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EDITORIAL

David Mappin

As we continue with our celebration of the silver anniversary of AMTEC's primary publication, it seemed fitting to take a second look at some of the ideas which CJEC has published on the field of instructional technology and on research into it. As a representative sample of these issues we repubiish four papers. The first two are on the subject of research into media and technology. The first of these is by Robert Bernard, the editor who deserves kudos for moving this journal into its current format and who is also a long time faculty member at Concordia University. The second is by Gerald Thorkelson, who was for many years an active scholar in the field based at the University of Washington. In both these short pieces the criticisms of our general approaches to our research work topics seem to me to have cogency a decade after they were published.

The other two articles we have chosen to place before people again are, perhaps, the two articles which sparked more discussion within AMTEC and the Canadian media and technology community than any other. They are Don Beckwith's article *The Future of Educational Technology* first published in volume 17 (1) in 1988, and the retort by P. David Mitchell, *The Future of Educational Technology is Past,* published in volume 18 (1) in 1989. It seems to me that both of these are worth re-reading.

Not to remain contemplating the past for too long two new pieces of scholarship round out this issue. The first of these by Laurie Wadsworth deals with important aspects of television, nutrition, and health. The second by Elizabeth Boling and her colleagues outlines an interesting avenue of possible research regarding navigating in hypertext documents. I hope you find them both interesting.

COMMENTARY

IS RESEARCH IN NEW TECHNOLOGY CAUGHT IN THE SAME OLD TRAP?

Robert M. Bernard
First Published: Volume 15, No. 3, Summer I986

Last week as I was basking in the leisure of the waning days of my sabbatical leave (in actual fact I was typing one of the articles that appears in this issue), a student came into my office with a with a question about a research design that he was analyzing. I won't go into the details of the question since it is irrelevant to the thrust of this argument. But the research question he was asking and his selection of variabies brought to mind what I believe is one of the major conceptual errors that has plagues, and continues to plague, research in educational communication and technology. I will argue that the methodological contortions necessary to test the student's hypothesis are so cumbersome that the question should not be asked in the first place. Yet old lines of questioning persist, in spite of pleas from a variety of critics (Salomon & Clark,, 1979; Clark, 1985; Salomon & Gardner, 1986). The student's research problem involved comparing mean differences of achievement among three independent variables (i.e., that class of variables that are considered to be under the control of the researcher). One of the variables was gender of the student (you guessed it, the levels were male and female). A second was type of content (language content versus mathematics content), and the third was method of delivery ("computer-based instruction" versus "traditional classroom instruction")*. The sample was comprised of male and female adolescents. To begin with, it is questionable whether such a design could serve to exhibit the instructional potential of different delivery methods in interaction with student gender and content type. It is true that previous research has identified differential gender-related rates of skill development in language and mathematics. But it is the cause of these differences that is troublesome. If one subscribes to a biological/psychological explanation of sex differences in the two content areas (most people would not argue along such deterministic lines),

*"Traditional teaching." As used here, refers to all forms of classroom-oriented, teacher-directed instruction.

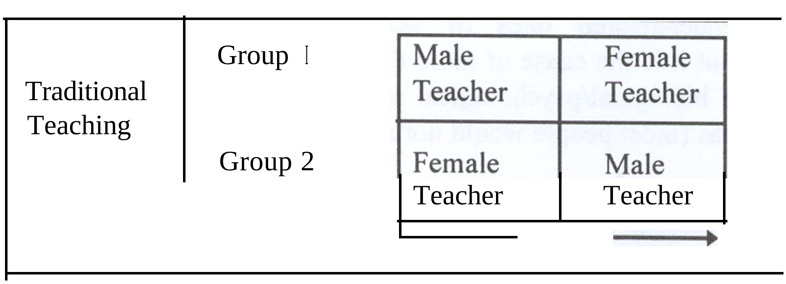
a design of this type, or any instructionally-oriented design for that matter, has little hope of much more simply reiterating those differences. Even for a nurture-oriented argument that implicates a complex cluster of social, attitudinal and instructional variables, this design is woefully inadequate. Only if one believes that instructional delivery makes nearly all the difference, does the research approach proposed stand a chance of demonstrating the hypothesized three-way interaction. In pointing this out, I am not criticizing the student so much as simply indicating the limited theoretical scope that his design can test. However, this is not the main point of this somewhat protracted tale.

Let's assume for a moment that we have successfully performed the mental gyrations necessary to accept the latter theoretical view – that instruction, and particularly method of delivery, makes all the difference to achievement. What can we expect as we begin to operational& the independent variables?

We can dispense with the content variable (language versus math) rather quickly by considering the nature of the dependent measures necessary to test differences between instructional methods in these fundamentally different areas. The proverbial "you can't compare apples with oranges" comes immediately to mind. However, just because we can't compare apples with oranges directly, doesn't mean we can't examine them descriptively. In our design, that connotes a correlational approach, not a direct comparison of means. The content areas can be dealt with, but in a fundamentally different way than was originally anticipated.

Now we come to the "horns of the dilemma" (although it may appear that we are approaching them tail first). What methodological considerations are necessary to provide a fair test of the difference between computer-based instruction (I'll call it CBI from now on) and "traditional teaching"? At first glance it seems that the two delivery methods should be comparable since a single set of objectives could be constructed to guide each. It is true, then, that method of delivery stands as a unitary testable concept? Let's see.

Figure 1: Counterbalancing scheme to control for student-teacher gender differences.



Whenever human teachers are being compared with some alternative, we should immediately ask ourselves "What kind of teacher?" The answer to this question, and others, has a direct bearing on the interpretability of the outcomes (internal validity) and how widely the results can be generalized (external validity). Since teachers come in two varieties, male and female, and since male teachers, for example, may interact differently with students of different sexes, this aspect of "teacher' should not be ignored. Sex of teacher can be handled in two ways: (a) by counterbalancing student exposure (See Figure 1) to each type of teacher, or (b) by including teacher sex as another independent variable in the design (See Figure 2). The latter approach exposes differences that may be attributable to same sex and different sex (teacher and student) combinations while preserving a modicum of external validity (external validity is considered to be high when experimental conditions are similar to those in the "real world"), as contrasted with the counterbalancing alternative.

