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ABSTRACT
          Papers which explore the aspects of current work in
instructional technology and promote research and development in the
field are collected in this bulletin. An introductory paper provides
some general perceptives on the current state of instructional
technology in relation to the contemporary educational scene and the
various problems and challenges for instructional media. Eight papers
enter into some of the various issues and areas involved in research
on media: interaction, cognition, aptitude, expression, perception,
and learning theories. The final papers in the volume offer a summary
and overview discussion of problems, as well as pose possibilities
for future research. (Author/JY)

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IN THIS ISSUE:

commentaries on research
in instructional media:
an examination
of conceptual schemes

BULLETIN of the
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VIEWPOINTS

BULLETIN OF THE SCHOOL OF EDUCATION
INDIANA UNIVERSITY

COMMENTARIES

ON RESEARCH

IN INSTRUCTIONAL MEDIA

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AN EXAMINATION

OF CONCEPTUAL SCHEMES

gavriel salomon   richard e. snow

guest editors

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INTRODUCTION

Papers presented here (from the first of a series of confer-
ences sponsored by the Division of Instructional Systems
Technology, School of Education, Indiana University) aim
at exploring the many areas and aspects of current work in
instructional technology, and promoting research and devel-
opment in this field. This first conference addressed re-
search on instructional media in particular but served also
to introduce general problems and issues that will un-
doubtedly be seen again in future conference reports.

The term "instructional media" has been used loosely for
decades to refer to the collection of audio-visual devices,
methods, and materials presumably of use in educational com-
munication. Programmed, and now computer-assisted, instruc-
tion has at times been included in this broad classification,
at times not. One purpose of this conference was to elabor-
ate a more detailed and well specified conception of "in-
structional media," to reach some recognition of the under-
lying commonalities and uniqueness of different instructional
methods. A consensus on some explicit definition of media
was not expected and was not sought. Rather, our hope was
and is that the general field can be charted and that the
major classes of variables and phenomena can be identified.

With such a framework in hand, a second purpose of the
conference was to survey existing approaches to research in
the field, identifying the critical features that will need
to be embodied in research programs aimed at understanding
and improving instructional media. If such features can be
defined and disseminated, future research efforts might be
guided increasingly by a common set of principles and thus
might contribute to an integrated body of knowledge. The
need for such integration has long been perhaps the most
overarching need in the instructional media field. It is
hoped that this conference, and those to come in the future,
will stimulate significant progress toward this end.

The present report is organized in three sections. First,
the paper by Allen provides some general perspectives on the
present "state of the art" in relation to the contemporary
educational scene and the various problems and challenges for
instructional media apparent therein. Second, a series of
eight papers, by Mielke, Salomon, Snow, Seibert, Eisner,
Fleming, McDonald, and Conway explore the areas and issues
involved in research on media. Finally, DeCecco, Salomon,
and Snow offer some summary and overview discussion of prob-
lems as well as pose possibilities for future research.

The editors wish here to thank the participants for their
contributions and their cooperation in this first conference,
and the administration of the Division of Instructional Sys-
tems Technology, Indiana University, for making this series
possible.

--*G.S. and R.E.S.*
Guest editors

CATEGORIES

OF INSTRUCTIONAL

MEDIA RESEARCH

william h. allen

THERE ARE MANY WAYS to categorize the research with instruc-
tional media, all of which may be valid for particular pur-
poses and several of which may be useful as maps of the ter-
ritory encompassed by such media.* The classification
scheme presented here represents one tentative attempt to
block out the structural features of media research in the
expectation that such a model may lead to a more systematic
knowledge of the field and even suggest variables for future
study. As such, it is more descriptive than prescriptive,
and is intended as an introduction to the types of problems
warranting investigation.

Traditionally, research on instructional media has

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*For the purpose of this discussion, "media" is a generic
term referring to a class of instructional resources and rep-
resenting all aspects of the mediation of instruction through
the agency of reproducible events. It includes the materials
themselves, the instruments used to deliver the materials to
learners, and the techniques or methods employed.

focused on the different classes of media. Thus there has
been a plethora of research on film, television, programmed
instruction, audio presentation, computer-assisted instruc-
tion as such to the exclusion of research on factors that
are more directly related to the learning process. It is
only within recent years that systematic attention has been
given to research on these variables, perhaps impelled by
the application of rigorous analysis of instructional objec-
tives, the nature of the content, and the techniques of ma-
terials design advocated by the behavioral psychologists,
particularly as it applied to the development of programmed
instructional materials.

This conceptualization of the more appropriate and rele-
vant research has switched attention away from the broad
class of evaluative research that is so unproductive in
terms of direct, scientific contributions or generalization
to a consideration of those individual and situational fac-
tors that may interact with media to make them more or less
effective instructional instruments. It is to the descrip-
tion of these factors that this paper is directed.

The Classification System

Factors relating to the stimulus

The first area of instructional media research deals with
the instructional material itself--the nature of the stimulus
material, its form, organization, and design. It would ap-
pear that there are at least four categories characterizing
the research into this area:

1. Characteristics of media types. Although the broad
and undifferentiated research in which one type of media
(motion pictures, programmed instruction, television) is
compared with another or with some other kind of material
presentation may be subject to criticism, it nevertheless
exists as a legitimate category for research. The criticism
of such research, as explicated by Lumsdaine (18:594-J01),
concerns the comparisons of a single instrument or class of

William H. Allen, professor of education and direc-
tor of research in the Department of Cinema at the
University of Southern California, acquired his
Ed.D. degree from the University of California, Los
Angeles. He formerly was an associate social sci-
entist and advisor on communications in the RAND
Corporation and System Development Corporation in
Santa Monica. In addition to his teaching and in-
dustrial careers, Dr. Allen has been active in pro-
fessional organizations. From 1953-69 he was editor
of A V Communication Review, the research journal of
the Department of Audio-visual Instruction (DAVI) of
the National Education Association. He was president
of DAVI in 1963-64.

instruments of certain type (e.g., motion picture) with
those of another type (e.g., conventional instruction)
wherein there is lack of specificity between the alternative
modes of instructional presentation. However, there would
appear to be justification for comparisons of different
media wherein all factors other than the unique specific
media characteristics are controlled. An example of such a
study was that reported by Gropper (14:37-69) in which pro-
grammed "visual" lessons were compared with programmed "ver-
bal" lessons in the teaching of scientific concepts and
under different conditions of student response, mode of
response, and mode of testing.

2. Characteristics of stimulus presentation forms.
Closely associated with the above category and directed to-
ward the same objective is research on different stimulus
presentation forms. The term "stimulus presentation form"
is used in the sense advanced by Tosti and Ball (24:5-25),
that is, as encoding dimensions of media that comprise a
more general class of characteristics than do the specific
media types. Tosti and Ball listed four such forms: envi-
ronmental structure (the real object), pictorial, symbolic,
and verbal. Other kinds of presentation forms are also pos-
sible: for example, realistic vs. abstract, motion vs. still
pictures, and expository vs. programmed text. The crucial
point here is that the stimulus materials have different

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characteristics which can be identified and their instruc-
tional values determined for particular instructional out-
comes. Whether the variables shown above are important or
even relevant will be determined only by future research.
There is little question, however, as to the educational
significance of further investigation of the form of presen-
tation. Little research has been conducted on such problems
although Conway's work (9:371-385, 10:403-414) and the study
by Allen and Weintraub (4) are suggestive of some research
approaches that might be undertaken.

    3. Media production variables. Research on specific
production variables has been conducted for many years, be-
ginning with the extensive Instructional Film Research Pro-
gram at Pennsylvania State University following World War II
(7, 8) the U.S. Air Force research program directed by A. A.
Lumsdaine from 1950 to 1957 (17), and the more recent large
body of research on programmed instructional variables.
This category of research encompasses a wide range of pro-
duction variables that would be built into the materials
themselves at the time they are produced. Examples of such
factors are: color vs. black and white film, visual and
auditory embellishments, camera angle, animated vs. live
photography, variations in the audio narration, attention-
gaining devices, characteristics of captions, step size,
linear vs. branching programming, and countless others.
Hoban and Van Ormer (15) reviewed research on production
variables, and two recent reviews by May (19, 20) treated
these factors in greater detail.

    4. Internal organization of media. Related to research
on the production variables and difficult to separate from
it are several broader and more prevailing factors. These
variables are concerned with the internal organization of
the media itself and include such factors as the sequencing
of instruction (6), the compression of information (25),
repetitive presentation (2:123-130), structure of the mes-
sage, and the rate of presentation. Little research is ex-
tant concerning these elements, but the need for future in-
vestigations is clearly evident.

Factors relating to student response

Even prior to the present surge of research on student response factors in programmed instruction, considerable research attention had been given to this variable. Allen (1:42-43) and Lumsdaine (18:583-682) had reviewed the literature in depth, and Lumsdaine had edited the symposium volume, *Student Response in Programmed Instruction* (1961), which contained a number of experimental studies of cue and response factors in group and individual learning from instructional media. Thus, considerable evidence has accumulated to indicate that student response or participation of some kind accompanying exposure to instructional media is one of the most prevailing contributors to increased learning. However, the precise conditions under which these responses may be optimally evoked are less clear, and continued future research is indicated. Lumsdaine's (18) review of the research literature presents a number of variables that deserve stu..,: amount of active response, time as a variable, form of overt response, overt vs. covert responding, feedback and knowledge of results, reinforcement, guidance and cuing, and prompting vs. confirmation. These factors and numerous others not stated suggest the rich research possibilities with the student response variable.

Factors related to content attributes

There are several ways to investigate those characteristics of the learning experience that we call content attributes. By "content attributes" we mean those qualities of the main substance or meaning of the corpus of the instruction. Thus, the content attributes include far more than the subject matter content of the instruction alone, but extend to those different ways of looking at the essence or purport of the teaching. Different categories of content attributes will be presented, all susceptible to research and as yet inadequately investigated.

Subject matter content. The relationship of the

different media to instruction in various subject matter
content areas (e.g., science, social studies, art, mathemat-
ics) has not been determined. Early studies have suggested
that subject matter content is not a variable when determin-
ing media effectiveness, media use being as appropriate in
one school subject as another. However, a recent study (4)
indicated that an interaction might exist between the sub-
ject matter content and the particular learning objective
being served regardless of the instructional media used.
Some attention to the subject matter being taught might be
given in future media research.

Broad instructional objectives. Increasing research
attention is being accorded to the interactions of media
with those broad educational objectives described by Bloom
and his associates (5, 16)--cognitive, affective, or per-
ceptual-motor. In recent considerations of this question
(13, 21, 11) the need for a more precise fit between the
type of media used and the objectives being served was im-
plied. There is some evidence that media may interact dif-
ferentially with the various instructional objectives, but
the precise directions such interactions take is not clear.

Learning hierarchies. The hierarchical learning tasks
described by Gagné (3)--signal learning, S-R learning,
chaining, verbal association, multiple discrimination, con-
cept learning, principle learning, and problem solving--
comprise another way the content attributes may be categor-
ized. The conditions of learning Gagné sets forth assume a
hierarchical order of knowledge acquisition, each higher
order of learning depending upon mastery of all other orders
subordinate to it. It would appear that a fruitful line of
research would be the determination of the relationships and
the appropriateness of the different media or media combina-
tions to the learning of the different levels of the hier-
archy.

Learning tasks. Closely related to the learning

hierarchy category, and possibly subordinate to it, is the classification of the content into different types of learning tasks. The grouping of learning tasks into an order that includes the identifying, comparing, classifying (conceptualizing), generalizing, and applying of content presented for learning probably follows a hierarchical order. On the other hand, such tasks as learning facts, learning procedures, learning to solve problems, etc. probably do not fall into a hierarchical order. The critical point to note in the classification scheme for media research that is being explicated here is that different learning tasks may be learned differentially under different presentational conditions. The determination of the appropriateness of different forms of media for the presentation of different tasks may be an important area for future research. Little research attention has thus far been given to this problem, although Allen and Weintraub (4) have gathered some preliminary evidence.

   Instructional functions or technical skills. Yet another way of considering the content atributes is in accordance with the particular functions or skills they are designed to establish. Gagné (4) presented the following eight instructional functions and attempted to rate the various media types according to their value in accomplishing each function: presenting the stimulus, directing attention, providing a model, furnishing external prompts, guiding thinking, inducing transfer, assessing attainments, and providing feedback. Gage (12) presented a list of technical skills, some of which overlapped with Gagné's functions: establishing set, establishing appropriate frames of reference, achieving closure, using questions, recognizing and obtaining attending behavior, control of participation, providing feedback, employing rewards and punishments, and setting a model. It is evident that such categorizations as these relate very directly to specific teaching activities, and it is reasonable to expect that the teaching procedures used--including the use of media of different kinds--could have a variable effect upon the acquisition of each of the skills.

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Content inherency. A final category of content attri-
butes might be called "content inherency," in which an as-
sumption is made that the content itself possesses certain
inherent dominant traits that could interact with the mode
of presentation used. Allen, Filep, and Cooney (3) found
some confirmation of this assumption in a study that charac-
terized the content as consisting predominantly of verbal
concepts for which there were no direct concrete referents
and of content having referents of a concrete nature. They
found that no media-inherency interactions existed for the
"non-concrete" content, but that the "concrete" content was
learned more effectively when presented by means of pictorial
material. Other types of content inherency might be included
for study--for example, abstract vs. concrete or action vs.
non-action.

The six categories of content types discussed above were
not presented as exclusive categories, but rather as sugges-
tions of the kinds of ways the researcher might look at the
instructional content. Some of these may be completely in-
appropriate for investigation, and additional categories
may be added. The important thing to keep in mind is that
there is an extensive group of intervening variables, pos-
sibly interrelated and overlapping, that have received vir-
tually no research attention and which may be highly impor-
tant when selecting the mode of instructional presentation.

Factors relating to learner attributes

The significance of the learner's characteristics as a
variable in educational research has been recognized for a
long time, and many facets of such learner attributes have
been studied under a variety of instructional conditions. As
discussed by Snow and Salomon (23:341-357), however, this
factor has been largely neglected in research on instruc-
tional media; and they have marshalled considerable evidence
to support the need for inclusion of aptitude variables in
future research. Such learner aptitude variables as age,
sex, mental ability, personality factors, learning styles,

and cultural factors, would seem to be appropriate factors
for inclusion.

Factors relating to psycho-physical processes

The inclusion of this category of research within the
classification scheme is prompted by the belief that there
are processes operating in learning and instruction that
may be relatively invariable through the population as a
whole and which sould be considered as the basic underlay
for any kind of instructional event. The exact nature of
these factors can probably not be precisely defined at this
time; but, they might include such overriding considerations
as perceptual, physiological, motivational, and cognitive
factors. For example, any research on mediated instruction
should probably take into consideration the principles of
the research design. It is not really clear to me whether
or not this factor is manipulable in the experimental sense,
but I have a hunch that the particular operations of the
perceptual process interact differentially with various media
types or forms. The question is left open here and is in-
cluded merely to suggest that this area may be susceptible
to fruitful research.

Factors relating to instructional use

Another category of research effort is that in which the
variables related to the actual instructional application of
the media in the classroom are investigated. Thus far in
the explication of the categories of instructional media
research we have been concerned with those factors relating
to characteristics of the instructional material, the nature
of the content being taught, and the attributes of the stu-
dents who are engaged in learning. The focus in this section
is on the activities of the teacher, who brings these ele-
ments together in the instructional situation.

Teaching techniques. This category of research involves
the study of specific procedures the teacher uses in

manipulating the instructional media. For example, research
has been conducted on the use of introductions to films,
study guides, student participation techniques, direction
of attention, repetitive use of materials, and discussion
follow-up (2:123-130). Although considerable research evi-
dence has already accrued, these, and countless other tech-
niques, may be investigated in order to discover their ef-
fects upon the learning of the material.

Instructional strategies. At a higher level of teacher
use are those instructional strategies that might be employed
to enhance student learning. These could include such strat-
egies as the use of inductive-deductive methods, discovery
vs. directed methods of teaching, rule-example relationships,
feedback and knowledge of results, the establishment of
learning sets, the use of anxiety-producing and fear-arrous-
ing communications, etc. Very little research attention has
thus far been given to these factors, and the need for in-
vestigation appears to be great.

Teacher characteristics. We know virtually nothing
about the relationships of certain teacher characteristics
as they affect learning in the classroom, much less learning
from different media types.

Factors external to the direct instructional situation

Finally, there is that extensive group of factors that
will doubtless influence the overall impact of media, but
which are outside the control of the media designer, the
materials producer, the student, or the teacher. Such fac-
tors are the administrative procedures used in the organiza-
tion of the school itself and/or the media program within
the school, cost-effectiveness benefit considerations, the
nature of innovative practices, applications of media to
teacher education, psychometric applications, course devel-
opment procedures, the design and development of equipment,
etc. With some notable exceptions these areas have yet at-
tracted hard systematic research effort.

Conclusion

In the attempt to categorize instructional media re-
search into a meaningful structure it has been necessary to
break it into neat circumscribed categories. In actual
practice, however, this just does not occur. The signifi-
cant feature of research today is not the investigation of
carefully isolated hygenic variables, but rather the in-
vestigation of several interacting variables (22, 23:341-
357). As we discover these interactions and build them into
a media design model, developing theories of media use, we
may approach a true science of instruction.

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. . . We can sharply improve the teacher
by improving the instructional material he
uses. Thus the student will have access both
to the live teacher in the classroom and to
the teacher mediated through print, photograph,
film, television, videotape, magnetic tape,
radio, filmstrip, EVR (electronic video record-
ing), or other devices.

> ---*Edgar Dale, Editor*
> *The News Letter*
> *March, 1970*

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It is simpler and more comfortable to
make moral judgments on each of these ac-
tions than it is to understand their mean-
ing. Vandalism and violence, strikes, fiscal
neglect, and confrontation are symptomatic
of profound and complex discontent. We must
hear the complaint for what it is--a plea
for reform and action.

Once again schools must become mind-
expanding experiences--for students and
teachers. The nineteenth-century classroom
does not meet the needs of twentieth-century
society. The electronic revolution that has
so seized the American community must be let
into the classroom and made an integral part
of the educational process. Likewise, teach-
ers, administrators, and school boards must
come to accept the importance of audiovisual
and electronic aids. We are shamefully neg-
ligent in any effective use of television in
the educational system. Cybernetics and tele-
vision have become mainstays in the American
Way of Life. They must serve equally in
education.

> ---*Hubert H. Humphrey,*
> *guest editorialist in*
> *The School Administrator,*
> *May, 1970*

MEDIA-MESSAGE

INTERACTIONS

IN TV

keith w. mielke

THE WORD "interaction" refers here to special types of rela-
tionships among variables. Here is one example of interac-
tion: In terms of how comfortable you feel, there is an
interaction between what you wear and where you are. The
hypothetical data below illustrate this:

Comfort Indices for Two Types of Clothing in Two Locations		
	Percent of Time Outfits are Comfortable	
Outfit	in Alaska	in Hawaii
Swim Suit	10%	90%
Fur Coat	90%	10%

In predicting how comfortable you would be, you can't say
that either Alaska or Hawaii is best across the board. It
depends on another factor: what you wear. Also, you can't
say that, across the board, the swim suit is more comfortable

than the fur coat or vice versa; it depends on where you are.
The swim suit is satisfactory in one setting, but less so in
the other.

The analogous topic being explored here is the possible
interactive relationship between medium and message in tele-
vised instruction. Are some messages likely to be more ef-
fective over one medium than another? Are some media more
effective when carrying one type of message than another?
Can you predict "across the board" effectiveness on the basis
of medium or message alone, or do you need to take both me-
dium and message factors into account before making the pre-
diction? What types of messages are best suited to the tele-
vision medium?

These are not comfortable questions to grapple with. The
more dedicated one is to scientific values of precision,
rigor, and theoretic relevance, the more uncomfortable he
feels asking such global questions as "What can television
do best?" Nor can we expect precise, clean-cut answers to
such general questions. These questions are raised, then,
not out of initial preference, but from frustration in try-
ing to reconcile the empirical view of instructional tele-
vision (ITV) collected to date with persuasive but more
intuitive insights into the medium of television.

The "hard" research data comprising the empirical view
of ITV has been summarized periodically and extensively (5).
This literature contrasts with the "softer" insights into
the medium of television that have received less attention
by the ITV community. Varying degrees of sensitivity to a
potential medium-message interaction in television can be
found in these more speculative remarks. What follows is
not intended to be a formal literature review. Instead, the
series of brief quotations should function as montage would
function in film: a rapid succession of "images" designed
to elicit association of ideas. The quotations are arranged
so as to form a crude continuum of viewpoints, beginning

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with *minimal* emphasis on the unique contributions of the television medium.

> At present, however, there is little evidence that there will be evolved any technique of instruction which is *totally* distinctive of instructional television. By and large, television provides the opportunity to put old wine in new bottles.(8:30)

> Evans (1964) prepared an hour-long filmed interview with Carl Jung. Some of his students in psychology were shown the film. Others read only the printed transcription of the interview. Test results showed that both groups learned from the presentation, but there was no significant difference between the two groups.(6:91)

> When it comes to format, interest and learning appear to depend on considerably different qualities. Presentation of similar material to proper control groups has almost invariably resulted in students rating programs with dramatic or documentary formats as more enjoyable and more interesting than those presented in straight talk or interview programs, even using the same visuals. Yet test results increasingly indicate that more is usually *learned* from the simpler formats. This is fortunate in view of usual educational budgets. With regard to popular commercial programs, it is likely that young people learn less from dramatized programs of violence and antisocial behavior than they would learn from talk programs teaching the same techniques and behavior.

> The techniques of Mike Hammer, James Bond, gangsters, and others, in other words, would probably be taught somewhat effectively by simple talks

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and demonstration programs than they are in their pres-
ent dramatized form. (23:61)

An interesting experiment was conducted at New York
University several years ago, with two courses, both on
television, one with all kinds of video gimmicry, with
graphs that melted and reformed themselves, and all
sorts of wonderful things, and the other course with
simply a lecturer talking to the students. The students
all found the first one much more interesting, but two-
thirds of them failed. I don't want to go on with the
implication of this suggestion except to suggest that
technical people involved in TV may want to make a
little more video interest than perhaps is necessary, to
make a Shakespeare 'show'; as they used to say, instead
of a Shakespeare 'lecture.' (14:92)*

The questions must be asked, Is there any instruc-
tional value in having a professor deliver a lecture
with no student participation which would warrant the
use of televised lectures instead of using, as a distri-
bution form, the same lecture material printed in mimeo-
graph form? It is a different type of input, but is it
better? Videotape has been used merely to replicate
what is presented in a lecture-class situation. In terms
of economics, the benefits of print are obvious. (4:8)

As is true in the case of the conventional media, the
newer techniques do not adequately serve some purposes.
Their successful use requires the recognition both of
their strengths and their limitations. They are not use-
ful, for instance, in some forms of discussion, super-
vision of activities, consideration of unanticipated
questions, or individual consultation. (7:43)

Television can be used--and in some places is being
used--to do the traditional job of education, and to do
it well. However, those who have had experience with the
medium know that, if wisely and imaginatively used, it
also can bring to students educational experiences far
beyond what is possible in the conventional classroom.
Students in today's classrooms can be eyewitnesses to
history in the making. They can have a closeup view of
physical and chemical processes that cannot be duplicated
in any but the most expensive laboratories--indeed, some
that cannot be duplicated in any laboratory. They can
see and hear the outstanding scholars of our age. They
can have access to the great museums of art, history, and
nature. A whole treasure-trove of new and stimulating
experiences that were beyond the reach of yesterday's
students can be brought into the classroom for today's
students. (11:68)

*Hans Moeller, "Production: National Film Board Resources,"
in Lewis Miller, ed., *Educational Television: Conference in
Newfoundland and Labrador, 1966.* © 1967. Reprinted with the
permission of Information Canada.

Most producers, directors, graphists and tele-
vision teachers had been trained to manipulate tele-
vision as a mass communication device primarily
suited to passing along information. They often
lacked a basic understanding of how an individual
perceives and learns. Moreover they had little
knowledge of the newer concepts of organizing and
sequencing instructional presentations for effec-
tive individual learning. They tended to treat the
medium as a mirroring non-interactive surrogate of
the classroom teacher in his old familiar role as
a talking dispenser of information. (25:15)

Researchers have noted that the different media
are capable of producing different kinds of effects.
It is often suggested that print media are often
more effective in conveying information, while radio
and television are more often persuasive due to their
abilities to simulate social contact. (17:68)

Some of our difficulties here lie in the fact
that we take television for granted, attribute
great power and influence to it, yet lack an ade-
quate theory of media. Theories of signs and
iconicity are not of great help, if for no other
reason than they are more or less speculative, and
are heavily philosophical rather than psychological.
In coping with the realities of media in education,
such theories have roughly the same utility as
Marie Antoinette's cake. (13:33)*

Communications channels impose conditions on the
audience--by their physical demands and by the social
situations they encourage or preclude. Theater films
are presented to large numbers of people sitting to-
gether quietly in the dark. Novels are usually read
alone, with little distraction, and at a time, place,
and pace selected by the reader. Television is more
often watched after the evening meal, in a particular
room of the home, and by several family members at
once. The media also vary in the size of their audi-
ences, simultaneous and accumulative. Over time,
such concomitants give rise to important and persist-
ent generalized associations. As a result, signifi-
cant aspects of attitudes and feelings toward the
various media relate not only to *what* is seen or
heard or read, but to theater-*going*, or novel-*reading*,
or tele*viewing*--in and of itself. (24:51-52)**

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. . . No medium of mass communication exists in
a vacuum. It is part of tremendously complex and
changing social and cultural systems within which it
exists and operates. Its fate will be dependent not
only upon the characteristics of the medium itself,
but upon the existence within those same systems of
a set of salient norms and values that shape and in-
fluence it. Its destiny will also be partly influ-
enced by the presence of other media with which it
must come to terms. It is in these ways that a so-
ciety has a profound influence upon its media. (9:75)*

There has been a great deal of discussion in
recent years about the devices that can be employed
to aid in the teaching process. These devices are
of many kinds. Some of them are designed to present
material to the student of a kind that would be avail-
able to him in his ordinary school experience. Films,
TV, microphotographic film, film strips, sound re-
cordings, and the like are among the devices ordin-
arily employed in such work. Books also serve in
this role. These are the tools by which the student
is given vicarious though 'direct' experience of
events. It does not serve much to dismiss such ma-
terials as 'merely for enrichment,' since it is ob-
vious that such enrichment is one of the principal
objectives of education. Let us call these *devices
for vicarious experience.* (2:81)**

In terms of the message, the more dimensions or
channels involved, the greater the realism. But
realism also involves fidelity. For instance, con-
tinuous motion is more 'real' than a still picture
sequence. Thus, other things equal, television or
motion picture with full sound has greater realism
than TV or film with sound dubbed in, the latter has
greater realism than silent film, silent film has
greater realism than still photography, etc. (1:241)

Merely to put the present classroom on TV would
be like putting movies on TV. The result would be
a hybrid that is neither. The right approach is to
ask, 'What can TV do that the calssroom cannot do
for French, or for physics?' The answer is: 'TV
can illustrate the interplay of process and the
growth of forms of all kinds as nothing else can.
(16:332)

Television is not just a medium, not just a
tool, a device, a gimmick, a gadget to be used for
teaching. You cannot necessarily teach effectively

on television by setting the camera up pointed at a
teacher. You do have to have what the networks and
commercial stations call 'production.' (27:61)

One disappointing aspect of the research on in-
structional television over the past decade is the
relatively small number of studies that have dealt
with production variables or variation in methods of
organizing and presenting the program content. This
is rather surprising since television production fa-
cilities are widely available and since it is not a
difficult task to develop differing versions of tele-
vised lessons or courses for comparison under con-
trolled conditions. (12:14)

The color and brightness, referred to in commer-
cial television circles as slickness, should be
brought in to make illustrations clear· and to demon-
strate through pictorial means the points the pro-
fessor is trying to make. For instance, instead of
the traditional television close-up of the face of
an economics professor lecturing about the circum-
stances during the depression and the bread and soup
lines, the screen should show film clips of dejected
people cold and hungry waiting in lines to get a bowl
of soup and a piece of bread. (3:1)

As presently organized it is difficult to believe,
for instance, both the transmission channel views and
the film language views. If film is a transmission
channel only, then clearly it has no unique 'language';
if film does organize experience in unique ways, then
it is not merely a transmission channel. (21:375)

There is some tendency to confuse the physical
paraphernalia of television as a transmission medium
with its stimulus properties per se. From the latter
standpoint, film and television can be considered
substantially identical media for many purposes
(aside from such physical properties as grain, color,
and screen size, and the much-talked-about factor of
'immediacy' or suspense in live television). But
since many television programs are pre-filmed, or
recorded for later playback on film kinescopes or
video-tape, the distinction between TV and film is
at best a fuzzy one--both media producing essentially
moving pictures, in the generic sense, with sound
accompaniment. (15:478)*

For each communication channel codifies reality
differently and thus influences, to a surprising
degree, the content of the message communicated. A
medium is not simply an envelope that carries any

letter; it is itself a major part of that message . . . . (5:176)

Is educational television merely a convenient distribution method? To some extent I am sure it is; but I am not satisfied that it is entirely. Educational television must have a special language of its own, and let's try to find it. I'm not sure that we have. There are experiments here and there that suggest that educational television can be far more interesting than it generally appears to be. So let's try to explore this special language and let us experiment with the medium, as we have for many years with other visual educational media. (19:122)*

The results seem to substantiate the use of visual aids in promoting student achievement of learning objectives similar to those measured by the drawing test. Or, we need to reorganize our thinking on the types of critical measures we employ; that is, visualizations may increase learning that is not detected in the tests employed. (10:41)

If production techniques of the medium and the effect of visual and audio stimuli were identified in the studies at all, they were usually treated as intervening variables. Why has the medium itself received so little research attention? Why has the broadcaster accepted the role of providing only a pipeline from the source to the receiver? (22:25)

Just as Vasily Kandinsky established a new aesthetic of painting by working inductively with the basic elements of point, line, area, texture, and color, we can establish a television aesthetic by examining the factors of light, space, time and motion, and sound, and by experimenting with a variety of factor combinations, all within the framework of television communication. The examination of the various factors will help to build the television vocabulary; the combination of these factors will suggest the potentials of a television language; and the recurring trends within the various combinations might, eventually, suggest a television grammar, a system which will permit meaningful production research. (23:38)**

If you are tuned to KQED, San Francisco, one of the more adventurous educational stations, you sometimes pick up weird images. The telecasts are sketches or doodles of the electronic art of the future. Artists and technicians at KQED are exploring the potential of broadcast art. 'Electrons' says experiment director Brice Howard, 'are our medium.'

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*Sidney S. Lamb, "Credit Course Programming: The University Television Teacher," in Lewis Miller, ed., *Educational Television Conference in Newfoundland and Labrador, 1966.* © 1967. Reprinted with the permission of Information Canada.

**Herbert Zett, "The Study of Television Aesthetics," *Educational Broadcasting Review*, © 1968. Reprinted by permission.

> And the picture tube is the canvas. Moving images
> are blended many times over on video tape (like making
> a double-exposure snapshot, only more so), and then
> sound is added. The result is a flowing video mon-
> tage--a little like a painting that you turn on in-
> stead of hang up. (26:61)*

Although the quoted remarks may correspond only roughly
to the pure hypothetical continuum, it can be seen that the
area of media-message interactions in television would fall
in the middle, where contributions of both media and message
are consciously sought. Consider the media-message inter-
actions implicit in the following excerpt from a televised
review of ITV. The verbal sound track begins as follows:

> When it began in the early fifties, extraordinary
> promises were made for instructional television. To
> every classroom it would bring the performing arts.
> Television would bring to students the events of
> today and the history of tomorrow. Television would
> reveal the otherwise invisible. It could also
> simplify the complex and abstract. Students would
> encounter creative people. Master teachers would
> reach more students through television. Television
> would capture the reality of other lands. It would
> reveal critical problems of our own nation. (20)**

The very phenomenon of media-message interactions now pre-
vents a realistic portrayal of the televised information that
accompanied those words. When the off-camera voice said "To
every classroom it would bring the performing arts," an or-
chestra was seen and heard. No arrangement of words here can
reconstitute the sight and sound of the orchestra. No matter
how economical or efficient, print cannot handle this job.
If, on some measure, there would be "no significant differ-
ence" between the televised version of the orchestra and some
mimeographed, printed, verbal rendition of the orchestra, it
would tend to reveal more about the nature of the measure
itself than about similarities of media.

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Those who have sampled ITV will know that the "typical"
lesson does *not* bring to the classroom the performing arts,
the history of tomorrow, the otherwise invisible, or the
like. The characteristic of the television medium most con-
sciously exploited seems to be its multiplicative potential,
its economy of distribution, its ability to reach many class-
rooms with one teacher. Early advocates of television in
education frequently made their case on the characteristics
of TV as a *distribution system*, as opposed to a method of
information packaging.

Conceiving of television as an electronic pipeline or as
an electronic extension of the eye relieves one of consider-
ations of content or content-medium interactions. Clear-cut
examples of this pipeline analogy would be, say, the tele-
vision systems that monitor hotel lobbies and prison corri-
dors. The pipeline itself is insensitive to what passes
through it. The eye can be extended to see more of the same
things it normally sees. As a distribution system, televi-
sion would be evaluated primarily by engineering criteria.

Of course, when television is used in the service of edu-
cation, content considerations cannot be ignored. There is
necessarily some degree of concern with the content of the
stimulus, some degree of concern with television as a method
of information packaging. Given conscious control over what
comes through the channel, there is probably some bed-rock
minimum interaction between *what* is said televisually and
how it is said televisually.

To structure this idea a bit, three arbitrary levels
might be differentiated: (a) At the lowest level of message-
medium interaction, a typical classroom teaching performance
would be given a very "straight" TV production treatment.
(b) At an intermediate level, there would be expansion of
the kinds of content covered (e.g., televised field trips,
outside resource persons, etc.) but still fairly "straight"
production treatment. (c) At the highest level of message-

medium interaction, the raw material would be expanded far
beyond the confines of the classroom as in level two, but
there would also be extensive and conscious manipulation of
the production variables.

Careful consideration would be given to the presenta-
tional style, the televisual "statements," the conscious
structuring and ccntrol of the stimulus to achieve a desired
effect. There would be awareness of what might be called
the "language" of television, as well as an aesthetic or
pedagogical rationale for using one treatment instead of
another. This trichotomy is admittedly very imprecise, and
it should be abandoned at once if a more useful structure or
taxonomy can be imposed on these same concerns.

