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ABSTRACT

This is an initial examination of findings from laboratory and field studies done in Israel on the cognition-cultivating functions of media. The studies reasoned that highly explicit presentations of film-mediated operations can be imitated by observers, and that once imitated, they are internalized and can serve as modified mental skills. Two laboratory experiments provide empirical support. A field study of "Sesame Street" in Israel sought to determine if, in fact, a mass medium can produce cognitive changes. The absence of an adequate control group was solved by the methodological technique of multiple regression. A few of the findings of this complex study are that media can be made to affect mental skills, and that given sufficient novelty and cognitive stress, media does cultivate specific abilities. Second, television is an important force in cognitive development, although little is yet known about exactly how this takes place, with whom, and under what conditions. Third, the distinction made between formats that accomplish the function of modeling skills has received empirical support; and finally, the findings show who learns more through modeling and who from skill activation. (WMC)

COGNITIVE EFFECTS OF MEDIA IN INTERACTION WITH LEARNERS' TRAITS

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The possibility that media cultivate mental skills

When the effects of the mass media, particularly TV, are discussed, the readily available associations are "aggression", "family relations", "knowledge", "attitudes", "consumption", and the like. It is interesting to note that most of the research, up to the present, concerned with the effects of TV, dealt with nearly only three classes of factors: The typical contents of commercial TV, particularly as they affect attitudes, aggressive and anti-social behavior (e.g. Eisenhower, 1969; Feshbach & Singer, 1971), knowledge, and the like (Schramm et al., 1961); the televiewing situation, particularly as it affects homework, family habits and the like (e.g. Furn, 1971); and the technology of televising -- outstanding in its interest among educators (e.g. Allen, 1971), as it affects achievement.

However, there is one factor which, for some reason, has received hardly any empirical treatment, namely -- the coding system (i.e. the symbolic-communicational formats) of the medium. It was Edmund Carpeter (1960), followed later by Marshal McLuhan (1964) who first drew our attention to the possibility that the communicational "language" of media may have unique effects of their own, above and beyond the effects of content or situations of exposure. Yet in spite of the wide spread publicity of McLuhan's writings, and possibly also due to his style, the question as to how (if at all) the "language" formats of media can affect one's psyche, was never brought up to an empirical test.

Still, the possibility has not escaped the attention of researchers. Munsterberg (1972), has observed as far back as 1916, that film "externalizes" our modes of recall, association and thinking. Bruner (1961, 1964) much later, speculated that man has to develop

internal systems to serve as counterparts of external media and technologies. Thus, media are not just the extensions of man, but man adapts himself, psychologically, to their novel demands. Olson (1970) speaks of intelligence as being skill in a medium. Expanding this argument (1972 a,b) he asserts that media "cultivate" mental skills. Feldman (1972), taking a Piagetian point of view, theorizes that media, as well as other types of experiences, accomplish a "crystallizing" function in conceptual development, thus enhance movement from stage to stage.

In short, as one can note, the possibility that media affect cognitive skills has received some theoretical consideration, but with little empirical evidence to back it up. In the present paper I wish to further examine this cognition-cultivating function of media and provide initial findings from laboratory and field studies done in Israel.

That different media have different types of coding systems, or "language" formats, seems to be a common observation. It is quite obvious that digital codes, which characterize language and mathematics, are very different from analogical codes of pictures, drawings, films and TV. Similarly, the spatial representation which constitutes maps is quite different from that of aerial photos or of photographed landscapes. Clearly, some media have more similar coding elements while others are more dissimilar.

It could be possible to suggest even a hierarchy of media and classes of media according to the extent of their shared and dissimilar coding elements[1]. However, for our present purpose it suffices to agree on the assumption that media differ not only in terms of their tech-

[1] Particular chapters in the Forthcoming 1974 NSSE Yearbook (D.Olson, ed.) deal more directly with this issue.

nologies of transmission, but also (and perhaps more importantly) in terms of their coding systems, or "language" formats.

Another assumption which we could safely make is that as coding systems differ, so do also the information extracting and processing activities which are applied to them. In other words, the way one extracts and processes information from one coding system is quite different from the way he does it from another. The question of whether the resultant knowledge or meaning is, or is not the same, is somewhat irrelevant to this point. Indeed there is evidence to show that storage, recall, solution of problems, recognition, even kinds of mediators which are activated, differ as a function of the coding system, spatial arrangement or format structure of the input information (e.g. Paivio & Yarmey, 1966; Samuels, 1970; Fleming & Sheikhian, 1972; Brooks, 1968; Huttenlocher, 1968).