Figure 2: 2 X 2 Factorial Design in Which Student Sex and Teacher Sex are Crossed Variables.

	Sex of Student	
Sex of Teacher	Male Male	Female Male
	Male Female	Male Female

So far the only criticism that can be leveled at this addition is one of increased complexity until one realizes that the gender of teacher distinction applies only to the "traditional teacher" condition (until they invent a CBI equivalent of Mr. and Ms. Pacman). This leaves what is called a partially-crossed factorial design – crossed on "traditional teaching," but not on CBI (Figure 2 shows the complete crossing of teacher sex and student sex, since each level of each factor is represented by a cell) or a retreat to our counterbalancing of like and opposite genders. In this alternative, differences due to gender combinations are spread over the treatments rather than isolated for measurement and analysis. This is not an unreasonable tack to take (provided we can live with the decreased external validity resulting from several teachers in the same course), but look what has happened. The differential nature of our treatments has forced us to neutralize one potentially important aspect of "traditional teaching" (teacher's gender), or face immense analytical headaches.

Consider another aspect of the teacher issue. Since we know that teachers differ from one another on many continua and that teacher effectiveness contributes somewhat to learning effectiveness, what sort of teaching characteristics should we count as important in, operationalizing this aspect of "traditional teaching"? Naturally, no single teacher embodies all of the relevant characteristics of all teachers. Even if we could establish a reasonable set of criteria that defined the "ideal teacher," we would have a-devil-of-a-time finding one, much less one of each sex. But the real problem with our design lies not in the fact that teachers vary (many behavioral variables that are regularly researched, vary), but that teachers vary as a method of delivery, but CBI doesn't (or at least not in the same way). A similar claim might be made from the opposite direction concerning a characteristic such as length of instructional episode. CBI should proceed at a student's own pace (suggesting that length of instructional episode will vary with students), while "traditional teaching" is usually confined to a pre-set period with outside study time varying from individual to individual. But should student time be counted as a characteristic of method of delivery? If not, CBI varies on contact time, while "traditional teaching" does not.

The class-oriented nature of "traditional teaching" and the concomitant effects of class size (Glass & Smith, 1979; Smith & Glass, 1980 on learning is another knotty problem. Students usually work on computers independently, while "traditional teaching" is usually conducted with classes of students which may vary greatly in size. If one believes in the socializing effects of classroom instruction (e.g., students learning from the questions and comments of other students) or the greater or lesser amounts of teacher attention that is granted by different class sizes, is it really fair to compare this human-human form of interaction with human-computer interaction?

I have touched upon but a few of the issues that a conscientious researcher would need to address in attempting to answer, unambiguously, a "which is better" question concerning our two methods of delivery. But what I have characterized here is a raft of methodological headaches (also see Clark, 1985a, 1985b), is really not that at all. It is, in my view, a not too subtle warning that two instructional treatments are so different that they shouldn't be compared in the first place (of course, two well specified and comparable methods of delivery can be compared, like two different CBI strategies). If you sensed that from the start, you might be surprised to discover that the literature of educational communication and technology is replete with comparisons of just this sort (e.g., televised teaching, programmed instruction, multi-mediated instruction). Often the finding has been "no significant differences," thank goodness. But why bother to construct, what amounts to , a unilinear ranking of instructional methods, when it is likely that each has merit under some circumstance?

Originally, I had intended to end here and, acting on that resolve, asked my colleague, Richard F. Schmid, to critique this piece. His comments are worth mentioning because I think they help to explain a few motivations that drive research of this nature. “There is, on the one hand,” he said, “a natural curiosity about which of two things is better, especially when a popular view (and hope) prevails in some quarters, that one will replace the other (I am sure you know which “one” and which “other” he was referring to). On the other hand, there is a legitimate need in specific situations to know which of two (or more) instructional alternatives to select, especially when big bucks are involved.”

I have little sympathy for the former view since it is engendered by the naive belief, I suspect, that a single technology (used here in the broadest sense) can ever contribute substantially to solving the “ills of instructional practice.” To illustrate this view, I recently overheard a person touting the potentials of interactive videodisc for solving the “teacher problem”, followed by the statement, “after all, educational media failed.” In my view, educational media failed only in the minds of those who initially held unrealistic expectations for them. The use of media does not solve some instructional problems, but it never could and it never will represent a general cure. The same is likely to be the case with current manifestations of instructional technology. If we fail to see them for what they are; as alternative means of achieving instructional aims, that are useful only some of the time, we are bound to be disappointed yet another time. Curiosity* is a wonderful human endowment, but it is insufficient justification, in and of itself, for attempting to answer every question that it propagates.

The latter statement – that my previous arguments remove one means that practitioners have for selecting among instructional alternatives – is more difficult to address, since educational research should concern itself in large measure with answering “real” questions of practice. My earlier admonitions, however, were directed towards those who believe that a general literature of comparisons, however, were directed towards those who believe that a general literature of comparisons among methods of delivery can service specific needs. Here we are no longer asking an abstract question. The conditions upon which effectiveness is largely contingent are restricted and describable. How then can a general literature ever be legitimately useful when the answer must be qualified continually with, “it depends on the specifics”?

An expensive solution to this dilemma, it seems to me, is to conduct local research that is not intended to be generalized outside of the specific circumstances of the testing site (this form of research is akin to evaluation). A far less expensive alternative lies, I think, in careful logical analysis based upon needs that are identified within a specific instructional instance. As a simple example, one would

* In actual fact, many forces probably contribute to the pressure that is exerted for research of this sort (e.g., large institutional grants, pressure of publication, journal policies).

hardly choose CBI if a need for group interaction has been discerned. These models suggest critical features of the instructional environment, methods and materials that should be considered at each decision point.

My "solutions" are simply "off-the-cuff' answers to serious and vexing questions that plague the designers and redesigners of educational systems. In response to the critic who retorts, "decision making is not that simple." I would say, "that's true." Yet, we seem to be transfixed by the notion that research can provide "once-and-for-all", or more aptly, "one-size-fits-all" answers to these same complex instructional problems. If we are so willing to sacrifice ourselves on the alter of simplicity, we might as well go all the way, it seems to me, and simply flip a coin.