There are real world counterparts to these three levels,
however, so perhaps useful distinctions can be made in spite
of the imprecision. Examples abound for level one. The ITV
lessons now cited as being exemplary are frequently in level
two. Rarely in ITV, but apparently more frequently in film,
is the audio-visual stimulus package so carefully controlled
and orchestrated as to qualify for level three.

Value judgments persist throughout this paper because so
little in the way of media-message interaction is demon-
strable fact at this point. Production values in television
are defended more on the basis of conviction than research
evidence. The "hard" evidence, as some of the earlier quo-
tations suggest, does not encourage this line of thought;
in fact, "production" seems to have acquired a slightly
tainted image in ITV after most of the few studies dealing
in any way with production enhancements failed to demonstrate
their instructional advantages.

Why might this be so? At least three factors may be
working against greater research activity in television (18:
54-61). First, in certain applications of experimental
methodology, production enhancements could be considered as

errors to be eliminated or controlled out. The *ceteris
paribus* (other things equal) preamble, applied to a compar-
ison of live versus televised instruction, means that tele-
vision should be restricted in the research project to the
content and treatment available in the classroom. A dilemma
arises: the more dissimilar the comparative treatments
(live and TV) become, as when unique contributions of TV
might be exploited, the more uninterpretable the results.
The tighter the controls, i.e., the more rigid the imposed
similarity, the less freedom in either the live classroom or
the televised version to exploit natural advantages. An
investigator need not get caught in this trap, but if he
does, his unfortunate choices are to "sloppy" or "unnatural."

Second, there is a two-sided problem with the *measures*
actually used to determine effectiveness. In ITV, effec-
tiveness has been defined overwhelmingly as learning.
Learning is usually defined as test results. Tests tend to
measure some form of acquisition of information that was
presented originally in the verbal audio track. The audio
track then becomes not only *necessary* for satisfactory test
results, but, in all probability, *sufficient* instruction for
satisfactory test results as well. Given such a measure,
how could one expect production enhancements to make a
demonstrable improvement in learning? Part "A" of this
problem, then, is that the typical basis for evaluation is
probably insensitive to the media-message interactions which
exercise the potential of television.

Part "B" of this problem is that the *alternative* bases
for evaluation are more difficult to conceptualize clearly
and even more difficult to make operational. In some cases,
appeal can be made to "self-evident" values, benefits that
are so intuitively appreciated as to not demand empirical
justification. For example, television interviews with
famous persons may yield no better "learning" scores than a
second-hand retelling of the major points, or a printed
transcript. However, the experience of seeing the famous

person is worth something (although it would be difficult to specify exactly what). A televised course in American government at Indiana University incorporated several interviews with important national officials. Their comments typically did not fall into an easily testable format.

How, then, would you demonstrate that the interviews contributed anything of educational value? If each practice had to argue its way into the course on the basis of typical learning scores, it is doubtful that the interviews could be justified. A practice could, however, be "defined" as valuable, or *other* types of measures could be obtained to assess their contribution. For example, at end-of-course evaluations, students mentioned in free response items their *enjoyment* of the interviews. In exploratory research involving sequential still photographs of the students as they were instructed by ITV, it appears from preliminary data that the students *looked* at the screen considerably more in the interviews than in other traditional lecture lessons. Does it make any difference whether the students "enjoyed" the interviews? Does it matter that the students looked more consistently at the screen during interview lessons?

These questions may not seem as immediately relevant as the question, "Does it matter what score the students achieve in the final exam?" All three questions must be related to the educational objectives before they can be answered. These examples will serve to illustrate that there can be many significant differences between two instructional settings even though there may be no significant difference in typical measures of learning. The effects of using the medium of television would probably influence these "noninformation acquisition" measures more than they influence the typical test scores.

Third, the aesthetic and complex nature of many production decisions does not yield easily to the orderly classification of factors desired by the empirical researcher. Research

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which asks simplistic questions such as the relative effec-
tiveness of medium shots versus close-ups may be tightly con-
trolled but may be quite unrelated to the dynamic, multi-
dimensional, decision-making environment of the TV director.

Major contributions can be made by the research community
in the development of new measures of communication effects.
A variety of forms of these measures (paper-pencil tests,
physiological measures, nonreactive measures, etc.) along
with an increased sensitivity to what to look for, will col-
lectively tighten the net on the elusive effects that are
now untouched by most formal criteria in ITV. The cruder
and more restricted the measures, the less able we are to
assess the real effects of media-message interactions in
ITV, and the longer we must rely on intuitive insights.

The interactions between medium and message in television
may never emerge with the high definition afforded by the
opening hypothetical example (interaction between what you
wear and where you are). The concepts in the television
setting are not as straightforward. The proposition that
seems to be the clearest of the lot is that the medium of
television alone has no communication effects. This is
demonstrable in two ways: by removing the message from the
screen entirely (blank screen), or by carefully contriving
an artificial situation in which the message is actually held
constant across two different media. (18:54-61)

Messages do have effects. As a passive electronic pipe-
line, TV may possibly carry a wide variety of messages with
only minimal influence on the effects of those messages.
More typically, however, the television medium will interact
with the message to modify it or produce a new message. In
considering television as a method of information processing
and packaging, we are more likely to consciously seek and
accurately assess the more potent interactions that are dif-
ferent from the typical classroom stimulus patterns are made
possible with television. These involve television production

variables or what is sometimes called the language of tele-
vision. Although the effects of what a production man would
call "good television" are beyond our measurement capacity
at this time, it would be extremely shortsighted to down-
grade concern with production because of that.

Several different factors can be associated with favor-
able conditions for high-potency medium-message interactions
in ITV. The profile shown below is neither complete nor
intended as a precise description. Instead, it might serve
as a tentative conceptual map for discovering the presence,
extent, and impact of medium-message interactions in ITV.

verbal	_ _ _ _ _ _ X	nonverbal
concrete	X _ _ _ _ _ _	abstract
high control over stimulus	X _ _ _ _ _ _	low control over stimulus
verbal analysis of experience	_ _ _ _ _ _ X	simulation of direct experience
high amount of incidental learning, not covered on formal exam	X _ _ _ _ _ _	minimal amount of incidental learning, not covered on formal exam
cognitive	_ _ _ _ _ _ X	affective
primarily digi- tal information	_ _ _ X _ _ _	primarily iconic information
low visual stimulation	_ _ _ _ _ X	high visual stimulation
difficult- impossible to repro- duce or simulate in live class- room setting	X _ _ _ _ _ _	possible to have similar stimulus pack- age in the live classroom

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. . . Violent revolutions throughout
history have occurred when a country's in-
stitutions were too rigid and unbending to
accommodate change.

Even the most conservative will agree
that some changes are needed badly, and soon.
If they can't be had peacefully, they will be
had violently.

The question is: How do we get it done
peacefully? . . . We know what [the problems]
are: urban problems, education, health, wel-
fare, pollution, crime, traffic, dirt, crowd-
ing, and all the rest . . . If you don't like
what the Federal Government is doing with our
money . . . complain . . . complain to every-
one in authority every chance you have. It
sounds rather trite to say write letters, but
if there are enough of them, they really do
work . . . If there is a political candidate,
. . . [whom you] approve, give him a little
money, work for him, and vote for him. If
there is no candidate, find one and persuade
him to run. If you can't find one, run your-
self. That is the only prescription for
peaceably forcing the changes we need without
destroying everything in this country that is
worth having.

> ---David Brinkley
> NBC News
> from a paper pre-
> pared for Project
> 70's, sponsored
> by Schenectady,
> New York, Public
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WHAT DOES IT DO TO JOHNNY?

A COGNITIVE-FUNCTIONALISTIC VIEW

OF RESEARCH ON MEDIA

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PROGRESSING TOWARD a theory of instructional media, I shall
take the view that sound research in instructional media
needs to fulfill at least three conditions.

1.   Research on media needs to generate a framework of
valid questions to be asked. Questions which are interlocked
with other questions and which are based on valid assumptions
provide guidance and direction to research. As we know, too
many of the questions which were traditionally raised in the
field of research on media were based on erroneous, or inde-
fensible grounds, and hence led to invalid answers (20).

2.   Research on media needs to be closely related to re-
search in other areas such as human development, individual
differences, information processing, etc., and to become
part of them. Unfortunately, most of the known research in
media is quite unrelated to any of the better established
areas of research, as if to imply that media research is a
new field or a new discipline requiring an independent and
unrelated place in the world of scientific inquiry.

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3. The third condition is that research be done in a
theoretical framework. This point means that our research
conceptualizes rather than just tests new devices and novel
modifications. The ultimate goal of research is *understand-
ing*. Without this we have a mere accumulation of devices
and "significant differences" which add up to very little.
This is the case when we do not know *why* one thing works and
why something else does not; why something works in one case
but does not work in another case.

It is high time we divorce ourselves from the immediate
application and the testing of devices which were our major
foci until recently, and concentrate instead on *laying the
foundations for a theory of instructional media*. To echo
Cronbach at this point, *the only practical approach, for us,
is to search for interrelated explanatory principles* (6).

Now, what is this theory I am talking about? It is, in
my opinion, subsumed under a wider theory of instruction.
Such a theory, to follow Bruner, needs to be prescriptive,
rather than just descriptive; *it concerns itself with the
relationship between how things are presented and how they
are learned*.

When we speak of a theory of instructional media we have
in our minds the optimal way of presenting and arranging in-
formation, which can be carefully controlled and managed.
Such control is apparently best achieved with the help of
mechanical and electronic media. Moreover, certain overt or
covert behaviors, can be aroused, guided, shown, modelled,
etc., by no other means than those called "media." But just
knowing how to control, guide, etc., is not enough. The
theory must also provide *explanations* for the interactions
between learner and stimuli. We thus search for some optimal
and well understood matches between kinds of stimulation and
educational outcomes.

This, however, is far more complicated than it seems.

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Previous attempts to prescribe such matches, e.g., Gagné (8),
were not very successful because there were no psychological
justifications to pair certain modes of presentation with
educational outcomes. Two factors contributed to this de-
ficiency.

1. The first was to find psychological justifications
for matching say, pictorial presentation with certain kinds
of learning outcomes requires, by necessity, the analysis of
the mediating processes within the individual. And this is
rarely provided.

2. Once the analysis of mediational activity takes
place, inter-individual and intra-individual differences
need to be considered, and the much too frequent search for
some universal simple rules of matching becomes impossible.

Since, however, a theory of instructional media cannot
be constructed without the search for specific stimulus-
learner-task matches, there is a clear need to turn to con-
temporary psychological inquiries into cognition. To es-
tablish such a change, questions must be formulated in terms
of the interaction between stimuli and cognitive functions.

A cognitive-functionalistic view

Granted that our research is theory-oriented, it not only

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predicts and controls, but also attempts to explain. It is
common practice in nearly all branches of behavioral science
to ask not only what goes with what, and under what condi-
tions does this or that take place, but also *why* the phenom-
ena occur. This tendency, I think, is common to nearly all
researchers, including those of the neoassociationistic
school, e.g., Berlyne, 1965; learning, e.g., Melton, 1964;
the verbal-learning research, e.g., Mandler, 1967 (3, 17, 16),
and, obviously, research in the Piagetian tradition. Once
there is an attempt to explain, there is an inevitable need
to enter the "black box."

Attempts to study mental processes are as old as psy-
chology itself. Unlike attempts in the past, however, there
now are more advanced methodologies and tools of inquiry
which enable the researcher to bring mediational activity
under his control (e.g. 10, 25).

Contemporary researchers become more and more concerned
with the *functions* of stimuli, conditions, instructions, etc.
(27). They do not only look for statistically reliable con-
nections between stimuli and responses, but also add the
questions: What does it do to the subject? What is the
psychological situation we create? Asch (1), to provide
one example, writes: "Given the operations of relating, it
follows that the nature of psychological stimulus is the
first problem in the study of learning and memory. It is
necessary to distinguish between the external and the psy-
chological stimulus conditions. Activities of relating have
their correlates in objective conditions, but they are not a
copy of these conditions." (1:97)

We become more and more aware of the fact that the phy-
sical stimulus, taken alone, accounts for only a very small
portion of the response domain. The same stimulus is differ-
ently perceived, decoded, processed, etc. by individuals who
differ on a number of relevant characteristics. Thus, the
way they overtly handle the stimulus may have more influence

than does the physical stimulus itself on the way they overtly
respond to it. We thus turn to a conception of human behav-
ior which can be crudely characterized as a three- (instead
of two-) stage process:

$$S - r - R$$

where the stimulus (S) is responded to by covert processes
(r) which in turn lead to the final response (R). Yet, it is
the mediating behavior, r, which we are trying to affect.
Our major assumption is, to quote Ausubel that *"teaching it-
self is effective only to the extent that it manipulates
effectively those psychological variables that govern learn-
ing."* (2:12) And this means, understanding the cognitive
functions that particular modes of presenting information
may accomplish.

This seems to be in line with the emerging trend in edu-
cational psychological research today, and I think that re-
search in media should link itself to this. The questions
asked must be linked to such theories and lead to a new
theory which nourishes and is in turn nourished by these
theories.

Media from a Cognitive-functionalistic point of view

At this point, one would justifiably raise the question:
What is that mysterious "media" with which we are dealing?
We have opposing views ranging from McLuhan--The medium *is*
the message--to Carpenter, who states that ". . . it is the
content of the stimulus material (in psychological terms)
and its very special value for the individual learner that
is important and not the particular carrier of the informa-
tion." (5:236)

Scattered observations can be provided to support equally
well both premises. Yet, it is difficult to deny that ex-
tracting information from, say, maps calls for a different
set of mental processes than extracting information from a

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photograph of the same terrain. It is not unreasonable to
expect that the ways messages are shaped by their carriers
do require different strategies of approach on the part of
the learner.

But not all physically similar modes of presentation func-
tion psychologically in the same way. Likewise, not all simi-
lar psychological functions are stimulated by the same kind
of stimuli. For an analogy, see the discussion of language
behavior by G. A. Miller. (19) *Some* correspondence between
shape of stimuli or modes of presentation and, say, informa-
tion processing will certainly exist. But this correspon-
dence is only a partial one, and its degree will vary accord-
ing to the restrictions imposed on content and its organiza-
tion by the carrier of the information. Thus, for instance,
maps are far more restrictive in this respect than are films,
for example. Consequently, different maps will be quite
similar to each other in terms of their psychological func-
tions. Not so films. Their range of shapes, kinds of con-
tent, ways of arrangement, and other individual variation is
so wide that to speak of the "effects of film" *qua* film makes
little sense.

I propose, therefore, that we define an instructional me-
dium as the intersection of two variables: physical similar-
ity of psychological functions, i.e., *an instructional medium
is a package of unique modes of presenting information* (which
may or may not be a consequence of some attributes of a
machine) *which also fulfills a unique psychological function.*

If pictures in a book, on the screen, and in a film turn
out to fulfill the same psychological function (given common
learners), then they are one instructional medium. If, on
the other hand, they function in different ways and thus do
not fulfill the second condition, then they can not be treated
as one instructional medium. It should be clear, though,
that we refer here to the *unique* psychological functions that
a well differentiated mode of presentation *can* accomplish,

given certain materials, tasks, and learners. A wide screen
and a narrow screen may have the same effect on information
processing with one kind of materials and under a specific
set of instructions. They may, though, have entirely *differ-
ent* effects if we use them to convey different kinds of in-
formation, each of which being uniquely suited for one of
the modes of presentation. But even if the material is the
same, the different modes of presentation may have different
effects when they arouse different mediating processes which
are not equally relevant to the learning task at hand.

In sum, the conception of a medium is quite complex.
We define an instructional medium as the overlapping area of
two circles: the stimulus-attributes circle and the response
circle. When various stimuli have common structural attrib-
utes which do not call for common cognitive responses, they
cannot be said to constitute one medium. However, when such
stimulus attributes call for a common core of mediators which
is clearly different from the core of mediating responses
called for by stimuli who share other attributes, then, and
only then, can we speak of an "instructional medium."

Obviously, any kind of presentation accomplishes many
psychological functions by arousing and activating numerous
mediating processes. Most of these, however, can be accom-
plished by many other modes of presentation. If, as Pryluck
and Snow state, the most important message of a film is on
its soundtrack, why should it have any different effect than,
say, a lecture? (23) What concerns us here are the *unique*
characteristics of a mode of presentation and their *unique*
psychological effects. As stated above, when these two exist
in a lawful way, it becomes possible to speak of an instruc-
tional medium.

There is a clear difference between the cognitive pro-
cesses aroused by a stimulus, and their relevance to learn-
ing of a specific nature by a specific learner. This means
that unique effects on learning will be observed only when

the medium attributes under examination have a *central func-
tion which is relevant to the learning of X by Y.*

Here, then, we introduce two additional factors which
have little to do with media as the sole function of common
shapes of messages: These are *the learner and the task.*

Once we introduce these factors the following occurs:

1.   We move *away* from the controversy of medium vs. mes-
sage, since if a certain attribute is cognitively relevant
to only certain persons under certain task requirements, what
sense does it make to deal with the medium *alone*? For in-
stance, the effect may even result from the darkness which
accompanies the viewing of a film at a time when it allows
less restricted expressions of emotions and when these are
relevant to the learning objective (18).

2.   We concentrate on the triangle: learner, task-speci-
fic processes, and stimulus.

3.   The stimulus which we study is viewed as doing some-
thing to the cognitive processes of somebody under certain
motivational and instructional conditions, regardless of
whether it is considered a message, a medium, or a channel;
whether it is a sign, sign vehicle, or a signal.

Some questions that research needs to deal with

At this point we have to distinguish between research *on*
instructional media and research *with* media. The former deals
with *the unique cognitive functions that unique modes of pre-
sentation can accomplish.* And this area has hardly been
dealt with. The latter is research in learning which happens
to use media as a source of stimuli but does not tell us much
about the functions of media as defined here. We know many
studies which utilized films, televised presentations, or
other modes of stimulating. But using some mechanical or
electro-mechanical tools in a study does not qualify it as
research *on* media. Carpenter, to take one example, states

that "the central problem, as far as new media is concerned,
is that of determining how they can be best adapted to meet
the requirements for effective academic learning." (5) This
is fine. Yet then he goes to study whether programmed in-
struction can be adapted to CCTV and other media. However,
such research turns out to be concerned solely with programmed
instruction, not with "new media," since one loses the unique
effects that could have existed. What do such studies tell
us about the *unique* functions that CCTV can fulfill that a
text *cannot?* Sure enough, Carpenter's study shows that pro-
gramming is effective. Was not it known before? We would
be astonished if the results did not turn out as they did.

When I speak of research *on* instructional media I refer
to these aspects which were left out much too often. What I
am proposing is not research on learning nor is it "pure"
research of cognitive processes or communication. It is an
inquiry into *the relations between unique media attributes
and their unique psychological functions under specific
task requirements and specific learners.*

In light of all this, what kind of questions would we
have to raise? Consider the following series of illustrative
questions?

1. What are the physical elements which are unique to
different media and which may have some unique influence on
learning? (The assumption underlying the question is that
no medium *qua* medium has some built-in mysterious effects
which are universal.)

2. What is effected by these elements? (In this connec-
tion, recall one of Hilgard's remarks that in programmed in-
struction it is not the final overt behavior that we actually
reinforce but rather the covert behaviors which produce it!)

3. What unique patterns of influence can we introduce
with these elements? (Implied in the question is the possi-
bility that stimuli can do more than just reinforce, cue,
probe, or arouse.)

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4. Under what kinds of task conditions does a potential
influence become realized? This is to say, when do unique
media elements have a specific influence on covert behaviors
which are also relevant to the attainment of the learning
task at hand?

5. Who is to profit from the impact of certain elements
and who is to be hampered? (See Snow's paper, pp. 63-89, for
an extensive discussion of this point.)

Questions of this sort impose, of course, tremendous com-
plexities. It would seem, though, that unless they are an-
swered, there cannot be much progress in media research.
Posing questions, obviously ties research on media to re-
search in cognition, learning and development, etc., yet it
is not identical to them.

What kind of generalizations can research along the five
proposed questions lead to? Similarly to what we see taking
place in adjacent areas--e.g., learning by Discovery (7)--our
generalizations will be rather specific. Once we move away
from universal questions like "does ETV produce better learn-
ing?" we cannot but aim at much more limited conclusions.
As it is implied in the above list of questions, no generali-
zation refers to one nicely isolated variable. Rather, it
incorporates developmental, cognitive, informational and task-
relevant aspects. Thus a generalization of the sort I sug-
gest would look as Table 1.

As you will notice there are here three major components:
the medium-message dimension, the psychological task require-
ments and the learner's characteristics. This, of course,
appears to be quite complex. But, is not the whole process
of instruction rather complex? It is interesting to note
that many teachers, producers, and communicators think along
such complex lines although they do not put their thoughts
in lengthy statements of the kind proposed here. For in-
stance, when a producer of commercials plans his ad, he has

The Medium
{ film }
{ : } is capable of presenting
{ (computer) }
{ }
{ : } unique kinds of messages.
{ }

which in turn can fulfill the psychological function of
{ arousal }
{ ... }
{ (supplantation) } of the
{ }
{ (reinforcement) }

mental processes of
{ comparing }
{ ... }
{ relating } which in turn are needed by learning tasks of
{ ... }
{ (identifying) }

{ }
{ : } sort for a learner of
{ }
{ }
{ : }
{ }
{ mental or emotional characteristics. }
{ }

TABLE 1. Sample generalization based on five proposed questions for research on instructional media.

a very good sense of what kind of emotional, perceptual, or
mental processes he wants to arouse in what kinds of audi-
ences, and how these processes relate to the final behavior
(buying, consuming) that he wishes his audiences to under-
take. When the producer of commercials shows a famous actor
drinking a certain kind of beer, he assumes that some identi-
fication and hence imitation will take place and that these
processes, in turn, will facilitate the viewer's choice of
behavior when faced with a selection of brands.

Let us now examine a bit closer what is implied by the
five questions proposed for research:
- What are the influential elements?
- What do they influence?
- How do they influence?
- When does the influence facilitate learning?
- Who is to profit from these influences?

The questions are clearly interrelated and it would be
quite difficult to answer one of them within the framework
of one study without making some assumptions about the
others. What these questions imply is some kind of a grand
matrix composed of three dimensions: modes of information
presentation, learning tasks, and individual characteristics.
Modes of presentation can, hypothetically, be grouped accord-
ing to our two criteria: physical similarity, and psycholog-
ical function. Learning tasks need to be classified accord-
ing to the kinds of mediating processes which underlie them
rather than according to what Melton called the "primitive
operational categories of learning." (17) The third dimen-
sion, individual differences, is by its very nature a classi-
fication based on mediating processes.

The cells of this hypothetical cube are those points in
which a specific mode of presentation accomplishes certain
psychological functions (i.e., influences specific mediators
in some way) which are also required by a certain type of
learner for a certain class of learning tasks.

Let us take one example. Sieber (1968) wished to find a
way to overcome the debilitating effect that high levels
of anxiety have on learning. (26) First, it was found that
debilitation takes place mainly in complex learning tasks.
Second, it was suggested that one common attribute of such
tasks is their reliance on memory of previously executed
moves which lead up to a solution Anxiety, it was hypothe-
sized, affects learning indirectly: it actually interferes
with retention of the intermediate moves and their conse-
quences, and through them affects the observable attainment
of a solution. Sieber hypothesized that if highly anxious
Ss are provided with visual stimuli which retain the neces-
sary information for them, so to speak, then no debilitating
effect will be observed. In the experiment, high and low
anxiety Ss were faced with a rather complex task. When no
"memory supports" (drawings of already executed moves) were
provided, the former out performed the latter. However,
high anxiety Ss performed as well as low anxiety Ss when
"memory supports" were given.

This study illustrates the idea about the intersection
between the three dimensions of the hypothetical cube. Cer-
tain tasks (e.g., complex problems) call on certain mediators
(retention of intermediate moves), with which certain Ss
(high anxiety ones) have difficulties. A particular mode of
presentation (pictorial representations of the moves) accom-
plishes a specific kind of function (providing a substitute
for the unretained details) which in this class of tasks and
for these learners facilitates learning. One moves away
from this class of tasks and for these learners facilitates
learning. If one moves away from this class of tasks to
one in which memory of intermediate moves is unnecessary
(e.g., learning foreign words), "memory supports" should not
serve any relevant function. Similarly, move away along the
individual differences dimension to other Ss (low anxiety
ones) and, again, no relevant function has been served.

In sum, the five questions raised are interlocked and

one is no more primary than another. Sieber, in the study
described above, started by analyzing the influence of anxi-
ety on problem solving; then proposed a mode of stimulation
to circumvent this influence. Wicklegren and Cohen also
studied the functions of "memory supports" but their points
of departure were the analysis of concept formation as a men-
tal process, and individual differences in memory capacity.
(29) To take a third example, Salomon studied the psycho-
logical processes aroused by two modes of editing a film.
(24) The point of departure was the stimulus and its
functions.

Common to all these examples is the overt or assumed ref-
erence to the three dimensional cube where stimuli, tasks,
and individuals interact. The uniting tie is the psychologi-
cal function that is relevant to a certain learning task and
which is accomplished by particular modes of presentation.

What does it do to Johnny?

Of the five questions we have raised, one appears to be
of central importance. This the question which deals with
the kinds of psychological functions that different modes of
presentation can accomplish. It would be impossible to treat
in any honest way all the questions raised up to now, yet one
cannot avoid discussing this one. To claim that knowing that
this or that element has some effect on a certain mental ac-
tivity under particular conditions, is quite important. How-
ever, real understanding of the instructional value of media
can be achieved only if we have some insights into the nature
of this influence. In other words: when we understand what
a particular kind of presentation actually does to the mental
processes of the learner.

It has been claimed in the past, e.g., by Salomon and
Snow (25), that the use of a certain mode of presentation
will have a significant effect on learning only if it *arouses*

or *supplants* mental processes which are relevant to the
learning of a specific task. This is very much in line with
Ausubel's idea about effective teaching, which we have quoted
earlier, and is supported both by logic and by some empirical
data. Obviously, arousal or supplantation of task-relevant
mental processes are not the *only* functions one could think
of. Visual, verbal, and audio-visual stimuli can also rein-
force, inform, cue, guide, surprise, etc. and it would be
desirable to study the ways in which stimuli accomplish these
functions (see, e.g., Gropper, 11). Here, though, I would
discuss in more detail the function of supplantation, mainly
because it seems to be a unique potentiality of particular
media. It is one way to influence learning, and a rather
interesting one.

To supplant mental processes means to *execute them explic-
itly for the learner*. A mental process is supplanted when
an analoguous process is overtly executed in front of the
learner's eyes. Thus, *supplantation is the function accom-
plished by an explicit presentation of what would otherwise
have to be done covertly by the learner himself, such that
a certain learning objective will be attained*. When, for
instance, we show, in a film in which a globe rotates, when
we "split" an apple to show "halves," or when we show how a
mountain changes its shape and is viewed from above, etc.,
we apparently supplant the mental processes of, say visuali-
zation. It is quite reasonable to hypothesize that if learn-
ing of the year's seasons, of fractions, or of maps is based
(among other things) on the visualization of rotation, split-
ting or changing physical appearances, then explicit demon-
stration of this sort ought to facilitate the acquisition of
the information.

Similarly, one could think of a way to supplant some of
the major processes which underlie, according to Piaget, the
conservation of the volume of liquids. Both reversibility
(pouring water back into the original jar) and coordination
of dimensions (the "fat" jar becomes "thinner") can be shown

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explicitly with the aid of filmic techniques, thus supplant-
ing the mental processes of reversibility and coordination.

This analysis is based on two assumptions:

1. Signs and symbols have a dual function: they are
used in overt acts of communication to affect a receiver's
behavior, and they are used in a covert representational
capacity to guide one's own behavior. (3) We can communicate
overtly as well as stimulate and regulate our own behavior
by using the same or similar signs.

2. Information to be learned is composed of events,
signs, and their transformations. These, we believe, can be
stored, integrated, generalized and used as internal symbolic
stimuli and responses of two kinds: *situational and trans-
formational*, or, as Inhelder calls them, figurative and oper-
ative aspects of cognitive functions. (13) Situational sym-
bolic responses are internalized representations of object;
and events or of responses related to them. Transformational
responses are internalized representations of activities
which modify, manipulate, and transform the objects and
events. (3, 22)

The internal, representational signs and symbols (what
we have called the covert situational and transformational
behaviors) have a manipulatory origin: They develop from
prolonged daily contact with concrete objects which we manip-
ulate. (15) Later they become iconic and finally they take
on symbolic shapes. (4) At the same time they also become
organized into groups, schemes, etc. Once they are inter-
nalized they can assimilate increasingly more complex re-
sponses without the necessary overt manipulation of objects.
Thus when the child grows older he does not need to *manip-
ulate* everything new he is to learn. He can learn--i.e.,
internalize for representational purposes--signs and symbols
which are overtly presented to him by other sources.

These two assumptions lead us to hypothesize that

supplantation of mental processes can serve in two capacities:

1. It can provide compensation for what the learner
cannot execute mentally on his own, hence aiding him in
attaining a particular instructional objective.

2. It can offer him an image of a situation or of a
transformation to be internalized, stored, and made available
for later use in a covert form.

Some evidence to support the two hypotheses can be found
in the literature concerned with learning by imitation, as
studied by Bandura and his associates. Other evidence can
be found in some recent successful attempts to modify
through training and explicit demonstration children's con-
ceptions of conservation, space, casuality, etc. (e.g.,
Sullivan, 28).

Common to Bandura's work and to the Piaget-inspired re-
search are the attempts to modify behavior (social or mental
behavior) through the explicit demonstration of behaviors
which are assumed to underlie the final behavior. The rela-
tive success of such studies lends support to the hypotheses
stated above. Yet, this would be a slight oversimplification
of the matter. For one thing, there is some evidence to
show, as Berlyne indicates, that "images representing trans-
formations do not occur simply as a result of witnessing the
transformations in questions." (3) Such transformations are
not learned, until the learner can assimilate them into his
cognitive structure, hence give them "meaning." (2)

These points, therefore, tend to suggest that explicit
presentation of mental processes will function in a supplant-
ing capacity only when two conditions are met.

1. The presented information is sufficiently explicit,
thus provides enough supplanation of the mental processes
necessary for an item to be learned, a concept to be attained
or a principle to be formulated. Here, then, we are concerned
with the *amount of supplantation*, i.e., how much mental

activity is left for the learner who has been given a spe-
cific learning task.

2. The presented information is sufficiently close, with
respect to its semantic and contextual nature, to the learn-
er's cognitive structure. Showing how a jar changes from
"fat" to "thin" to a very young child may not facilitate the
acquisition of conversation. Nor will it facilitate the
understanding of the processes involved, simply because the
child is still in need of manipulating objects. The explicit
presentation, in this case, does not supplant any mental
process which comes close enough to what the child would have
to execute. The same applies to adults as well. As Kohlberg
points out, "concrete operational thought, or even sensori-
motor thought does not disappear when formal thought arises,
but continues to be used in concrete situations where it is
adequate or when efforts at solutions by formal thought have
failed." (15:1021) Therefore, an abstract explanation of
transformations which occur in space flights, even if very
explicit, does not supplant any relevant process that the
novice would have used, or could have incorporated into his
conceptual scheme.

Here, then, we can speak of *the nature of the supplanted*
as complementary to the former dimension.

Supplantation is not an all or none function. For the
sake of this discussion imagine an act of thought as composed
of three links: the initial situation (s), the transforma-
tion of that situation (r), and its final form (R). S, r,
or R may be highly specific or very general (a "rule"); they
may be overt signs or internalized representations; each may
be a single unit or a composition of more specific components.

When we examine the continuum ranging from least to most
supplantation, we can identify various points. One may
attempt only to *induce* the necessary mental activities by
showing nothing but the beginning state of a process. This
could be the case when we show the learner how X looks

and ask him to compare it to an absent Y. It appears quite
often in discovery learning studies under the label of "dis-
covery condition" or "rule not given, example not given."
Here, obviously, we assume that the learner has the necessary
mental processes in his response repertoire, that they are
not easily accessible, and that the degree of response uncer-
tainty aroused in him is not beyond his tolerance.

The "visual task" is significantly reduced when only the
initial situation is presented. The major burden falls on
the "mental task," to use Perrin's terms. (21) This may be
the best way to train learners in executing certain processes,
yet it may not be the best way to acquire a new operation or
item or an extension of those. Granted, however, that the
learner is capable of executing a process of comparison, ne-
gation, coordination, and the like, allowing him to execute
it on his own (thus being least explicit) may be just the
right amount of supplantation. When Perrin suggests the use
of simultaneous multiple-images, which according to him ought
to induce processes of comparisons, he is assuming that doing
it for the learner would only be redundant and restrictive.
(21) What we know about the relationship between uncertainty
and change (14), incongruity and change (12), etc. lends sup-
port to this assumption. The kind of processes induced and
the amount of uncertainty aroused will depend also on the
task to be performed. A sketch may be all the information
needed when only the outline of the object is to be learned.
It may require a very long chain of mental processes if the
objective is to extrapolate from it.

When we move a bit further on the continuum of amount of
supplantation we find the presentations that short-circuit
the necessary chain of mental transformations by presenting
the initial situation and its final modification (the way
it looks after being transformed). We short-circuit the
process because we do not show it, yet we expect the learner
to select from the storage of processes at his disposal the
right transformations.

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Programmed instruction, for instance, uses this procedure
but it also breaks down each and every link in the chain to
very small units that supplanting the intermediate transfor-
mations appears to be unnecessary. Bright students, as
many studies tend to show, prefer a somewhat less explicit
presentation. They seem to be better off with a situation
that does not short-circuit each move for them. At any rate,
what is required of the learner is to select a certain trans-
formation so that the initial and the final situations will
be tied together.

Toward the other end of the continuum we find the presen-
tation which provides the initial situation and its transfor-
mation, and the learner is expected to *apply the transforma-
tion* to the situation. Here, less selection needs to take
place. The most important link--the process of transforming--
is overtly shown.

Finally one finds the presentation which attempts to be
most explicit, thus to *supplant as much as possible*. Here S,
r, and R are provided and very little is left for the learner
to fill in. He is expected to incorporate the chain of trans-
formations, store them for later use and formalization.