Given these two assumptions, it follows that different media (not technologies) have to call upon different modes of mental activity, and that these have to undergo constant changes as one is continuously exposed to new and changing coding systems. Could we undergo such changes as the result of exposure to media which challenge our mental capacities with new demands? Cross-cultural studies repeatedly demonstrate the high media-illiteracy of non-Western people. Yet, as exposure to Western technologies and media increases also media-literacy develops. Does exposure to the media cause the shift from illiteracy to literacy? And if so, what constitutes that shift? As Lloyd (1972) observed: "Socialization in the Western pictorial mode is important although we are as yet unable to specify the precise dimensions of this experience"

In another place (Salomon, 1972), I have argued that if learning to cope with new coding systems means the cultivation of appropriate mental "counterparts" (Bruner, 1961, 1964), then becoming media-literate entails more than just learning some associations between formats and meanings. It could entail internalization of the code, its schematization, and its use as a "mental tool", mediator or covert representation. Thus, exposure to maps ought to lead to changes in spatial representation and exposure to film-- to better ability to think in terms of the filmic codes or formats. Olson (1972a), reaches a similar conclusion, although by means of a different rationale, suggesting that "experience has its effect on behavior through the information it provides." Any activity requires information for the guidance of every component in it. One acquires both the information provided by the experience as well as the skills involved in its extraction. Thus, sitting on chairs teaches us both about chairs as well as about the skill of sitting.

Two major questions can now be raised. First, <u>can</u> media be made to cultivate mental skills, and if so -- how is this function accomplished for different people? This is what I tend to consider an educational question. Second, <u>do</u> media, in fact, and particularly the mass media, cultivate mental skills? And if so, how is this accomplished? This is a developmental question.

<u>Some preliminary experiments</u>

To answer the first question, a series of experiments was car-

ried out. In these experiments a particular coding element of film was chosen and presented to children in varying degrees of explicitness. For example, in one case we chose the element of the zoom-in-and-out on details. This element is quite unique to film. However, the psychological function that it accomplishes is apparently isomorphous to the skill of selecting perceptual details out of a complex and noisy context. Thus, such a filmic element could be internalized and could be used as a covert mental schematized operation. In another study we have used the element of laying-out solid objects. This is less unique to film, but the filmic range of codes, or formats, allows us to lay out even the most unusual objects, in quite simple ways.

We have reasoned that such highly explicit presentations of film-mediated operations, can be imitated by observers, and that once imitated, they are internalized and can serve as modified (or newly acquired) mental skills. We have contrasted such explicit presentations with others (usually slides) which -- as we reasoned -- call upon or activate, rather than model -- the skill to be learned.

Our experiments indicated two things: (a) Exposure to films, which explicitly model a particular operation that is part of the filmic coding system, lead indeed to improved mastery of that operation. Learners showed improved ability to carry out tasks which required the mental skill modeled by the film. Thus, it appeared that a medium such as film, can modify mental skills.

(b) Systematic interactions between learners' initial ability and explicitness of presenting the operation were found. The poorer

the mastery of the specific operation -- the more is learned from the highly explicit modeling presentation. The better the initial mastery, the more is learned from a presentation that calls upon one's already existing mental skills. These results, simplified for the purpose of this paper, are presented in figure 1.

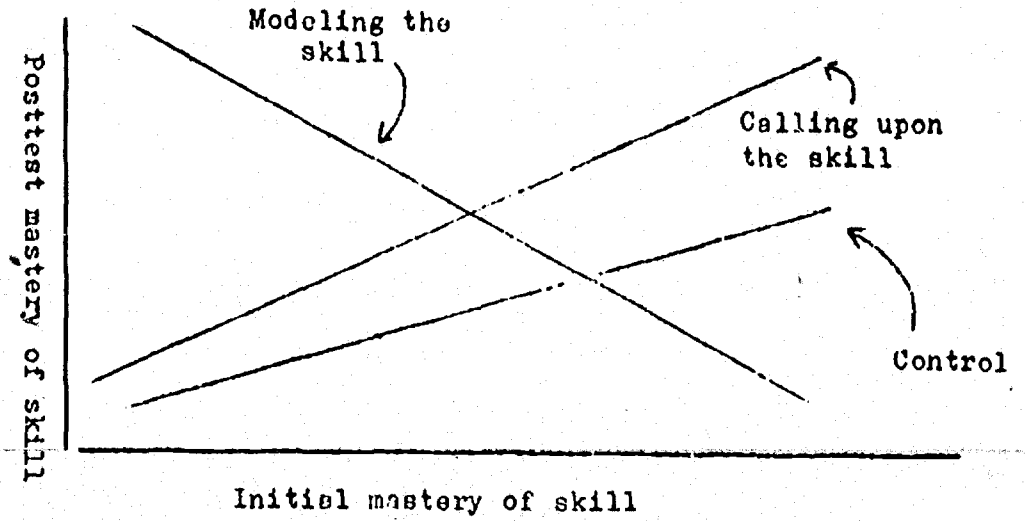

Figure 1: Interaction between learners' initial ability and two modes of using film to enhance mental skills.