References

Anderson, R. H. (1976). *Selecting and developing media for instruction. New* York, NY: Van Nostrand-Reinhold.

Clark, R. E. (1985a). Confounding in educational computing research. *Journal of Educational Computing Research,* I. 137- 148.

Clark, R. E. (1985b). Evidence for confounding in computer-based instruction studies: Analyzing the meta-analyses, *Educational Communication and Technology Journal, 33. (4) 249-262.*

Glass, G. V., & Smith, M L. (1979). Meta-analysis of the research on class size and achievement. *Educational Evaluation and Policy Analysis, I, 2- 16.*

Smith, M. L., & Glass, G. V. (1980). Meta-analysis of research on class size and its relationship to attitudes and instruction. *American Educational Research Journal, I7,4* 19-433.

Keiser, R. A., & Gagne, R. M. (1983). *Selecting media for instruction.* Englewood Cliffs, NJ: Educational Technology Publications.

Romiskowski, A. J. (1974), *The selection and use of instructional media.* London; Kogan Page.

Salomon, G., & Clark, R. E. Reexamining the methodology of research on media and technology in education. *Review of Educational Research ,* 47, (1), 99-120.

Salomon, G., & Gardner, H. (1986). The computer as educator; *Lessons from television research, Educational Researcher, 1.5,* (1), 13- 19.

Weston, D., & Cranton, P. A. (1986). *Selecting instructional strategies. Journal of Higher Education, 57,259-288*

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Perspective

THEORETICAL BASES FOR RESEARCH IN MEDIA

G. M. Torkelson
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A persistent problem facing teachers and researchers alike is finding answers to the questions: what point of view should I assume and what evidence should I use to determine the effects of media upon learners and the ways that learners utilize media to perceive and process information? After many years of research in media these same questions are still being asked and are still largely unanswered, at least to the degree that there are absolutes to guide educators in making decisions. Yet, looking at this situation from an historical perspective, developments over the past ten to fifteen years give promise of more definitive directions.

It is probably fair to say that most studies of media applications to instruction in the first five or six decades of this century were built upon narrower theoretical positions than today. That is, the effects of media upon learners were analyzed primarily as stimulus presentations which were to have a direct influence upon subsequent behavior. Learners were assumed to be reactive and under stimulus control. For example, in 1963, Finn, in defining "instructional technology", suggested that it was "...a branch of educational theory and practice concerned with the design and use of messages which control the learning process." But there were others who had a different view. Several years earlier than Finn, Carpenter (1957) contended that "...teaching materials are effective . . . depending on the degrees of their personal relevance to learners .... The organism or individual interposes its entire relevant life history between the stimulus material and his or her response." In a similar vein. Hartman (1963) in a review of learning theory, emphasized "...that facilitation or interference with learning arises from the cognitive organization the respondent imposes upon the message."

While there were others thinking as Carpenter and Hartman, most media studies were characterized in the familiar *gross comparisons* format. Such research seemed a natural reaction to the expanding availability of media through federal funding and the need to prove the utility of media for the improvement of education rather than a need to analyze the peculiar characteristics of media themselves. Much research studied learning *with* media rather than studying *about* media effects. All of us are familiar with the oft-repeated phrase "no significant differences." Subsequent analyses have criticized the assumption that global forms of media, such as television and films, were unambiguous entities that somehow could be described and controlled to determine a cause and effect relationship with any precision. Additional criticism focused on the theoretical assumption that learner responses were directly influenced by the stimulus input, with little regard for either the contributions of learner idiosyncrasies or the peculiar characteristics of media themselves.

More recent analyses of viable ways to conduct research and to define the nature of fundamental research questions have focused on the confounding effects of uncontrolled variables. Clark (1983), for example, has suggested that much of media research – that is, that which has been reported as media research – has actually been a study of variabie methodologies and settings in the uses of media. I would tend to agree, but with a recognition that there have been exceptions. One that comes to mind were the film studies done under Carpenter's direction in the Instructional Film Program at Penn State back in the 40s and 50s. In some of those studies there were careful analyses of variables within films as these affected the performance of subjects. On the other hand, subjects were not questioned to determine which variables were preferred; neither were learner repertoires explored to determine what affected their interpretation of stimulus elements.

Added to the problem of determining defensible theoretical paradigms for research in media are assumptions about the conditions necessary in a research setting to derive generalizations from methods and statistical analyses. I refer to the controversy between the reductionist view of research and those who advocate naturalistic inquiry as a more realistic approach to what life is outside the laboratory setting (Magoon, 1977; Guba, 1981). I do not intend to discuss the intricacies of each point of view, but rather to suggest that our initial orientations to what needs to be investigated and under what conditions quite logically affects our theoretical bases for research. For example, our attempts to control all conditions, either by statistical manipulations or tight controls of the situation and subjects, are based on assumptions that such controls are possible in the first place and that validity and generalizability are possible outcomes. An assumption is also made that reactions of learners as groups are indicative of the true picture about individuals in that group. The opposite view espoused by those who advocate naturalistic inquiry is that the assumptions of the reductionist are untenable, given the interaction of social, contextual, and personal factors which affect learner responses. Each approach to inquiry assumes its own conceptualizations about the nature of learners and becomes the starting point for judging what should be observed. On the other hand, both methods do provide a framework for the study of effects of variable media characteristics. But the extent to which each method takes into account relevant factors becomes an argument that inevitably leads to judging the results of each type of research paradigm.

Most of us are familiar with conditions that have brought changes in views about media/learning relationships since the days when media were considered primarily as stimulus control mechanisms. Government sponsored research through the National Defense Education Act in the United States, for example, supported traditional gross comparative studies. but also fostered studies of programming of instructional materials, which in turn had an important influence on greater interest among researchers in determining how learners perceived and processed information. While some studies compared the relative advantages of linear versus branching programming, there was also, through the so-called 90-90 criterion for the validation of materials, attention paid to the reaction of individuals to specifics in information displays.