Imagine that we begin with a collection of objects (S)
and want our learner to group them according to some common
attributes. Imagine also that we have some intuitive or em-
pirical reason to believe that to do so, our learner has to
choose one attribute of one object (e.g., round) and check
according to some pattern (e.g., scanning) whether it exists
in other objects as well. Finally, if the answer is positive
he "moves" all the objects which are round to one imaginary
side and the remaining ones to another. These three steps
are then the alleged mediators (r's), and the final grouping
is the solution (R). We may now show the collection of ob-
jects, focus the camera on the roundness of one object, move
to the rest and then let the round objects "move" closer to
each other. We have shown explicitly the whole process.

Given a learner who has the concept of "round" in his reper-
toire, we would hypothesize that this presentation would sup-
plant the whole process for him. The *whole* process? Proba-
bly not. If covert verbalization takes place (as studied by
the Kendlers, for instance), then this act has *not* been sup-
planted. However, knowing that verbalization takes place,
one can short-circuit it as well, by providing ready-made
labels.

We might have done less for the learner. We could have
shown him the objects (S) and the groupings (R) without show-
ing the transformations in between. This would have short-
circuited the process. The learner would have had to select
from his repertoire a suitable chain of transformations to
close the gap; or we could have begun with S and then have
shown the r's but not the resultant situation (R). Here we
ask the learner to apply the explicitly provided transforma-
tion to the initial situation to come up with the final R.
Finally, we could have provided him with S only, leaving all
the rest for him. The function of this would be to induce
in the learner appropriate mediators.

Recall again Sieber's study about "memory supports" (To
repeat the description of the study would be to "short-cir-
cuit" the process of recall, which seems to be unnecessary
here for readers with a good memory or for readers who are
familiar with the study). What did the "memory supports"
do to the subjects? They have apparently short-circuited
overtly each move in the process of solving the problem.

The question still exists as to whether we actually
supplant mental processes or whether we only substitute for
them. If only the latter is done, then, of the two functions
that explicit presentations can serve, only the first can be
accomplished. We would be able to compensate for deficien-
cies by doing for the learner (e.g., selecting an item out
of a context) something he may have difficulty with. We
would not be able to provide him with an image of an

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operation or a situation which he could then later apply internally. We are now engaged in a study in which we examine the effects of various amounts of assumed supplantation on immediate understanding of a message and on transfer tasks. The process we attempt to supplant is the visualization of transformations in space. Our early results show that both objectives are better achieved with a moderate amount of supplantation. We find also support for the hypothesis that our Ss have actually incorporated the presented transformations and applied them in new problems. Thus, real supplantation may be possible.

When we attack the question of supplantation from the point of view of *what* is supplanted (actually turning to the second question in the five-question list we have proposed), we face entirely new problems. An explicit presentation of a process which does not underlie the learning-task at hand could not be expected to facilitate its attainment. Similarly, it is rather important whether the supplanted process fits, or does not fit, the learner's mental structure. Thus, to be able to design a presentation so that it will actually supplant particular mental processes and facilitate the acquisition of bits of knowledge, we need to know something about the nature of the processes underlying the task at hand, as well as the cognitive nature of the learner. This is one of the reasons why research on media needs to be closely linked with research on cognition and development.

Gentile and his associates, while studying whether associational processes that underlie solving analogy items, did, actually, supplant the process of finding an association in one of their experimental treatments (To be more accurate: they short-circuited the process by providing an association). They conclude the report by stating that "Relationships [which are given to the Ss] which are congruent with those that S would have generated by himself . . . facilitate performance on analogy items." And conversely with relationships

which are incongruent with those S would have generated by himself. They also found that when E short-circuits the process, S will not generate his own relationship. This, then, should not facilitate transfer since S is not given any practice opportunity. (9)

For instance, ordering informational items into models, schemes, etc. may facilitate their retention (see for a detailed description Fleming's paper, pp.   ). When the items "organize themselves" in front of the viewer, the presentation may not only facilitate retention but also supplant the process itself. But will it lead to an improvement in the *ability* to categorize items? It is one thing to facilitate the understanding of, say, a principle by supplanting the underlying mental processes. It is another thing to expect a transfer effect. Does seeing specific transformations, instead of executing them covertly, have any generalizable effect? This is a question to be answered by research.

Let me now return to the question of research on media. It seems quite clear that media differ with respect to the amount of supplantation they can provide and with respect to the nature of the processes they can supplant. Some media can show how things look and how they change; these media, like film, seem to be best suited to supplant iconic processes. Other media, like maps and models, cannot show any transformations at all. Some media can show situations as they appear in reality while others can create contrived or fabricated stimuli which contrast or distort reality. It may very well be that the latter cannot only supplant processes which one could have acquired otherwise, *but provide images of situations and transformations which could have never been acquired without them.*

The distinction among media is quite different when it comes to the nature of the supplanted processes. While movies can supplant concrete transformations, language does it on an abstract level; and while a map can arouse iconic

mediators concerning the relations between geographic ele-
ments, a graph can do the same on a symbolic level. A real
model can arouse actual manipulatory activities while a draw-
ing of the same apparatus does it on an iconic level. One
thing, though, is clear: not all processes can be supplanted
pictorially or verbally. *However, it is the contrived ways
of presentation which may provide supplantation of processes
unthought of until now.*

All said, the function of supplanting mental processes
seems to be quite relevant to the study of the psychological
functions of instructional media. Now we could ask questions
of various types: How do I supplant best this or that proc-
ess? What processes does this or that mode of presentation
supplant? Under what conditions does supplantation of this
or that process, when done by means of a certain medium, lead
to such and such outcomes? Who will profit from the supplan-
tation of this or that process done by means of a certain
medium, and who will not? What learning outcomes can be ex-
pected if we suuplant a certain process by means of two dif-
ferent modes of presentation? etc.

The discussion above does not imply that all that media
can do is supplant different processes in various amounts
and on different levels of abstraction. Thus, one faces the
need to study the relations between supplantation and other
functions (e.g., cuing) as well.

Some implications for research

To recapitulate, research on media needs:

1. To relate itself to research in other fields.

2. To nourish other theories and, in turn, be nourished
by them.

3. To deal with the *functions* of stimuli.

When one goes now to conduct a media study with these
points in mind, he obviously needs to know something about--

1. the nature of the processes which are to be learned.

2. the degree of mastery that his subjects have of the specified aptitude or related (possibly, more general) ones.

3. the general level of mental activity of the subject relative to the material to be learned.

Given this information, the experimenter will have to decide how much uncertainty he wishes to arouse, how much, and what kind of, independent activity he wants to allow, etc. But these prescriptions sound as if taken from a book entitled: *The Impossible Research Procedures* . . . . Therefore, let me provide an illustration.

Assume we found that the more reflective teachers turn out more reflective students, and that the ability of "self-examination" correlated with reflectiveness. It would seem desirable to increase the reflectiveness of low-reflectivity teachers. We choose to improve their self-examination-ability to meet this end. We hypothesize, by the way, that this ability underlies reflectivity and that improvement of the former facilitates the latter.

We thus decide to induce processes which constitute the self-examination ability. But how do we induce them in subjects who are deficient in them? We decide to supplant some of the components of the process so that they will be incorporated and used, i.e., we tell the poor self-examiners how they actually perform. This may arouse quite a bit of conflict, as previous work concerned with the confrontation with one's own behavior tends to suggest. Providing a verbal description which is expected to supplant the process of self-examination implies that individuals really examine themselves verbally, and this may be wrong. And if it is wrong, then we may induce more transformational activity than needed and defeat our purpose. Thus, we devise an alternative way of supplantation, namely, by using video-tape

recorder. This may provide signals on a level closer to the
one people actually use to examine themselves.

We set up an experiment. Teachers of all levels of self-
examination ability are included, and three treatments are
given: visual-concrete supplantation (self-viewing on VTR),
verbal-abstract supplantation, and arousal. In the first
condition Ss see themselves on the VTR, in the second they
listen to a verbal description of their behavior, and in the
third they are told that they performed poorly--and will be
required to "examine themselves," thus creating an arousal
condition.

S. we compare two procedures of supplantation that differ
with respect to their relations to the images one tends to
use in such cases, and a third procedure which is supposed
to induce the relevant processes. *Note that we know very
well why we chose each of the stimuli.*

After administering these treatments we measure differ-
ences on a number of dimensions. Let us take a look only at
reflectivity--the correlate of self-examination. We find
that the VTR treatment is on the average as successful in
improving the Ss reflectivity as the arousal condition, and
that both are better than the verbal-supplantation condition.
Since there is improvement in reflectivity--we can support
our hypothesis that the process of self-examination underlies
reflectivity. We have nourished research in a field which
also nourished us.

But then we examine the interactions between our treat-
ments and self-examination aptitude measures which we took
at the beginning.

We find, as one would expect, that only the better self-
examiners profitted from the arousal condition. Hence, it
did induce in them the relevant processes. For the poor self-
examiners, this treatment aroused too much uncertainty.

SCORES ON A "SELF EXAMINATION" TEST
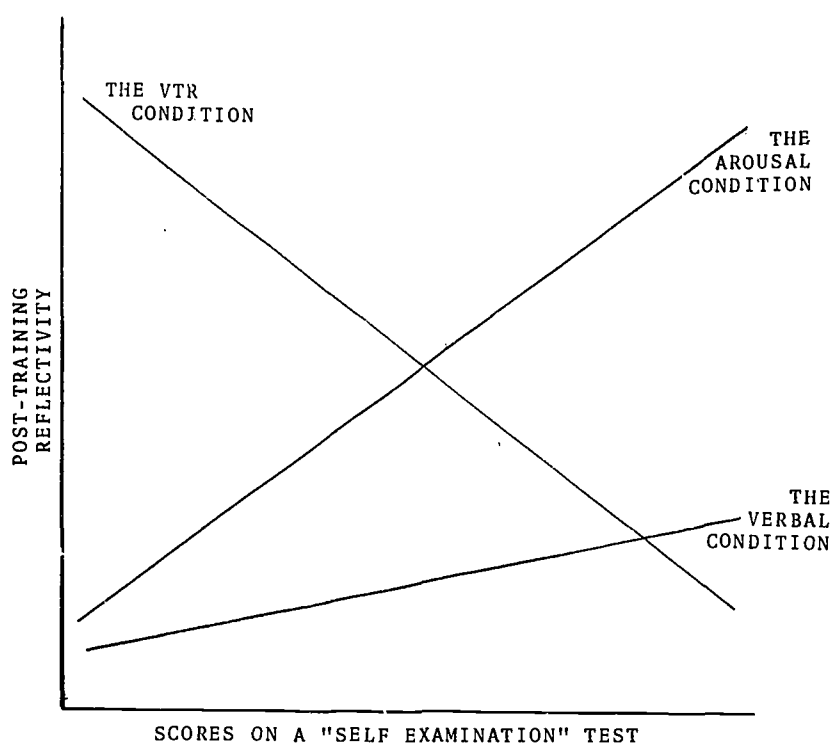
Fig. 1

However, the latter profitted most from the VTR presentation.
It supplanted something on the right level. For the good
self-examiners, VTR was too concrete; they perform perhaps
on a verbal rather than pictorial level and profit therefore
from the abstract.

This, of course, is just an hypothetical illustration.
But it highlights the approach I wished to present. Such a
study tells us quite a bit about the functions that self-
viewing on VTR can accomplish, with whom, and under what con-
ditions. This is not to say that other functions cannot be
accomplished. But most of them can be done equally well by
other media. Moreover, such a study does not only prescribe
the best uses for a medium, it also helps us in understanding

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the reasons why an effect is produced. This, in addition,
is tied to a conceptual scheme and some new hypotheses can
now be deduced.

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     But many of us fail to realize that com-
munications is not concluded when knowledge
is disseminated. This is only one-third of
the process. Communications involves dissem-
inating information, getting a response and
evaluating that response.

                         ---*Floyd Christian,
                            Florida State Super-
                            intendent of Education,
                            quoted in Public Under-
                            standing of Education
                            as a Field of Study,
                            p. 12*

RESEARCH

ON MEDIA

AND APTITUDES

richard e. snow

IN A PREVIOUS PAPER by Salomon and Snow (18) an interactional
approach to research on media was proposed. Following the
lead of earlier work by Cronbach (4, 5) it was suggested that
combining the ideas and methods of experimental and correla-
tional psychology offered the possibility of differentiated
instructional improvement in place of a continued, fruitless
search for the one best way to teach everyone. The new ap-
proach would assign learners to different instructional
treatments tailored to fit their own particular strengths and
styles of learning. A few examples of the interacting ef-
fects of selected aptitude variables in gross media compari-
sons were discussed and some rough guidelines for further
work were sketched.

Since that time, a fairly comprehensive, though not ex-
haustive, survey has been conducted of interactional studies
in instructional research generally (6). Some new data on
media variables have also been collected. The purpose of the
present paper is to review these developments and to

elaborate more fully the general approach and tactics sug-
gested for interactional research on media. It is hoped
that such discussion can identify a number of hypotheses
worth testing in future work, though it is acknowledged
that such hypothesizing must be frankly speculative at the
present state of our ignorance.

The General Problem

First, it will be helpful to review the definition of
aptitude-treatment interaction (ATI). A basic definition
comes directly from the method of analysis of variance; an
interaction is present when an effect found for one kind of
subject or in one kind of setting is not found under other
conditions. The focus here is on interactions which involve
at least one aptitude variable, representing some specified
individual difference among learners, and at least one
treatment variable, representing some specified or experi-
mental manipulation of theoretical or practical interest.
To be properly interpreted, such interactions must be repre-
sented in terms of a regression analysis displaying the re-
lation between aptitude and the learning criterion separately
for each treatment. Interaction is present when the regres-
sion lines for separate treatments are judged nonparallel,
using a standard $\underline{F}$ or $\underline{t}$ test for equality of slope. It is
helpful to specify two classes of such interactions: *or-
dinal* and *disordinal*. As shown in Figure 1, a disordinal
interaction is one in which the regression lines for treat-
ments intersect somewhere within the range of the aptitude
variable under investigation. Assuming that the two treat-
ments are alternative instructional media or methods, the
presence of disordinal interaction indicates that persons
with aptitude scores to the left of the intersection point
should be assigned to the other treatment. In the figure,
the light vertical line through the regression intersection
shows where the aptitude continuum would be divided. By
placing high aptitude students in Treatment A and low apti-
tude students in Treatment B, maximum learning outcome for
each individual is obtained. Note that there is no average

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Development in Teaching.

In 1966 he was a participant in the Netherlands
Universities Foundation for International Coopera-
tion NATO Advanced Study Institute on Psychological
Measurement Theory. A frequent consultant for USOE-
sponsored projects, he serves as a consulting editor
for the *American Educational Research Journal.*

difference between the treatments and hence no one best
method for everyone. An ordinal interaction occurs when the
regression lines have different slopes but do not intersect
within the aptitude range. In the example, Treatment A is
thus best for everyone. While not of primary interest
therefore, an ordinal interaction could be practically use-
ful where the better treatment is more costly than the other
or involves a quota on group size or other such limitations.
Then, the learners who most need the costly treatment are
assigned to the second treatment. An ordinal interaction
may also be of theoretical value for further ATI work if the
aptitude variable can be conceived as extending to a point of
regression intersection somewhere to the left or right of
the range under study.

With this definition in hand then the aim of ATI research
in education can be stated as follows (6):

> Assuming that a certain set of outcomes from an
> educational program is desired and considering any
> particular instructional treatment, *in what manner
> do the characteristics of learners affect the extent
> to which they attain the outcomes from each of the
> treatments that might be considered? Or, consider-
> ing a particular learner, which treatment is best
> for him?*

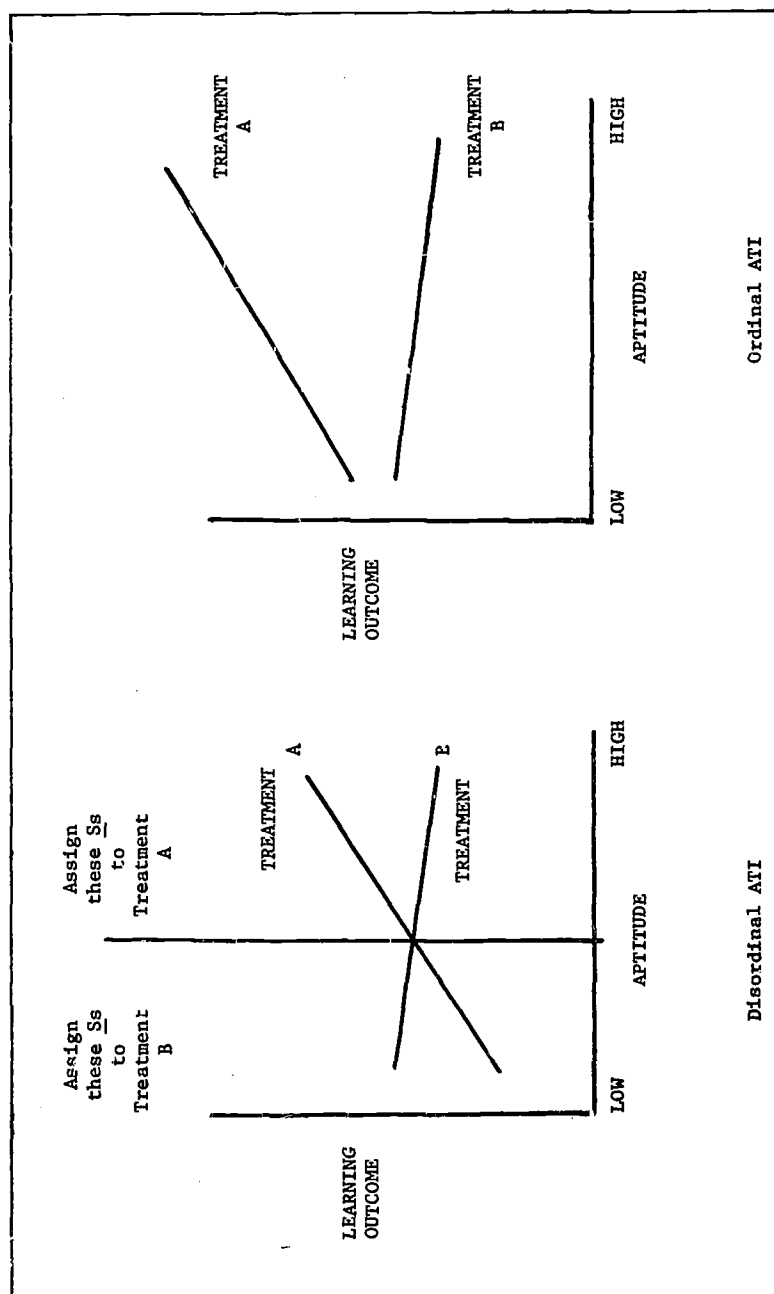ATI research in media is deemed particularly important in

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Figure 1.

this regard. The development of new media and instructional technologies is rapidly expanding the variety of educational experiences with which to confront learners and is permitting individualization of many learning situations. Without detailed understanding of how particular instructional treatments relate to individual learner needs, the advertised value of individualized multi-media instruction is an empty promise. Individualization implies classification decisions in schools and these require disordinal interactions, so we must begin to search for these important phenomena. The concept of a single best method of instruction for everyone is like the search for the Holy Grail.

There is, however, a more pervasive aim for ATI research in behavioral science generally. The experimental psychology of learning and cognition has developed to the point where the primary theoretical activity, whether neo-associationistic or cognitive in orientation, concerns the understanding of internal mental events mediating between observed stimuli and overt responses. The use of aptitude variables to represent the psychological and biological history of the organism may be the best and in many cases the only way to gain access to these events. Differences in the probability of occurrence of some internal event may be represented for individuals by scores in another task or test where performance depends on that response's occurrence. The relation of this performance to criteria for different experimental conditions shows the extent to which that mediating capability is involved in the process being manipulated. Similarly, comprehensive understanding of the differential psychology of man will never be achieved by more and more detailed factor analytic description alone. Access to the internal processes determining performance on differential measures is best gained through systematic experimental manipulation of the parameters controlling the appearance of differential capabilities or tendencies.

Ultimately what is needed is a grand Darwinian matrix of

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organisms by environments where both can be characterized by
many dimensions and partitioned to show the particular types
of treatments in which particular types of learners thrive.
For any given hypothesis, the goal is to find the limits of
generalization, that is, the subset of treatments and persons
over which a generalization applies. Or, to put the issue
again into educational outcome, find the combinations of
treatments and persons that maximize obtained outcome. An
adequate theory of instruction will never be attained with-
out simultaneous consideration of both the situation dimen-
sions and the person dimensions. These dimensions will need
to be expressed in roughly comparable terms, which may bear
little or no resemblance to descriptive dimensions currently
in vogue.

With respect to media research then, a prime task is to
define some initial stimulus and person dimensions. Their
value can be assessed for ATI hypotheses and the foundation
is then laid for the design of ATI research on media.

Person Dimensions Relevant to Media Research

If one surveys the field of differential psychology in
search of constructs useful in ATI work, one is first stag-
gered by the sheer number of different dimensions available
and then stopped by the recognition that few if any of these
dimensions have been sufficiently validated or interpreted
in terms of psychological processes presumably represented
by each. It is like walking through a supermarket where one
is unsure which of the brightly displayed packages contain
the advertised food, which hold cheap filler, and which are
empty facades. Depending on one's purposes, of course, there
are some guidelines. Some potential aptitudes have been in-
volved in a great deal of prior research, and one can gain
some idea of their meaning by reviewing that work. Most of
this prior research, however, will not have been interac-
tional in nature. On the contrary, many differential mea-
sures have been distilled through pilot research be retain-
ing only those items predictive of a wide variety of

situations. Potentially interacting items have been dropped.
Other measures have received construct validation in the
sense of intercorrelation among like measures, but rarely
have they been subjected to experimental manipulation of
either test or criterion situation. Since we are interested
in constructs offering some theoretical utility in ATI re-
search, we must start almost from scratch--selecting, modify-
ing, and constructing measures to fit our *new* needs. A re-
view of what ATI research has been done on the supermarket's
inventory will be worthwhile, since the nature of some exist-
ing differential dimensions may suggest important ATI hypoth-
eses; but much research will have to be done before confi-
dence can be attached to any particular construct or inter-
pretation.

We may start by subdividing variables into a few major
categories, though it should be noted that such clusterings
are convenient fictions at best. Eventually, the most val-
uable constructs may cut across these artifical boundaries.
The main groupings are intellectual abilities, personality
traits and interests, and cognitive styles and preferences.

The nature and organization of human intellect has been
the subject of much research in this century, particularly
by those of factor analytic persuasion. There now appears
to be two main systems of though about ability organization.
Guilford's (12) structure of intellect model, which follows
in the Thurstone tradition, posits at least 120 separate
mental abilities organized in a three dimensional Cartesian
system. The main distinctions deal with the kind of infor-
mation to be processed (figural, symbolic, semantic, or be-
havioral), the mental operations applied (cognition, memory,
divergent thinking, etc.), and the mental products to be
obtained (units, classes, relations, etc.). As suggested
elsewhere by Seibert and Snow (16) the number of factors
might be enlarged still further if test media other than
printed paper and pencil are considered. Guilford regards
his abilities as distinct mental functions which may usefully

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serve as components in task analyses of more complex intel-
lectual activities but which cannot reasonably be subsumed
under more general ability constructs. In contrast, Vernon
(19) and Cattell (3), following the tradition of the British
hierarchical model, suggest that Guilford abilities are rel-
atively specific and combinable first to form minor group
factors, then major group factors, and then still more basic
general factors. Cattell in particular has theorized about
the nature of two such general factors: fluid intelligence--
representing abstract analytic and reasoning ability, and
crystallized intelligence--representing complex and mathe-
matical comprehension and other educational skills.

If the ATI research done so far using ability variables
has any conclusion to offer, it is that fine distinctions
between Guilford's abilities are probably not justifiable.
There are only a few studies showing ATIs and these typically
involve only the content or kind of information dimension of
Guilford's model. Other distinctions have not shown inter-
action with instructional treatment variables, though admit-
tedly little work has been done. One value that can be
claimed for the model is its use in task analysis of in-
structional programs. It may offer some help in structuring
our hypotheses about learning processes, even if the ability
constructs suggested thereby are more global than Guilford's
individual cells. In learning from audio-visual presenta-
tions, one might expect heavier reliance on abilities repre-
senting figural and behavioral content and alternative strat-
egies for cognition and memory storage, relative to other
forms of instructional presentation. To date, research on
media has not examined these possibilities.

One clear conclusion is that some form of general abil-
ity, representing both fluid and crystallized components,
is strongly related to learning in many instructional situa-
tions. It has also been shown strongly evident in programmed
instruction, despite early claims that programming would
reduce the effects of intellectual differences among

learners. Some studies show that ATI are obtained using
general ability as the aptitude when an alternative treat-
ment deviates from conventional written or spoken instruc-
tion but the pattern is not really clear.

It has been suggested recently (6) that the hierarchical
conception of ability organization actually offers the most
reasonable kind of system for the purpose of *using* ability
variables in research or practice, regardless of whether
human ability is *really* organized that way or not. For some
purposes, one wishes a general construct. For others, quite
specific distinctions may be needed. This position implies
that ability constructs be judged in terms of their theoret-
ical utility rather than their correctness. The hierarchical
view is advocated especially for ATI work and is suggested
as a useful organizing principle for other domains of indi-
vidual difference variables and perhaps even for organizing
treatment dimensions.

The personality and interest domain is perhaps the most
difficult to deal with, yet ultimately personality variables
may have the most pervasive effects on learning performance.
Lists of trait labels abound, from the 5000 descriptor words
of Allport and Odbert (1), through the MMPI and projective
test scoring protocols, to myriads of commerically available
multiscale measures and the ever-present interest inventories
of Kuder and Strong. As with the ability domain, Cattell and
Eysenck have suggested hierarchical organizations of person-
ality. These seem less credible and less well substantiated
with data than the ability system; but it is possible that
similar use can be made of such organizations here, particu-
larly within more restricted areas like anxiety and achieve-
ment motivation.

These two general concepts appear to be the best candi-
dates for ATI hypothesizing currently inhand. Anxious per-
sons have been shown to perform better in more structured
situations, where error rates are low and feedback is clear.

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Cronbach (5) has advanced an ATI hypothesis contrasting con-
structive vs. defensive motivation as related to structure,
teacher control, and feedback conditions. This hypothesis
deserves attention as a general organizing rubric for re-
search in this domain. Also, it should be noted that there
is increasing evidence for different kinds of anxiety arising
from different classes of situations. As these differentia-
tions become clearer, alternative treatments for ATI work
with anxiety constructs may be suggested thereby.

Isolated findings have shown interactions using con-
structs like ascendancy, responsibility, and interest pat-
terns described as technical interest and masculinity; but
it is impossible to gauge the generality of these findings
or to relate them to clear media variables.

The newest and perhaps most intriguing category of indi-
vidual differences is a poorly defined group called "cogni-
tive styles." Among the many variables listed here, two
have received more systematic attention and appear relevant
to media research. One is called "field independence" or
sometimes "field articulation" or "differentiation" (20).
It represents the extent to which a person can isolate stim-
ulus details in a complex spatial array despite compelling
background forces. It is usually measured by Hidden Figures
or Embedded Figures tests and is known to be highly related
to general fluid ability. The second is called "leveling-
sharpening" (11). Across successive presentations, learners
assimilate new stimuli to a dominant cognitive organization
and tend not to distinguish further between new and old stim-
uli. Sharpeners, on the other hand, discriminate and sepa-
rate successive stimuli and notice changes in the series.

This dimension may also relate to intellectual abilities,
particularly in the memory domain. Both variables have shown
correlation with several personality dimensions also. It is
suggested here that these perceptual--cognitive styles may
be particularly useful in investigating characteristics of

audio-visual communication. Each represents a different as-
pect of stimulus reception capabilities in the learner and
thus may relate to variations in display characteristics
particularly in visual presentations. These individual dif-
ferences in perceptual styles may interact in important ways
with some of the perceptual phenomena. These stylistic var-
iables appear analogous to Fleming's spatial and temporal
structuring characteristics of stimuli. (See pp. 119-136.)

Treatment Dimensions Relevant to Media Research

In contrast to the volume of work aimed at identifying
personal dimensions, there have been few attempts to con-
struct a coherent system of treatment dimensions. As noted
earlier, if advances are to be made toward theory that in-
tegrates person and situation, then situations must be cap-
able of being arrayed on continua that represent dimensions
of stimulus variation and these dimensions must be describ-
able in terms comparable in some sense to those used to de-
scribe person dimensions. It is unlikely that any generally
satisfactory system can be achieved easily. Much theoretical
and empirical work is required. It is possible, however, to
make some rough suggestions toward that end, though presen-
tation at this time must be quite sketchy and brief.

The concepts of hierarchical arrangement and referent
generality have proved useful as organizing principles for
thinking about individual differences, at least in some
areas. One can examine a relatively specific spatial ori-
entation ability, interpret it as a component of more general
spatial ability, then subsume this with other measures to
form abstract reasoning and finally recognize the combina-
tion as a manifestation of general intellectual ability.
Similarly, this approach may be tried in attempting to de-
fine and organize treatment dimensions. Just as with mental
abilities, hierarchical order is not proposed as the neces-
sarily true or correct way to organize stimulus variables
but only as a potentially useful way to think about such di-
mensions.

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As one surveys the full array of instructional media and
methods, there appear to be some general dimensions that are
involved to some extent in all instructional situations. The
general concepts of amount of information, redundancy, com-
plexity, or difficulty displayed in treatments appear to be
general constructs of this type.

Three other fairly general dimensions, though placed
somewhat lower in the hierarchy, might be overall rate of
information presentation, kind of information content, and
general "grammaticalness" or coherence of a presentation.
Perhaps the extent to which an instructional communication
deviates from the conventions of its medium is part of this
"grammaticalness" idea. Similarly, we can deal with stimulus
dimensions still lower in the hierarchy. Such characteris-
tics as the extent to which responses to be learned are ex-
plicitly modeled, the extent to which treatments are ration-
alized or made meaningful through explanation, overtness-
activity vs. covertness-passivity of response requirements,
the extent to which the presentation is made smoothly struc-
tured and linear for the learner vs. the degree of control
the learner has over his own organizing activity, the in-
ductive vs. deductive aspects of the presentation, and the
style of reinforcement and feedback used.

At a still more specific level in the hierarchy, vari-
ables begin to represent unique features of media and methods
rather than features held in common across different media
and methods. Examples might be the kinds of prompting, fad-
ing or branching used, specific sequencing characteristics
of a medium, frequencies of concrete nouns or action verbs,
the mix of information channels in film or television, dif-
ferent cartoon or narration forms, the inclusion of attention
directing cues, the number of cuts or changes in camera
angle, etc.

There have been ATI studies conducted on some of these
dimensions and the results have not been impressive, for

many reasons. But more penetrating theoretical analysis,
particularly of the general dimensions, coupled with analy-
sis of the individual difference dimensions involved and
improved ATI methodology, should begin to pay off. Recent
studies by Salomon in this direction are quite encouraging
(15).

Heuristics for Devising ATI Hypotheses

With some ideas about person dimensions and treatment
dimensions in hand, it is then possible to begin thinking
about how such variables might combine to produce disordinal
interactions. The best strategy will probably be to choose
aptitude and treatment variables of interest, using whatever
evidence or theory is now in hand about them, and to inves-
tigate their interaction through a series of iterative ex-
periments. One investigator may be mainly interested in a
particular treatment comparison, like some variation in TV
production. He would then try to specify the kinds of
learner skills or styles particularly important for each
treatment. There is no substitute in this work for detailed
task analysis of what is required of the learner in each
situation. Some variants of the approach used by Gagne may
serve here (9). Impressionistic ideas about likely modes of
behavior in each treatment, perhaps obtained from introspec-
tions of learners in pilot trials, will also be useful. The
selection or construction of aptitude measures for this par-
ticular contrast then follows. The key questions are What
are the relevant strengths of learners who do well in one
treatment as compared to those who do poorly? Among those
who do poorly, are there strengths that are, or could be
made, relevant in the other treatment? What would one need
to do to either treatment to reduce its reliance on a partic-
ular learner strength or to avoid a particular learner
weakness? On the other hand, another investigator may be
primarily interested in a particular aptitude variable and
thus start from the other end. Again, task analysis of the
aptitude measure in question is indispensable. With such a
presentation in hand, one can then ask: What kinds of

stimulus situations would magnify the relevance to learning
of competence in this area? What would a treatment have to
provide or circumvent in order that the "low" aptitude
learner is not hampered by his weakness?

Given that the first work shows some interaction, suc-
cessive studies would add, subtract, or otherwise modify as-
pects of the aptitude and treatment conceptions in line with
the growing interpretation. Hoping eventually to maximize
the interaction, modifications might include the elaboration
of some explanation variable, the addition or dropping of
attentional cues or pictures, a change in the pacing condi-
tions, the sharpening of some measure to bring personality
or attitudinal variance into combination with intellectual
skills to help define an emerging stylistic variable, etc.

There appears to be at least two ways of thinking about
ATI hypotheses, which sometimes lead to conflicting predic-
tions. These two approaches to ATI are the preferential
model and the compensatory model. We may hypothesize that
some learners who are high in spatial ability would benefit
from increasing the figural pictorial component of an in-
structional program so that the central ideas are conveyed
by visual rather than verbal skills so we will reduce the
pictorial treatment's reliance on words. A verbal treatment
could then be constructed which played to the high verbal
student's strengths. It would rely on verbal means to convey
conceptual material and leave out pictorial representations,
which are probably lost on verbal learners anyway. This
hypothesis is the preferential model. The treatments are
designed to capitalize on the apparent strengths and pref-
erences of each kind of learner.

The compensatory model proceeds differently. Here we
might argue that the treatments should compensate for each
learner's deficiency by providing the mode of representation
that the learner cannot provide for himself. The treatment
then circumvents the weakness by short-circuiting, or

supplanting, in Salomon's terms. Since the highly visual
type cannot provide the complex verbalization himself, the
treatment should provide it for him, relating it to the pic-
torial representations he can generate himself. This treat-
ment would then include only those figural cues needed to
tie its verbal material to visualizations supplied by the
learner. The highly capable verbal learner, on the other
hand, would receive a treatment that supplied visualization
to go with the verbal representations he himself could gen-
erate. Thus, each treatment serves as an externalized apti-
tude, or prosthetic device, which compensates for the weak-
ness in a particular kind of learner.

Now note that, in this example at least, the two model
ATI hypotheses appear to contradict one another. In Figure
2 (a), the preferential model suggests that the relation
between spatial ability and performance will be positive in
the visual treatment but zero or negative in the verbal
treatment. The compensatory model in Figure 2 (b) predicts
the opposite, that the relation between spatial ability and
performance might be negative in the visual treatment but
positive in the verbal treatment.

