? The numerator is on the top. The denominator is on the bottom, which is the name of the fraction. (Teacher is at the board.) In adding and subtracting fractions forget it is a number. If it is apples or peaches or pears, you add them the same way. (She points to fraction on the board.) Can anyone see how you add them? You don't add the denominators, because that is the name of the fraction. How would we add chairs, chairs, chairs? So you wouldn't change them at all. I am going to let you copy the problem and add them. The denominators are going to be the same. That's another thing I'm going to help you with. Joey said the first fraction is 5/5. Is that right? It is one whole, and we are going to write it "5/5 or 1." Albert, what would make the denominator different?

Here again, though the children are being taught a number of extraneous matters, like mutual helpfulness ("Can you help him?"), and that the teacher likes some of the children ("Count them, *honey*"), the class is concentrating exclusively on trying to learn fractions.

Polyphasic learning is the process of learning more than one thing at a time. Normal human beings cannot learn only one thing at a time; rather they learn a pattern. This capacity to learn more than one thing at a time—to receive complex in-puts—is exploited in different ways by different cultures, and in different ways in various periods in our own culture. The present tendency in elementary school education is to *exploit consciously such polyphasic learning capacities.* In simple societies the storage processes often handle but very little information at a time; and even when information is relatively complex, the in-put process is not specifically developed with this complexity in the minds of the teachers. That is to say, for example, that while food-sharing among the Pilagá

Indians ends up being not only the process of giving away one's food, but also a way of operating a scale of social distance, food-sharing *as information* is not consciously taught as a social distance scale. It is the difference between saying, "Give food to people," and saying, "Give food to your first cousins through your mother." In the first instance the individual simply learns that he has to share food, in the second he is required to master a social system in connection with the giving of food. It is the second instance that is polyphasic in *intent.*

The present tendency in elementary school education in the United States is to exploit polyphasic learning capacities consciously. Thus a painting lesson becomes not only one in art, embodying the use of colors and brushes, learning the names of colors and how to mix them, and so on, but also a lesson in geography and human relations. A painting of the Sahara Desert becomes a vehicle through which to communicate information about Africa, Arabs, and the Mohammedan religion *all at the same time.*

The following extract from a protocol of observations in a fifth-grade classroom will further illustrate the point:

Teacher: What does art do for us?
Student: It cheers us up.
Teacher: It cheers us up. Yes, beautiful things will cheer you up when you're feeling bad. What else does it do?
Student: It expresses yourself—I mean it's not just copied.
Teacher: What does it express about yourself?
Student: How you feel.
Students go on to say that a happy artist draws bright colors, and unhappy artists use dark colors or gray. Teacher points out exceptions: when the artist is producing a scene in which the subject is dark or gray. She says, "If a person is not disturbed, mentally or nervously, he tends to like bright colors, doesn't he?" Teacher announces she is going to play records which a student has brought, and the class is to listen to them, get the feel and the rhythm—whether it is active, soft, soothing, or what—and then express themselves in a picture. She says, "You know, the more intriguing your picture is the more valuable it is. You may have a five hundred dollar picture when you get through." (Both sides of the record are waltzes.)
Teacher stops the record, says, "Some of you are drawing before you feel the rhythm. You are bound to have a picture in your mind, but I'll make a bargain with you. Listen to the rhythm of the music, and then just cut loose and express yourself this time, and we'll draw the old-fashioned way another day this week." Teacher stops the music and says, "If you were in New York in an art class, you'd be paying ten dollars for this lesson, and if you talked, out you'd go. It's selfish to disturb your neighbor—now just be quiet." Plays more music.

From this example we see that what is ostensibly an art lesson is exploited, as a polyphasic learning experience, for the purpose of attempting to teach, among other things, the following: (1) The immorality and even disease of being unhappy. (2) Notions of economic life and the market. (3) The myth of the pot of gold at the end of the rainbow ("You may have a five hundred dollar picture when you get through"). (4) The importance of "cutting loose," but under the proper circumstances. (5) The relationship (?) between music and painting on the one hand, and "self-expression" on the other. We observe also efforts to control children's spontaneous expressiveness (dark colors should not be used); and above all, we can see that this art lesson is used to maintain level or organization in the American culture as a whole.

Since here, as in most of the procedures in these classes, spiraling methods are used, the reader should note the cut-off point. There is, for example, no inquiry about what "disturbed mentally or nervously" means; yet the child with a desire to use dark colors may be left feeling he is quite loathsome because of his wish to use them. For a truly sharp contrast between this painting lesson, as a polyphasic learning experience, and what is almost its opposite, the reader may refer back to the painting lesson described by Chiang Yee.