A more recent movement, Trait-Treatment-interaction (TTl) is based on the premise that knowledge of the interactive effects of learner aptitudes with instructional treatments would make it possible to predict the proper types of materials and methods to insure desired learner responses. But TTl has also to contend with basing measurement on a *moment-in-time* in the life of a learner as a defensible basis for predicting future performance. The continuing problem, not only for TTl but for all types of research methodologies and theoretical orientations, is that learners are dynamic individuals changing constantly as more information from many diverse sources is processed each passing day. What causes idiosyncratic responses among learners is still quite elusive.

Clearly, the major focus today is upon the processes by which a learner perceives the environment, processes and stores information, and retrieves it for use. This emphasis has come about because of the recognition that indeed each learner is unique, a product of many experiences, and that messages appear to be meaningful only as each person gives them meaning.

There are current opinions that media, in fact, do not make any difference in learning, at least as measured by typical research paradigms that tend to manipulate situational variables rather than intrinsic attributes of media themselves. But there has been a shift from the more incidental role of media in instruction to a greater emphasis upon the interacting relationships among content and symbol systems with specific learner characteristics. A case in point is the hypothesis of Salomon that the greater the similarity between the coding systems in the message and the coding system in the repertoire of the learner, the more likely learning will occur. Such a shift is also seen in Olson’s (1972) theory of instructional means which says that technologies and techniques used with learners are accompanied by the development in learners of relevant cognitive skills.

What, then, are some prominent theories which have evolved in the last decade? For current opinions I am indebted to Clark and Salomon's (1984) final draft of a manuscript they prepared for the *Third Handbook of Research on Teaching.* Those of you who have studied the 1974 volume by the National Society for the Study of Education, *Media and Symbols,* will find some of these theories familiar.

The first has to do with the nature of symbol systems. This model offers a theoretical foundation for differentiating among symbol systems and may provide a systematic way for defining those aspects of symbols that may not only be pertinent to certain types of information, but also which may serve as devices by which learners process information. I am referring to Goodman's Symbol System Theory, discussed by Gardner (1974) and others. Goodman divides symbols into two categories as being either notational or non-notational. By notational, he means that a symbol must meet the criteria of being unambiguous, such as the concept "one is always one"; it must be semantically disjointed – that is, no two characters can have a common referent – and it must have a finite differentiation. For example, the signs for the bass and treble clef in musical notation are finite differentiations and remain so, assuming no other meaning. Non-notationality, on the other hand, suggests symbols that are dense, replete with information, and subject to a variety of interpretations. A picture may be classified as non-notational because it may be interpreted in a variety of ways. There can, however, be symbols within the picture which can be finite in their meaning and designation, and hence notational. While this discussion is not the place for a detailed explanation of Goodman's model, there is an additional model worth mentioning which complements Goodman's work. It is Gross's identification of various information modes that contain symbol systems peculiar to given sets or types of information. The modes, which he calls primary, are linguistic, socio-gestural, iconic, logico-mathematical, and musical. Each of these categories provides a system for differentiating among symbols used by learners to acquire and process certain kinds of information. They may also be useful for determining whether learners utilize these symbols as tools in their own cognitive processing.

Gross has also formulated two other general symbol classifications which utilize primary modes in idiosyncratic ways. One is the derived mode, such as poetry, dance, and film. The other is the technical mode, suggesting the peculiar language of the sciences, engineering, technologies, and architecture.

A second prominent theoretical formulation of is that of Olson (1972, 1974) referred to earlier. Calling his theory one of instructional means, Olson pinpoints two aspects of media which affect learning. One is that content may assist in the acquisition of rules and principles. The other aspect relates to the acquisition of skills which are required to utilize the information presented in the medium. Thus, the coding system and means for presenting information may become tools for utilizing similar coding systems and means.

Olson also points out that there is a significant difference between an *utterance* and *text* which have direct implications for our understanding of the functions of media. Olson defined an utterance as oral language that is flexible, unspecified, with a low degree of conventionalization, and that it is negotiable in a social setting. Written language, on the other hand, generally demands precision and explicitness of meaning. It serves to maintain philosophical, scientific, or analytic knowledge. Thus, as learners are schooled in written language, they develop the skill and habituation to textual material. For purposes of analyzing the effect of various forms of media, it may be important to note that long, training and practice in text materials may inhibit learning from other than text. This may be a partial explanation for the discovery of Guba when he observed the visual attention of subjects who watched science demonstrations on television. At times their eyes went out of focus and they tended to watch the mouth of the demonstrator more often that the details of the demonstration. Do we perpetuate dependence upon text by utilizing it continuously in our testing procedures and thus condition learners not to observe other forms of information? Perhaps we need to spend more time in conditioning learners to interpret and glean information from non-textual materials.

The third theoretical model is Salomon’s Media Attribute Theory (1979, 1981). The theory says, in effect, that both media and the human mind employ symbol systems for acquiring, storing, and manipulating information. Also, some of the tools of cognition are the consequence of employing symbols that were inherent in the media. In essence, he has suggested a supplantation theory which says that it is possible for technological devices, such as a zoom lens, to provide an observable analogy to the mental process of proceeding from a generalization to a particular and back to a generalization again. The use of a zoom lens to assist field-dependent students to observe details in a picture is offered by Salomon as tentative evidence of this phenomenon. Clark (1983) on the other hand, argued that zooming is not a media attribute, but a method of enlarging and focusing.

In addition to these three theories, there is a controversy that cuts across all of them. It is the controversy whether humans process information through images or propositions. Those who support the imaging hypothesis contend that a mental image is analogous to the perception of the actual object. In the opposite camp, those who deny the possibility of imaging see no direct connection between what one observes and the final knowledge acquired, because all stimulus situations are affected by beliefs, goals, previous knowledge, experience, and emotional states. Final knowledge is governed by rationality, that is, all stimuli are acted upon by the learner’s repertoire of the moment.

There is some evidence supporting the notion that factors other than media have more influence on learner responses to media than the elements or coding systems within media themselves. Clark and Salomon (1984) suggest that one relates to the effects of learner anticipation of media in terms of efforts that must be invested in their use. It appears that where media are perceived as critical to future performance, learners will expend more effort. Where media are perceived as entertainment, less effort is expended. Twenty years ago Greenhill (1967) wondered why television instruction did not often prove superior when compared with traditional university instruction. He hypothesized that good television instruction required less expenditure of effort by students; therefore, they put more time into traditional courses which were less well presented, thereby diminishing television effects.