I have picked this practice example to show extreme al-
ternatives using simple conceptions of aptitude and treatment
variations. It may be helpful to use these two models in ATI
hypothesizing, but it may also be that obtained ATIs will
represent some combination of both models. If so, then some
more complex form of compensatory-conciliatory process will
need to be entertained. It should be noted also that the
gross verbal-visual contrast exemplified here is probably not
a valuable hypothesis. Studies by Carry (2), Hamilton (13),
and Gagne and Gropper (10) suggest that finer delineation of
treatment content variables and more exacting analysis of
the cognitive skills involved in each is required. This par-
ticular global hypothesis appears untenable.

Now let us take up some real studies that should serve to

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LEARNING
OUTCOME

VISUAL
TREATMENT

VERBAL
TREATMENT

LOW   SPATIAL ABILITY   HIGH

(High
verbal
ability)

(Low
verbal
ability)

Preferential Model

Figure 2(a).

LEARNING
OUTCOME

VERBAL
TREATMENT

VISUAL
TREATMENT

LOW   SPATIAL ABILITY   HIGH

(High
verbal
ability)

(Low
verbal
ability)

Compensatory Model
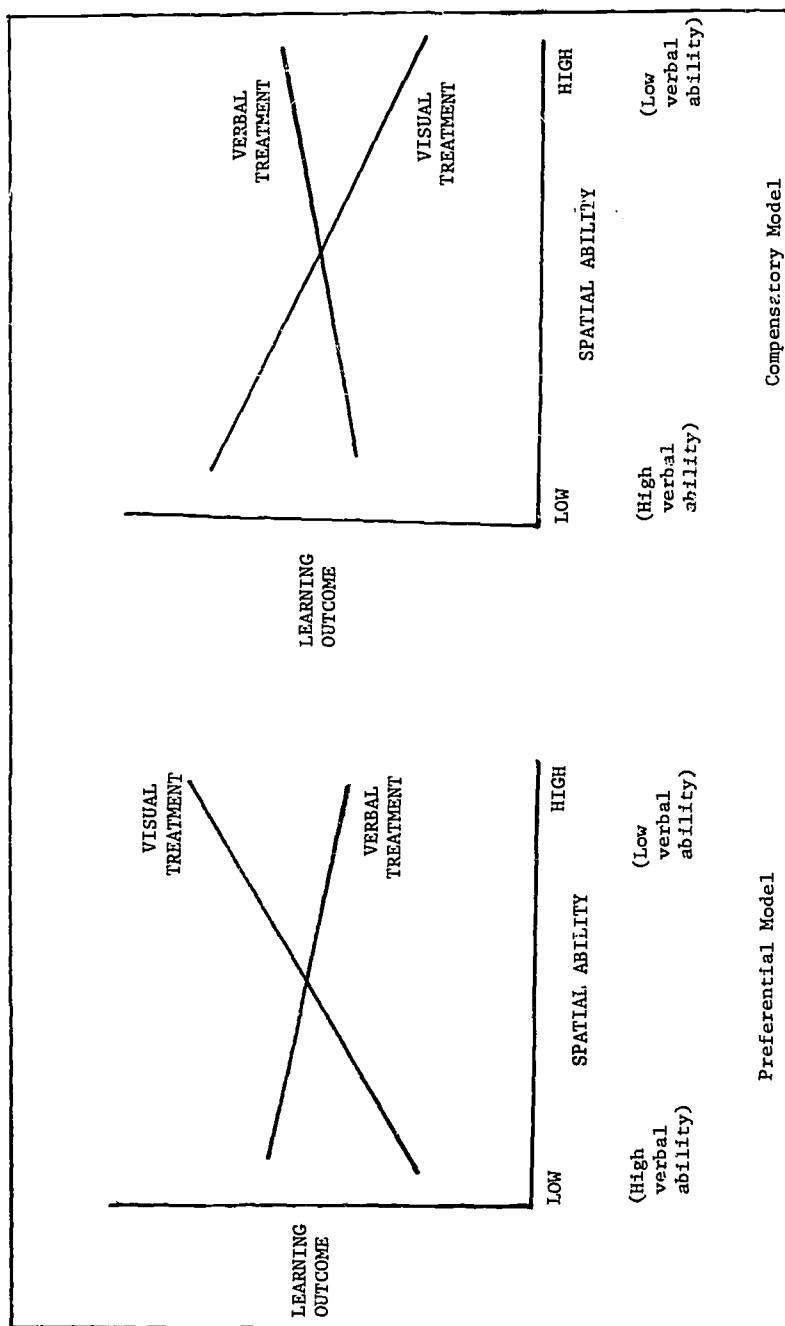
Figure 2(b).

demonstrate the kind of hypothesizing represented by the models.

Salomon randomly divided 26 teachers in training between treatments designed to improve hypothesis generation (HG) or cue attendance (CA) skill (15). Both groups saw a film made by random reorganization of scenes from a coherent film. HG Ss were then asked to provide as many alternative explanations or hypotheses about the underlying story as they could. The film was replayed until Ss produced at least 12 hypotheses. CA Ss were asked to report as many stimulus details as possible. Trials were repeated until Ss had listed 150 visual details.

After training, a transfer test ("Information search") posed a complex problem involving the development and staffing of secondary school English departments in a Spanish-speaking district. Each S generated questions he would want to have resolved as he worked on the problem, his score being the number of questions listed. The aptitude variable of interest was general verbal reasoning (GRE-V).

HG training led to more question asking where GRE-V scores were 550 or better (Figure 3); Ss scoring below 550 produced more questions after CA training. CA apparently requires one to lift restrictions on attention, to report details without evaluating. Perhaps this bores the more verbal subjects. It may be best for less able Ss precisely because it promotes attention to detail. HG training may require more verbal analytical and reasoning skill and thus may be more challenging and preferable to high-ability Ss. In other terms, HG and CA approaches may represent alternative problem-solving strategies, each useful to different pupils. Such findings might also result if skill in CA is prerequisite to HG performance, and both are dependent on general ver-verbal facility.

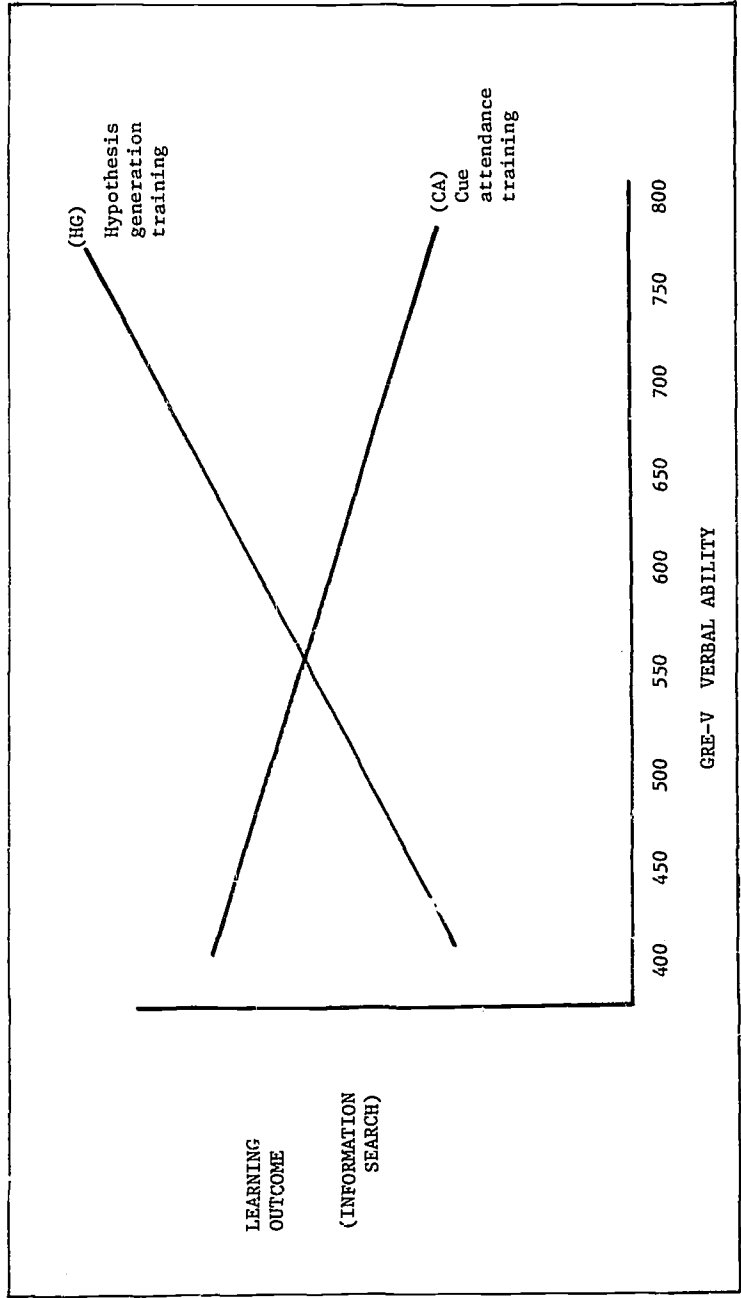Koran, following earlier work by McDonald, designed

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Figure 3. Salomon study.

alternative treatments involving various kinds of models to
improve intern teachers' ability to ask analytic questions
in microteaching situations (14). Microteaching is a lab-
oratory arrangement in which the trainee teaches a prepared
lesson to a few pupils for ten minutes. The trainee re-
ceives feedback or criticism and replans his lesson, then
returns for a further teaching trial with other pupils.
Teacher interns (N=121) were randomly divided to form three
groups. In a video-modeling treatment (VM), S viewed video-
tape of a master teacher performing the required skill be-
tween microteaching trials. In the written-modeling treat-
ment (WM), S studied a typed transcript of the sound track
for each trial. In the control treatment (NM), S received
no information between trials. The number and nature of
analytic questions served as criteria. Pretest aptitude
measures were perceptual and verbal factors from the ETS
Kit (8) and from earlier work (17).

The relation of criterion performance to Part 1 of the
Hidden Figures Test is traced in Figure 4. Parts (a), (b),
and (c) show separate regressions of the criterion on apti-
tude for the three teaching trials, respectively. The WM
treatment worked best for those scoring high on Hidden Fig-
ures, Part 1, while VM was best for low scorers. As noted
earlier, Hidden Figures performance can be interpreted as
an index of general ability or of Witkin's field independ-
ence. The verbal, self-paced, unrestrictive, articulate
treatment, WM, made this aptitude of positive value. In VM,
the audio-visual, fixed-pace, attention-restricting treat-
ment, "low aptitude" Ss did best.

Part 2 of the Hidden Figures did not show interaction,
but it should be noted that two parts of speeded unusual
tests may well tap different aspects of learning ability.
In addition to the Hidden Figures results, some similar
interactions were obtained using Maze Tracing Speed, another
perceptual test. Also of note were interactions obtained
with an experimental film memory test, to be described below.

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TRIAL 1

TOTAL
ANALYTIC
QUESTIONS
ASKED

(Before
treatment)

(a)

HIDDEN FIGURES PART I

WM   Word modeling
VM   Videomodeling
NM   No modeling

LOW   HIGH

TRIAL 2

TOTAL
ANALYTIC
QUESTIONS

20
15
14
8
4
3

(b)

LOW   HIGH

HIDDEN FIGURES PART I

WM
VM
NM

TRIAL 3

20
15
14
8
5
4
3

(c)

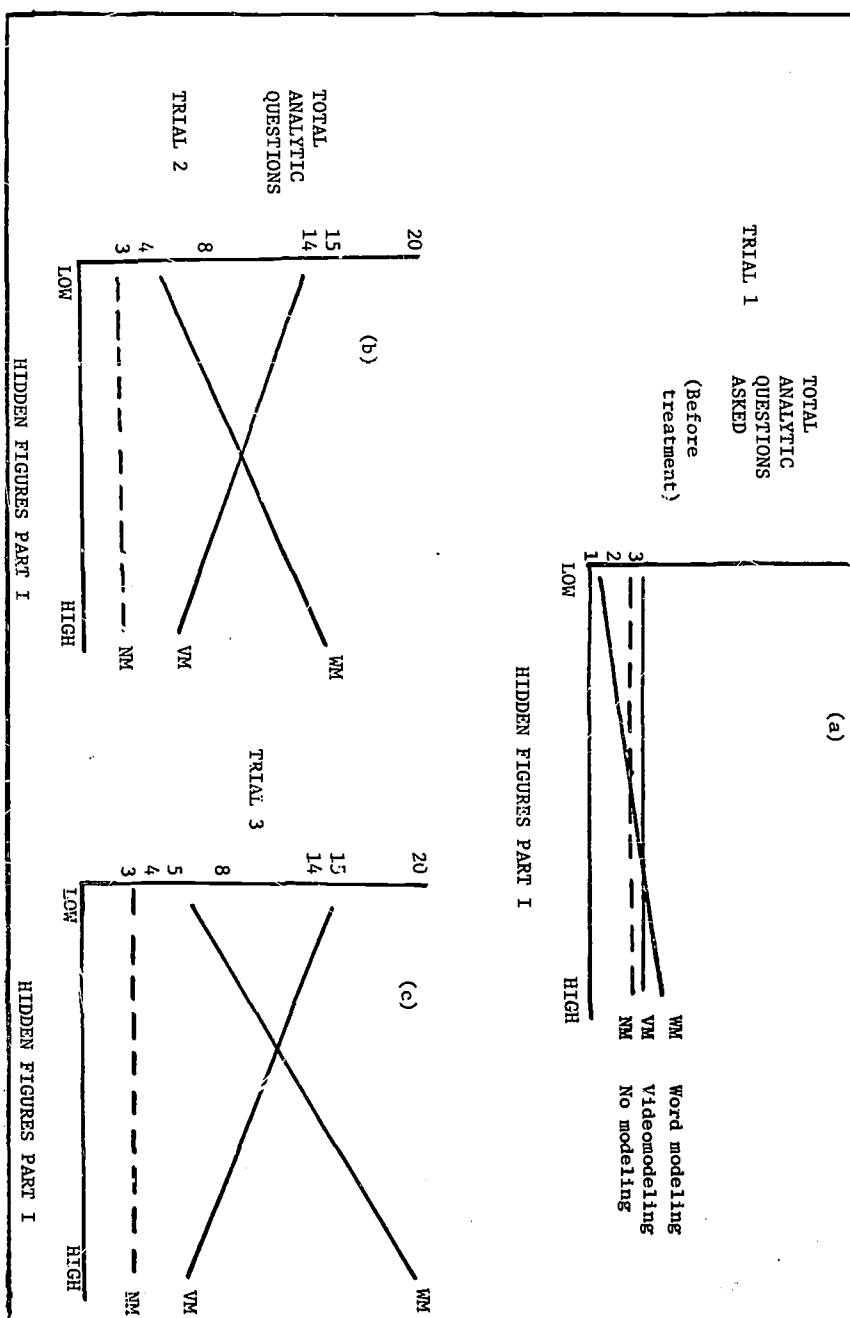LOW   HIGH

HIDDEN FIGURES PART I

WM
VM
NM

Figure 4. Koran study: simple regression analysis.

No ATI were obtained using tests representing perceptual
speed, verbal comprehension, auditory memory, or expres-
sional fluency.

Let us here attempt to interpret the Salomon and Koran
work together, along with some other implications. The
emphasis of the CA and VM treatments appears to be attention
to and differentiation of stimulus detail. In HG and WM
treatments, these processes presumably are necessary but are
not explicitly forced. These treatments allow more associa-
tive inferential behavior. Now suppose that the aptitude
variables used in these studies are taken as aspects of gen-
eral ability. Perhaps lower-ability $\underline{Ss}$ are weak primarily
in attentional and discrimination skills, as suggested by
Zeaman and House (21). This would account for weakness in
CA and VM treatment. Perhaps such $\underline{Ss}$ are deficient also in
employing certain kinds of symbolic coding during conven-
tional instructional tasks. CA and VM treatments compensate
for this lack by detailed drill that isolates stimulus ele-
ments and employs concrete representations. These treatments
may provide coding systems for the learner thus improving the
performance of low-ability $\underline{Ss}$. High-ability $\underline{Ss}$ do badly on
these treatments, perhaps because they react negatively to
emphasis on detail. High ability pays off in HG and WM,
where these $\underline{Ss}$ can mediate, abstract, and reason at their
own relatively fast pace. The emphasis in these treatments
is on the rapid manipulation of symbolic meaning, probably
a preferred mode of operation for high-ability $\underline{Ss}$ but one
unsuited to low-ability $\underline{Ss}$. These latter treatments are
more similar to conventional meaningful instruction where
outcomes typically relate positively to general ability.

Thus, it does seem that interaction arises in these
studies from a compensatory-conciliatory process in which
some harmony between the defects or style of the learner and
the characteristics of the treatment is achieved. For the
low-ability $\underline{S}$, the good treatment provides aid in stimulus
differentiation where he is deficient and needs compensation.

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For the high-ability $\underline{S}$, the good treatment provides the associational latitude which he prefers.

If this hypothesis has validity, it should be possible to take some further steps toward expanding the current conception of aptitude. Those who do best under CA and VM treatments should be describable in positive terms, not merely as persons of low general ability. We should be able to construct new aptitude measures, which tap skill in stimulus differentiation and in the use of coding systems not typically found in conventional instruction. Some attempts at such development have resulted in a number of experimental tests using motion pictures as the communication medium (16, 17). One such measure, called Film Memory, was involved in the Koran study. In this test, $\underline{S}$ attempts to recall the content of a live-action silent film. The content portrays complex human behavior, largely nonverbal, that is probably hard to encode in symbolic or verbal terms. Combining this test with Hidden Figures, Part 1, in multiple regression analysis, Figure 5 was obtained. The criterion here is the number of analytic questions asked by teacher trainees on trial T_3 of the three-trial microteaching treatment. (The control group is not shown.)

The planes for the two modeling treatments are differently pitched. Film Memory functions in a manner opposite to that of ability measures considered earlier; the regression slope is *positive* for VM and *negative* for WM. The two planes intersect to form a line, which has been projected onto the base plane to show how a two-dimensional decision rule would be used to classify $\underline{S}$s on the basis of the bivariate aptitude. $\underline{S}$s high on Hidden Figures, Part 1, and low on Film Memory should be given the written modeling treatment. Those with good Film Memory, especially if poor on Hidden Figures, Part 1, would be better off in the video-modeling treatment. The earlier discussion of preferential and compensatory processes applied here. One can interpret positive slope as indicating that a treatment capitalizes on

an ability, while negative slope suggests that a treatment compensates for low ability and frustrates high ability.

TOTAL
ANALYTIC
QUESTIONS

TRIAL 3

VM

WM

HIGH

HIDDEN
FIGURES
PART I

LOW

HIGH

LOW

FILM MEMORY

VM + -.31 (Hidden Figures) + .58 (Film Memory) + 3.77
WM + .94 (Hidden Figures) - .30 (Film Memory) + 10.65
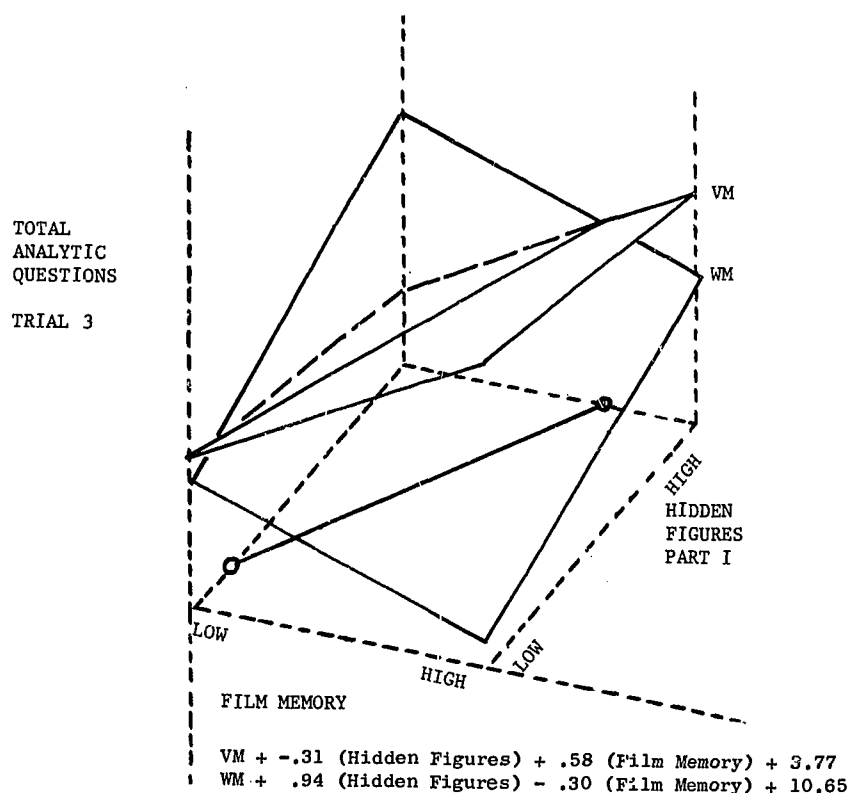
Figure 5.   Koran study: multiple regression analysis

Figure 5 suggests that multiple combinations of specially constructed aptitude measures may be necessary to reach large ATIs that generate considerable achievement payoff. The kinds of aptitude defined in the base plane of Figure 5 represent a significant departure from traditional conceptions. Film Memory is not an ordinary experience in test taking, even for college students; and Hidden Figures, Part 1, is just the first half, perhaps the learning-trial half, of a conventional test.

The preceding discussion leads toward a general

conception of instructional treatments as prosthetic devices
for particular aptitude groups. A treatment that proves es-
pecially appropriate for a person deficient in some partic-
ular aptitude may be functioning as an "artificial" apti-
tude. It contains the information processing functions that
the learner cannot provide for himself. Whether there is
value in this conception as a guide for identifying ATIs
remains to be seen.

This discussion also leads to some further thoughts
about media. Interpretation of the Salomon and Koran stud-
ies rests on a choice of general fluid ability-field inde-
pendence as a first aptitude. This variable should corre-
late positively with instruction that allows self-paced,
rapid scanning and review and allows meaningful association
and inference. Many familiar conventional instructional
situations can be characterized this way. Why does Film
Memory function so well as a second aptitude? Is it partic-
ularly useful for ATI work with audio-visual media? Does its
value suggest a uniquely important role for cine-psychometric
devices in ATI research on media? There is not much infor-
mation about Film Memory available from the earlier work
since it has usually defined a factor of its own, but there
are implications from some similar tests used in the
earlier work and also some hints from a theoretical consid-
eration of the nature of the task involved. Film Memory
performance may represent the ability to distinguish and
remember both central and incidental visual details in com-
plex ongoing visual presentations. The individual who per-
forms well here may use a different form of image represen-
tation, storage, and retrieval system from individuals who
perform poorly. This process, in turn, hints at three other
ideas about human learning and development. One, suggested
by Deese (1964), is that incidental learning is different
from intentional learning only in the coding or representa-
tion system used. Thus, the incidental process may rely on
a less efficient but more exacting internal record of the
stimulus situation. Note here also, Fleming's review of

Bower's work. Secondly, this matches Bruner's notion of
iconic representation system which forms a stage in early
human development but which remains for use throughout life
as a kind of more primitive and subordinate, but sometimes
more useful, learning system. The third idea is that a per-
ceptual cognitive-style like leveling-sharpening may repre-
sent the same distinctions between representation systems.
The leveler conceptualizes, integrates, and accumulates a
dominant cognitive organization. Perhaps he uses abstracting
codes (i.e., modifies new stimuli to fit a growing symbolic
system). The sharpener discriminates and maintains a per-
ceptually distinct set of stimulus images, perhaps a more
iconic representation. This is essentially speculation but
it is consistent, if loosely, with a rough organization of
much theory and research now in hand on learning, develop-
ment, and the effects of some kinds of audio-visual experi-
ences. If it is borne out by further work, however, it rep-
resents the first example of a new definition of aptitude of
particular relevance to research on audio-visual media. The
conventional concept of general intelligence or aptitude was
the Victorian Englishman's way of understanding differences
in learning from his kind of instruction. With new forms of
instruction, it stands to reason that there should be new
conceptions of aptitude.

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The development of self-instructional,
self-testing, easily-understood materials of
instruction can be revolutionary. They can
break the grip which inflexible requirements
of time and place of instruction now hold on
schools and colleges. Our present focus of
attention is often on the teaching and not on
the learner. There can be learning without
teaching and teaching without learning. If
students learn well, they have been taught
well--no matter who taught them or what in-
structional materials were used.

> ---*Edgar Dale, Editor*
> *The News Letter*
> *March, 1970*

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Our Declaration of Independence tells
us that life, liberty, and the pursuit of
happiness are our inalienable rights. How-
ever, without the right to education, all
other rights are diminished. The right to
education is as vital in today's society as
that of freedom of speech. What value are
the freedoms to speak or to petition or of
the press if one cannot articulate a griev-
ance, proffer an appropriate solution, or
even read? Who can calculate the loss to
the nation--indeed to the society of man--
of an undeveloped latent talent? Have we
lost a cure for cancer, a new brilliant
social philosophy, an inspiring symphonic
composition because an infant was malnour-
ished, because a child never learned to
read, or because the tuition for college
could not be paid?

The ideal for a democratic society must
be the fulfillment of the capabilit_es of
all individuals. Educational opportunity is
a fundamental means to that end.

---*Hubert H. Humphrey,*
guest editorialist
in The School Adminis-
'rator, May, 1970

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THE MOTION PICTURE

AS A PSYCHOLOGICAL TESTING MEDIUM:

A LOOK AT CINE-PSYCHOMETRICS

warren f. seibert

FOR REASONS that should be clearer later, the inclusion in
the present context of a report concerning the psychometric
uses of motion pictures is based more on the novelty and the
unexploited promise of such work than on the quantity or
firmness of evidence thus far produced. This is not to say
that data are absent; they are only in short supply. And
although this is essentially true, the opposite might have
been true, since some recognition of the film's psychometric
potential dates back two generations, touching even the ear-
liest days of modern work on human abilities. In other words,
it pre-dates World War I.

Even though film's psychometric potential is old and rec-
ognized and even though several of the most honored psychol-
ogists are among those found in the accumulated literature--
names like Boring (3), Guilford (10:414; 11:396), Gibson (9),
and Thurstone (16:404)--there still is no sustained effort
or momentum in the field. Currently, a quarter of a century
after one major project and a half-century after the field's

inception, research is dormant again. That fact and some
earlier experience in describing cine-psychometric work to
other audiences suggest that this report should proceed as
if psychometric films were a new idea; audiences still too
readily associate film with entertainment or, to a lesser ex-
tent, with instruction; and they associate ability testing
with paper-pencil techniques. They seem not to accept easily
statements that violate these associations. Nevertheless,
we can with profit regard film as a versatile, generally re-
liable audio and visual communications medium; and we can
regard psychological testing simply as communication which
has rather specialized purposes.

Once the prevalent and artificial separations of films,
tests, and communications are overcome, it can become easy
to generate research questions which are finally within
reach, to imagine applications of such tests in educational
assessment, talent identification, and otherwise. It may
seem that most earlier research on the nature and dimensions
of human ability has been unjustifiably narrow in its con-
ception and procedures, since "Many human decisions are made
within contexts which are not static, not principally verbal,
and not characterized by the presence of print" (14:140).
If one suspects, as do Ferguson (6, 7) and others, that cul-
ture exerts a major influence on the nature of the developed
human abilities, then there is likelihood also that these
"many human decisions" leave their mark on the intellect of
the culture's members. Much of this is speculation, of
course, but that does not make it necessarily weaker than
the opposite assumptions which extend implicitly through the
literature on intelligence and ability. Speculative as it
is, we may entertain the notion that human abilities are not
only various and shaped by the requirements which culture
imposes, but also that they include components which are not
amenable to the prevailing and conventional forms of testing.

The suspicion that conventional forms of testing are too
restricted was a major factor in the decision during World

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War II to establish the Air Corps' Psychological Test Film
Unit. This unit, under the direction of Dr. J. J. Gibson
(9), developed more than 20 motion picture tests, virtually
all designed for use in the selection of military aircrewmen.
It seemed then, and is reasonable still, that the task of
air crew members puts a premium on several rather specialized
perceptual abilities, especially visual perceptual abilities.
Air crew members are required to operate in a moving, three-
dimensional visual environment and to judge distances, motion,
positions, and rates of motion or change. Ability to make
these judgments is rarely evaluated directly by conventional
ability measures, and it was therefore plausible that their
measurement could contribute to improved selection of air
crew trainees. In the almost two years of the unit's exis-
tence, it planned, produced, and refined the nearly two dozen
novel tests; but material shortages and then the decline in
the training requirements and tempo of the war resulted in
the limitation of contemplated validity studies. It still
is unknown whether the tests' original purposes were met.
The few validity estimates that were obtained gave too little
indication of worth to allow such judgments; however, the
work established the feasibility of such tests and the prints
which still remain demonstrate well the new forms and tasks
which film makes possible.

The work of Gibson and his co-workers can be regarded as
the earliest of "modern" film testing, since for the first
time film was extensively used as more than a container or
record of normally-occurring events. The earlier applica-
tions of films had tended toward these simpler recording
uses, as evidenced in the work of Boas (2), Boring (3),
Metfessel and Warren (12), and Carmichael, Roberts, and
Wessell (4). But Gibson, while not totally avoiding the
events-recording or "window-on-the-world" functions of film,
made extensive use of animation, editing techniques, and
mock or simulated conditions to achieve test purposes.
Among his test films are examples simulating approaches to
an airport runway and requiring judgment of the likely point
of landing; others requiring judgment of an object's veloc-
ity or change in velocity; and still others requiring inte-
gration or discrimination of simple, momentary cues in a com-
plex visual field. These are but a few of the tasks prepared
a quarter century ago; and they are described here only as
they appear, not necessarily as they may function
psychologically.

The history that is barely sketched here and that is
more thoroughly treated in an earlier article already cited
(14) gives many justifications for the study and use of psy-
chometric films. This history reveals not only the names of
illustrious contributors but also a field for psychological
research that is promising, novel, and largely untouched.
It offers, first, greatly expanded opportunities to examine
hypotheses that derive from views like those of Ferguson (6,
7), views which assign major importance to cultural demands
as shapers of intellect. Second, with film the chances for
studying a great variety of abilities, especially memory
abilities, are immediately available. More will be said
about this later, so suffice it to say here that the very
short-term memories, which conceivably encompass the most
significant events-phenomena from all of psychology, can be
efficiently and systematically examined. Also, since the
presentation or exposure of item materials can be precisely

sequenced and controlled, film tests allow expanded and more
detailed response recording: GSRs during problem-solving,
electroencephalographic recording, and visual scanning rec-
ords, as well as all conventional forms of response and
record. It is hard, for example, not to be interested in
examining the EEG patterns or the visual scanning behaviors
of $\underline{S}$s who are presented with systematically varied and/or
factorially distinctive test items.

On the more practical side, there are other motivations.
Film can be used to assume the main tasks of the test admini-
strator and to perform these reliably on each occasion. It
can more nearly simulate many real decision situations, as
in trouble-shooting or the analysis of information from a
real and complex perceptual field. It can present informa-
tion in large or small amounts without necessarily using
language; the significance of this in the testing of special
populations--the educationally deprived, the auditorially
handicapped, the young--is not hard to imagine.

A difficulty for most researchers, but especially for
those who choose large and uncharted regions to study, is
deciding what portion of the domain to examine. For Gibson
this question was largely answered by wartime manpower re-
quirements. He needed to focus on the development and
study of perceptual ability measures which seemed related to
air crew tasks, but unrelated to other successful measures
already used for air crew selection. In one very limited
sense it would be good if a similar, clear need could be
found to guide contemporary work, but none has; and the
work, when it is not altogether dormant, seems somewhat
schizophrenic. Our own work has attempted to make both
early and practical contributions and to ask more basic
questions. There was need still to demonstrate the feasi-
bility, or perhaps it was the ease, of developing and em-
ploying novel test types. This need surely is accomplished
now. There was and is the desire to devise measures useful
in educational and in other applied settings, especially

those which might assess ability to learn in non-conventional
(e.g., audio-visually mediated) instructional settings. Then,
more basically, there are the broad, strong, and related sus-
picions that intellectual abilities can develop in response
to cultural requirements and also that static print is too
restricted to elicit the full variety of abilities.

Recent research, like Gibson's work a quarter century
ago, is forced to rely heavily on ideas and experimental
tests specially developed for the purpose. In all, about
fifty such tests have been developed during two research
projects (15, 13) and these tests represent not only many
purposes, hopes, and formats, but also a wide range of tech-
nical quality. Some were never developed past the point of
being a few filmed items which are unedited, unrefined, and
so far as anyone can yet tell, uninteresting. Others have
been extensively planned, edited, and refined through multi-
ple uses. They not only make good appearances, but also ad-
minister well and yield satisfactorily reliable scores.

Difficult as it is to describe the more novel and, we
always hope, the more promising tests, some descriptions
seem needed. As introduction, one should recognize that
even though it is possible to develop "unitized" film tests
(our term for tests which base several questions or queries
on a single, continuous stimulus), most of the tests pro-
duced thus far have been "itemized." In these, a single
question is posed and a single response required for each
item stimulus. For a typical item, an item number will first
appear for perhaps two seconds, the stimulus and its implicit
or explicit query will be presented, and then a few seconds
(i.e., 8-12, usually) are provided for Ss' decision making
and response recording.

Several short-term visual memory tests have been devel-
oped, each of which borrows liberally from the experimental
procedures of Averbach and Coriell (1). In the items of one
of these, for example, an 8-letter (4 x 2) array is flashed

on the screen for the duration of one film frame, which is
about 31 milliseconds (msecs). Then, at an interval which
may precede the array by 52 msecs or follow it by 10, 94,
177, 260, 344, 427, or 510 msecs, a bar marker is flashed on
the screen to designate one of the eight array positions.
The S̲s are then required to record the letter which occupied
the designated array position. They are in effect required
to hold the array in memory for intervals up to one-half
second before they are told which element to record. As can
be seen, eight subtests are derivable from this test--one
for each memory duration--and, as it happens, each subtest
includes eight items. Hence, there are 64 items and the
total testing time is approximately 18 minutes. Two varia-
tions on this same test use, in the items of one, a circle
or encircling marker, rather than the bar marker; and, in
the other, a bar marker presented simultaneously with the
eight-letter array and an encircling marker at the planned
intervals after or before the array.