We were in the position to suggest that media can affect mental skills in two ways: They can model an operation, which may be internalized[2] by those who start out with poor mastery of that operation, and

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[2] J.S. Bruner, while commenting on these results suggested that the modeling films enhanced the mental skills through "scuffolding" them, rather than leading to the internalization of the model (private communication, Toronto, 1972).

they can modify the operation by calling upon it, or activating it, in those of initial better mastery of it.

These findings suggest that media can modify mental skills in differential ways. But do the mass media, in fact, lead to such cognitive changes? That is what the study of "Sesame Street" in Israel came to answer.

A field study: The effects of "Sesame Street" in Israel

"Sesame Street", the educational, but commercial-TV like program, was originally designed for American 3-6 year old children. What characterizes these, in comparison with, say, Israeli children is the large quantity of commercial TV broadcasts which they consume daily. Acknowledging this fact, the producers of "Sesame Street" have tried very hard to present their educational messages via the most sophisticated, commercial-like programe, and make them resemble, in format, the most advanced commercial TV programs. The educational messages themselves were much more pedestrian and resembled the typical contents in every common kindergarten.

When such a program was brought to Israel, whose children have had only a very brief exposure to TV with quite oldfashioned programs on it, the question of TV-literacy came immediately to mind. If the program's formats are geared to play upon the televiewing habits and to call upon the mental skills of the American TV generation, what kinds of mental requirements do they make to the relatively TV-illiterate Israeli children? More importantly, to what extent does exposure to such a program modify, or cultivate, specific mental skills

in Israeli children?

It is important to note that the encounter of children, like the Israeli children of 1971, with an extremely unique TV program like "Sesame Street", provides a rare opportunity for the study of the question of whether a medium's specific formats do affect mental skills under realistic and natural conditions.

The study was rather complex and only a few of its major findings will be reported here[3]. 517 children, aged five, seven and eight, and representing low income and middle classes, took part in the study. A battery of "TV-literacy" tests was developed following a careful analysis of the program's most outstanding formats. Thus, e.g. we found that the show is highly fragmented. We reasoned, therefore, that it calls upon one's skill of synthesizing the various elements and imposing some logic on it. Hence, a test for this skill was developed. Similarly, we found that the camera in the program often takes the viewer around objects to show him the object from different points of view. We hypothesized that the program models the skill of changing one's point of view. Hence, a test of this skill was developed.

Other tests of additional skills, such as disembedding a complex

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[3]A more detailed description can be found in G. Salomon et al. Educational Effects of "Sesame Street" on Israeli Children (Brief Summary). The Hebrew University of Jerusalem, Israel, September 1972.

figure, relating components to wholes, were developed. Some of those skills we assumed to be called upon and thus expected them to be cultivated in children who had already some mastery of those or equivalent skills. Other skills were assumed to be modeled, and we expected them to be cultivated in children with initial poor mastery of them.

However, since the program had also specific instructional objectives, we tested their attainment (using the ETS battery, Ball & Bogatz 1970) as well. We wanted to examine the extent to which attainment of the contentual knowledge (the intended objectives of the show) is related to cognitive changes resulting from the novel "language" formats of the show.

The execution of such a study poses many methodological problems, not the least of which is the absence of an adequate control group. We solved that problem by using the technique of multiple regression (Cohen, 1968; Walberg, 1971) to analyze our data. This technique enabled us to partial out variance which was due to background and initial ability differences, and to examine the extent to which different amounts of exposure, and different components thereof, accounted for variance in learning. In other words, we asked, how much difference in mental skills and in the intended knowledge-areas does exposure to the program make?

Briefly stated, we have found, first of all, that exposure to the program has a significant effect on TV-literacy mental skills. This effect was far larger on highly specific mental skills, such as changing points of view or relating components to wholes, than on

more general abilities, or styles, such as field dependency. But even in the latter case, exposure to the program accounted for up to about 10% of the after-the-show ability variance. In the former cases exposure was found to account for up to 23% of the variance. In sum, then, exposure to a psychologically demanding program as "Sesame Street" has rather substantial cognitive consequences, thus indicating that TV does, apparently, cultivate certain mental skills.