Clark (1983) in reviewing studies of student effort found that high-ability students chose structured methods and media because they perceived that they would have to expend less effort. Lower-ability students, on the other hand, chose less-structured media and more discovery-oriented methods because they wished to avoid the failure that may have come from being unable to fulfill the requirements of the structured and directed situation. In a letter to me, Clark (11/15/83) said, “I have arrived at a very reluctant conclusion that media do not contribute much to learning.. . and only minimally to decoding. I do think that the symbol system approach has promise for instructional design but not much theoretical importance.. .“. He thinks media contribute only “...indirectly through variations in persistence which are contributed by our subjective impressions of how much effort is required to learn from various media.”

Where, then, are we in our search for theoretical foundations that have viability? Theoretical bases for research have proceeded from one of regarding the learner as reactive and under stimulus control, to one in which the learner is much more a participant in determining what effects media have upon the transmission of information, upon perceptions, and upon cognitive processes themselves. It is not only a matter of how learners perceive the messages conveyed via media, but also one of discovering whether and how learners utilize the coding systems of media as tools for manipulating information. It seems that the attempt to prove media utility is a dead issue, as is the attempt to depend upon gross comparative studies for definitive answers about media characteristics and their influences upon learner behavior. Yet. some fruitful questions still need to be asked for research purposes:

- Do the coding systems of media actually serve as tools for cognition?
- Do skills required for utilizing media content and methodologies become skills in cognition?
- What methods might we use with learners to discover the uniqueness of media?

- Can qualities of media and technological devices supplant or support given mental activities?
- Are notationality and non-notationality viable for analyzing coding systems effects?
- What methodologies best complement the uses of media?
- Do unique qualities of media support particular learning needs, or is it methodologies which contribute the differences in learner responses of media?
- Are learner attitudes and motivations the only dependable evidence to account for media effects?

Finally. let's turn to a questionnaire survey four graduate students and I conducted to determine which of fifty propositions about media characteristics and use would be judged valid or invalid and important for research by a random selection of the membership of the Research and Theory Division, AECT. Nine of the hundred questionnaires were sent to persons outside the Division. Forty two returns were used in data analysis. The fourteen statements regarded valid and important for research follow:

The greater the match between learner experience and media attributes the greater the likelihood of learner acceptance of media content.

Overt/covert responses of learners to media experiences are more likely to result in greater memory storage than covert/passive responses.

The more a symbol system matches the criterial features of an idea or event, the more appropriate it is.

Fitness of a message form depends upon the characteristics of the information.

Negative teacher attitude toward a media presentation creates negative student attitudes.

Presenting various forms of media provides the greatest compatibility with the nature of idiosyncratic brains.

It is critical for effective media usage to know the range of coding elements available in each learner's repertoire.

Sequential build-up of illustrations leads to better understanding.

Excessive detail interferes with transmission of intended information.

The advantage of visual over auditory materials increases for more difficult material.

The more similar the coding schemes in the teacher's and student's repertoires the greater the possibility for learning to take place.

Message, message forms, and conveyance systems interact to convey the intended message.

Cultural differences affect learner interpretations of media.

Learners have difficulty discriminating between subjectivity and objectivity in their interpretation of messages.

References

Carpenter, R. (1977). *Audio Visual Communication Review, 5* (1), 364-365.

Clark, R. E. (1983). Reconsidering research on leaning from media. *Review of Educational Research, 53 (4), 445-449.*

Clark, R. E., & Salomon, G. (1984). Media in teaching. *Third Handbook of Research on Teaching.*

Finn, J. (1963). *Audio Visual Communication Review,* Supplement 6, 1 l(1).

Gardner, H., Howard, V. A., Perkins, D. (1974). A philosophical, psychological, and educational investigation. In D. Olson *(Ed.), Media and symbols: The form of expression, communication and education* (pp. 27-55). 73rd Annual Yearbook of the N.S.S.E. Chicago, IL: University of Chicago Press.

Glaser, R. (1976). Components of a psychology of instruction: Toward a science of design. *Review of Educational Research, 46* (1), l-24.

Greenhill, L. (1967). Review of trends in research on instructional television and film. In J. Reid, & D. MacLennon (Eds.), *Research in instructional television and film* (pp. l-17). Washington, DC: US Government Printing Office.

Guba, E. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal, 29 (2),* 75-91.

Hartman, (1963). *Audio Visual Communication Review 11 (6),* 155.

Magoon, A. (1977). Constructivist approaches in educational research. *Review of Educational Research, 47 (4), 65* l-693.

Olson, D. (1972). On a theory of instruction: Why different forms of instruction result in similar knowledge. *Interchange, 3* (1), 9-24.

Olson, D., & Bruner, J. (1974). Learning through experience and learning through media. In D. Olson (Ed.), *Media and symbols: The forms of expression, communication and education.* 73rd Annual Yearbook of the N.S.S.E. Chicago, IL: University of Chicago Press.

Salomon, G. (1970). Interaction of media, cognition and learning. San Francisco, CA: Jossey Bass.

Salomon, G. (198l). *Communication and education.* Beverly Hills, CA: Sage Publishing Co.

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Perspective

THE FUTURE OF EDUCATIONAL TECHNOLOGY

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Introduction

> What we need is a transformation, not just a reformation of the educational system. We will prepare Master's students for jobs that don't exist and look for school systems with the vision to hire them. We'll call them "Instructional Transformers" and their job will be to guide the learning of our children (Welliver. cited in Middendorf & Coleman. 1987)

Welliver's visionary projection epitomizes the expectation of altruistic dream fulfillment that has drawn people to the field of educational technology for years. Educational technology is a winner. Upon encountering the field one immediately senses the powerful promise of potential. Within educational technology resides the potential for better schooling, better learning, better transmission of information, better interactive communication, better worlds.