When polyphasic learning is utilized as a *conscious* storage process, two questions arise: (1) At what point does it become self-defeating because of the sheer quantity and complexity of the in-puts? (2) When information about many things is given, let us say, during an art lesson, and all the information has *equal* emphasis, how does the storage mechanism in the head operate? Possibly all a child may retain of a painting lesson may be that you are disturbed if you use dark colors.

It seems likely that monophasic and polyphasic *emphases* in education belong to different kinds of cultures. That is to say that although it seems unlikely that any culture attempts always to teach one thing at a time, some cultures will *emphasize* monophasic learning while others will emphasize polyphasic. It would seem that monophasic emphasis will be found in cultures where few and simple factors require tight, indissoluble associations. Polyphasic emphasis belongs to societies where what is required is the communication of much information which can be "moved around" inside the head with relative ease to form new combinations, where the important thing is not fixity and simplicity, but rather change and recombination. Again I would like to offer the contrast between rural China, as a culture where relatively simple and rigid combinations of information were emphasized along with monophasic processes, and contemporary Euro-American culture, as one where change and recombination are emphasized, along with polyphasic processes.

The general problem of quantity.—As cultures become more complex and increase their content, more information has to be stored in their carriers. This must be accomplished by storing more information per unit of time and by increasing the number of methods employed. For the time being we beg the important question of *efficiency* of teaching methods. Now if n stands for the number of things to be learned, t for the time spent in learning each thing, and m for the methods used in teaching (f stands for, *is a function of*), we may set up the following model:

$$n = f\left(\frac{m}{t}\right).$$

This equation suggests that as the number of things to be learned increases, the time spent on learning each thing must diminish, or more methods must be devised, or both. We can then perceive from the equation that as the number of things in a culture increases, the culture may enter a cycle from which there is no escape except by arbitrary, authoritarian fiat. Since as n increases m must also, n receives a "double" increment, for a *new method* (m) *is itself another "thing"* (n). If, for example, we add a compass (n) to a culture that never had a compass, then one not only must learn about compasses, but methods (m) must also be devised for teaching about compasses, as there were no such methods before. Thus two "things" (n) are added to the culture, not one: the material object, compass, and the method for teaching how to use it.

It is also true that as teaching methods increase in number there is always the possibility that they will trigger new perceptions which will then add to the value of n.

As for t, it is a matter of common experience to elementary school teachers that as the number of things they must teach pupils increases, the teachers must devote less and less time to each thing. In such circumstances learning *how to switch* at fifteen-minute intervals from arithmetic to writing to geography to music becomes a new skill, which is also information.

Interesting data bearing on these points are available from *Life*, May 11, 1953, where a picture story is presented of a high-school teacher of English, who

> . . . uses 102 teaching devices. His students learn spelling through a kind of baseball game, grammar through a variation on bingo [called Lingo]. He makes them keep journals . . . has them go through mock telephone conversations in class. . . . He knew all along that once he got his excited 15-year-olds "reading, reacting, recording" they could be coaxed into reading and thinking *about books they would otherwise shun.* [Italics supplied.]

Thus this story supports not only the hypothesis of the necessary increase in teaching methods when the number of things to be learned increases, but also the suggestion that there is a hidden danger in employing new teaching methods, new perceptions may be triggered, which in turn lead to new knowledge.

On May 24, 1954, *Life* published an article entitled "Why Do Students Bog Down on First R?" The article, signed by John Hersey, was a summary of the findings of the Citizens' School Study Council of Fairfield, Connecticut. It illustrates the problems teachers, pupils, and parents have in coping with time and teaching methods. Throughout the article it is clear that speed, speed, SPEED in learning is the constant lash of teachers, students, and parents:

> A basic principle of present-day public school education is that each child should be taken along at his own most suitable rate of speed in learning.
>
> Children do not progress at the same rate of speed in all subjects.

> In a public school classroom with from 25 to 40 pupils, the teacher simply does not have time to devote to special enrichment for advanced pupils; *she has a hard time getting through the basic material for all.* [Italics supplied.]
>
> The fast learners are not always the fast performers; indeed they are prominent among the dawdlers, daydreamers, and out-the-window-gazers. . . .
>
> Some educators now believe beginners could absorb as many as 200 words in the first six months provided words are used that the children want to learn.

If one were to ask, "What's the hurry?" the answer might be, "Because kids have to get on to the next thing, and the next, and the next." There are so many things to learn, and since speed itself is a cultural value, t is especially important in the equation in our culture.