Short-term memory tests based on multiple-element arrays
have been particularly interesting to develop and study.
They include not only the three tests (and 24 subtests) just
described, but also others based on 8-letter arrays that re-
quire recording (a) of each *full* array, (b) of only the
vowels from each array, or (c) of letters *common* to two
flashed arrays. Two other memory tests employ six color
patches or samples in each item. These appear in a 3 x 2
array for 177 msecs, 344 msecs, or 510 msecs. There is then
a 60 msec delay, which is followed in the items of one test
by a hexagonal position marker and, in the other, by a col-
ored horizontal bar which designates a color to be remembered.
The S̲s' task in the first of these is to select the color
name which coincides with the designated array position. In
the second, they must indicate the array position which coin-
cides with the indicated color. These same two test formats
are also used in two "object memory" tests. For object mem-
ory, photographs of common objects (a car, a shoe, a camera,
a chair) are used in place of colored patches or samples.

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The tests briefly described above are among the more at-
tractive developed thus far and no small part of this attrac-
tiveness derives from the unusual, "Fleishman-esque" analyses
(8) to which they are so amenable. Those who know Edwin
Fleishman's work are usually intrigued by his productive
combination of correlational and experimental methods. His
method, in outline, is to administer multiple motor and in-
tellectual ability tests, to give Ss multiple (and scored)
trials for the learning of some motor skill, and then to fac-
tor analyze the several ability and skill-learning scores.
His data repeatedly show changes in the factor composition
of successive stages in skill learning. Our short-term mem-
ory tests, since they are systematically divisible into sub-
tests, are equally suited to such analysis. In these analy-
ses, the varied memory intervals or stimulus exposure dura-
tions are used in lieu of Fleishman's practice (or learning)
stages (see, e.g., 15:83; 13:40).

These analyses of short-term memory abilities have pro-
duced some unusual results, much as the similar analyses did
for their originator, Fleishman. A principal feature of the
results also relates to some tests and to an ability factor
which must now be identified. First, as brief background,
in early work we borrowed a test title from Gibson and in-
vented a task to go with it. The title was "successive per-
ception," which for Gibson applies to two faintly similar
tests. In one, each item requires Ss to identify a two-
dimensional geometrical figure which is cumulatively re-
vealed behind a downward-moving viewing slit. The entire
figure is never seen, but over time, all parts are revealed.
In the second test, a dot moves on the screen and describes
a pattern, but leaves no trace as it moves. The task is to
remember the trace, path, or pattern and to select it from
among five alternatives.

Our versions of the Gibson idea, which we entitle Suc-
cessive Perception III and IV, use a photograph of a common
object within each item. The object is filmed while

successively concealed behind eight white mats or masks. In
each mask square openings allow portions of the photograph to
be seen and, across the full set of eight masks, all portions
are revealed. In ne version, Successive Perception III, the
mask changes with each film frame, thus revealing all por-
tions of the photograph three times per second. In the other,
the mask changes every 625 msecs. Thus, all parts of the
photograph may not be seen for almost 4.5 seconds. Not only
does the slower change rate alter the appearance of the
items, making the square openings seem to dance, but it
seems also to increase the task difficulty by a large factor;
mean scores on the first version have been in the range of
9.0-10.5 (of 20) and have been 4.0-5.5 for the second version.

In the few factor analyses completed thus far, our suc-
cessive perception tests have shown a consistent affinity for
each other and have been the principal, but not the exclusive,
tests in a consistently appearing ability factor which has
been named serial integration (or temporal closure); yet they
show no affinity for Gibson's similar measures. The factor
which they represent seems to be the ability to "bridge"
small gaps in time and to merge intellectually the time-seg-
mented fragments. Another of the tests appearing consistent-
ly in this same factor and one which adds credence to the
above interpretation is entitled Sequential Words; its items
present six-letter adjectives, one letter at a time, during
an interval of roughly .5 second, and with each letter ap-
pearing in the same center-screen location. Examinees are
required to recognize and record each word. As with our
two Successiv, Perception tests, the ability to close or to
integrate across gaps in time seems the most prominent fea-
ture in performance on Sequential Words.

The consistency of the serial integration factor is re-
markable and impressive. Not only does it appear in each of
our analyses where we could expect it (15, 13), but its com-
position continues to support the interpretations originally
given to it. It also represents the best available evidence

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that human abilities are more numerous and more varied than
we normally think and that printed, static tests do not eli-
cit sufficient variety. Furthermore, as suggested earlier,
serial integration ability has given repeated evidence of
involvement in certain subtests from two short-term visual
memory measures. These measures, STVM II and III, have re-
vealed and replicated a result which is essentially the fol-
lowing: during very short (i.e., 10 or 94 msec) memory in-
tervals, serial integration ability is prominently involved
and may account for as much as 20 percent of the variance;
it subsides and is not involved noticeably with the inter-
mediate intervals, but appears again and more weakly at the
one-third, four-tenths, and/or one-half second memory inter-
vals. In other words, these two STVM measures, which have
in common a simple 4 x 2 stimulus array and an encircling
marker to designate one element from each array, also show
distinct and apparently reliable patterns of correlation
with the serial integration factor. In these tests, when
memory is required to operate across very short intervals,
serial integration is most prominent; it is least prominent
(or essentailly absent) across the intermediate memory in-
tervals and is detectable again across the "longer" (e.g.,
.4 sec) memory intervals.

The significance of these sparse results, of course, can
not be specified yet; but some of the more striking features
bear emphasis and thought. First, the serial integration
factor is a "first"; it is a talent or a fragment of human
ability which is generally unexpected and unlike others that
abilities psychologists have studied. It is also a dutiful
and responsible ability, since it has always appeared when-
ever its conditions were met. In a sense, it is a brazen
ability, not content simply to appear in factor analytic
results and otherwise to remain invisible and aloof, but
intruding itself into the STVM performances clearly and yet
selectively. Because of this selective intrusion, there is
now not only a mystery to pursue, but also a buttressing
demonstration of the uses of Fleishman-esque analyses, and

the alarming realization that even though the STVM task was
altered in the most trivial way (i.e., memory intervals were
made longer or shorter, but always within a range of one-half
second), it was still accompanied by detectable changes in
what seem to be the underlying intellectual processes. A
few milliseconds now seem more important than we customarily
think.

In conclusion, Ferguson has suggested several points at
which the interests of correlational and experimental psy-
chologist overlap; centrally, the two groups share a concern
with "ability." Also, Cronbach (5) has traced the separate
courses of experimental and correlational psychology and has
shown how reasonable it would be for them to merge and to
develop supportively. Fleishman has demonstrated his agree-
ment through a novel joining of procedures and concerns which
are partially correlational and partially experimental.
Limited though the cine-psychometric research has been, it,
nevertheless, seems productive and seems most promising in a
framework like that which Ferguson, Cronbach, and Fleishman
reflect.

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MEDIA,

EXPRESSION,

and the

ARTS

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THIS PAPER DESCRIBES the relationship between media, expres-
sion, and the arts and suggests what these relationships im-
ply for educaticnal practice and media research. To do this
requires brief excursions into the meaning of expression,
into the components with which the artist works, and into
the demands visual works make on those who wish to encounter
them on the plane of meaning.

The content of this paper rests upon seven ideas:

1. Expression is a consequence of intelligence.

2. The arts are one of man's major expressive modali-
ties, hence depend on intelligence.

3. Expression proceeds through the forms of art by vir-
tue of the symbols, syntaxes, and media with which the
artist works.

4. The expressiveness of the arts is known by the ex-
perience the forms of art evoke.

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5. To experience art forms requires an ability to "read" the form, that is, to decode what artists have encoded.

6. Artistic development depends not only on the artist's ability to create new symbols and syntaxes but also on the nature of the media available.

7. New forms of art evoke new forms of experience, inform us about the qualitative aspects of life, and reawaken our awareness to the old.

To assert that expression is a consequence of intelligence is not a self-evident truth. There are many situations in which the term expression is used to describe states of affairs that appear unrelated to intelligent action. An example would be facial expressions. We frequently describe certain postures or demeanors as expressive; we often express anger or joyfulness during certain events that touch our lives. The display of these conditions is not usually thought of as dependent upon the exercise of intelligence, and we seldom talk about them as acts of intelligence. If it is possible to describe expression as unrelated to intelligence, why should it be asserted that expression is a consequence of intelligence?

Expression demands more than self-disclosure. Expression requires a transformation of idea, image, or feeling into a medium that will give it public form. To behave impulsively, to display certain actions or attitudes is not to engage in expressive actions, for to conceive of such activities as expressive would require a conception of expression that included all of man's activities. Sleeping, snoring, the style of one's gait would in such a conception all be expressive acts. Such a concept would obfuscate the distinctly intelligent character of expressive action, not only in the arts but also in all other spheres of human activity where action depends upon deliberation. The distinctive feature of those who express themselves is their ability to relate matter in ways that reveal the qualities they have

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seen, felt, or conceptualized. The material that they em-
ploy properly functions as a medium, a vehicle, for carrying
their ideas, images, or feelings forward. The material *as
medium*, comes to embody these ideas, images, and feelings
only after the artist has exercised intelligent control over
the material. Material lacking intelligent action never be-
comes a medium. For material to become a medium, appropri-
ate transformation must take place. Such transformation
requires intelligent decision-making in the selection of the
material to begin with, as well as during the process of
creation. To express oneself, then, as Ryle (5) might say,
is an achievement verb, not a task verb; to express oneself,
is to attain a state of affairs through deliberative, if not
always through deliberate action.*

That expression is a dominant concern of artists and
that works of art express something is almost a truism.

Deliberative action is action undertaken with purpose
and serious intent. It seeks to achieve something of conse-
quence but not necessarily something which is defined or
conceived in advance. *Deliberate action* is action under-
taken to achieve a pre-specified purpose. It is goal-
directed in a highly particular way. Thus, Aristotle's ob-
servation that "Art loves chance" allows in the deliberative
context opportunities for the emergence of forms that were
not specified deliberately.

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What is infrequently recognized is the role intelligence
performs in achieving expression. For too long the arts
have been viewed in educational circles and by the general
public as a consequence of the unfettered discharge of emo-
tion. To "express" oneself in art was to let oneself go, to
give vent to feeling, to have catharsis. While this exper-
ience may include a satisfaction of artistic achievement,
these achievements are not the result of emotional discharge.
Artists like scientists must work long and hard to gain the
type of disciplined control that art demands. The intelli-
gence that is exercised in art, though often overlooked, can
be cultivated through experience. That the forms of art are
the result of that cultivation and are based upon intelli-
gence has been argued cogently by Dewey:

> Any idea that ignores the necessary role of intelli-
> gence in production of works of art is based upon
> identification of thinking with use of one special
> kind of material, verbal signs and words. To think
> effectively in terms of relations of qualities is as
> severe a demand upon thought as to think in terms of
> symbols, verbal and mathematical. Indeed, since
> words are easily manipulated in mechanical ways, the
> production of a work of genuine art probably demands
> more intelligence than does most of the so-called
> thinking that goes on among those who pride themselves
> as being 'intellectuals.' (2)

The recognition that the arts are expressive and that
expression demands intelligence does not by itself reveal
how expressiveness becomes a pervasive characteristic of
artistic form. An examination of the tools and tasks of the
visual artist enlarges the concept of expressiveness. The
task of the visual artist is one of transforming ideas,
images, and feelings into an organization of qualities.
"Quality" means the direct apprehension of sensory exper-
ience. Red, blue, light, dark, bright, dull are examples of
qualities that the artist uses as vehicles and through which
his ideas, images, and feelings are transformed into visual
forms or encoded. These qualities are used as vehicles for
the construction of morphemes, literally forms that are put
together in composition. Morphemes are constructed and are

subsequently composed. They function as symbols of the art-
ist's experience; they are the forms that convey or evoke
the experience that is called art.

The forms of artistic symbols may be classified into
four types: the conventional symbol, the representational
symbol, the connotative symbol, and the qualitative symbol.

The conventional symbol is an arbitrary form that stands
for certain events or ideas that are known by individuals in
a particular culture. The Star of David, the Swastika, and
the Valentine's Day heart are examples of conventional sym-
bols that point to certain events or ideas that are a part
of the currency of a culture. These symbols are imbued with
meaning no different from those assigned to discursive terms.
They are arbitrary forms that have been conventionalized by
cultural patterns and as such are capable of being employed
in artistic acts for the expressive ends the artist seeks to
attain. The work of Picasso, Chagall, Levine, and especially
Westermann and Kienholtz often utilize such devices for ar-
tistic purposes.

Representational symbols are forms which are designed to
represent, almost literally, the empirical aspects of reali-
ty. Paintings which, for example, depict in literal detail
the features of empirical objects are described as examples
of representational painting or of realism as a style of art.
Although it is clear that no work of art can be an exact
imitation of a work of nature, it is also clear that some
artists use forms which imitate closely the objects that are
the subject matter of their art. The works of Wyeth, Homer,
Bohrod, and Hopper are examples of works in which represen-
tational symbols play a prominent role.

A third type of symbol used in the visual arts, the con-
notative symbol, is the result of the morphological distor-
tion of representational symbols and is used to convey a
particular quality of expression, a quality which often can

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not be conveyed in any other symbolic form. Connotative sym-
bols are those symbols which alter the form of empirical ob-
jects for the sake of creating particular qualities of ex-
pression. The treatment of the human figure in prints by
Munch, the exaggeration of animals in Guernica by Picasso,
and the elongation of men in sculpture by Giocometti are ex-
amples of connotative symbols used in painting and sculpture.
These symbolic forms--the elongated men of Giocometti, for
example, take on peculiar expressive characteristics not
only because the form as form is long, slender, and open,
but also because the form is recognizable as man. The
effect of the work is a function of the interaction of the
form of art and what we perceive as non-art contexts. One
might say that the most thoroughly imitative reproduction of
an object, the most lifelike representation has the least
degree of connotative quality, while the forms of art which
deviate most from the objects from which they are derived
have the greatest degree of connotative quality.

The fourth symbolic form the artist employs is the qual-
itative symbol. The qualitative symbol is an organization
of qualities designed to represent some idea, image, or
feeling the artist wishes to convey; it has neither objec-
tive referent in the empirical world nor arbitrary assigned
meaning as does the conventional symbol. The qualitative
symbol is a non-objective form whose physionomic properties
alone evoke experience related to those properties. The
treatment of form, line, color, shape, and other visual ele-
ments can evoke in the viewer qualities of life that are
affect-laden in character. Alternative descriptions of line
as fluid or mechanical, of colors as raw or serene, and of
shapes as taut or organic indicate the recognition of two
meanings: (a) the way in which discursive metaphors are
used to capture the expressive character of visual form and
(b) the evidence of our recognition of the expressive char-
acter of such forms to begin with. These forms are evidence
of the artist's recognition of the expressive content of
visual qualities. He uses his understanding of the

expressive power of visual form to evoke, convey, and elicit
experience. What is termed non-objective art is a prime ex-
ample of the exclusive use of qualitative symbols in the
visual work of art. These forms are, as Langer (4) would
say, the forms of feeling and their creation evidence of the
nondiscursive knowledge artists possess and by virtue of
which they are able to create works of art.

Each of the symbols identifi 1 and described--the conven-
tional symbol, the representational symbol, the connotative
symbol, and qualitative symbol--represents the units the art-
ist uses to encode the message he is trying to convey; each
type of symbol is an element through which the artist's mes-
sage is realized. Any expressiveness the work possesses is
embodied in the symbolic forms the artist employs. The
statement "the work of art expresses something" means that
the symbols of art used are capable of conveying, eliciting,
and evoking an experience that the viewer finds meaningful.
But what is required to secure meaning from visual forms?
What competencies and experience does the viewer require?
It is patently clear that not all people are able to encoun-
ter works of art on the plane of meaning. Indeed, the most
common complaint of the artistically illiterate is not that
the message of art is insignificant but that it is
meaningless.

How does one acquire the art of retrieving meaning from
visual form? It is to this question that the distinctions
made about types of symbols used in art become more than an
exercise in analysis. The type of symbols used in art re-
quire different types of understanding if they are to be
appropriately experienced.

To decode works of art in which large numbers of repre-
sentational, connotative, and conventional symbols are used
requires that the viewer know something of the referents of
those symbols. Take for example the painting by Jack Levine
entitled "The Senate." The painting depicts a number of men

sitting around a table. The men are well dressed. They
huddle around the table. On the table are papers, a pumpkin,
and two birds. One of the men wears a pointed black hat
like that worn by a witch. To deal with this painting mean-
ingfully, to be able to decode the symbols used in the paint-
ing requires an understanding of the symbolic significance
of the pumpkin, of the witch's hat, and of the birds on the
table. If one is not familiar with the term "stool pigeon,"
if one has no knowledge of the import of Halloween and of
witch hunts, one is likely to miss the message encoded in
the work. While the formal structure of the work can, of
course, be a subject for artistic analysis, such treatment
would short-change the viewer and would render the work in-
effective.

To have appropriate experience with visual works dis-
playing connotative, representational, and conventional sym-
bols requires that one understand the relationship between
the referent and the symbol, and between the symbol and the
work as a whole. In Levine's case, the referents for the
symbols used emanate from the McCarthy era. Those ignorant
of that era in our history or of the Spanish Inquisition or
of similar events will find it difficult, if not impossible,
to uncover the meanings built into the work in the first
place. It is here that cultural history makes such an im-
portant contribution to the aesthetic experience. By pro-
viding the viewer with a frame of reference for viewing a
work, the artist conveys the richness of the meanings em-
bedded in the symbols. Experience with the work moves from
exclusive attention to the primary surface toward attention
to the secondary surface of the work as well.

The problems involved in dealing with forms in which
only qualitative symbols are used are somewhat different.
Since non-objective works display no symbols having refer-
ents outside of the work, knowledge of such referents are
not relevant to the experience of such works. Non-objective
works of art are formal arrays that are to be entertained

for expressive qualities* inherent in the forms, per se.
One does not and need not look for referents or analogues
in the world aside from the work. Since non-objective works
by definition consist wholly of qualitative symbols and are
not dependent on knowledge of empirical forms or convention-
alized meanings outside the work, they are *in this regard*
less culture-bound than works containing conventional, rep-
resentational, or connotative symbols. To successfully en-
counter works by Pollock, Kline, Mondrian, Kandinsky, and
others working exclusively with qualitative symbols requires
no knowledge of concrete forms outside the work. The viewer,
in large measure, explores the formal relationships the work
displays to gain access to expressive content of the form.

When it comes to a work by Reginald March, for example,
the situation is different. Unless the viewer has some no-
tion of what tenements are like, who lives in them, and what
life in such dwellings must be like, he will have difficulty
appreciating the character or import of the work. The
viewer, in short, must have some modicum of experience that
impinges on the content of the symbols used in the work.
Some beachhead of experience needs to be established outside
of the work of art for the artist to vivify that experience
through his art.

Caution must be taken in the treatment of works consti-
tuted wholly by qualitative symbols, that is, in the viewer's
conception of the nature of art itself. While non-objective
works do not demand knowledge of empirical forms outside the
work, they do require a willingness on the viewer's part to
accept such works as candidates for artistic attention. If
such works fall outside the pale, if they do not fall within

* The notion of expressive qualities inherent in the
forms per se is derived from the concept of physionomic per-
ception. This concept holds that visual forms have expres-
sive character which are inherent in their organization.
Our description of forms having the character of swiftness,
sleekness, stodginess and stability is a metaphorical indi-
cator of our awareness of the expressive quality of form.

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the viewer's cognitive conception of the nature of art, the
likelihood of affective experience with them is minimized.
Thus the problem of decoding works using qualitative symbols
in part rests exclusively on the viewer's willingness to ad-
mit the works into the arena of art.*

The process of encoding visual symbols in the visual
arts has certain parallels to the encoding processes used in
discursive fields. Encoding requires not only that the art-
ists use or create a symbol or symbols designed to represent,
convey or evoke the feeling, image, or idea he wishes to ex-
press; it also requires that the symbols be related, that
they be ordered appropriately to serve the ends sought. The
problem of constructing an appropriate relationship among
symbols is one of establishing a syntax for them. This vis-
ual logic or qualitative syntax consists of the "rules"
through which visual symbols are ordered and is typically
referred to as the style or pervasive quality of the work
of art.

In discursive communication, syntax and symbol are highly
conventionalized and are readily available. As children
acculturate, they learn the conventional symbols which serve,
at first, to relate the noises called words to empirical re-
ferents; in addition, they learn the rules through which the
noises are to be related. Deviation from these rules marks
one as an alien; and when one is deviant in the extreme, he
is out of communication with others. The syntactical and
symbolic systems, as Bernstein and others have indicated
(1, 3), define communication patterns within sub-cultures
and effect the types of cognition that can be exercised with-
in those cultures.

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*The problem of set is crucial concerning the nature of
experience people are willing to have with art forms. The
set that is held by an individual determines the parameter
of expectation that he brings to the forms of art. Those
forms which violate those parameters are not attended to aes-
thetically but assigned to the class, non-art. One major
problem in art education deals with the expectation of form
their particular concept of art admits.

In the visual arts, too, certain syntactical systems are
developed. These systems are created in the visual arts as
symbols and are ordered into new relational forms. The spare
treatment of minimal art exemplifies a highly restricted
coding system compared to the system used in abstract expres-
sionism. In the former, the nature of the syntax precludes
symbolic elaboration and confines the artist's statement to
the creation of visually simple symbolic forms. Young art-
ists striving to make it will learn the language of the
emerging visual syntax and will work within the parameters
it presents. Living in New York is an asset for the aspiring
young painter, not only because it provides a vital market
for his work but also because he has an opportunity to
encounter early the new visual languages that creative art-
ists are producing.

There are, however, certain important differences between
the symbolic and syntactical systems used in the visual arts
and those used in discursive language. Most apparent is the
rate with which each type of expressive modality changes.
The visual forms of the 1850's are not those of today. Both
the symbolic and the syntactical forms have changed enor-
mously. Indeed, if the creation of new art styles is an
instance of such change, the language of the visual arts has
gone through about a dozen major transformations since 1850.
To render comprehensible these languages, one must understand
the symbolic and syntactical forms they present.

If the rate and degree of change in syntax and symbol in
written and verbal language were comparable to the rate and
degree of change that has occurred in the visual arts over
the past fifty-year period, we would have a virtual Tower of
Babel. The codified rules of discursive language serve to
contain and to constrain radical change in discursive communi-
cation. In the arts, however, symbolic and syntactical
change is sought since through such change, artists help us
escape the stock responses and the humdrum. Indeed, change
in symbol and syntax appears to be a necessary condition for

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the survival of art.*

The development of new artistic syntaxes and symbols de-
pends not only on the creative imagination of the artist,
but also on the nature of the materials he has available.
The availability, for example, or plastic and the invention
of chemical day-glow color have made it possible to conceive
and realize artistic possibilities that previously were in
the realm of wishful thinking. The invention of the acety-
lene torch has made forms of sculpture available that Bernini
and Donatello could hardly conceive. In short, the material
and tools that culture provides affect profoundly the modes
and quality of experience that culture can undergo.

Art, like other forms of human experience, is affected
by the technology of the time. The tools that technology
provides not only make possible new formal qualities, they
not only permit the development of new connotative, repre-
sentational, and qualitative symbols, but they also further
stimulate new content for expression. Since these materials
affect the formal qualities one works with and since these
qualities serve as the medium for the message, the medium,
while not the message, shapes the message by its own pecu-
liar characteristics. Artists capitalize on these peculiar
characteristics and exploit them for their own artistic ends.
The available materials of the time are not mere recipients
of the artist's imaginative conceptions; the materials are
suggestive and bring to bear on the artistic mind their pe-
culiar characteristics. They open the realm of possibility
and in so doing contribute to the expansion of our awareness.

Thus far the attempt has been to identify the meaning of
expression as well as to show how the arts depend on human

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*A brilliant essay dealing with the conditions necessary
for artistic survival and with the evolution of artistic
concepts may be found in "The Nature of Art." Morris Weitz,
(Weitz, 1966).

intelligence for their expressive power. Further, four of
the symbolic elements with which visual artists work and com-
pose into new syntactical structures have been described.
The thrust of these remarks indicates that the encoding pro-
cess in art is a vehicle for the creation and the communica-
tion of meaning and that securing meaning from visual forms
requires an understanding of the symbols and syntaxes created
by the artist.

But, what about the meaning of these ideas for the prob-
lems of education? What do these notions imply for educa-
ting humans? What do the new media in visual fields hold
for educational planning and for educational research?

First, it should be clear that the new materials which
are now available to schools can only become media through
the process of symbolic transformation. Students can have
a hand in using these materials as media in two ways. In
one sense, they can be used critically; that is, the new
materials can be used by students as vehicles to be decoded,
as recipients of meanings already imbued in the symbolic
forms the material displays. This has been and is the dom-
inant role students occupy when dealing with encoded forms
in school, the most conspicuous form being the printed word.
This student role, however, is maintained in newer materials
as well, such as their relationship to film, television, and
the computer terminals at which they are stationed. In al-
most all instances, the role of the student is that of re-
ceiver. His task is primarily critical and receptive. It
is one of decoding messages being channelled through these
vehicles.

In another sense, however, new materials can be used as
media by encouraging students to use them as tools for ex-
pression, to have them use materials productively in order to
create meaning. In this way, the new materials that can be
used for expression become part of the resources schools
would use for the intellectual and sensible development of

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student. Schoolmen would encourage students to express and
to seek new meanings through the experimental exploration of
such materials. At present we have hardly scratched the sur-
face of this possibility. Schools still tend to be bookish
in character and the new materials that are used for instruc-
tional purposes tend primarily to be vehicles for verbal
explication.

Second, if the assertion that the material when used as
medium effects the message is true, we might encourage stu-
dents to attempt to express new meanings through new mater-
ials. In terms of educational practice, this would mean
providing studios and experimental media laboratories where
a host of new resources could be explored and exploited for
new ways of forming expression. The overly verbal and di-
dactic character of schools would be ameliorated by extend-
ing the range of expressive vehicles students would have the
opportunity to work with. They would attempt to construct
new forms--some visual, some audial, some multi-sensory--
which would enable them not only to transform verbally per-
sonal beliefs and observations (something which the school
attends to now almost exclusively) but also to discover new
conten⁺ for expression by following the leads suggested by
exploration with such media in media laboratories.

Third, if these conceptions concerning media and expres-
sion have validity, they appear to be suggestive to the
research community as well. The range of media research
would extend well beyond the task of attempting to determine
how to convey more efficiently what is now carried in words.
It would attempt to determine what the unique consequences
of nondiscursive media are for facilitating human under-
standing and for vivifying human experience. We might not
be so concerned with using visual modalities as conveyors
of discursive data. We would be less concerned with using
verbal response modalities for determining effects of non-
discursive input. We would be looking for outcomes that
take form in the new materials and laboratories. In short,

our research questions and the data we would seek would lose
much of their parochial character because of the wider con-
ception of human intelligence that we would use to generate
those questions.

Fourth, as empirical data became available to support
our hypotheses concerning the effects of new materials (and
of new symbols and syntaxes of expression), we would have
factual bases useful for reformulating educational goals.
As long as our concept of intelligence is so highly saturated
with verbal aptitudes and as long as our educational means
and ends are conceived of and dominated by verbal perform-
ance, we will always harbor a crippled if not effeminate con-
cept of human potentiality. The data we seek depend on the
paradigm of mind we employ. With a more generous concept of
mind, we could begin to secure data that might do much to
demonstrate the effects of new symbolic forms. Such a model
of mind might require new nondiscursive ways not only of se-
curing data but also of reporting the conclusions of our in-
quiries. This sounds iconoclastic, but where is it written
that efforts to understand must culminate in discursive
propositions?

Finally, the symbolic and syntactical systems we inherit
and create are not merely arbitrary conventions that point
to referents in the world of experience. To hold such a
view is to conceive of symbol and syntax as passive vehicles
for describing experience. I have suggested that the sym-
bols and syntaxes we acquire through cultural forms shape
experience. They affect what we perceive and what we be-
lieve. They form the maps through which we find our way
about. Artists have long know this--and Madison Avenue em-
ploys it on a regular basis. If education has as one of
its goals the expansion of human consciousness, it can not
achieve such a goal and at the same time restrict its atten-
tion to only, or even primarily, what discursive systems can
convey. Research into the educational uses of media might
make its most important contribution to education by expand-
ing our understanding of the potential of the human mind.

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That a weekly meeting of teachers for
using apparatus, and other exercises in re-
lation to their schools, would have a ten-
dency to raise their qualifications and to
increase the value of their services.

---*The Constitution of a Lyceum, 1829*

MEDIA RESEARCH PROJECTS:

CONSIDERATIONS

FROM A PERCEPTUAL POINT OF VIEW

malcolm l. fleming

SOME of the deterrents to the conduct of research dealing
with media in the context of perception are definitional.
Not only is a medium difficult to define, but so also is
perception. For example, a medium such as television can be
defined as hardware, i.e., in electronic and mechanical
terms or as software, i.e., as a script or a videotape. Gen-
erally speaking, researchers' definitions of television have
differed in emphasis depending on their discipline: media
professionals tending to emphasize the stimulus aspects and
behavioral scientists tending to emphasize the behavioral
consequences.

The difficulties the researcher encounters in defining
media extend as well to the operational definition of media
variables. One approach has been to employ media per se as
variables, i.e., to compare film with TV, programmed instruc-
tion with conventional. It is now apparent that such gross
categories yield research data that are meaningless, for
the within-category variance turns out to be potentially as

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great as the between-category variance. A more fruitful
approach is to employ within-media variables, i.e., to com-
pare films with optical effects and without, to compare
programs with constructed responses and with multiple choice.
Such variables are particularly appropriate where the inter-
est of the researcher, or of the funding institution, is
limited to a particular medium. However, this writer's
preference is for an essentially media-free definition of
experimental variables. For example, such variables as the
order in which the learner encounters certain cues or certain
concepts in a message, or the length of his encounter with
any one cue or concept in a message, are media-free, i.e.,
they are not limited to a particular medium. It may be more
appropriate to call some of them *pan*-media variables in that
they occur in essentially all media. Characteristic of this
approach is the use of the term "message" to refer to that
"thing" which the subject encounters, whatever the medium
involved. The experimenter's choice of medium for the dis-
play of his messages then becomes a matter of convenience,
economy, or *availability* on the one hand, and on the other,
a matter of which medium permits the desired types of dis-
plays and degree of control. From such studies, comparisons
with and generalizations to studies in other media can be
made where comparable variables have been investigated.

The definition of perception also presents serious prob-
lems. Bartley,(2) for example, cites a half dozen different
definitions from the literature and himself chooses one
relying heavily on a time line. Perception is seen as "the
overall activity of the organism that *immediately* follows or
accompanies energistic impingements on the sense organs"
(2:22). As this definition suggests, one of the primary dif-
ficulties in defining perception has been that of distin-
guishing, both conceptually and procedurally, between percep-
tion and the subsequent cognitive processes such as learning
and concept formation. Other recent writers have conceded
the artificiality of such distinctions. Forgus (9), for
example, considers perception to be a process of information

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variables. His most recent publication (VIEWPOINTS,
July, 1970) was the product of a survey of the per-
ceptual research literature. It reports more than
60 perceptual principles which are of potential util-
ity to the designer, developer, and user of instruc-
tional materials.

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uate course which relates behavioral science research
to instructional technology practice.

extraction, a process in which perception interacts sub-
stantially with the other cognitive processes. Neisser (15)
in a book titled *Cognitive Psychology* deals almost entirely
with vision and audition, topics which in the past have been
primary foci of the study of perception. It thus appears
that the study of perception can be constrained to some
rather arbitrary and isolated segment of the cognitive proc-
ess or can be conceived as an integral part of it.

For the purposes of this paper, messages will be seen
as objects of the perceptual process, objects which both
facilitate the process of information extraction and place
limits upon the amount and kind of information extracted.
Within this context, interest lies in such problems as the
media correlates of perception and the perceptual correlates
of learning.

The media researcher (or, as we shall call them here,
message researcher) might assess his interest in perceptual
data with reference to several considerations. First, it is
the contention of this paper that the antecedent character
of perception, relative to such cognitive processes as
learning, concept formation and problem solving, gives per-
ception the status of a prior condition for such other proc-
esses. For example, in a concept formation or problem-
solving situation, the perceptual conditions may be highly

determinative. In many studies of concept formation the
subject's primary task can better be described as the *per-*
ceptual discrimination of the relevant attributes than as
the *learning* of a concept or the *solving* of a problem, for
the latter typically follow rapidly once the discrimination
is accomplished.

A second reason for a message researcher's attention to
perceptual data is that the very immediacy of perceptual
responses in relation to stimulus conditions more directly
and positively relates stimulus with response. This has the
effect of reducing the import of arguments favoring attention
to one over the other--arguments such as Gropper's (11) for
response-oriented research or arguments such as those of many
audio-visual professionals for *stimulus*-oriented research.

Thirdly, perceptual responses typically permit a more
detailed and interactive account of the transaction between
the learner and the medium than do the response data typi-
cally collected within a learning paradigm. For example,
eye-movement data can suggest the order in which the learner
deals with stimulus elements and the amount of time he spends
attending to each element in a display, while recall data
yields only the eventual consequence of such antecedent per-
ceptual behavior. However, the distinctions here labelled
as between perception and learning might more profitably be
viewed as temporal distinctions within a cognitive process.

In sum, the collection of perceptual data in message
studies, while not yielding sufficient information in most
cases, can provide the basis for a more complete and more
analytical account of the learner's behavior with reference
to more of the details and subtleties of the stimulus.

In the search for interesting message variables, a kind
of perceptual analysis of messages may be appropriate. The
intent is to seek basic units or elements common to messages
in several, if not all, media. For the verbal components of

messages, i.e., those employing digital signs, there are a
number of reliable taxonomies which provide sets of re-
searchable variables. Examples are letters, syllables,
words, phrases, sentences. Words, for example, can be cate-
gorized by length, part of speech, frequency of use, sense
or nonsense, degree of appro imation to English word struc-
ture or order. However, for the pictorial components of
messages, i.e., those employing iconic signs, there are
very few reliable taxonomies for use as sets of experimental
variables.