Educational technologists can be recognized by the stars in their eyes. They know they are sitting on the most explosive potential of the century. Theirs is the apex of innovative motivation. Whether they are fashioning learning environments, creating media, designing instruction or effecting research and theory, educational technologists have a dream – a dream that can sustain them, and those they touch, well into the next century. As Finn (1964) prophesied, "the educational future will belong to those who can grasp the significance of instructional technology" (p. 26).

With the power of the systems approach, the promise of mastery learning and the potential to subsume and redirect all relevant resources, educational technology can effect the transformation of learning processes and learning outcomes. Further, if it is accepted that improved learning can improve individuals and that improved individuals can effect improved environments, educational technology is a vanguard of social transformation. Educational technology is visionary, for its base, its focus, its vantage point, its lofty goals are all grounded in the future. Its dream is the transformation of the way things are to the way things could be.

But the dream, while ever present, remains only a dream. The power, promise and potential of educational technology have not been realized. Resultingly, mild insecurity and disappointment have been replaced by unrest and discontent The focus has turned from transformational leadership to survival within the status quo. And the voice of discontent is getting louder and more persistent.

Much of the discontent can be attributed to the realization that educational technology has not yet assumed its predicted third stage of evolution. Analyses of the past and future essences of educational technology (e.g., Davies, 1978) have determined three levels of evolution. The past has been described as the tools approach (Educational Technology 1), i.e., the application of audio-visual devices to the improvement of teaching. The present has been described as the systematic* approach (Educational Technology II), i.e., the development and application of methodological, rule-based processes to the facilitation of learning. The future has been described as the systematic' approach (Educational Technology III), i.e., the creation of unified and dynamic wholes (from previously separated components) to effect the transformation of learning. The field dreams of the ideal of Educational Technology III while operating within the status quo confines of Educational Technology 11.

The discontent with mere survival within the level of the systematic approach, however loudly voiced and/or solution oriented, has been insufficient to force the field to the level of the systemic approach. The mission and the belief in the mission remain – to transform the learning process to a level that can only at present be imagined. Just as a master coach can transform individual teenagers into an Olympic medalist team; just as a master architect can stretch the capabilities of each construction team; just as a master film director can transform almost any assortment of people, things and processes into a vibrant and scintillating whole – so too can a master educational technologist systemically structure environments to effect higher and higher levels of cognitive ability. Instead, the status quo of Educational Technology II appears to be guaranteeing its survival at the expense of the realization of Educational Technology III.

The purpose of this Perspective is to review the mounting discontent (and its imbedded solutions) in order to determine the traps that must be avoided and

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* "The words 'systematic' and 'systemic' come from different roots. The former the Latin, with a nuance of order or interval; and the latter from the Greek, with a nuance of organized whole" (Davies, 1984, p. 9).

the pathways that must be created so that educational technology can force its evolution to the systemic approach and the then reachable dreams beyond.

The Discontent

The discontent within the ranks of educational technologists is not new, nor is it surprising. A future- and ideal-oriented field will, by definition, be discontented with the present, the status quo. Whereas the discontent of the past focused on the non-realization of Educational Technology III, however, the more recent discontent appears to be focused on the difficulty of surviving at the level of Educational Technology 11. Concern has shifted from the future of learning to the future of educational technology. Moreover, for the past ten years the latter concern has increased in tempo, breadth and frequency. Postulates abound on why educational technology has not yet realized its transformational potential. Proposed solutions to the problem are even more prevalent. These solutions, however, especially ones that purport to effect short-term survival, may, in fact, effect a continuation of the problem.

Finn (1955) warned that unless the field creates and communicates, throughout society, a public philosophy that is adequate for the times, “we can well disintegrate... we can become so immersed in trivia that a scientific dictatorship is inevitable” (p. 252). While this warning was targeted at a field that was at the time struggling to evolve from Educational Technology I to Educational Technology II, it remains valid for the struggling emergence to Educational Technology III.

Expanding on Finn’s concern years later, Silber (1970) suggested that educational technologists did not even know what field they were in, that they had not communicated to themselves – much less throughout society – either the field’s conceptualized purpose or even the interrelations of the components of the system called educational technology.

Torkelson (1977) reviewed what educational technology had accomplished and had yet to accomplish. Still needed, he suggested, were for the field a) to apply its intellectual technique directly to the benefit of humankind, by, for example, encompassing “value systems and idiosyncrasies of individuals in the large purposes of schooling and society” (p. 357); b) to integrate the combined energies of its subgroups to common problems, such as the lack of an agreed-upon path and continuity for future inquiry, and the distance between the practitioner and researcher; and c) to constantly challenge itself by asking the “blunt, yet critical question: SO WHAT!” (p. 358).

Clark (1978) criticized graduate programs for producing practitioners rather than scholarly inquirers; and faculty for conducting too little research, teaching inappropriate research skills, holding experimental design and data analysis skills in low esteem, and for allowing soft-money contracts to control the focus of doctoral programs.

Silber (1978) chided that unless educational technology overcame its problems i.e., a) the lack of proactive synthesis of the subprofessions within the field, due to the restricted conceptual frameworks of the membership of each; b) the failure to effect or even recognize our potential impact on the educational system; c) the concern with the means rather than the ends of education, and therefore the nonenforcement of the field's ethical and value positions; d) the inappropriate and limited focus of research; e) the low quality of professional communication among educational technologists; f) the lack of understanding of the field's conceptual framework; and g) the inadequacy of leadership development efforts – "the profession will remain only partially developed or, perhaps, regress to a less fully developed stage" (p. 184), i.e., a subservient rather than a leadership role.

Torkelson (1980) urged that educational technologists move away from reductionist research (which could be said to typify the systematic approach of Educational Technology II) and toward constructionist research (which could be said to typify Educational Technology III).

Heinich (1984) placed the blame for educational technology's slower than desired evolution partly on the shoulders of those in other fields who reject our cause, but mostly on our own shoulders for a) creating alliances with those who have neither the power nor inclination to effect change; b) being blind to what-should-have-been obvious institutional constraints; c) allowing vested interests to interfere with scholarly inquiry; d) failing to distinguish "between our administrative 'home' and our intellectual foundations" (p, 73), thus fostering the inhibition of intellectual freedom; e) artificially restraining our technology to fit institutions within which it is being applied; f) narrowing our research focus on such as learning gains rather than exploring the system effects of technology" (p. 76), i.e., emphasizing conclusion-oriented research over decision-oriented research; g) trying to apply established but inappropriate research questions, designs and techniques to systemic issues; and h) failing to "produce" sufficient reflective, thinking educational technologists. He further labeled educational technology a craft rather than a profession (again characteristic of the systematic approach of Educational Technology II).