The article emphasizes the pressure under which the American system places the teacher to develop her methods in order to meet the demands of cultural complexity and speed:

> On top of *all her other duties*, the teacher who tackles reading is expected to be a psychologist, a literary tourist guide, a charming storyteller, a perfect grammarian, a steady workhorse with the mass of average pupils, and one with a special knack for bringing out the best in geniuses and morons. . . . [Italics supplied.]

The relevance of this paragraph to the equation is as follows: Psychological insight into the nature of children and reading difficulties is a methodological tool (m) added to the pedagogical armamentarium of the teacher in order to reduce the amount of time (t) needed to teach the child to read (n) and to reduce the number of so-called reading failures. A "literary tourist guide" is also a useful instrument (m) in awakening interest in reading in children. And so it goes. The reason the teacher has to be all the things mentioned is that they all are expected to add to her methodological competence. The article continues:

> What does the teacher do in the face of such demands? She does what one of the teachers we visited does. "I like the manual," she says. "If you follow that you can't go far wrong."
>
> But what does the manual urge? It urges a *multiplicity of techniques and procedures* that simply cannot be followed. The reading-readiness manual used by our teachers urges the keeping of a notebook containing a continuing checklist of the readiness of individual pupils. The checklist contains 52 items. A teacher who has 30 children in her class is therefore expected to keep running track of 1,560 items. . . . In higher grades the manual divides teaching instructions for every single lesson into the following sections . . . [The names of eight different sections are given. Italics supplied.]

While this article makes clear the close interrelation between the *number* of things to be learned, the *time* available for each thing, and the number of *methods* used, it suggests some further considerations. For example, when the aim is shifted from teaching a *mass* to giving attention to the *individual* child, then new methods have to be developed for getting at the idiosyncrasies of the individual child. This means in turn cutting

down on the time available for other *subjects*. When attention to the *individual* goes hand in hand with a vast increase in the learning *population*, then new methods must be developed for getting at the individual child in *less time*, for the population of individual children is so much larger. Emphasis on the individual child, of course, goes hand in hand with individuality as a value. If the feeling in our culture or the structure of the economic system was such that large numbers of reading failures were of no consequence, the development of special methods for teaching reading to "geniuses" or "morons" would be a relatively minor source of concern. Thus the values placed on time and individuality are parameters that must be made explicit.

It has been pointed out to me, especially by Professor Coladarci, that there is no strict relationship between n and other elements in the equation, because so often related things are taught together. I believe, however, that the emphasis on polyphasic learning in our culture, in which the effort is made to teach several things at once, is related to the large number of things that have to be taught and the small amount of time there is to teach each thing.

Inadequacy of the mechanism.—In elementary school classrooms in our culture we have regularly observed that the child is given a problem that is beyond his *immediate* capacity to solve.[7] In engineering terms, the storage mechanism is not equipped with the parts adequate to the immediate storing job—something all good engineers avoid as a matter of course, for they know the capacity of the machine and they do not give it jobs to do for which it is unsuited. Furthermore, if they are careless the machine will break and be out of order for a long time. In the classroom, however, there often seem to be three assumptions at work: (1) that the machine, the child, cannot break; (2) that it is spontaneously flexible and will instantaneously adapt to the new storage operation; (3) that it can perform the operation. These assumptions are most obvious when the class is midway in the course of any new learning. Thus a child is sent to the board to subtract $\frac{2}{3}$ from $\frac{2}{3}$. In this case all the assumptions may be wrong in the case of a particular child, and the machine stops as visibly as a typewriter when several keys are pressed at once. Let us watch it happen in the fifth grade:

> The child at the board stares at 2/3 minus 2/3. There is a faint titter, snicker, giggle or something (observer could not quite identify the feeling) as child stares, non-plussed by the problem. Teacher goes up to her and demonstrates with measuring cup: "If we have 2/3 cup here, and we pour it out, what is left?" Child remains baffled, and teacher says it again, seeming to try to force her presentation of the problem on the child in such a way as to cut out the distracting influence of the class, which is eager to be helpful. Child finally says, "Nothing," and teacher says, *"That's right."*

It can be seen here that not only is the machine jammed, but that the

[7] Ruth Benedict (1953) has discussed this and compared our culture with some primitive ones where the child is always given tasks nicely suited to his capacities.

culture is intolerant of jammed machines: the snickers of the children are an expression of the wish to kick and shake the machine in which the nickel has got stuck!