As a step toward remedying this deterrent to research,
this writer directed a study (7) in which a sample of il-
lustrations from 40 textbooks in four subject areas was ana-
lyzed. This analysis provided the basis for the development
of 13 scales, such as area, framing, position, chroma, en-
coding medium, encoding style, information level. Scale 5,
for example, categorized illustrations with references to
their constituent elements, i.e., whether they contained
pictorial elements in combination with verbal elements, pic-
torial elements in combination with design elements, or a
combination of all three. Scale 10 categorized the informa-
tion level of illustrations, i.e., the degree to which the
following factors were present: the environment or the
ground for the subject of the picture, the shading of the
subject, the dimensional cues other than shading, and the
internal detail of the subject. Using this scale a re-
searcher would rate an ordinary photograph as level 1 and,
at the other extreme, a silhouette or outline drawing as
level 5.

These categories of pictures were shown to occur differ-
entially across types of school subject matter and across
types of instructional objectives assigned by teachers to
the illustrations. However, systematic investigation of the
relationship between these message characteristics and the
perceptual and learning responses of subjects is yet to be
undertaken. At minimum, these scales should alert the

researcher to the variety of dimensions that he can control
or vary as he deals with pictorial stimuli. There is no
longer any excuse for employing outline drawings in a study
and generalizing from them to pictorial materials having
markedly different characteristics.

Other studies dealing more abstractly with nonverbal ele-
ments have employed geometric figure, sometimes randomly gen-
erated, which employed elements such as line segments, aster-
isks, etc. In recent unpublished studies of memory in rela-
tion to visual imagery, Bower has employed what can be called
a slash in stroke alphabet. This is comprised of a variety
of line segments, the horizontal ones running either up or
down, and several diagonal ones. From such alphabets, a very
wide range of sizes and shapes of geometric and iconic fig-
ures can be generated, either randomly or systematically.
Such figures can be categorized with reference to the number
and type of constituent elements in a way or to a degree that
has not been attained with other approaches.

Somewhat more realistically, a series of studies by
Harrison (13) employed schematic representations of faces
which were constructed from a limited alphabet of features,
such as mouths which curved up or down or were straight.

Recent physiological evidence regarding visual perception
(10:118-124) supports the notion of a kind of alphabet of
stimulus features which the visual system can readily detect.
The visual system does *not* appear to be a simple point-for-
point system in which a point of light from the environment
stimulates a point in the retina which in turn stimulates a
point in the visual cortex. Rather, a feature of the envi-
ronment such as a horizontal edge or contour stimulates a
whole *pattern* of retinal cells. But the effect in the visual
cortex is such that one brain cell can respond differentially
to the whole retinal pattern. For example, one cell will
respond maximally to a vertical edge, while another will re-
spond maximally to a diagonal line, and still another will

respond maximally to horizontal movement. Thus, there ap-
pears to be a capability for selectively detecting certain
stimulus features as *wholes*.

Tnis capability is of particular interest because some of
the experimental visual alphabets discussed earlier are to a
degree consistent with those features found to be of physio-
logical import. Further, some of these same elemental fea-
tures are of significance to the practitioner. The line,
for example, has long been considered by artists to have
important aesthetic and expressive qualities. For the mes-
sage researcher dealing with iconic signs, further studies
are called for which investigate elemental stimulus features
such as lines, angles, curves, contours, edges, as well as
their combination into sense and nonsense figures.

In sum, the further analytical study of visual elements
or features would seem to be potentially fruitful for both
message researcher and practitioner.

Thus far, perception has been treated as a process of
analysis in which the constituent elements or features of the
environment or of messages are apprehended. However, the
perceptual process consists not only of analysis but also of
synthesis. Perceptual processes are wholistic as well as
atomistic. The perceiver attempts to construct unified good
figures and coherent events out of the sense data he re-
ceives, and he gives them the most likely interpretation that
the sense data and his experience will allow. Where sense
data are insufficient, the perceiver's own experiences and
needs become increasingly important determiners of his per-
ceptions.

But these general findings from perceptual research re-
quire further verification and delineation in instructional
contexts before they are of use to the designers and users of
instructional materials. For example, it is one of the so-
called laws of perceptual organization that objects or events

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that occur or are encountered in close spatial or temporal
proximity will tend to be grouped or functionally related,
i.e., similarities or commonalities are perceived when stim-
uli are proximate.

Work in discrimination learning, however, suggests that
proximity of stimuli also facilitates the perception of dif-
ferences. A relevant question for message researchers is,
Where two stimuli are displayed side-by-side in close prox-
imity, under what conditions will similarities be perceived
and under what conditions will differences be perceived?

A perceptual development dimension to the question is
suggested by a study by Vurpillot (17). Subjects were to
make a judgment of "same" or "different" with reference to
side-by-side pictures of two houses. The six windows in any
one house were all different, having certain curtains or
shutters or flowers. However, in half the stimuli, the win-
dows were identical between houses, i.e., windows in the two
houses matched exactly in size by location. In the other
half of the stimuli, there were differences between some of
the windows in matching locations.

Ideally, an adult subject would need to perceive only
one difference to report the houses different, but would
need to compare all window pairs to report houses the same.
In contrast, subjects under six years of age in this study
reported either similarity or difference after scanning half
or fewer of the windows, and these were frequently not paired
comparisons between matched locations in the two houses. For
example, in inspecting identical houses, one almost four-year
year-old fixated only four of the twelve windows, including
no matched pairs, and incorrectly judged the houses to be
different. A four and a half-year-old in inspecting identi-
cal houses fixated half the windows, including two paired
comparisons, and made a premature but correct judgment that
the houses were the same. Subjects between six and nine
became increasingly adept in search strategy, making more

paired comparisons and varying the overall number of comparisons as needed to establish difference or similarity. For example, a six and a half-year-old in inspecting identical houses fixated every window and made paired comparisons of five of the six pairs. He correctly judged the houses to be the same.

While perceptual research has investigated the behavioral consequences of different arrangements and structurings of stimulus elements (as just noted in the Vurpillot study), it is pertinent here to note that much learning research has also been done with similar types of independent variables. It has long been known, for example, that the beginning and end of a list of words are better remembered than those in between. Where the words are presented one at a time in sequence, this primacy and recency effect would seem to be a temporal phenomenon. From a perceptual point of view one might observe that the only parts of such a stimulus structure that are distinctive enough to facilitate perceptual grouping are the beginning and end points.

Where a rhythm is introduced into such a task, learning can be increased (15:233). An example of such rhythm would be the introduction of a pause after every third word. Although such stimuli contain more information to be learned, namely the rhythm pattern, memory is facilitated. Perceptually speaking, such stimuli exhibit a degree of organization or structure which facilitates differentiation and grouping. In a sense, each three-word group becomes a figure which can be differentiated from the others and which fits well into the limits of memory span. The stimulus information can be said to be in a partially coded form that simplifies perceptual processing.

When a spatial dimension or structure is added to such tasks, learning can be further increased, and the effects of primacy and recency tend to disappear. For example, Asch (1) displayed a list of syllables in several different

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spatial patterns. He found significantly fewer errors when
the syllables were displayed successively in a triangular
pattern than when they were displayed successively in one
location. There were 149 errors when the syllables were dis-
played successively in one location, 121 errors when they
were displayed successively in a linear pattern, and only 85
errors when they were displayed successively in a triangular
pattern. Interestingly, there was a marked difference in the
type of error which was typical for each stimulus structure.
For example, for the triangular pattern, there was a marked
reduction in errors among adjacent syllables. The lowest
number of such errors in the entire experiment was between
those syllables located at the vertices of the triangle and
those immediately adjacent.

Thus far, perceptual and learning gains have been noted
with reference to stimulus structures, both temporal and spa-
tial, that are essentially meaningless or that are at least
not meaningfully related to the material being encountered.
Much more marked facilitation can be noted where words are
meaningfully arranged in certain spatial structures. For
example, Bower (3) found that over twice as many words were
recalled where the words were *meaningfully* arranged in a
hierarchical structure as compared to when they were ran-
domly arranged in such a structure. In only four trials,
the group encountering the meaningful structure learned a
surprising 108 words, while that group encountering the ran-
dom structure learned only 46 words.

The replication and extension of such studies with mean-
ingful classroom materials would seem to be a fruitful area
for message researchers to exploit. Various media permit
various temporal and spatial structurings. Individual text-
book illustrations permit the study of spatial structures
while audio tapes permit the study of temporal structures.
Film and television media permit the simultaneous and inter-
active study of both spatial and temporal structurings.
Perhaps one type of stimulus structuring could experimentally

be placed in competition with another so as to discover their relative strengths.

Message researchers might also find profitable the study of message structures with reference to different subject matters. For example, the left-to-right time line has long been used to give order to historical events, and the circular figure is commonly used in biology to represent life cycles of plants and animals. Are these optimum matches of substantive structure and message structure? Do they facilitate perception and learning? Can other spatial and temporal structures be invented or adapted which will facilitate the perception and learning of other types of concepts?

A study by DeSoto (5) suggests one line of investigation for such questions. He found that certain kinds of concepts or relationships were better learned where the constituent elements were spatially arranged in a certain pattern. Specifically, problems presented in syllogistic form were more accurately solved when the spatial order of the elements was consistent throughout. For example, in the following syllogism the light-to-dark order of the elements is maintained:

> A has lighter hair than B.
> B has lighter hair than C.
> Does A have lighter hair than C?

Whereas, in the following the light-to-dark order is changed:

> A has lighter hair than B.
> C has darker hair than B.
> Does C have lighter hair than A?

Responses to this syllogism were 63 percent correct when the order was consistent but only 39.7 percent correct when the order was changed.

However, even when elements were consistently ordered within a syllogism, some orders appeared to be more readily learned than others. The following syllogism is arranged consistently in a better-to-worse order:

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        A is better than B.
        B is better than C.
        Is A better than C?

Similarly the following syllogism is arranged consistently
but in a worse-to-better order:

        C is worse than B.
        B is worse than A.
        Is C worse than A?

Responses to the better-to-worse order were 67.5 percent
correct while those for the worse-to-better order were only
47 percent correct. Apparently, logical thinking tends to
be directional in such cases, "better" being conceived either
spatially to the left or worse, or temporally as occurring
before worse. DeSoto (5) refers to this phenomenon as spa-
tial paralogic. The above-below relation was also tested and
a directional tendency found favoring the above-to-below
order.   In contrast, no directionality was found for the
lighter-darker relationship.

    There is also evidence that graduate students reliably
assign certain types of substantive relationships to certain
forms of structures. In a study by Fleming (8), subjects
were to judge the presence or absence of certain relation-
ships between elements in various spatial structures. For
example, when one element was placed below another in the
conventional hierarchical d agram, their positions was judged
by most subjects (at least 13 of 15) to suggest greater-
lesser relations, before-after relations, cause-effect rela-
tions, and part-whole relations. In contrast, when the two
elements were placed on the same level in the hierarchical
structure, none of the four relationships was reported.

    Many other structures were also tested (8). For example,
two adjacent elements on a circular structure were ascribed
strong before-after and cause-effect relations when they were
connected by arrows, but were ascribed no relationship when
arrows were absent. Consistent with DeSoto's findings, a

greater-lesser relation was ascribed much more frequently to elements in a vertical-linear array than to such elements in a horizontal-linear array.

As these studies suggest, the basic phenomena of *perceptual* organization or structure have proven productive as well in studies of learning. Such studies add further weight to the suggestion that researchers in media could productively conduct extensive series of studies of the relationships between various digital and iconic message structures and the perception and learning of various forms of conceptual relationships.

In the past, atomistic and wholistic conceptions have been largely irreconcilable in theories of perception. Recently, Neisser (15:86-104) has described the visual process in such a way as to suggest a partial resolution of the two. Vision is shown to consist of two different but highly interrelated systems: central and peripheral. Central vision is atomistic in that highly selected parts of the environment are presented to the very small central area of the fovea for detailed analysis. The fovea is capable of fine color discriminations and the resolution of fine detail. But only about one four-letter word can be centered on it at one time under normal conditions of reading distance and type size. However, the eye moves, so that new information is presented to the fovea about three times a second. From this rapid series of fixations, an image of a sentence or a picture is sequentially built up or synthesized by a process called analysis-by-synthesis.

However, all this atomistic vision takes place within the wholistic context provided by peripheral vision. While there is a marked loss of color and resolution capability from the fovea to the edges of peripheral vision, there remains the ability to spatially localize and differentiate objects within the whole visual field. Thus, the tiny aspect of the environment which is in central vision at any one moment is

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seen in relation to the whole visual space, the gestalt, if
you will. This conception of a dual but highly integrated
visual system has important implications for the message
researcher.

As an example, it is apparent that foveal vision must be
used sparingly and efficiently because of the smallness of
the fovea. This condition aided in the interpretation of
perceptual data in a study by Mackworth (14). An aerial
photo of a peninsula was divided into inch squares and pre-
sented square by square to subjects for rating as to inform-
ativeness. The photo was then presented as a whole to other
subjects whose eye movements were recorded. Subsequent
analysis of the eye-movement data was by squares. It was
found that, in general, the fixations were concentrated on
the squares which had been independently rated as most in-
formative. This was as expected. However, there were some
exceptions to this pattern, and these seemed to be limited
to the squares containing exceptionally regular and dominant
contours. The suggested interpretation was that the regular
contours, while judged to be high in informativeness, were,
because of their goodness or predictability or redundancy,
adequately apprehensible with peripheral vision. Contrari-
wise, the high information areas which contained more ir-
regular and unpredictable contours and patterns required ex-
tensive foveal attention, hence the greater number of fixa-
tions. A very interesting line of inquiry for the message
researcher might be the application of such methods to the
study of a student's perceptions in relation to his learning.
For example, one might gather eye-movement data for students
who were studying a textbook illustration and answering
questions about it. The efficiency of the students' percep-
tual behavior could be judged relative to teacher estimates
of the informativeness or substantive relevance of each por-
tion of the illustration. Also, alternative versions of an
illustration could be compared for their effect on eye-
movement patterns and on subsequent learning scores.

Another implication of the dual-visual system for the
message researcher has to do with one of the communicator's
prime problems, that of getting and holding the attention of
his audience. It is typically in the peripheral area of vi-
sion that an object of potential interest is localized prior
to its being given foveal attention. Thus, to attract atten-
tion by visual means is largely to appeal to peripheral vi-
sion, which, though reduced in acuity and in color sensitiv-
ity, is particularly sensitive to movement and to changes in
brightness. The survival value to the race of such cues to
attention is apparent, whether approaching danger is in the
form of a predator or a speeding car. Message researchers
might examine the relative power of various stimulus changes
in gaining audience attention. Movement of elements in a
visual field could be in competition with changes in bright-
ness or changes in color, the latter being interpreted at the
edges of peripheral vision as changes in brightness.

Attracting attention is only the initial problem of the
communicator, he must then hold and direct it. A series of
studies of children and adults by Faw and Nunnally (6) sug-
gests that when two visual stimuli are presented side-by
side, the one which is more novel or more complex supports
or holds the attention longer. Much further research is
needed to examine more fully the implications of such find-
ings for particular instructional contexts and particular
learners. For example, given the generality that novelty
attracts attention, just *what* is the state of stimulus
novelty relative to? Is novelty relative to what the sub-
ject expected or to his perceptual set; or is novelty
relative to the subject's past experienced; or is novelty
relative to the product of his accumulated experience?
Another whole series of studies might deal with the problem
of stimuls induced set. What kinds of stimulus features and
changes (including both verbal and pictorial factors) induce
a perceptual set? What stimulus features and changes serve
to *extinguish* a perceptual set?

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Lastly, I will touch briefly on an exciting area of
investigation: the mental image. An early area of
logical investigation, but long since banned from the halls
of behaviorism, the mental image is once again being rein-
stated to respectability and, further, appears to this writer
to be of considerable theoretical import for message re-
searchers.

A quote from Harré, a philosopher, suggests one line of
investigation.

> Postlinguistic philosophy is characterized by the
> insight that *language is not the only vehicle of
> thought.* There may be concepts which are not con-
> nected, at least in the first instance, with the
> uses of words. The additional vehicle is the image
> which linguistic philosophy expelled from paradise.
> The restoration of the image has come about through
> the realization that the study of images need not
> be entirely subjective or without strict canons.
> Image thinking does have an objective counterpart.
> Just as propositions have their objective counter-
> part in sentences, which can be serious objects of
> study, carrying propositions independent of indi-
> vidual thinkers, so models and pictures can perform
> the same task of objectivization for image think-
> ing. Thus, a new analytical discipline has ap-
> peared in the last year or two--the formal analysis
> of models. (12:13-14)*

Another line of investigation of the mental image is
being pursued by men interested in memory. Several ancient
systems for memorizing quantities of data rely on the mental
image. Some are being studied currently. Related is the
work of Paivio (16) dealing with the paired-associate learn-
ing of nouns. He found that instructions to employ mental
imagery produced significant increments in learning as com-
pared to the standard instructions to simply associate the
two words in each pair.

An extension of such work by Bower (4) adds fascinating
ramifications. Subjects were shown pairs of words and in-
structed to imagine the object pairs in some interactive

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scene. However, instead of instructions to memorize the
word pairs, subjects were told simply to rate the vividness
of their image on a five-point scale. They then, unexpect-
edly, were tested for recall in the paired-associate manner.
Their incidental recall was not different from subjects who
had been given the same imagery instructions but with ex-
plicit directions to memorize. And they recalled twice as
many words as did control subjects who had been given stand-
ard paired-associate instructions. Further, their recall
varied directly with their rating of the vividness of their
image: just over 50 percent recall for images rated lowest
in vividness, and just under 90 percent for images rated
highest in vividness.

A few of the many implications of perceptual research
have been reviewed briefly. In particular, attention has
been directed toward some of the medium or message conditions
for perception that might be investigated further. This led
finally to a consideration of some of the perceptual condi-
tions for learning that might also be investigated further
by the message researcher.

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RELATIONS OF MEDIA

TO OBSERVATIONAL LEARNING

frederick j. mcdonald

THE WORK to be reported on here has a history of about ten
years. The earliest research was conducted by Bandura,
Walters, their students, and other investigators interested
in "Observational Learning," a social learning theory.

The history of the ideas underlying this theory is worth
examining because the early research had very little to do
with media, though the research is highly relevant to the use
of media. When I began my work on the training of teachers,
media, to me, were simply devices to use (the only medium we
used was a videotape recorder which served both for presen-
tation of models and as a feedback system). Subsequently, it
became apparent that the problems in which I was interested
were problems in how one processes information, the generic
problem of all stimulus events, and, therefore, of how media
influence learning.

The early history of these ideas began with studies in

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child psychology. In his first such research, Bandura
pursued an interest of how children learn aggressive behav-
ior. His study of aggressive adolescents dealt with the
differences between boys who had a history of acting out
aggressive behavior in contrast to those who did not.
Bandura was impressed with the correspondence between the
value systems of the parents and the value systems of the
boys; the boys in trouble because of their aggressive act-
ing-out were in many ways replicas of their fathers. Exten-
sive interviews with the boys revealed how thoroughly they
had assimilated their parents' attitudes, even to making
almost identical verbal statements about values.

Bandura next conducted an experimental study with nurs-
ery school children. He presented them with a model of
aggressive behavior and studied the extent to which they
imitated the model. He found a significant amount of imi-
tation, even to repeating words and movements of the model.
In a later study, the aggressive model was presented on film
via television. The children again imitated as they had
done after observing a live model. The issue of whether the
model was observed live, on television tape, or on film
audiotape became an incidental aspect of subsequent studies.
In the interest of efficiency and economy, observations of
the model's behavior were mediated through audio-visual
presentations.

In this same period, another point of view concerning
which factors were most important in learning grew in popu-
larity. The time was 1962, and B. F. Skinner attracted at-
tention by applying his concepts of operant conditioning to
programmed learning. Skinnerian ideas caught on so well
that a new orthodoxy on instruction soon developed, with
programmed learning specialists and buffs preaching the doc-
trines of successive approximations and immediate reinforce-
ment.

Bandura's explanations of learning by imitating were an

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alternate and competing way of interpreting acquisition be-
havior. In his paper before the University of Nebraska's
1964 Symposium on Motivation, Bandura uses the standard psy-
chologist's ploy of taking his opponents' position and
reducing it ad absurdum. He describes, for example, what
steps would be required in learning to drive an automobile
in terms of successive approximations, if one applied
Skinnerian principles literally. Suppose the would-be
driver climbs into the trunk. Since he is not reinforced,
he will eventually climb out. He works his way forward, in
and out of the back seat, until eventually he is in the
front seat. This new location offers numerous behavioral
alternatives, and it takes little imagination to visualize
the innumerable false starts that can be made. The point is
obvious: without demonstrations of the desired behaviors,
learning can be extraordinarily slow.

The issue as posed from 1962 through 1965 pursued the
idea that one can learn more quickly by observing another
person's behavior than by being reinforced for enacting be-
haviors in a sequence of successive approximations. Studies
from 1962 through 1964 included conditions in which rein-
forcement procedures were contrasted with modeling proce-
dures, but it quickly became apparent from 1965 on that the
main problem was to explain why learning occurred by obser-
vation. Almost all the latter work of Bandura was designed
to extend his theoretical framework for explaining why peo-
ple learn so easily by observing other people's behavior.

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From the above theories, I generalized the concepts and
methods of observational learning to study a very complex
form of behavior, that of acquiring teaching skills. My ex-
periments began with the acquisition of some simple behavior
patterns. But as the teaching behaviors to be learned be-
came more complex, opposing imitative learning conditions to
reinforcement conditions became an unproductive procedure.

We reached a point in the intellectual history of these
ideas when it was clear that there were two ways to learn:
by imitation and by being reinforced for making the desired
responses. The problem then was to find when modeling was
more effective than reinforcement or when combinations of
modeling and reinforcement conditions were more effective
than either process alone. In a recent study by Bandura,
one of the most effective conditions mentioned was one that
I had also found effective in teacher training studies:
the combination of modeling and feedback (reinforcement)
conditions.

These were the major ideas in the development of one
form of social learning theory. How do these ideas relate
to the use of media? Media presentations of models gave me
considerable practical trouble; I was forced to think about
where the media as a unique psychological event intervenes
in the learning sequence when one uses modeling treatments
or a combination of modeling and feedback treatments. Later
in this paper, my concepts of some of the important categor-
ies of observational learning are presented along with sug-
gestions that certain kinds of learning are facilitated with
one kind of media arrangement and others with another kind.

First, let us be clear what we mean by observational
learning. Observational learning occurs when we learn by
watching another person without being directly reinforced
for learning and probably without any overt practice. This
explanation of observational learning eliminates two of the
traditional components assumed to be necessary for learning,

namely the rehearsal phase and the reinforcement or feed-
back phase.

Two naturalistic examples illustrate the paradigm of
observational learning. There are societies whose major
activities are learned by the watching of elders who enact
their behaviors, The young Papuans, for example, learn to
build canoes by watching older, experienced canoe-builders
of the society. When the young men think they are ready to
build a canoe, they simply announce that fact. Anthropolo-
gists report that they usually build a maneuverable and un-
sinkable canoe on the first attempt.

Another example is the training of girls from the hill
country of Guatemala to work machines in textile factories.
The girls sit next to experienced textile-machine workers
and watch them. The girl learning does no more than take
away the, spools at night and put spools in the machine in
the morning. After a relatively short period of time, when
she thinks she is ready, she begins to operate the machine
effectively after minimal practice.

The experimental paradigm of observational learning
studies is identical to this cultural paradigm. First,
expose a person to a model that is performing the behavior
to be learned. Then let the person perform the behavior.
The purpose of such experiments is to find out if the per-
son imitates, and under what conditions he imitates. This
same paradigm may be adapted to a training program: First,
present a person enacting the behavior to be learned; second,
provide conditions for reenacting the model's behavior.

When considering the cultural paradigm, the experimental
paradigm, or the training paradigm, some of the problems of
learning under these conditions become immediately obvious.
One of the most obvious problems is controlling the attention
of the observer. A second problem is deciding the best way
to portray the model's behavior. A third one is the

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complexity of the stimulus, the question whether the stim-
ulus is too complex for the learner to "process" simply by
observing the model. A fourth problem might be the need for
rehearsal or practice because of the nature of the response
systems. Complex performances require integrations of psy-
chomotor responses: for these kinds of behavior, some re-
hearsal may be necessary.

When the concepts of observational learning were first
discussed, they were ridiculed on the grounds that something
must be missing, people could not learn that easily. More-
over, everybody knew that imitative behavior was childlike
behavior. It was silly to think that adults learned in this
way. Another criticism was that behavior change did not
really occur; the learner imitated behavior but did not ac-
quire it. Since the days when these criticisms were made,
they have been undermined by hard data acquired by extensive
research.

Three studies represent the research literature in a
minor way. First were the studies on the acquisition of
aggressive behaviors. In these studies, the child observer
watched an aggressive model. The aggressive behavior was
fairly simple; for example, in one study, the model was in
a room in which there was a Bobo doll (a life-size plastic
blow-up). The model punched the Bobo doll, hit it with a
mallet, muttered aggressive remarks at it, and engaged in
similar and obvious overt acts of aggression. In another
study, two children acting as models were playing with each
other. One child abused the other, and concluded the scene
with the very aggressive act of walking off with all of the
toys with which the children were playing.

In these early studies, children observed overt acts of
aggression. They were then placed in a room or situation
identical to that portrayed. For example, they went into
the same experimental room in which the model's aggressive
acts were filmed, and were observed there. The experimenters

counted how many times the children hit the Bobo doll with
a mallet, how many times they uttered the same words the
model had used, and all other instances they copied the
behavior portrayed by the model.

Another type of study is the one that Bandura and I did
in which the children were exposed to a model who made a
certain kind of moral judgment. Piaget's theory of moral
judgment postulates that children make two kinds of moral
judgments, but in successive stages in their development.
He developed his theory from data gathered when presenting
children with two kinds of stories, and asking them to make
a judgment as to who did "the worst thing." If the children
judged one way, they were called *objective* judgers; if they
judged another way, they were called *subjective* judgers.

We developed stories of the kind Piaget had used, most
of them involving minor legalistic or moralistic infrac-
tions, such as raiding the cookie jar. In one of the
stories, the first child was always a "good guy" who tried
to do the right thing but made a horrendous mistake in the
process. For example, a child trying to fill his father's
fountain pen drops it, spilling ink all over his father's
desk. In the comparison story, the child is obviously act-
ing from less than good motives but he does not do much
harm. He knocks something off his father's desk while
raiding it for stamps or envelopes but he does no damage.
The child is asked, "Who did the worse thing?" If he chooses
in terms of the consequences of the action, he is *objective;*
if he chooses in terms of the intent of the actor, he is
subjective. We exposed children who were subjective judges
to objective models, and children who were objective judges
to subjective models.

Since Piaget was one "foe," we were interested in demon-
strating that children could be moved back and forth be-
tween stages. Since Skinner was another, we were interested
in showing that modeling demonstrations were more effective

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than operant conditioning methods. We did reverse the
stages. The experiment used three conditions. In one con-
dition, the model was reinforced for making the judgment
that he was preplanned to make, and the child was reinforced
if he imitated the model. In the second condition, only the
model was reinforced. In the third condition, a model was
not present, but the child was reinforced if he made the
desired judgment, either objective or subjective.

The two model conditions were effective; the reinforce-
ment condition was not. It was impossible to shape the
desired behavior in the experimental time. There were,
however, no differences between the conditions in which the
child was reinforced and the one in which he was not re-
inforced.

It became apparent that the critical factor in learning
by obse. ving was that the model whom the child observed was
reinforced for the behavior that the experimenter wished to
be acquired by the observer. The reinforcement of the ob-
server during the observation period did not influence his
acquisition of the behavior. Note that the mediating proc-
ess by which the model was portrayed appeared to be irrele-
vant or of minor importance. The fundamental psychological
principle was that if the model was reinforced during the
demonstration, the observer learned.

In a series of studies on the influence of modeling and
feedback variables in the acquisition of teaching behaviors,
we obtained similar results to those obtained in the earlier
studies on the imitation of aggressive behavior. Although
we obtained results similar to those Bandura obtained, the
modeling effects were not very powerful; they were, in
fact, rather weak. It was the exploration into why they
were so weak that led to an analysis of the influence of
media on the observation process.

We were studying how certain behaviors were learned,

such as a teacher reinforcing a child for participating in
class discussion. Another teaching behavior that we studied
was the question asking form that could be used in a class.
By means of television tape we presented model demonstra-
tions to show question asking of a specified kind while
trainees observed the teacher. The trainees subsequently
practiced the behavior in a simulated teaching (microteach-
ing) situation. We counted how frequently the trainee asked
the same type of question as did the model.

A problem developed in these studies that did not imme-
diately become apparent. We were studying categories of
behavior, not single acts. In the early Bandura studies,
the child imitated single acts; he struck a Bobo doll with
a mallet; he did not strike a live human with a mallet.
In our studies, the trainees were not literally imitating
the behavior. (We did only one study in which trainees
retaught the same lesson as that taught by the model. We
obtained a high frequency of literal imitative responses.)
When the trainees had to generalize to their teaching the
behavior they had observed, the effects of modeling were
relatively weak.

Our procedure was to expose a trainee to a model teach-
ing a lesson, e.g., a history lesson. In this lesson, he
asks a specified class of questions. The observer may be
another teacher of history or he might be a teacher of
science. He must ask the same class of questions on dif-
ferent content in the same field or on different subject
matter. The trainee's problem is to transform the behavior
that he has observed into a similar, analogous behavior
represented in his own teaching performance.

Assume that we are viewing a model; we perceive a link
between stimulus cues and behavior as the model responds to
stimuli in his environment. The observer sees both the cues
and the behavior. The question is, What is happening while
you are sitting there that will subsequently elicit similar

behavior? (In the second step of training, the trainee
attempts to enact the behavior he has observed.) Should
these intervening events be conceptualized as a storage
problem, or is a straightforward behaviorist-type question
more relevant: What is eliciting the behavior in the trans-
fer test? In the studies of aggressive behaviors in chil-
dren, if the child goes into exactly the same experimental
room in which the model enacted aggressive behavior, the
cues that elicit the aggressive behavior are obvious.
They are the same cues that the observer saw in the demon-
stration: There is the Bobo doll, and there is the mallet.
There is a representational carry-over; the learner needs
only to recall the words that the model used and his move-
ments. But when the observer teaches a *different* kind of
lesson, he is presumably carrying around in his head some-
thing that stimulates him to ask a certain class of ques-
tions.

At the present time, the problems in observational
learning and the theoretical issues revolve around two kinds
of questions: (a) What is the character of the mediational
responses; (b) How are these links made? The greater the
differences between the model context and the practice con-
text, the more obvious it becomes that the connection be-
tween the mediational responses and the performance behavior
is critical.

At this point, we can relate the points just described
to the ideas developed by Salomon (pp. 33-62) and to those
discussed by Eisner (pp. 103-118). First, list the class of
learning problems that are represented in observational
learning. In one type of learning, an individual may al-
ready have the behavior available in his repertoire of
responses. It may not be a high frequency behavior. The
learning problem is to take the low frequency behavior and
attach it to a new cue so that it is elicited more fre-
quently. An example can be drawn from the moral judgment
study in which some of the children made both subjective and

objective responses, but made one kind with greater fre-
quency. Initially, the subject would say that the child in
the story who broke the most dishes "did the worse thing,"
(when he was asked the question, "Who did the worse thing?").
After he had been exposed to a model, he would say that the
child who did less damage but whose motives were undesirable
"did the worse thing." When he made that second response,
he was using a response that he already had available at
some strength in his repertoire. He was now linking it to a
cue to which he had previously linked another kind of
response.

In the first teacher training experiment that we did, we
trained teachers to reinforce students for participating ver-
bally in class. The trainees were using responses already
available in their repertoire. Most people have some form
of verbal reinforcers that they use for a variety of situa-
tions. They can say, "Good," or "That's fine," or Excellent."
The training problem was to link these words to a specific
set of actions of students. It was a difficult learning
problem for the teachers because they have a tendency to hold
off using the reinforcer until the student gives a right
answer. We were trying to teach them to use the reinforcer
for the act of attempting an answer even if that answer was
not correct. The learning problem was again to attach an
available response to a new set of cues.

That kind of learning can be mediated quite easily by
modeling training techniques. The method is to portray the
new cues and demonstrate the behavior to be learned as well
as the connection between cue and behavior.

Another type of learning occurs when one learns both new
responses and the cues which elicit them. There are two
kinds of learning involved in this type--learning the re-
sponse itself and the links to the cues. The early language
learning of children is a relevant example. A child may learn
some language behavior simply by echoing it. He hears

somebody say "Good morning," and he repeats the words, al-
though he may not repeat them under the same set of circum-
stances that he heard them uttered originally. Thus, he may
learn the response mode without learning the cues to which it
should be attached. Or, he may learn the cue-response link
as a unit; for example, the child learns to say, "Hello" to
each person who comes into his house. The cue is, "Person
entering house for the first time;" the response is, "Hello."
Again, both the response and response-cue link can be learned
by observing.

Learning mediational responses, the third type of learn-
ing, is not a substitution of a new stimulus to elicit re-
sponse nor the acquisition of a new link. The acquisition of
complex types of behavior can frequently be explained only by
postulating that mediating responses intervene between stimu-
lus and response. The mediating responses are also learned.
The question is, Can mediating responses by learned by ob-
serving? The answer to that question is obviously, No. We
usually cannot observe such responses unless we have devel-
oped a special experimental technique whereby the learner
reproduces the kind of mediational responses he is observing
into observable responses (e.g., verbal, pictorial, kinetic).
All we are able to say at the present time is that apparently
learners acquire sets of mediational responses which are
linked to stimuli and these responses in turn serve as cues
for eliciting observable actions.

This kind of learning may be a case of learning connota-
tive symbols, in the sense in which Eisner uses that con-
cept. The appropriate learning model for acquiring media-
tional responses may be whatever is involved in learning
connotative symbols. In learning connotative symbols, one
is learning a complex representational system.

A fourth kind of learning may be involved in observa-
tional learning: learning the link between a mediational
response and the performance behavior. Insofar as

mediational responses are used, this link has to be made.
The question is, how is it made?

A fifth kind of learning is the link between the stimu-
lus and the mediating response. Again, the question is, how
is the link acquired?

Of the five kinds of learning that we are reasonably cer-
tain are involved when one learns by observing, three kinds
are not under the direct control of the experimenter studying
observational learning. All we know is that if people are
placed where they can observe other people, they eventually
begin to behave like the people they watch whether or not
they are reinforced for imitating. Why and how does learn-
ing occur in this way?