Clark (1984) suggested that educational technology graduate programs have focused on instructional design models and procedures at the expense of the mindset of science' and the tools of research, resulting in reducing the number of graduates who have the independent and original inquiry skills and the devotion to keep our field alive and well.

Hynka and Nelson (1985) building from Davies' (1978) threefold definition of educational technology (the tools approach, the systematic approach and the systemic approach), presented an argument for viewing the field as a metaphor in order to realize a tripartite system which could sustain a creative productivity through its synergy.

Winn (1986), echoing a host of prior discontent with research in educational technology (e.g., Becker, 1978; Beckwith, 1984; Clark & Snow, 1975; Koetting, 1983; Salomon & Clark, 1977) stated that we are not only addressing the wrong research questions but also are applying inappropriate research methodologies. And Torkelson (1987) called for an end to the use of static research models in the study of dynamic learners and learning processes.

Gagne (1987) regretfully reminded us "that instructional design is not a part of the established order" (p. 20) in industry, military or universities, and warned that the valuable technical knowledge that instructional designers have "must be guarded from contamination, and not be compromised by the various influences of the marketplace" (p. 20).

Clark (1987) suggested that in order for us to become the world's third profession after medicine – and engineering – we must emulate the first two professions. Echoing Heinich's (1984) concerns, he said that until we do so, we will remain a craft.

At the recent (1987) conference of Professors of Instructional Technology and Development (PIDT), 85 professors from the U.S. and Canada shared a weekend of informal presentations and discussions. In steady succession, throughout the conference, concerns about the survival of educational technology were expressed, and a wide array of "solutions" were traded. Rossett (1987), for example, traced her department's success at finding new, alternative and amazing markets, during the late 70's and early 80's, primarily in business and industry. "It was easy. It was also seductive" (p. 1), but now that the school market is beginning to resuscitate itself, we must, she suggested, for survival (translated in terms of monetary and administrative support for faculty and equipment), be ready to balance the needs of our diverse markets.

Bratton (1987) once again offered a plan for certification as the solution to our problem, the premise being that through the national and international certification/accreditation of educational technology graduates and graduate programs, quality and survival will be assured. By following the paths of such as the National Board of Medical Examiners and the Institute of Industrial Engineers, educational technology, too, could emerge as a respected profession.

Walter Dick offered the Florida State University model of linking, inseparably, educational technology and educational psychology in our graduate programs in order to do better what teacher education purports to do. Canelos (1987) offered the Pennsylvania State University examples of working with and for departments of engineering, which are currently receiving large development grants and in need of instructional design consulting. Schwen (as cited in Middendorf & Coleman, 1987) suggested the development of an educational technology degree to "rock the boat of regular teacher education" (p. 4). Barry Bratton proposed that educational technology needed some type of continuing education system so that graduates can keep up with the field. (Perhaps this too could be accredited.)

Caffarelia and Sachs (1997) announced the forthcoming publication of *Doctoral Research in Educational Communication and Technology,* conceived to "help the profession to identify invisible colleges and research trends, (for) by building upon the research of others, future researchers can advance the field more collectively than could be done by one individual working in isolation" (p. 3)

A large number of participants expressed concern about the next generation of educational technology professors, since very few graduates opt for academia over the higher-paying corporate world. In fact, this worry seemed to pervade the conference as an undercurrent theme. Such comments as, ". . . for those who will sit in these chairs at future meetings. ..“; ". . . for those who will follow us...“; "very few of our graduates are interested in our jobs, jobs in higher education"; "we must do more to emphasize the positive aspects of professorship and de-emphasize the negative aspects" were sounded and echoed throughout the weekend. Another question was posed more than once: "Why do most college of education faculty view educational technology and instructional design endeavors as superficial, unprofessional, training rather than education, or any of the other negative comments often expressed?" Again, the concern was that of survival – survival of the professors of educational technology, survival of the field of educational technology.

Throughout the presentations and discussions, the underlying questions of "who are we", "where do we want to go", "how can we best affect the world?" Middendorf & Coleman, 1987) were omnipresent. To the extent that one can judge a field by the words and actions of the professors within that field, it would appear that educational technology is undergoing a period of anxiety, a temporary loss of focus/direction/raison d'etre. Silber's (197 1) old question: "What field are we in, anyway?' is resurfacing in a number of interesting and, perhaps, frightening ways.

The discontent expressed in publications, presentations and conversations is clear, and it is pervasive. We are not being complacent about the situation. Solutions are being offered. Solutions are being applied. But these very solutions may be the seeds of our own infertility. If we are to survive, purposefully, as the cutting edge field of our original vision, there are some solution-related traps that must be avoided.

The Traps

The three major traps (Compromised Integrity, Status Quo Adherence, and Solidification) are presented as separate categories to ensure comprehensiveness and to facilitate discussion. The categories (and their sub-categories) are not intended to be seen as mutually exclusive. Approach them as a set of interrelated and interdependent traps.

The Trap of Compromised Integrity

The trap of Compromised Integrity can be found in three forms: a) Innovation affiliation, b) Greener pastures, and c) Political expediency.

Innovation affiliation. This trap is realized as the temptation to define learning and instructional problems in terms of the latest innovative 'solutions' rather than to create appropriate solutions to pre-addressed problems. Whether the ensnarement is in the form of 'blind' adoption of hardware, software, methodology or structure, the bait is alluring. Within the shining, bright newness of the innovation resides hope. How many have not been swept away (at least momentarily) by the dreams embedded within videodisc technology (or substitute any other magnetic innovation)?

The innovation is there. It is tangible, public and can be put to use immediately. Further, since innovations tend to be popular, those who affiliate with them may also be popular, or at least be seen as people who are in step with important trends. There is also the hope of survival; with a new gimmick, a new thrust, we may be able to stay alive long enough to do what we really must and want to do.