On the other hand, it should be borne in mind that the need to exploit to the maximum the organism's capacity for spontaneous expansion is a requirement of an expanding culture: though the process of putting the machine in jeopardy is dangerous to some, it is a steady-state requirement of one part of our culture. That such exploitation ultimately results in an over-all steady state is an open question. Meanwhile it is to be observed that *the capacity to rise spontaneously to the management of a new problem is again a capacity to be learned.* This underscores the circular character of the equation of which I spoke earlier.

It is to be noted that in the process of pushing some organisms toward new capacities we damage others. This makes us aware of the close relationship between social processes and human evolution, for those organisms that can accept the pushing, flow with the tide of evolution as it is at the moment, while those that are "jammed" by a fifth-grade failure may be forced to leave the field.

Noise.—In communications theory "noise" refers to the uncontrollable random fluctuations of the apparatus (von Neumann, 1951). Such things as the hum in a telephone line or radio receiver are noise, because such sounds have no relation to the actual message that is being transmitted. We thus deal with two problems: *lack of relationship* of noise to message, and *uncontrollability.* In discussing this paper Dr. L. K. Frank suggested that noise ought to be handled as I have handled other concepts from communications theory. This suggestion, taken together with Dr. Coladarci's that some account ought to be taken of the relationship between intended and actual learning, which is really the same as noise in many instances, makes it imperative that a section of this paper be devoted to the problem of the stimuli that impinge upon children from *areas of awareness not strictly related to the explicit lesson at the moment.* It can be shown, I believe, that from a psychological point of view the problem of noise is really *the* classroom problem in our culture, for the unintended learnings that children pick up, almost as a radio picks up static from the atmosphere, are very numerous, exceedingly subtle, and almost uncontrollable. Let us look at a game of "spelling baseball" in a fourth-grade class:

> Children form a line along the back of the room. There is to be "spelling baseball," and they have lined up to be chosen. There is much noise, but teacher quiets them. Teacher has selected one boy and one girl and sent them to front of room to choose their sides. As the boy and girl pick children to form their teams, each child chosen takes a seat in orderly succession around the room. Apparently they know the game well. . . . Now Tom, who has not yet been chosen, tries to call attention to himself, in order to be chosen. Dick shifts his position more in direct line of vision of the choosers so that he may be chosen. Jane, Tom and Dick, and one girl whose name Observer does not know, are the last to be chosen. . . . Teacher now has to remind choosers that Dick and Jane have not been chosen. . . . Teacher gives out words for children

to spell, and they write them on the board. (Each word is a "pitched ball," and each correctly spelled word is a "base hit." The children move from "base to base" as their teammates spell the words correctly.) With some of the words the teacher gives a little phrase: "Tongue—watch your tongue; don't let it say things that aren't kind; butcher—the butcher is a good friend to have; dozen—12 of many things—knee—get down on your knee; pocket—keep your hands out of your pocket, and anybody else's. No talking!" Teacher says, "Three outs," and children say, "Oh, oh!" . . . "Outs" seem to increase in frequency as each side gets near the children chosen last. . . . Children have great difficulty spelling August. As children make mistakes those in seats say, "No." Teacher says, "Man on third." As child at board stops and thinks, teacher says, "There's a time limit; you can't take too long, honey." At last, after many children fail on August, a child gets it right, and returns grinning with pleasure to her seat . . . (Observer notes: Motivational level in this game seems terrific. They all seem to watch the board, know what's right or wrong, and seem quite keyed up. No lagging in moving from base to base.) . . . Child who is now writing Thursday stops to think after first letter, and children snicker. Stops after another letter. More snickers. Gets word wrong. . . . (Frequent signs of joy from the children when their side is right.)

Here learning how to spell is made part of a competitive game in an effort to eliminate "boredom." However, what happens here, as may happen in the use of *mechanical* filters, is that one noise is substituted for another; while boredom drops out, *competitiveness* is *reinforced*. Another important noise is the desperation of the children who are chosen last—they learn they are cultural rejects; and their low valuation by the group is excruciatingly obvious, for the teacher even has to remind the choosers that these children have not been picked. Additional noise is provided by some of the teacher's short phrases: "watch your tongue," "get down on your knee," "keep your hand out of your pocket, and anybody else's," are suggestive. The child may learn from these phrases that the teacher thinks that people should sometimes get down on their knees; he may wonder why he should keep his hands out of his own pockets, and be frightened that the teacher should suspect that he wants to put his hands in other people's. He learns also, perhaps, that the teacher stands for morality. Finally the children themselves introduce noise into the system by snickering at comrades who find the tasks beyond their capacity. In all this the child is on public view; all the children in the class see that he is or is not chosen and when; that he spells correctly and quickly or that he is slow or fails. He *learns a conception of himself* in which failure and success, being chosen or rejected, being fast or slow, weigh heavily. Before closing this section it will perhaps be interesting to look at a situation from traditional China. The example again comes from Chiang Yee's *A Chinese Childhood* (pp. 81–82).