There are at least two explanations. One is that covert
rehearsal and vicarious reinforcement occurs. While the ob-
server watches a model, he rehearses responses and vicar-
iously reinforces himself for performing these responses or
visualizes himself being reinforced because he sees the
model being reinforced. An example is observing a commercial
in which the product used produces certain highly desirable
effects; one visualizes himself engaged in the behavior por-
trayed for using the product and receiving the same kinds of
reinforcements. Another explanation to apply is contiguity
theory. We know that these events occur in contiguity to
each other and the continuity principle accounts for the
reproduction of the performance behavior.

But what has this to do with media? It is obvious that
we have used media primarily as a portrayal or representation
device. Media have not been used to stimulate, control, or
expand upon the development of the mediational responses.
We have also used media in a feedback system. The feedback
system gives the learner an opportunity to compare his per-
formance to that of a model. We have thought of arranging
media systems so that the learner could observe the models

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behaving and also observe his own behavior in a directly
linked compare-and-contrast system. A feedback system may
also stimulate vicarious reinforcement; that is, in watching
oneself perform the desired behaviors, one may find a rein-
forcing event. Media have been used almost exclusively to
describe the cues and the responses to cues. They may also
show the links between the cues and responses.

Now let us draw some similarities between what presumably
occurs in observational learning and Salomon's concepts. As
I see the relations, observational learning in some way re-
produces the process of "supplantation." On the other side
of Salomon's continuum of explicitness, there is, however,
no response-arousal condition except by implication. One can
assume that some general-arousal to learn has occurred be-
cause the learner is motivated to observe the model, but
there is no real arousal condition. The earlier studies of
Bandura were, I think, in this form. An aggressive act is
portrayed and the link between the stimulus and response is
easily observed. I think this partial supplantation is
analogous to the connection between the stimulus and the
mediating response referred to earlier in this discussion.
But the basic paradigm for observational learning is the one
at the top of the explicitness continuum. Essentially what
one tries to do in observational learning is to reproduce
that supplanation effect. Assume that the learner is in some
way going through an act of supplantation, making some form of
covert rehearsal perhaps; or he may be engaging in a form of
vicarious reinforcement. Whether we make that assumption or
not depends upon what variables we want to use. The kinds of
problems that I would describe in the analysis of media in
relation to observational learning are very similar to the
kinds of problems that Salomon discussed in analyzing the
characteristics of stimulation. The psychological problems
are essentially the same.

One of the problems in designing media to facilitate ob-
servational learning is to find a way to highlight the

response to be learned. Almost all of the problems that we
had in our teacher training experiments were related to com-
plexity of the stimulus used in portraying a model. Even
though short videotape segments were used, there were enor-
mous amounts of verbal content presented to the learner. If
verbal material was also presented in experiments where we
wanted the teacher to learn nonverbal performances, no learn-
ing at all took place. Apparently the teachers attended to
the verbal cues rather than to the nonverbal cues. Problems
associated with a concrete-abstract dimension and a complex-
ity of the stimulus dimensions are all related practically
to the highlighting of the response to be learned.

Another problem is highlighting the cues to which the
responses are to be linked. In the past year we did a study
in which an experimenter was present during modeling ses-
sions. As the model portrayed the desired behavior, the ex-
perimenter would cue the learner on the behavior to be ob-
served. All conditions in which this cuing was done during
the modeling session were found to be highly effective.
Again there are intercepts with the work on the problem of
controlling the observer's attention. Anybody who has
worked with people watching themselves on videotape, for
example, knows that there is a phase when people look at
themselves and utter profundities such as, "Is that what the
back of my head looks like?" Personalogical variables con-
trol the perceptual processes of observing oneself as they
control other perceptions.

Another problem which is not a media problem is the
problem of maintaining the behavior once it has been ac-
quired. When designing instructional systems, the general
principle on which most people are now operating is that
during the acquisition phase, observational learning is
likely to be more effective and more efficient in producing
behavior change than are other methods of producing learning.
But to maintain learning once it has been acquired, the
learned behavior has to be continuously reinforced. In that

respect, media may or may not be of some help, depending on
the kind of learning problem with which one is working. In
a teacher training program, for example, one can videotape
the teacher and give him feedback on a particular type of
performance. This feedback acts as a form of reinforcement
and maintains the behavior.

Another problem (discussed by Conway, pp. 155-164) which
clearly affects observational learning, is the multi-media,
multi-sensory stimulation of learning. In observational
learning, the learner encodes many different kinds of sym-
bols. As he encodes these variety of symbols in different
channels, one would expect system conflicts to occur. As I
suggested earlier, the experiments in which no results were
obtained were ones in which the learner had to encode and
transform messages in different channels, one primarily vis-
ual, the other primarily oral. The teachers seemed predis-
posed to listen to the oral material.

By way of summary, let me suggest that observational
learning is an established psychological fact. People do
learn by observing. *The media probelm is to use the media
to facilitate observational learning*. The facilitation can
take the form of a more effective portrayal of the model's
behavior.

*The problem which has not been solved is how to use media
to stimulate the learning of mediational responses.* I can
visualize, however, a training procedure in which media are
used to stimulate the generation of mediational responses.
Work has been done by Maltzman in developing creative re-
sponses. His subjects engaged in certain types of verbal
activities which seemed to stimulate and generate new types
of creative responses. This paradigm could be applied to
elicit mediational representations needed to carry a learner
from an observing situation to a performance situation. The
hypotheses that people hold about the characteristics of a
presentation on observational learning are the kinds of

hypotheses that have been discussed here--hypotheses about
simplifying the stimuli, reducing its complexity, and so on.

The only tenuous point about reinforcement, of course,
is the extent to which vicarious reinforcement acts as a
mediator in the learning process. That, in itself, has
nothing to do with media. Whether one holds that as a hy-
pothesis to explain what occurs in observational learning
depends upon how one evaluates the vicarious reinforcement
literature and how much he is willing to invest in inferences
about processes that are not directly observable.

There are a number of social-psychological type hypoth-
eses about the influence of the characteristics of the
model. That again, has nothing to do directly with the char-
acteristics of media. If the influence of a high prestige
model, for example, is compared with that of a low prestige
model, it makes no difference whether the model is presented
alive or mediated on film. They same effects occur whether
the presentation is mediated or not. Also, hypotheses about
the relations between characteristics of the observer and
what is being observed have little direct bearing on the use
of design of media.

The main problem is the effects of the characteristics of
the stimulus presented. Therefore, any connection made be-
tween the use of media and observational learning has to be
made in the domain of how the stimuli are used to make links
between cues and responses.

The simplest problem, it seems to me, is finding ways to
use media to portray the behavior to be learned. The ordin-
ary problems of complexity of stimulus need to be solved and
can be worked out either from traditional hypotheses or from
new and more imaginative points of view.

My preference in designing training programs is to com-
bine what we know about feedback systems with what we know

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about modeling systems to create new kinds of instructional
systems that alternate modeling and feedback phases. The
guiding principle I enunciated earlier seems to apply,
namely, that the modeling is most effective in the early
phases of learning and feedback systems are needed to main-
tain the learning.

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What then might the role of the future
teacher be? I see this teacher as a learning
coach, as an organizer, manager and creator
of learning experiences, as a sensitive diag-
nostician of the needs of students, a compas-
sionate mentor. I see teachers committed to
motivating students to learn how to learn and
to develop a zest for learning. I see a shift
in emphasis from the lower mental processes of
uncritical memorizing to a concern with devel-
oping the creative, thoughtful, sensitive
learner.

---*Edgar Dale, Editor*
The News Letter
March, 1970

FORMS

OF INFORMATION REPRESENTATION

AND COGNITIVE OPERATIONS

jerome k. conway

THIS PAPER CONSIDERS some difficulties in a research area
that may have general relevance to instructional media and
tries to point a way to the generation of more significant
research issues and questions.

The phase of research considered here has been labelled
many things. Using the terminology of the current *Review of
Educational Research* (7), it is named multiple versus single
channel research.

A critical assessment of what has been repeated examina-
tion of the same problem for over 60 years must affirm the
inconsequence of our knowledge. The most current review (7)
in its attempt at brevity and conciseness provides (uninten-
tionally) an amazing distillation of those conceptual ques-
tions whose continued avoidance must be intolerable to any-
one trying to make sense of the research. An interesting
exercise in frustration is to go through the review

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attempting to determine first, if a clear referent exists
for each use of the term "channel(s)" and second, if the
referent is consistent through the review. In all fairness,
this is no fault of the reviewer. The review reflects the
state of research, even to the extent of providing a bogus
rationale in practical affairs for the research which fol-
lows. I intend to comment on these matters, for it is
exactly in the nature of the conceptualization of the prob-
lem that most "channel" research suffers. Although probably
true of any area of research, it persists for a number of
reasons when a manifest concern is directed to the external
conditions of "efficient" information presentation.

Prescription and/or description?

A rather interesting ploy used by most researchers in
the area, and a clue to their prescriptive inclinations, is
the "naive audio-visualist" gambit. The researcher de-
scribes what he claims to be a widely held assumption among
producers of audio-visual material, and then proceeds to
demolish the assumption with his research. This ploy is
most persuasive and subtle, for it at once associates the
research with the "real world"--with an apparent relevance
to what audio-visualists do, even while it attacks what it
·claims to be common practice. The first sentence in the
AERA review exemplifies this: "A prevailing assumption of
audio-visualists and many research investigators is that
learning will be more complete as the number of cues in the
learning situation increases." Here is a further variant of
the "naive audio-visualist" ploy: "An assumption of commun-
icators using multichannel media seems to be that the more
channels used to reach the receiver, the greater the amount
of communication" (8). I cite this last expression because
it resulted in a higher development of the "naive audio-
visualist" gambit. The research which followed *both* demol-
ished and affirmed the assumption.

It is apparent that much of the recent research on multi-
ple versus single channel comparison derives ·its initiation

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and impetus from something less than a well-documented ex-
pression of what is currently being done by producers of
audio-visual material. Were it possible to clearly index
what audio-visualists say about using more channels to reach
the receiver, one would still have to assess what they did.
From their actions, it is my opinion that audio-visualists
are really visualists; and if their actions are to be be-
lieved, then they feel that the greatest communication gain
is derived from use of a single channel--the visual.

This kind of analysis is in a way quite irrelevant. The
key point is that the research problem appears to derive its
impetus from a base of general practice, and the researcher
believes that his information of the problem and the data
and interpretations he offers are in turn relevant to prac-
tical affairs.

Now, it may be that this strategy is in some cases war-
ranted. But memorizing a list of nonsense syllables simul-
taneously presented visually and auditorially is no way par-
allel to what happens when a learner is exposed to any in-
structional film presentation. Yet this is the range of
extrapolation from multiple-channel study data that is often
implied. It may be that the situations are "functionally"
comparable, but then this would be an extrapolation from
theory, not from data. It remains for theory to explicate
how they are comparable and how separate studies are func-
tionally similar. Of course, this happy situation does not
exist. The dilemma that has confronted multiple versus

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single channel research is that in attempting to be pre-
scriptive the context of research has become descriptively
more rigorous, and therefore more remote in surface charac-
ter from "real world" activities. It is not the research
which can in itself speak about the "real world"; it must
now be theoretical level statements. Many researchers are
still not prepared to confront this situation.

What is being studied?

Consider the situation where a researcher presents a
series of items (usually single words) to Ss and asks them
to remember each item and then tests them for their reten-
tion. The items can be presented as spoken or as printed or
as simultaneously spoken and printed. This in its simplic-
ity has been the standard "multiple versus single channel"
research paradigm. It would seem that it should be rather
straightforward to get an unequivocal answer to a question
like: Is a combination of two media or communication chan-
nels more efficient for the communication of the same infor-
mation than a single medium or channel? However, it just
will not work. Because of several considerable conceptual
problems buried in the question, it is doubtful if the ques-
tion is even answerable in part.

As already suggested, so apparently simple an issue as
defining a "communication channel" immediately assumes over-
whelming proportions. An examination of the research liter-
ature will show that although the term is used freely, it
really has no functional specificity. One finds alternatives
like "transmission channel," "sensory channel," "pictorial
media," "sensory modality," "information channel," used
interchangeably.

The handling of the notion of presenting "the same infor-
mation" in either multiple or single channels has been
equally facile and trivial. The simultaneous presentation
of the spoken word "apple" and the printed word "apple" we
would all agree involves the "same information." But, we

have to be careful. The two items are not physically the
same--one is a spoken word with visual attributes. They are
clearly *conceptually* the same; they make reference to a sin-
gle concept. One can give other examples of parallel "same
information" combinations where it is even more explicit that
the items themselves are physically quite different but con-
ceptually equivalent. For example, the combination of the
printed word "apple" and a line drawing of an apple. This
latter combination is most interesting because, unlike the
earlier example of the spoken word and printed word, it is
limited to visual presentation. Is it meaningful to speak of
multimedia combination using a visual presentation only? Is
it reasonable to try to understand how individuals assimilate
conceptually equivalent combinations by drawing from explan-
atory constructs that are solely appropriate to the discrim-
ination of physical characteristics of a presentation?

It seems that in this domain we have been and are dealing
with the manipulation of information and with rather re-
stricted types of information units and the relationships be-
tween units. Within this context of the standard experi-
mental paradigm we are further concerned with a specific set
of conditions under which information is processed, stored,
and retrieved. I would submit that the real issue has lain
dormant underneath the multimedia or multichannel question;
that is, the relationship between the way information is ex-
ternally represented and how it is internally processed.

The best example of this hidden issue is the way in which
pictorial forms of information representation have *not* been
handled in "multiple channel" research. For all intents and
purposes, when even considered for experimentation, these
forms have come to be regarded as "bristling stimuli"--stim-
uli with many more cues for the mind to get stuck on. Per-
formance involving these stimuli was assumed to be encom-
passed by a theoretical framework that has recourse to cue
summation and stimulus generalization as explanatory con-
structs. The attempt has just not worked. For one thing,

the logical argument that held pictorial forms to be external
stimuli never seemed to extend to what the researcher actu-
ally did. If he paired a word form and a pictorial form and
claimed this to be a multichannel presentation of informa-
tion, then cue specification or stimulus attributes were ir-
relevant in determining whether the paired presentation in-
volved same or different information. The presentations were
implicitly interpreted by the researcher to be conceptually
equivalent or not, and from that point on he evoked stimulus-
related constructs to explain performance of his subjects.
The recourse to these constructs is somewhat gratuitous if,
after all, we can look to what the researcher himself did in
relating (processing) presentational units as he organized
them, and the consequences this processing might have for
memory performance. The incongruous alternative arising from
such work is to have a cognitive account of the experiment-
er's behavior and an S-R account of his subject's behavior
when they are involved in essentially the same task.

Finally, there are considerable empirical difficulties in
conceiving of pictorial forms of representation as just more
complex external stimuli. There are conditions of informa-
tion presentation and information testing where the forms of
representation used are externally quite different, yet mem-
ory is as efficient as where the form of information repre-
sentation used to test memory in a recognition test is iden-
tical to that presented earlier. Thus, for example, one can
use the word "apple" to test the prior presentation of the
concept "apple" given in a line drawing form of representa-
tion. One finds memory performance equivalent to that where
the subject has seen the word "apple" earlier and is tested
with the word "apple." These sorts of findings are unac-
countable in a simple stimulus-related framework.

A reasonable account of these types of data has begun to
take shape in terms of the way in which external forms of
representation, and in this case, pictorial forms, are in-
ternally represented and used in memory tasks (4,2). This

position claims that simple pictorial forms of representation
can be and are transformed internally through a cognitive op-
eration of linguistic encoding. This transformation although
not the only cognitive operation which these forms undergo,
is the one most characteristic of them. This idea is not
entirely new. The basic notion of linguistic encoding of
nonlinguistic events is found in the study of "codability" as
a language-related variable affecting performance (1,6) and
the Verbal Loop Hypothesis (3).

It is a new approach, however, when brought to the infor-
mation processing issues that were always implicit in multi-
ple versus single channel research. It seems grossly naive
to presume to manipulate information presentations and to
provide accounts of information processing without ever at-
tempting to specify what the information might consist of and
how it is assimilated by the interpreter of the presentation.
This has been particularly true of pictorial forms of repre-
sentation. These forms are most often approached in the neg-
ative terms of what they are not, i.e., nonverbal stimuli.
However, in a very significant sense, pictorial forms as as-
similiated can be strongly verbal.

We have to rethink our rather gross categories about
what it is we are dealing with when we talk about pictures
and words. A language-related processing of pictorial forms
may be a useful way of looking at the way people handle not
only static but also dynamic pictorial representations. How
useful this processing is, is still difficult to say. It
does raise the more general question of how various forms of
information representation are operated on by a human pro-
cessor. The theoretical constructs man develops and employs
will undoubtedly have to recognize the symbol-handling that
is specific to that processor and not characteristic of other
organisms.

The multiple versus single channel problem has led to
considerations of internal "channel capacity" (10). This is

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indeed an important aspect of information processing. The
issue is important but the answers we have now, I submit,
are still very incomplete. Once again, the question of what
is processed and how it is processed seems to me a more fun-
damental and prior question. Rather than focusing on what
individuals do under restrictive and extremely atypical con-
ditions of information presentation, a more instructionally
relevant strategy would be to examine how they can in fact
function to expand information assimilation and retrieval
under normal conditions. As we already know, a so-called
"limit" on memory capacity is often far exceeded through ap-
plication of a recoding strategy. The conditions under
which memory for pictorial representation occurs, allows for
a truly amazing retrieval of the form (9)--yet we know al-
most nothing of how this occurs.

What an individual can do under relatively moderate
levels of information input, particularly when different
forms of representation are used in conjunction and are
temporally sequenced, seems particularly worth examining.
For example, Knowlton's (5) category of the analogical pic-
ture presents a most intriguing relationship of forms of
representation in interaction. Quite clearly, the verbal
context of such a picture transforms the given of the pic-
torial representation. Thus, for example, a picture of two
lumberjacks sawing down a tree can go beyond the information
given and illustrate the reciprocal action of muscles in sup-
porting bones. A distinction between "surface" and "deep"
interpretation of analogical form suggests itself. The term-
inology "surface and deep" is, of course, taken from else-
where and still needs to be explicated here. It does at the
least convey a type of discrimination that may have value,
and the making of such discriminations is a necessary begin-
ning of movement toward theory.

In sum, I anticipate that we will relegate multiple ver-
sus single channel studies to the same woeful category as
most comparative media research--an unproductive experience

of only passing, historical interest. As the role of re-
search becomes more clearly associated with the broader goal
of a theory of instruction, and as we begin to make discrim-
inations of a higher order than "two of something versus one
of another," our efforts may yet become a focal part of the
everyday assumptions of audio-visualists.

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. . . We must identify the education
gap . . . Only some human ailments can be
taken care of by education right now . . .
In the long run, education will provide, I
think, better employment; education may in-
deed eradicate the slums; and, certainly,
education is the answer in the long run to
prejudice and injustice. But if you want
to really eliminate unemployment, you create
jobs. If you want to eliminate the slums,
you clear up the slums, but you don't ask
education to do that job . . . When Presi-
dent Johnson said: 'If you look deeply
enough into any problem, education is at its
heart,' he was partly right and he was partly
wrong. One of the unfortunate consequences
is that we have become disillusioned about
education without really trying it. Because
education is a long-term answer to mankind's
problems, not a short-term one . . . We must
very carefully, at all levels of educational
decision making, differentiate between what
education can do in the long run and what
human engineering can do in the short run.

> ---*John I. Goodlad, Dean*
> *School of Education,*
> *University of California,*
> *Los Angeles, paper prepared*
> *for Project 70's, sponsored*
> *by Schenectady, New York,*
> *Public Schools and NEA*

NEW INSTRUCTIONAL FORMATS,

THE MEDIA

AND MEDIA RESEARCH

IN A CRISIS AGE

john p. dececco

WHEN I WAS first asked to participate in a summer confer-
ence in instructional media, I was in the midst of my work at
the Center for Research and Education in American Liberties
on civic participation and education in a crisis age. A few
months earlier I had left San Francisco State, just minutes
before the students and faculty were hoisting their revolu-
tionary banners. I arrived at Columbia University just as
the dust was settling over a campus deeply scarred by the
spring crisis of 1968. When Dr. Gavriel Salomon spoke to me
about his research on subjective response uncertainty, I
thought I knew how uncertainty felt, and I was generating
more competing hypotheses about the academe and education
than I ever thought possible for a tenured full professor.
I urged Dr. Salomon to conduct clinical research on subjec-
tive response uncertainty on university personnel. They are
the ones who by traditional Establishment criteria had in
recent years "made it" on the academic and professional scene
only to discover that there are serious, vocalized doubts
about the basic fairness of the rules of the Establishment

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game and about the value of the game itself.

At the time the invitation to speak was presented, we
were engaged in film making at the Center. With gleeful na-
ivete, a lot of rented equipment, and little professional
advice, we were trying to make a couple of training films
depicting "democratic dilemmas." These are situations in
which alternative courses of action in a conflict situation
embody poignant value conflicts or choices between conviction
and expediency. We used the films to train 40 data collec-
tors who, in turn, were to ask high school students to de-
scribe dilemma incidents in which they had been involved.

As a means of extending the training and initiating the
data collection, we made a videotape in the first school we
entered. The package contained one of the films, an expla-
nation of our research purposes, and directions for filling
out the dilemma incident form. On closed-circuit television,
in all social studies classes throughout all periods of the
day, the videotape played; and we collected data from the
more than 2,000 students enrolled in the school. We were
rather proud of this electronic research feat, but wrapped
in the innocence of university research methodology, we were
not fully aware of some important side effects. In gathering
data on democratic dilemmas in a school on the brink of stu-
dent protest, we uncovered so much hushed information on the
indisposition of school governance in that school in one day
that we were asked not to return the next day when we were
scheduled to make observations and conduct interviews.

We were also prey to the fact that Columbia University
had lost some of its Establishment legitimacy after the cri-
sis of 1968. Furthermore, several of our data collectors
preferred to symbolize their radical politics and personal
life styles in ways and with words rarely consonant with
school conduct codes. This contributed both to our hasty and
awkward departure and to our careful observance of school
access and visitation rules on future research sites.

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> For the past two years (1968-70) he has been visit-
> ing professor of psychology at Teachers College,
> Columbia University and research director of a civic
> education project. Among several books he has pub-
> lished are *Psychology of Learning and Instruction:*
> *Education Psychology* (1968) and *Civic Education for*
> *the Reformed: An Alternative to Repression*, Review
> (1970).

I describe this incident for three purposes. First, al-
though we were not doing research *on* the media, we were at
least doing it *with* the media. Later on, for example, *after*
we obtained permission to enter another school, but *before*
we actually entered, two-thirds of the students went on
strike, and were were able to conduct taped interviews with
the adult and student strikers and nonstrikers. It is in-
teresting to note that a cursory reading of the protocols
of a sample of students who remained in class (the non-
strikers) reveals that they were not ardent Establishment
supporters. They believed, in fact, that the whole school
situation was so futile that nothing, including a strike,
could help. Second, the incident sharpened my awareness of
the very real political context of school governance. One
cannot expect to inves_igate such sensitive school issues as
the state of civic satisfaction among high school students
within this context and win Establishment blessings.

I now wonder--though the doubt may be incongruous at a
research conference--whether it is the theoretical and meth-
odological impurity of field research alone or the risk of
martyrdom as well which discourages the practical investiga-
tion of the burning educational questions of our time.

Finally, this incident, among several related incidents,
illustrated the inescapable moral dilemmas facing the inves-
tigator. He quickly realizes that research on the condition
of school governance is research on the present moral

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condition of the school and our society; research methodol-
ogy must conform not only to scientific but also to ethical
canons. If we really believe, as we did, that the length of
one's hair and the style of one's clothing is the individ-
ual's private choice, and if we are concerned with how much
freedom the school allows students in these matters, can we
ask our student data collectors to sacrifice personal taste
and symbol for school conformity?

Getting back to subjective response uncertainty and to
possible applications of media research, the emphasis of my
present work and thought falls increasingly on the first
part of the title of this section--new instructional formats.
I saw, as well, the futility and, even if it could be accom-
plished, the danger and the undesirability of attempting to
foster a technological or media revolution in an educational
system which is highly authoritarian in practice and fre-
quently irrelevant to almost every important personal, so-
cial, and moral problem of our time.

My major theme, therefore, is that there must be radical
change from the present educational system before we can in-
corporate into American education the truly magnificient po-
tentialities of the media and media research. If the trouble
is with the *system*, toying with the curriculum in some narrow
sense will not effectively change the teaching or the rele-
vancy of what is taught. If progressive education is to be
reflected by computer-assisted instruction of Shakespeare or
the glories of the Puritans and the Civil War, but ignores
Marx and black history, then such toying is neither a tech-
nological nor a political revolution and will only hasten the
demise of American education. How often, if ever, does one
find the program or film in our schools which, as Scriven
states, makes clear that this "nation was founded on subver-
sion, on bloody revolution, on the wanton destruction of pri-
vate property, on deliberate disobedience to constitutional
authority in a representative democracy"? (7:6) The answer,
of course, is that one usually does not find this

revolutionary tradition described in the history textbooks,
and, where the new media have followed the textbooks, neither
can one find it there.

It is easy to document the thesis that the trouble is
with the system, that educational reform must be radical if
it is to equip students to live in the Age of Crisis and the
Gun. Westin provides these figures on student disruption in
the high schools from September to December, 1968 (9):

Type of Protest	Number of Incidents	States Involved
Racial	132	27
Political (including Vietnam)	81	21
Against dress regulations	71	25
Against discipline	60	28
For educational reform	17	14

The historian of American education, Frederick Rudolph in
Sunday's *New York Times* review of Harold Tyler's new book,
Students Without Teachers, had this to say about unrest in
the American university:

> The recent upheavals on American campuses are not
> simply temporary and unpleasant incidents perpetrated
> by vicious enemies of the social order. The riots
> may indeed record a social, economic, and political
> revolution, but fundamentally they are manifestations
> of the emergence of the university as the central in-
> stitution in modern democratic liberal society. The
> military-industrial state cannot exist without it; an
> informed and imaginative electorate, sensitive to the
> conditions necessary to sustain human life and spirit,
> is impossible without it; attacks on the indifference
> and criminality that have bred our ghettos and rural
> slums, polluted our air and water and poisoned social
> life will get nowhere without it. The prospects of
> American civilization--and all that means for our
> friends and critics elsewhere--are now entrusted to
> the American universities. They are the guardians of
> humane action (5:3).*

· Scriven, in describing the magnitude of the contemporary
educational and social crisis, writes:

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sion.

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What have we done to educate our citizenry for
instability, for revolution, for radical intrana-
tional and international transfers of effective
power, and in particular, for being on the short end
of such changes, for unemployment, poverty, retire-
ment, military defeat? Nothing . . . Perhaps the
most important cluster of discoveries in educational
psychology has shown a staggering lack of transfer of
learning between domains and skills which intuitively
seemed essentially the same or very close. Even the
temporary survival of a society whose citizens are
not *directly* educated to instigate and handle radical
change is mere luck; the survival of a society whose
citizens are educated in a way that *presupposes the
absence* of a radical change is likely to be a very
short-lived accident of evolution (7:2).

Schieffelin describes how the marriage of the public
school and computer technology can further stultify American
education. She writes:

The public school is one of the most lethargic
and reactionary institutions in America. The aver-
age teacher seems to be from the lower middle class,
upwardly mobile, unimaginative, and afraid of change.
He likes the security of routine, accepts without
question the virtue of compulsory education and its
democratic rhetoric, and is by and large subservient
to his superiors. Young, creative teachers often
have little patience with this stodginess and torpor
and even less power to change things . . . Given the
present nature of school personnel, there is the
danger that any new technology that is applied to
the schools will be used to perpetuate an archaic,
irrelevant, and educationally invalid system.
Throughout history, educational goals have rarely
been determined by educational philosophers. Yet
certain philosophers and practitioners have a fair
understanding of the process of education. If these
educators could ally with the technologists, who are
not lethargic, then perhaps fundamental educational
changes could occur (6:15).*

Finally, I offer a quotation from the Black Student Union
newspaper published by students in a suburban New York City
school, which paraphrases the Declaration of Independence.
It well reminds us of our revolutionary tradition but also
focuses on an anachronistic school system:

—————————

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uate School of Education, Harvard University. Reprinted by
permission.

> We hold these truths as being self-evident, that
> all men are created equal, that they are endowed by
> their creator with certain inalienable rights, that
> among these are life, liberty, and the pursuit of
> happiness. To secure these rights within the schools,
> governments are instituted among the students, de-
> riving their just powers from the consent of the
> governed, that whenever any form of student govern-
> ment becomes destructive to these ends, it is the
> right of the students to alter or abolish it and to
> institute new government; laying its foundations on
> such principles and organizing its power in such
> form as to them shall seem most likely to effect
> their safety and happiness.(2)

To summarize to this point--I believe that the educa-
tional establishment requires radical change to meet the
crises facing us as a nation and a society. The marriage
of media technology with an outmoded school system will be
mutally disastrous. Where this marriage has been joined in
the past decade, it has frequently resulted in the hardening
of the old system and increasing disenchantment with technol-
ogy and the school on the part of both teacher and student.

Students are deeply disenchanted and rather pathetically
immobilized by the irrelevance of their education to many
present problems. This is supported by the data we are gath-
ering on civic satisfaction of students in the schools and
from newspaper clippings on student protest collected from
about 1,800 papers (including the student underground press).

What does the most preliminary inspection of our 7,000
student protocols show? First, we will probably find that
most of the students see a lack of due process in school dis-
cipline, discrimination, and inequality. They see the
limited opportunities for dissent and decision making as per-
sonal grievances, not widely shared (as they are) by other
students in other schools. They see them not as the result
of encounters with the system but with particular teachers
and principals in their particular schools. Second, we may
well discover, when students find themselves in conflict
situations, that they usually see only one course of action--
that one actually taken by them and/or their adversaries.

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They are usually unaware of the full range of options avail-
able for both parties. This, I would guess, results in early
behavior rigidity or acquiescence of one or both parties--
as we see so frequently in the encounters between university
administrators and student protestors.

Third, our content, as opposed to our process, analysis
of the protocols will probably reveal that most students do
not clearly see that they are ultimately demanding a funda-
mental change in school governance. There are a myriad of
substantive issues that arise in the schools today--smoking,
drugs, search and seizure of student property, privacy in
the rest rooms, hall and cafeteria conduct, and so on--the
sum of which calls for deep change. The reformers and the
radicals, the articulate student editors and journalists of
the underground press, who raise this basic issue are less
than one-half of one percent of student enrollment in the
high schools.

Fourth, when we look at conflict *resolution*, we may very
well find that acquiescence to decisions made by authority
or peers and violence by authority and students are the
favored modes of resolution. Negotiation, mediation, peti-
tion, and arbitration do not appear to be dominant parts of
the conflict resolution repertories of either students or
school personnel.

If the formal data analysis supports these tentative con-
clusions and others like them, we have a rather severe in-
dictment of the educational system, a system which in the
past has failed to teach our political leaders and in the
present fails to teach students to deal openly and directly
and analytically with conflict situations. Further, it
fails to teach them to skillfully and constructively use the
conflict resolution. The maxim of most school administrators
in dealing with conflict is to avoid it at all costs and, if
this cannot be done, to settle it as quickly as possible by
co-opting the adversary.

School administrators, like the rest of us, after all,
have been reared in the American evolutionary historical
tradition which teaches that all valuable change must be
gradual and within the system. It must occur within our
traditional middle-class economic priorities even though
these priorities often place property above humane values.
So administrators sometimes save the buildings and the uni-
versity endowment but lose the students! Although our his-
tory is as much a history of conflict as a history of eco-
nomic prosperity, we play down conflict, defeat, war, rebel-
lion, the conflict between the rich and poor, the white and
other races. The result is we do not learn how to engage in
conflict very well. Our deep propensity to avoid conflict
is probably one of our most psychologically and socially
damaging attributes in an era of swift change.

To summarize to this point, I have presented some opinion
and evidence that the educational establishment requires
radical change. The students, I believe, and indeed the
school personnel as well, are woefully unprepared by their
education to meet and analyze situations in which conflict
escalates. They are unprepared to handle with constructive
skill, short of violence and acquiescence, the alternative
ways of de-escalating and resolving conflict.

What are the various responses that the leaders in the
technological revolution in the schools can make to the edu-
cational problem as described here? First, take a cautious,
evolutionary position, arguing for the gradual translation
of the traditional curriculum into media language and elec-
tric mechanisms within the present political framework of
American education. Second, take a bold elitest position,
arguing for a vast overhaul of the school plant and personnel,
with the decisions made by enlightened educational techno-
crats. Third, take an equally bold participative position,
arguing for those changes in the schools which will make
them radically more responsive to the needs of the students
and communities they serve. Such a change could begin with

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a broad share in the decision-making power of the schools
by all those affected by the decisions and policies made.

I beli.ve the evolutionary position, as indicated earlier
in this paper, will result in the emasculation of one's work
and the elitest position in its catastrophe. There is proba-
bly considerable evidence to support my predictions. The
traditional schools show enormous resistance to even innocu-
ous uses of instructional television and programmed instruc-
tion. This resistance is further seen in the magnificent
creativity displayed by both teachers and students in sub-
verting the best-laid plans of elitest administrators, try-
ing to reform their schools from the top. What I call the
participative position may have little evidence to support
it as the best of the three alternatives. Simply, however,
it strongly implies the virtue of subordinating the means
and instrumentation of education to the ends they serve. If
the end or goal of education, as Glasser argues in *Schools
Without Failure*, is to substitute success in love and in the
achievement of self-worth for the failure to love and achieve
self-worth, then the participative approach promises best to
subordinate the new technology to this humane goal (3:12).

It is considerably easier for me to outline the magni-
tude of educational change required than to specify in some
degree the changes, therefore, I offer the following intro-
duction.

We need new instructional formats to remove particular
rigidities that no longer provide an education which stu-
dents find relevant or necessary. First, there is the tra-
ditional division of content along disciplinary lines. The
pursuit of the pure discipline enjoys a nobler, more vir-
tuous status than the focus on glaring political and social
problems which require the crossing and integration of parts
of several disciplines for their analyses and projected solu-
tions. Take almost any current crisis we face--the racial
crisis, the generational crisis--and compare the anemic

uni-disciplinary with the heuristic multi-disciplinary approach to their analysis und comprehension,

Or, to put the issue another way, in a problem-centered curriculum dealing with our rapidly changing and pluralistic sexual preferences and needs, is it really necessary to begin with the fruit-fly and recapitulate the sexual behavior of all infra-human organisms? Must this come before we can ask some troublesome questions and make some rather trenchant observations concerning human sexuality, the separation of myth and taboo from what we really desire and do? How much organic chemistry does one need to grasp the nature and effects of the currently popular drugs, their interesting individual mediating and behavioral effects? And if organic chemistry and biochemistry and psychopharmacology are the necessary school prerequisites for a meaningful discussion of drug usage and effects, how many potential student drug users will ever qualify for the consideration of this problem?