There were, of course, differences among the age and SES subgroups. Older children were more affected by the program's "language" formats than smaller ones, and more well-to-do children benefited more than low-income ones. This comes to no surprise, as the older and the more well-to-do children were more exposed to the program. More important, they were mentally better equipped from the outset and thus understood the show much better from the early days of its presentation. Indeed, it was not sheer amount of exposure to the program, but rather the intelligent viewing which made it have so profound a cognitive effect.[4] Naturally, intelligent viewing cannot exist without exposure but the latter can, and often does take place without the former.

Another finding of the study further strengthens this point. Half the mothers of our five year old group were urged to view the show with

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[4]While, for instance, amount of exposure over the four months period of the study accounted for hardly any significant portion of the learning variance, it was the knowledge of what has been seen to which much of the variance could be ascribed.

their children, explain it and elaborate on its messages. This did not make much of a difference for middle-class children. Encouraging their mothers to join them in viewing the show did not make them learn more or be more strongly affected. However, encouraging mothers made a large difference for the lower-class children. The result was that SES differences, a dominant factor in the non-encouraged group, ceased to play a role in the encouraged group. That is, lower and middle-class children benefited to a similar extent as a result of encouraging their mothers. The active participation of the lower class mothers made their children view the show more intelligently.

How did the program cause the cognitive effects which we have found? Claiming that it is "novel" and "demanding" (in formats, not contents) explains very little. Thus, we have tried to distinguish, as best as we could, between those formats that modeled skills, and those which called upon skills. We hypothesized, on the basis of our former experiments, that while the less skillful children ought to benefit more from what is modeled, the latter ought to profit more from what calls upon their skills. Indeed, we found negative or zero correlations between pre- and post-viewing measures of skills which were modeled, meaning that the initially less skillful children learned more from what was modeled. On the other hand, we found positive correlations between pre- and post-viewing measures of those skills which were called upon, suggesting that the more one mastered a skill at the outset, the more it was developed (see table 1).

Table 1: Correlations between pre- and post-viewing abilities in the high exposure group

Mental skills which were called upon	1. Test of Picture arrangement	.46**
	3. Field dependency	.36**
	4. Close-up -- long-shot	.33*
Mental skills which were modeled	5. Test of changing points of view	.01
	6. Components and Wholes	-.40**

* $p < .05$

** $p < .01$

n = 55

These findings suggest the conclusion that media cannot only be made to affect cognition, but that, under particular conditions, they do in fact have such effects. Furthermore, these are differential effects, interacting with children's capabilities. Less able ones are more affected when the TV "language" formats model a skill, while initially better able ones are more affected when the formats call upon, or activate, existing skills. In these respects, our findings in the "Sesame Street" study are in full agreement with those obtained from the experiments.

Finally, what about contentual learning and mental cultivation? Two findings suggest a close relationship between the two. Firstly, we

found little relationship between the two groups of variables before the program was broadcasted. The absence of relations took place also after the broadcasting season was over, among the little-exposure children. However, among those who were intensively exposed to the program, mastery of TV-literacy skills and contentual learning became strongly interrelated. The second relevant finding was that, other things being equal, exposure to "Sesame Street" made the children be better able to learn from another instructional film. That is, they were better able to extract and process scientific information presented to them via film, as a result of their exposure to "Sesame Street".

Taken together, these two findings support the hypothesis that "Sesame Street" did, indeed, affect TV-related mental skills, and that these -- once developed -- facilitate contentual learning from the medium.

Concluding Remarks

Media have their effects on human beings. But this assertion means very little. Specific components of media, such as typical contents, situations of exposure, or particular technologies, have some kinds of effect on some types of people in some social settings. To this list of factors and interactions, we have added -- what we consider to be the very heart of media -- the cognitive effects of particular "language" formats which characterize one medium or another.

As a result of our experiments and field study, we are now a bit better able to claim that media can be made to affect mental skills, and that -- given sufficient novelty and cognitive stress -- they do

cultivate specific abilities. It becomes now more evident that children's exposure to, say, TV is a rather important force in their cognitive developments, although we know as yet too little to state exactly how this takes place, with whom and under what conditions. The distinction we have made between formats that accomplish the function of modeling skills, and those that call upon skills, has received empirical support. The findings show also who learns more through modeling and who from skill activation. However, all this does not tell us yet what role media play in the overall process of cognitive development.

The study of "Sesame Street" in Israel provided a rare opportunity to see how media, in a non-laboratory setting, affects cognitions. But it would take a longitudinal cross-cultural study to make us understand the role modern media play in developing abilities.

All said, we seem to discover that the "coca-colonization" of the world, through the wide dissemination of Western media, makes the world into a "global village", not only in terms of shared knowledge, interests, habits, aspirations and attitudes, but also in terms of shared mental skills.

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