Once when [my] youngest uncle had, for some reason or other, offended the tutor, "Old Beard" made him kneel down in the middle of the courtyard. . . . To make him keep his back straight a huge square inkstone full of water was placed on his head. The tutor's seat being directly opposite him, he could not move for fear of spilling the water. [He had to kneel about half an hour.] My youngest uncle bore this punishment with remarkable patience. . . . He did not seem particularly exhausted. [On being questioned by Yee about his patience and lack of exhaustion, the uncle said it was because while he was kneeling] he remembered a story he had read in some book about a well-trained wrestler, and he went on thinking of this until he forgot about himself.

Here it would appear that while the tutor, "Old Beard," was trying to teach the child to be respectful, the child was learning fortitude, or even how to be a great wrestler. Significantly the story adds that the punishment was taken as a great joke by the children.

In the metaphorical sense in which the term is used here, we can think of the educational "apparatus" as including teacher, all students, and a particular child, who, let us say, is at the board trying to spell a word, or is kneeling with an inkstone full of water on his head. We can then see that there are noises that originate *inside* an individual's head (like a phantasy of being a wrestler), and noises that originate *outside* the individual student (like the snickering of the class at his failure to spell Thursday). It is clear, then, that different problems of control (of "random fluctuations") confront us, depending on whether we are concerned with one type of noise or the other.

One more interesting comparison between machines and human beings remains. In using a machine one makes a sharp distinction between noise and message, in the sense that the noise may be ignored except in so far as efforts are made to prevent it from interfering with the clarity of the message. In human learning, however, *the noise is often learned with the message*, and it is not ignored by the person; the child learning to spell, for example, does not, in our culture, ignore the deprecating snickers of his classmates if he fails to spell a word.

I have suggested that noise, in the sense of all those unplanned learnings that take place when human beings are educated, is one of the central problems of learning in any culture. As such it requires an extended treatment, which is quite beyond the scope of this paper, although I hope to give it extended treatment in a later publication. Here I have just tried to present enough to show the character of the problem and how it might be approached.

In discussing this section with Karl Deutsch he argued as follows: It is not quite proper to call noise the things I have characterized as such in the spelling lesson. He urged that the spelling lesson is, in a certain sense, a screen for the most important learnings, which I have called noise. He urged that what the culture is most interested in, and hence the most important part of the lesson, is that children should learn how serious it is to fail, how important it is to succeed, what they must do to stop being cultural rejects, that knowledge is power, that they must develop themselves so that they can function well as a team (as in baseball), that the culture hates slow people and rewards fast ones. These are the really important lessons to be learned, for when you are adult nobody really cares whether you can spell or not, but they do care whether you know how to co-operate, whether you know how important it is to succeed, and

so on. I confess I am sympathetic to this view of Deutsch's, and his observations point up the great difficulty one runs into in transferring the frame of reference of communications theory from engineering to social science. Meanwhile let us note that this very effort has suggested some interesting cultural problems.

Conclusions

Even if we take the position of the "life adjustment" school of education, it would be difficult to show that education is anything more than the acquisition, interpretation, and integration of information. Hence the student of education cannot ignore the contribution of communications theory. But in education we also deal largely with information that is traditional and of a high level of standardization. Hence education comes within the purview also of cultural anthropology. Thus educative processes, communications theory, and culture theory ought to be brought together in a systematic way. This paper is an effort to show how this might be done, and to show also that simple, invariant categories of theoretical significance can be set up and used for the cross-cultural study of education. The equation is an effort to show how methods must change with content and how the time factor presses constantly upon us in our own culture as we increase the scope of our knowledge. While such formulations may not at present be considered laws, they are useful as heuristic devices and suggest a direction in which some laws of social learning may be sought.

Throughout the paper an effort has been made to show that what is taught, how teaching is done, and who does it to whom, are related to total sociocultural systems. A culture's values and goals, its social organization, technological developments, and the characteristics of its processes of change and stability all affect the What, the How, and the Who of teaching and learning. Even if the metaphors and their related categories could be shown not to suit the data, it seems to me that this contribution from the theoretical framework of anthropology—that educational patterns are related in complex ways to over-all cultural ones—is useful.

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