But even more tragic in the missed potentialities for the media are the marvelous feats of film and television. These, in particular, reveal to the young their own inner states and motivations which correlate with their preferred modes of sexual behavior and drug usage. Gene Lichtenstein, a member of our Center staff, shows in his film on drug usage among college students how close the skilled film producer and director can get to the open expression of the thoughts and feelings of the young--an accomplishment most noteworthy in the Age of the Wide Generation Gap. A New York friend of mine, John Becker (once a Madison Avenue producer and now professor of media at Queens College) who originated those brief, dramatic cigarette-cancer films we see so frequently now on television, tells me that he knows nothing about media research but a great deal about the media--another poignant reminder that at least some of our research, as well as our instruction, should go "where the action is."

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A secondary school rigidity is the physical separation
of the school plant as one arena of activity and interest
from the community as another essentially unrelated activity
sphere. Indeed, Columbia was constructed on the aristocratic
European model of the university as a tower and citadel of
learning and *belles lettres,* influencing and leading the sur-
rounding community, but remaining solitary and uncontaminated
by the community. It provides at best a pleasant reminis-
cence of a past which probably never existed and for which
there is entirely no future prospect. The media, particularly
the movies and television, have done more than almost any-
thing else to breach the ivy walls. They have provided a
daily panorama of the life in the urban ghetto, in congres-
sional committees, in the public square, in the elegant
haunts of the rich and hedonistic and the simplistic, and in
the crumpled haunts of the young gyrating to the cacophony
of folk rock. Despite this, the school goes on teaching the
same curriculum in about the same way that it has taught for
the past 100 years. The media surely could end this strange
juxtaposition of two realities by doing within the school
what they often do so well outside the school--presenting to
us the raw and yet human reality of the communities in which
we live.

Furthermore, the movement between school and community
should be easy and reciprocal. On the one hand, the impor-
tant social and personal laboratories we must all learn to
think and live in are the buildings and streets of our com-
munities; on the other hand, an important locus for develop-
ment of the requisite cognitive and social skills are the
schools.

The town-gown hostility of the medieval university proba-
bly helped a young institution gain the sense of mission and
integrity it required to survive and develop. Today the
academic gown is a symbol of aristocratic snobbery, repug-
nant to the reform and radical students who would rather
tear it than wear it. To them it is a symbol for filching

support from without responsibility to the community which
gives it.

Finally, if the students in the colleges and high schools
manage to democratize administrative and faculty hierarchies,
the media will be of crucial importance in teaching the non-
student young and adult populations how to democratize their
churches, factories, offices, and homes.

A third dichotomy, which I believe our educational sys-
tem should well surmount, is the practice of separating edu-
cation for morality from education for content acquisition,
problem analysis, and scientific skill. With our historic
and constitutional separation of church and state, we fell
into the awful trap of believing that *all* ethical and value
considerations were relative and private and, therefore,
inappropriate for public school education. This view is as
naive, and perhaps as forgivable, as our belief that school
integration would reduce color consciousness to color blind-
ness and that color blindness would ultimately solve the
racial problem. Human behavior, particularly in its inter-
personal, social, and political contexts, is never value
free. To think, most certainly to act, is to decide; and
man cannot choose among options without committing himself
to a set of values.

A friend of mine, a psychoanalyst, tells me that the suc-
cess syndrome is not uncommon in many of his patients where
status and success have opened to them more options than
they can handle. Apart from success, status, and gain, they
have developed little personal sense of preference and value
that would enable them to select some options and relinquish
others comfortably. Unable to let go of anything for fear
that it will result in some absolute diminution of free
choice, they become frenzied, quivering globs of omnipotence.
This metaphor may well apply to our society, with its enor-
mous human, physical, and technical resources, yet its
apparent inability to solve its many crucial problems.

support from without responsibility to the community which gives it.

Finally, if the students in the colleges and high schools manage to democratize administrative and faculty hierarchies, the media will be of crucial importance in teaching the non-student young and adult populations how to democratize their churches, factories, offices, and homes.

A third dichotomy, which I believe our educational system should well surmount, is the practice of separating education for morality from education for content acquisition, problem analysis, and scientific skill. With our historic and constitutional separation of church and state, we fell into the awful trap of believing that *all* ethical and value considerations were relative and private and, therefore, inappropriate for public school education. This view is as naive, and perhaps as forgivable, as our belief that school integration would reduce color consciousness to color blindness and that color blindness would ultimately solve the racial problem. Human behavior, particularly in its interpersonal, social, and political contexts, is never value free. To think, most certainly to act, is to decide; and man cannot choose among options without committing himself to a set of values.

A friend of mine, a psychoanalyst, tells me that the success syndrome is not uncommon in many of his patients where status and success have opened to them more options than they can handle. Apart from success, status, and gain, they have developed little personal sense of preference and value that would enable them to select some options and relinquish others comfortably. Unable to let go of anything for fear that it will result in some absolute diminution of free choice, they become frenzied, quivering globs of omnipotence. This metaphor may well apply to our society, with its enormous human, physical, and technical resources, yet its apparent inability to solve its many crucial problems.

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The media have always had a traditional alliance with
the theatre and concert hall, with the lighting and graphic
arts, with the literary tradition of the novel, play, and
scenario, and with the journalistic tradition of newspaper,
magazine, and television news and documentaries. Because of
these diffuse ties, the media rarely make pretense of exist-
ing in a moral vacuum. Even when these art forms try only
to reveal the reality "out there," they are obviously and
necessarily highly selective a. 1 interpretive. In fact,
their aesthetic skill and appeal lies in how well they sim-
ulate and highlight rather than blindly ape reality or, as
aptly phrased, how well they "package information."

To remove some of the instructional rigidities I de-
scribe, Alan Westin, director of our Center and professor of
public law and government at Columbia, has proposed an insti-
tute plan for university undergraduate instruction (9). In
this plan, faculty members' commitments for the academic
year alternate between six-week institute periods and 10-
week work periods. These periods are accordingly devoted to
research, reading, writing, or active community involvement.
The institutes explore the pivotal conflicts of American
society such as race, technology, student unrest, and war
and peace. They represent intensive and serious faculty com-
mitments to full-day teaching. Their membership consists of
faculty, research staff, graduate students, students from the
professional schools, and undergraduates. During our spring
institute on high school unrest, for example, the partici-
pants were four faculty members from Teachers College and
Columbia University, including a social psychologist who
acted as process observer; several Center research assist-
ants; a media specialist; students from the Columbia law
school; undergraduate men from Columbia College and women
from Barnard College; and graduate students from psychology,
political science, sociology, and education. The students
prepared case studies of schools which had experienced ex-
ceptional unrest during the past school year.

The institutes represent a considerable investment in
the media because of their heavy reliance on films, video-
tapes, audiotapes, and so on. In the spring institute,
producers and directors of the films we saw told us about
some of their views, feelings, values, and the technical
problems which guided their selections and interpretation of
material. We used audiotaping and videotaping for interview
training and for the development of skill in approaching
students and school personnel in conflict situations. As
once wisely suggested, the methodology derives from the
students' grappling with the problem. The implacable eye
of the television camera focused on our sweating brows as
we encounter opposition, challenge, epithets, and flaying
fists and arms, ruthlessly reveals how awkward and rigid we
become as conflict escalates. In fact, it is my belief that
film and television, more than anything else, have given the
McLuhan generation its powerful sense of the individualiality
and personal life styles it now expresses so brilliantly and
conspicuously.

My thoughts about the media and new instructional formats
boil down to this: We need to experiment with instructional
formats which break through conventional school and univer-
sity administrative and curricular structures. The media,
which have proved their worth and enormous influence outside
the ivy walls, require new teaching formats to demonstrate
the great impact they can have in m king education powerful
and relevant.

I have said relatively little about media research,
because I am only an occasional consumer of this research.
Granting me this almost prenatal innocence, I confess that
I have not yet heard arguments which convince me that the
research, like the instruction, should not sometimes go
where the action is. I am not certain where the action is.
I am not certain where all the action is, but at least a
significant part of it is in the ad agencies on Madison
Avenue, in the TV studios of the national networks and some

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local stations, and in the film industry in this country and abroad. There is surely action in New York theatre--particularly off Broadway in the participative living theatre. Here actors and patrons sometimes divest themselves of most of their clothing and superego faster than the ushers collect their tickets. Some media researchers may want to get closer to this action than others. I believe, however, that some relatively direct study of what the most skilled directors, cameramen, and actors do to produce powerful effects will undoubtedly suggest some casual relationships amenable to controlled laboratory investigation. Given the impression multiplicity of factors comprising media instruction, catalogued so brilliantly by William Allen; given the theoretical wisdom and empirical insights of the investigators participating in this conference; and, finally, given the intuitive, almost nonverbal grasp of these factors by the practicing professional, we have the ingredients for the radical expansion of present laboratory theory and methodology necessary for a thorough understanding of the media. I suggest the same interweaving of field and laboratory research which may pay off so well in developing theories of instruction.

Quite evidently, I have dealt very little with fantasy and very much with grim reality. Fantasy dissolves quickly into reality these days as so many of our venerable institutions are caught in the limbo of failure to fulfill old missions and to create new ones. The school and university have reached this crisis point. We have always expected a great deal from our schools. When they fail, it seems American society, in some crucial aspect, also fails. Consider the protesting student, if for a moment we can overlook his political overzealousness, as he must often overlook our bureaucratic inertia. He has a vision for the school and university, perhaps in detail extravagant yet wholly appealing. He sees them as communities where learning and democracy flourish in an atmosphere of open inquiry, frank confrontation of opposing beliefs, of belongingness, and of regard for human dignity and welfare. I know of no

professional persons who could more dramatically help the
students transform this fantasy to reality than those who
devote their enormous knowledge, talents, and energies to the
schools and the media.

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There are vast influences, both from the
emotions within us and from groups who are
striving to manipulate us for their own pur-
poses, which make it easy for groups and in-
dividuals to tend to resort to force and vio-
lence to express themselves and to compel
attention to their grievances. Yet we as
educators must believe that the intellect
can and will surmount all other forces and
will succeed with increasing frequency as
the person, group, or even nation using it
matures. To take the position that reason
cannot prevail, and that violence and other
extremist tactics are necessary, or their
use condoned in order to achieve worthy ob-
jectives in and for education is to deny the
efficacy and the basic value of education
itself.

> ---*Richard Barnes Kennan,*
> *former executive secre-*
> *tary, NEA Commission*
> *on Professional Rights*
> *and Responsibilities*

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SUMMARY

AND SOME REFLECTIONS

ON THE CONFERENCE

gavriel   richard e.

                            and

salomon   snow

THE DESIGN of meaningful research on instructional media is
a far more complex task than it may seem at first glance.
Despite the quantity of research, summaries of research,
conferences on research, etc., that has appeared in recent
years, no one seems satisfied with the present state of the
field. While production of films, tapes, programs, and
other "instructional packages" is increasing at a rapid pace,
and while new and more sophisticated technology is regularly
introduced, theoretical conceptualizations rarely underlie
technological developments and no general conceptual frame-
work to provide some integration for this tremendous expan-
sion is in sight. There are some encouraging beginnings,
as Allen points out in his paper, yet they appear so far to
be isolated, uncoordinated attempts.

    Given this general background, it is striking to learn
that scholars of such diverse interests and disciplines as
represented in this conference share some fundamental views

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and assumptions after all, and reach quite similar conclu-
sions. There are of course many important differences among
the participants. In spite of this diversity, however, a
few common and basic themes emerge from this conference.

In this summary chapter, we risk being too much like the
"levelers" of Snow's paper, perhaps reading into the papers
underlying ideas and themes that authors may not have men-
tioned explicitly or have considered. Given this forewarn-
ing, we submit that there are three key concepts appearing
explicitly or implicitly in most, if not in all, of the
papers. These we shall label *interaction, conceptualization,*
and *organization.*

Interaction. One finds in the papers a basic common
thread. It is the notion that the components of any of the
phenomena we investigate generally interact in complex ways.
Unless possible interactive effects are thoroughly explored,
meaningful conclusions and generalizations cannot be reached.

Complex interactions between instructional objectives
and media, machines and messages, learners and modes of
stimulation, etc., are to be expected and regarded as law-
ful. Otherwise, there is little that a researcher can do
aside from stating that the matter is, indeed, complex.
There was a time when universal laws were sought. However,
researchers have now become more cognizant of the fact that
the impact of A on B depends on many additional factors
which we cannot simply push aside by saying "other things
being equal."

The idea of interaction can be discussed in various con-
texts. First there seems to be some general agreement, al-
though still fuzzy, as to the primary object of research,
namely, the nature of instructional media. Implicit in all
papers is the rejection of media as machine. Rather, the
participants seemed to have in mind the notion of media as
the result of interactions between the instruments of

transmission and the messages they transmit. Allen analyzes
this point by offering numerous kinds of stimulus and con-
tent variables which he feels cannot be handled in isolation.
Mielke devotes his paper to the question of medium-message
interaction and raises one of the central questions to be
dealt with: What can medium A do that is most appropriate,
given its structure, that no other medium can do? His quo-
tation from Carpenter (1:176) provides the idea in a nut-
shell:

> ...each communication channel [i.e., machine, medium]
> codifies reality differently and thus influences...
> the content of the message communicated. A medium is
> not just an envelope that carries any letter; it is
> itself a major part of that message.

Eisner seems to have the same idea in mind when he
states that

> ...Since these materials [the tools that technology
> provides] affect the formal qualities one works
> with, and since these qualities serve as medium for
> message, the medium, while not the message, shapes
> the message by its peculiar characteristics.

A similar point of view is expressed by Salomon.

On the other hand, Fleming expresses his preference for
"pan media" variables like the organization of stimuli, the
order in which the learner encounters certain cues or cer-
tain concepts in a message, etc. This may seem to contra-
dict the interactional point of view. The author even
states that the experimenter's choice of a medium (in the
more daily sense of the word) is a matter of convenience,
economy, availabil cy, or a matter of which medium permits
the desired types of display and control. This last note,
however, clearly implies interaction between media and pan
media variables, though perhaps unintentionally.

If instruments of transmission and messages interact,
then research on instructional media must focus on the
nature of this interaction. That is to say, one is not
satisfied with the gross effects observed in an experiment.

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The stimulus, i.e., the result of machine and message inter-
action, appears to be of equal importance.

It is evidently quite possible to study the effects of
cuing, prompting, organizing stimuli, etc., but this has
little to do with media research. Modeling, as McDonald
describes that line of research, was successfully done with
the aid of film. But what knowledge has been gained from
this research about film in instruction? This is research
with media, not on media. To answer a question like the one
McDonald raises, namely, how to use media to stimulate the
learning of mediational responses, calls for a thorough
understanding of the interaction between the machine and the
unique kinds of messages, message organization, symbol
encoding, etc., that it permits.

Another kind of interaction discussed or implied in the
various papers is between instructional media, as conceived
above, and instructional objectives and outcomes. It is
interesting to note that no participant referred to media
for distribution or amplification of information. It seems
quite clear that media can provide economical teaching,
from an administrative point of view, and offer some obvious
advantages as an adjunct to traditional teaching, bringing
rare or relatively inaccessible information into the class-
room. But this is only one aspect of media utilization and
research. The more important question concerns the kinds of
effects one can anticipate when media are used in the unique
ways made possible by their distinctive features.

Both Mielke and Eisner suggest that entirely new objec-
tives need to be formulated and entirely new measuring de-
vices need to be invented. The much-too-common and pedes-
trian measures of recall, recognition, application, and
transfer may not be appropriate to imaginative use of media.
This, however, is only part of the story. What may facili-
tate one kind of learning outcome (even a novel and most im-
aginative kind of outcome) may not facilitate another.

Under particular external conditions, it may even be of a
hindrance. Bringing the war in Vietnam into the living
rooms probably evokes strong feelings about war and peace,
commitment and sacrifice, that one could not have evoked by
other means, perhaps even in those who actively partici-
pated in combat. This results from television's character-
istic ways of shaping and conveying information. The same
scenes will likely fail if shown to facilitate objective
judgment of the war, or to establish better understanding
of the historical context in which this particular war takes
place.

On a much smaller scale, this kind of interaction has
been demonstrated by Salomon and Sieber (5). Results showed
that arousing uncertainty in a learner, by using random
splicing of film scenes, will facilitate one kind of per-
formance, namely, that which requires this sort of uncer-
tainty. But another kind of performance is debilitated,
apparently because it requires the arousal of another kind
of uncertainty.

A more important type of interaction may be that between
learner and mode of presentation. Snow's paper is devoted
entirely to this kind of interaction. Mielke, Eisner,
Fleming, McDonald, Conway, and DeCecco do not refer to this
type of interaction directly. However, the same idea fol-
lows from their papers as well. *The moment one is ready to
refer to internal psychological processes, whatever the
theoretical context, the question of individual differences
becomes unavoidable.* Just as it is recognized today that
individual differences between soils are crucial for the
selection of fertilizers, so the same must be the case with
humans. On this basis, the need to search for ATI's (Apti-
tude-Treatment Interactions) is discussed at length by Snow.
Abilities, personality, and attitude variables, entering
knowledge and skills, etc., become independent variables in
media research.

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The process of choosing appropriate aptitude variables
for inclusion in a particular kind of research leads di-
rectly to a second idea to be emphasized in this summary.
Most participants seem agreed on the need for deeper, more
rigorous conceptualization.

Conceptualization. Researchers are typically concerned
about the population of subjects to which their findings
generalize. No researcher will fail to describe his sample
in detail and many take pains to secure representative
samples of subjects. At the same time, the question of
sampling of stimulus situations is overlooked. Conway
states this clearly when he questions the representative-
ness of single-word learning or the acquisition of paired
associates.

Research is usually a compromise between accuracy and
relevance. But the two need not be mutually exclusive. A
procedure, a task, a mode of presentation may lead to ac-
curate and valid conclusions and still be relevant to the
world "out there." This process takes place when the tie
between the "out there" phenomenon and the experimental
treatment is convincingly clear. We need to *show* that what
we employ in the laboratory is a fair, although simplified,
representation of the class of events (stimuli, tasks, ma-
terials) in which we are *really* interested. This is what we
can call "ecological validity."

The treatments and stimuli used in an experiment are
valid to the extent that they represent a construct or in-
terest. A construct can be operationally defined in many
ways, but it is of little theoretical value to learn the
results of a study whose experimental conditions are opera-
tional definitions of *themselves*. One goes about establish-
ing the tie between the construct and the experimental op-
eration by either explicating the former or conceptualizing
the latter.

Conceptualization or, better, theory, should be the goal of research; but it is often absent in typical research on media. A number of participants in the conference showed concern for this problem. Hence, the strong emphasis on conceptualization and theorizing.

But conceptualization is not the same as generalization. Generalization is a function of similarity or representativeness. The learning of specific nouns in a paired associate list, as observed in the laboratory can under certain conditions be generalized to other words in other paired associate lists. The finding that a sample of students from Introductory Psychology I learned French verbs quicker when given a programmed text, is generalizable to some extent. But this remains a rather gross generalization at best.

When we conceptualize we see not only the wider range of phenomena but also their internal relations, their parts and the contexts in which they appear. Generalization is based not just on *structural* similarity: it is rather a generalization of a higher order, based on *functional* similarity.

Stolurow (6) points quite clearly to this difference: "...Instruction is characterized in terms of a set of functions, not in terms of a set of physical components. Every function can be accomplished by a variety of means." Thus, we create concepts which specify functions, not just generalizations about physical attributes. A similar point is made by Lumsdaine (3) and has been echoed many times in the present conference.

Conceptualization implies understanding the functions something involves. Thus, Allen makes reference to "Factors relating to psycho-physical processes"; Eisner speaks of evoked experiences; Salomon asks, "What Does it Do to Johnny?" Snow analyzes the "preferential" and "compensatory"

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functions of media variables; Seibert speaks of measuring
previously untapped cognitive abilities with media; Fleming
discusses perceptual and cognitive correlates of "pan media"
variables; McDonald asks how media can be used to accomplish
certain learning functions; and Conway refers to the same
question by stating that research on media should address
itself to "the relationship between the way information is
externally represented and how it is internally processed."

Although the theoretical backgrounds guiding each par-
ticipant are diverse--ranging from S-R theories, through
quasi-cognitive S-r-R views, to Gestalt notions--the same
main idea comes forth consistently: it is not enough to
know that A leads to such and such an increment in learning
of B by person C. We need to know what each of them repre-
sents psychologically, and how and why it has this kind of
effect. We thus return to the study of internal processes
and to interactions.

A further implication is that the kind of research ad-
vocated in this conference is *conclusion* oriented, rather
than *decision* oriented (2). This is neither sheer trial-
and-error-like research, nor is it designed to provide imme-
diate guidance to producers or teachers. The research aims
at gaining understanding, at increasing knowledge, at ex-
plaining phenomena. This aim cannot be served either by
blind empiricism or by decision-oriented research.

This is not to say that conclusion-oriented work is
sterile, irrelevant, or detached. On the contrary, if the
researcher conceptualizes what he does and attempts to
understand the functions that his treatments serve, and if
he also chooses variables which represent constructs of
value, then his conclusion-oriented research may provide
far more guidance, in the long run, than decision-oriented
studies. Take for example the three ATI studies discussed
by Snow. These are all conclusion-oriented studies. No one
should consider basing practical decisions on them at this

point. As we understand better the phenomena under consid-
eration, however, there may emerge some rather important
practical guidelines.

Conceptualization as discussed here cannot be accom-
plished in a theoretical vacuum. Moreover, it requires a
means not only to tie findings to some theoretical framework,
but, more importantly, a way to organize that portion of the
world with which the researchers are concerned into some
overall scheme or structures. It is to this aspect we turn
next.

Organization. Although there is consensus among partici-
pants on the general definition of "media" in the instruc-
tional context, agreement on identifying the key "media var-
iables" is far from being at hand. It would be naive, how-
ever, to expect agreement here, given the diversity of
disciplines represented by the participants. For some par-
ticipants, notably the psychologists, the unit of analysis
for both stimulus and response is rather molecular. For
others coming from the fields of art and communication, the
preferred unit of analysis is more molar and more complex.
This difference is important because the two approaches
usually lead to different styles of research: one to more
rigorous, laboratory-like research (which may, as Mielke
hints, miss the essentials of media), the other to "sloppier"
but perhaps more inventive and lifelike research.

Are the two approaches as far apart as it might seem?
Allen and Snow each offer ideas aimed at reconciling some of
the differences, by organizing the various aspects, compon-
ents, and units of this vast field into hierarchies of media
variables. Allen lists several general classes of variables,
each of which is then further divided into subclasses. Snow,
on the other hand, suggests a matrix of persons and environ-
ments, where both are characterized by many dimensions, hier-
archically subdivided. As he argues, a "hierarchical order
is not proposed as the necessarily true or correct way to

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organize stimulus variables, but only as a potentially use-
ful way to think about such dimensions." The two hierarch-
ies differ quite a bit. While Allen puts stimulus presenta-
tion forms (e.g., real, pictorial, symbolic, and verbal) at
the top of his hierarchy, Snow prefers to start with the gen-
eral concepts of information, redundancy, complexity, etc.
Allen places types of media, in the traditional sense, at
the second highest level, while Snow places there the dimen-
sions of rate of information presentation, kind of content,
"grammaticalness" of presentation, etc.

The advantages of having such hierarchies as guidelines
are quite clear. It is apparent that the minute, "atomic"
variables discussed by Fleming, Salomon, Conway, or McDonald
are closely related, perhaps subordinate, to the more gen-
eral variables referred to by Eisner, Mielke, and DeCecco.

Given a hypothetical hierarchy of variables it should be
easier to see how the "packages" discussed by Mielke relate
to the explicit supplantation of mental processes discussed
by Salomon. Similarly, it should not be too difficult to
see how the nondiscursive media Eisner suggests for explora-
tion as to their ability to vivify human experience, relate
to Fleming's discussion of graphical elements in drawings.

A hierarchical organization of stimulus variables would
be of significant help in conceptualizing functional rela-
tionships. If B has such and such an effect, and accomp-
lishes this or that function, and if it is a part of a sub-
class of A, then we can predict what to expect from A as a
superordinate category.

Somewhat less general hierarchies are suggested by other
authors. Salomon, for instance, discusses by way of illus-
tration the dimension of explicit presentation of informa-
tion, whose function is, as he argues, to supplant mental
processes. At this point two dimensions (playing a subor-
dinate role) are discussed: amount of supplantation and

nature of the supplanted processes. Questions of abstract-
ness and concreteness of information appear even lower on
the hierarchy, and types of media are subordinate to the
latter.

Regardless of whether some form of higher order organi-
zation is eventually found useful, simply the attempt to or-
ganize variables appears to be helpful in promoting the con-
ceptualization of what is being studied. This is not true
only of stimulus variables. Hypothesized internal processes
can be considered individually but eventually one needs to
organize them as well into some form of meaningful struc-
tures. When researchers ask, as most of the participants
seemed to do, what is the relationship between mode of pres-
entation A and information processing activities of B, then
both A and B need to be seen as parts of a larger structure.
Add to this the dimensions related to learning tasks, and a
third kind of hierarchy, perhaps like the "taxonomy of
learning processes" (4) is suggested.

Although commonalities emerge, some interesting differ-
ences appear as well. Obviously there are theoretical dif-
ferences between more Gestalt-like views, traditional S-R
views and S-r-R notions. Yet these seem relatively super-
ficial. The convergence of views, apparent with respect to
research on learning in general, also appears here. Even an
approach which may appear atheoretical to some (such as
Snow's paper), is really a cognitive-functionalistic view.
McDonald, although starting from a traditional behavioristic
view coupled with a social learning theory, ends up in a
quasi-cognitive (or rather a neo-behavioristic) position.
The real differences among participants revolve around the
question of *what should be studied*.

Allen provides a general framework for research. His
list of variables covers many aspects of research on media.
The other participants then attempt more analytic treatment
of selected subareas. Mielke concentrates mainly on the

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unique message-media interactions, an idea repeated in a
different context by Salomon. This opposes Fleming's view
which focuses on the basic units or elements common to mes-
sages in several, if not all, media. A deep-seated differ-
ence is reflected here.

To seek out for study only the unique attributes of
media, or only the unique combinations of media and mes-
sages, means that more basic variables, which by definition
are less unique, are to be ignored. Why? Apparently be-
cause no unique instructional outcomes can be accomplished
with them. Thus, for some participants, the AV experience
as such is not of interest; they would rather focus on those
experiences which may serve unique functions in instruction.
Fleming and Conway ask questions like: Given mode of presen-
tation A, what are its perceptual, or information-processing
correlates? Yet Mielke asks: Given medium A with such and
such unique communicational characteristics, what novel kinds
of learning outcomes can I expect from using it to its best?
Salomon asks questions in a similar vein: Given that medium
A is unique for doing this or that, what unique psychological
functions are served by it? When are these functions rele-
vant to what kind of learning, and to whom?

Actually the difference between the two approaches re-
flects a difference between research that aims at general
description of "normal" human behavior in "typical" situa-
tions and research that seeks prescriptions for new stimulus
arrangements and unique behavioral outcomes. To search for
perceptual, learning, and information processing correlates
of conventional modes of presentation means to study human
behavior in the real world toward a kind of norm-referenced
or normative psychology. On the other hand, to seek out and
capitalize upon unique stimulus constructions and resulting
behavior is to build a more criterion-referenced or engi-
neering psychology approach aimed at understanding behavior
in newly (and purposefully) contrived stimulus situations.

The two approaches should not be confused with conclu-
sion-oriented research, though the second of the two fre-
quently is directed at specified purposes and needs, rather
than general psychological understanding. Also, the two
approaches do not seem to call for different methodologies.
It is the selection of phenomena and foci which separates
one from another, rather than procedure. One might even
argue that the one type of research serves as a foundation
for the other. A particular study by Mielke for example,
might find that a new combination of optical effects achieves
some instructional purpose not previously attainable. But
when we then ask *why* this effect, it is necessary to revert
to the kind of general descriptive research discussed by
Fleming and Conway.

Eisner and DeCecco introduce an entirely new focus of
attention which is in strong contrast with the other papers.
Their main issue is not with how to study media meaningfully
but rather with the aims and goals of using media in educa-
tion. What DeCecco actually told the conference was that
from an educational point of view, most research seems to
miss the major point. "As leaders in the technological rev-
olution," he asks, "what are the various responses you can
make to educational problems?" A major point is that "the
marriage of media technology with an archaic school system
will be mutually disastrous." Thus, he suggests that we ex-
periment with new instructional formats which break through
conventional school and university administrative and cur-
ricular structures. This experimentation, in turn, requires
some direct study of what the most skilled and creative prac-
titioners are doing already.

This approach is in line with Mielke and Eisner's papers,
but it introduces a dilemma: Should we study typical and/or
unique behavioral correlates of media used for traditional
objectives, or should we rather study the way media can be
made to accomplish entirely new, even revolutionary, objec-
tives?

Put this way the approaches appear mutually exclusive. But this need not be the case. We may encourage students to use new materials as media for creative expression, as Eisner suggests, and at the same time use media to convey information. And in conveying information, we may also experiment with the most daring and unconventional techniques, using media to achieve DeCecco's vision of truly powerful and relevant education. None of this implies that rigorous research is unnessary or irrelevant. On the contrary, the more diverse our expected outcomes become and the less uniform our teaching procedures and curricula, the more both conclusion-oriented research and decision-oriented research is needed.

Even decision making, an ability which DeCecco notes is important to acquire, has a social learning or imitative component to it. Now if media are to be used to teach people how to choose between alternatives and take more responsible parts in governing their own lives, and if there *is* an imitative component in the process, then the questions raised by McDonald are quite relevant.

There are other differences of focus which emerge from this conference. Some participants are mainly effect oriented; others are concerned with mediating processes and still others with audiences. As stated earlier, however, these different emphases can be regarded as various dimensions of the same realm and hence complementary.

Reflections

One is reminded of the anecdote about the effects of some films in a general campaign for hygiene in a developing country. One of the issues concerned health hazards associated with flies. One film attempted to dramatize the problem by showing a fly, screen wide, and focusing on each leg, hair, etc. While dramatic beyond doubt in the viewing, the experience didn't seem to affect the housekeeping practices of viewers at all. Later interviews included questions

like, "Didn't you see how harmful a fly can be?" "Yes, we
did," came the answer, "and we really think that in places
where they have such huge flies, they ought to take precau-
tions." The result of this revelation, of course, was to
make the designers think not of what they had done, but
rather of what they had failed to do.

We will follow a similar course. It seems that we have,
for the most part, concentrated on one fly, enlarging it to
tremendous size, but ignoring the more general context in
which it operates. We should not overlook the general
framework within which instructional media exist. We should
also not overlook any approaches to research that offer some
promise of utility. Let us therefore examine the wider
field and context so that the flies we have been dealing
with will appear in the proper proportion.

With the exception of one paper (DeCecco's), all focus on
the study of media in instruction for the single learner.
Thus, the primary concern is with the mental processes that
correlate with various modes of presentation, or on the
learning tasks facilitated by them. This, though, is only
one aspect of the interrelationships of media and education.

Different modes of information presentation have, no
doubt, different kinds of impact on one's immediate mental
activity and thus can have different amounts of instructional
utility. However, modes of presentation may, in the long
run, have much more general effects. Such effects may ac-
cumulate and shape to some unknown degree the ways individ-
uals, perhaps whole societies, extract information from dif-
ferent media. The immediate instructional utility of a
certain medium could be closely related to the overall
impact of media in society.

Research on instructional media thus proceeds on a num-
ber of levels of generality. These levels range from fairly
specific ones as in the papers presented here to general

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levels (e.g., studying the impact over the years of media
on the social structure of society). Levels of generality
can be distinguished in two ways: *Temporal generality* con-
cerns the time sampling needed to study the phenomenon,
ranging from the single-point study (e.g., the way college
sophomores react to a certain kind of two-channel input),
through the developmental study (e.g., how do individuals
develop film literacy,) to the historical study (e.g., the
functions that a certain medium fulfilled over the years in
altering the character of political processes). *Social
generality* refers to the size of human unit sampling needed
to study the phenomenon, ranging from specific concern with
an "average individual," through the level in which differ-
entiated groups are studied (e.g., the ATI approach dis-
cussed by Snow), up to levels where subcultures and even
societies are studied.

Research on instructional media, as discussed in the
foregoing papers, resides for the most part on the most
specific level of generality. Yet, such research cannot
shed much light on other more general levels. It can,
however, generate hypotheses worthy of examination at more
general levels, just as research on general levels can be
a source of hypotheses useful on a more specific level.
Work should, however, go on at all levels of the generality
continuum. At present, several levels appear to be
ignored.

In at least two conference papers, reference was made
to "relevant aptitudes" which could interact with modes of
information presentation. But couldn't it be possible that
many of these "relevant" aptitudes are themselves subject
to modification by constant exposure to prevailing media?
"Media literacy," for example, may be an aptitude relevant
to specific instructional outcomes; but it is itself af-
fected by exposure to media. Let us not forget that the
immediate psychological impact of a particular presentation

is, to a large extent, a function of many preceding media-
produced responses.

Moreover, let us not overlook the fact that the same
media and modes of presentation which serve to *differentiate*
instruction, serve mass dissemination of information on an
undifferentiated basis. Given that the mass communication
remains a dominant characteristic of our society, it will
be useful to study its aptitudinal, attitudinal, emotional,
and social effects so that research questions on more spe-
cific levels become more meaningful in content.

The conclusion from the preceding discussion is not that
research on media should proceed in lock step, linear fash-
ion "downwards" from general to more specific levels, or
vice versa. There is, probably, vital information flow in
the form of hypotheses and findings from each level of re-
search to every other. A study concerned with the impact
of televiewing on social behavior can be supported by infor-
mation about the development of, say, moral judgment in
children, and then fed into research on attention, redun-
dancy, or incidental learning, examined on a much more spe-
cific level. Similarly, research concerned with the use of
TV broadcasts to facilitate the acquisition of basic lingual
and numerical concepts may reply on more general research
dealing with televiewing habits of children. The main point
is that research on all levels must be promoted and must be
interconnected at least by communication. Perhaps a time
will come when research at different levels can also be
integrated by programmatic coordination.

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5. Salomon, Gavriel, and Snow, Richard E., guest editors, Commentaries
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