For the above reasons – hope, convenience, popularity – the pressure will remain on educational technologists to adopt and incorporate the latest innovations. Some recent examples: Clark (1987) suggested that an educational technology graduate program should be structured along the lines of the latest problem-orientation models of medical education (operationalized by such leaders as Harvard, McMaster and Maastricht); Rossett (1987) suggested that opportunity is here and now to teach computer literacy skills to all public school teachers, for we have the hardware, the expertise, and the desire has been communicated by governments and university administrators. Beckwith (1987) suggested that computer-mediated conferencing has the potential for effecting superior group problem-solving skills.

While there is nothing inherently wrong in hop-on-the-bandwagon suggestions such as these, the risks are threefold. First, looking for the cutting edge in other fields can have the effect of transforming a leader into a follower, constantly looking for the next innovation to latch on to rather than creating the cutting edge to lean out and lead from.

Second, while it is important for a cutting edge field to be aware of and purposefully incorporate what is new and viable within its systemic framework, educational technology cannot afford to run the risk of defining itself (or letting itself be defined) through current phenomena. By falling into this trap, educational technology has, *inter alia,* been defined as a field of equipment jockeys, Skinnerian behaviorists, media producers and computer software specialists. When the vanguard message is not strong enough, educational technology runs the risk of being defined by its most visible and tangible parts; it becomes just another nomadic craft following today's sun, hoping that a new sun to follow lies just beyond the horizon.

Third, the time and energy given to the adoption of innovations can deplete significantly the time and energy needed for goal realization. This phenomenon is especially relevant when there are so many tempting innovations on the marketplace. While educational technology is, by definition, a subsumptive field, i.e., it is systemically possible to incorporate *all* on the way to goal realization, history suggests that innovation affiliation has more often led to the divergent dissipation of desired goals.

Through innovation affiliation temporary survival may be guaranteed at the cost of identity, purpose, and cutting edge leadership. Being on the cutting edge of positive change is not to be equated to latching on to what appear to be the current winners. When a field is truly operating on the cutting edge, the world comes to it. As true now as it was when the field first emerged, there is a need for a collective of educational technologists (balanced on the cutting edge) which, by its very integrity of systemic validity, demands followers.

Greener pastures ". ..Leadership will have to come from individuals who do scholarly inquiry for its own sake, who do not have one eye (or both) constantly on the alert for the next consulting opportunity" (Heinich, 1984, p. 85).

Now that the consulting opportunities in medical education, public schools and much of higher education have been all but exhausted by educational technologists, and those opportunities in business and industry appear likely soon to follow suit, we are once again seeking greener pastures. Engineering, for example, has been touted as the ideal pasture for current and future grazing (e.g., Canolis, 1987), for engineering has the. money and is in need of the services that educational technology can provide. There are potential contracts and internships galore, and even, it is said, possibilities to link academically in a variety of ways with departments of engineering in higher education. The obvious risk in falling into this trap is that of losing one's intellectual integrity by selling out to the highest bidder.

At three educational technology conferences in the past year people have been seen wearing T-shirts proclaiming, "We will do IT in your field". While on the way to becoming the world's third profession (after medicine and engineering) we might, instead, become part of the oldest profession.

Political expediency. In any educational technology endeavour, be it in academia or on the front line, there is the temptation to use political expediency to ensure temporary (and perhaps on-going) survival. Compromise, in the form of doing what is expected of us (by those who do not know what we are, capable of or by those who know very well what we are capable of and feel threatened), instead of doing what we know must be done, is high risk behaviour.

While all educational technologists must deal with significant others who may in some way affect their destiny, the trap snaps shut when the time and energy expended satisfying the perceived desires/mandates of these significant others preclude the time and energy needed to satisfy the mission of educational technology. Compromise for political expediency is not a critical attribute of a cutting edge field. Every instance of relinquishing the integrity of the cutting edge ideal is one step closer to the status quo. Every realization of others' misconceptions (whether through their ignorance or awareness) is one step backward from the educational technology ideal.

Such steps may be rationalized with surface logic, e.g., "It's what the client (Substitute 'dean', 'boss', 'student', 'subject matter expert', 'employer') wants"; "These are our bread and butter courses"; "It's where the money is"; "If we don't, we'll be forced to amalgamate with Department X"; "By doing this, we'll generate FTE's (Substitute 'further contracts', 'student employment possibilities'.), and *then* we can do the important things we really want and need to do"; "the state/university/administration expects it"; ."This is the way it is"; "This is the reality of the situation". The true reality, however, is that by accepting and submitting to "reality". the ideal is lost.

The compromise of political expediency can have a stifling effect on every aspect of educational technology – its programs, its graduates, its professional work, its goals. Yet the practice persists. In fact, the trap of political expediency has so exacerbated the ill-being of the field that radical "solutions" have been proposed. Heinich (1984), for example, so frustrated with educational technology's futile attempts at transforming the educational status quo, advocated that our place is on the side of management (rather than labor) so that a top-down coup may be effected. Schwen (cited in Middendorf & Coleman, 1987), so fed up with the ineffectuality of teacher education, proposed the creation of an undergraduate educational technology program to compete directly with teacher education programs. Clark (1984) so discontented with the inability of educational technologists to do what they should be doing (i.e., scholarly inquiry) urged that educational technology faculty and students have a solid background in and mastery of science.

Awareness of the deleterious effects of political expediency, not the least of which is the radical reaction to these effects, is a necessary first step toward avoidance of the trap. The solution – minimizing the compromise – can follow. Other proposed "solutions", such as the above-mentioned, face yet another trap, that of Status Quo Adherence.

The Trap of Status Quo Adherence

This trap awaits in three guises: a) Emulation; b) Legitimacy; and c) Absorption.

Emulation. Educational technology emerged to fill a gap left by the status quo. Educational technologists were and remain dissatisfied with the efforts of established fields to effect positive, meaningful change. While dedicated to a transformation to the teaching-learning ideal, educational technology persists in seeking out other models to emulate, status quo fields to mimic, instead of forcing to realization Educational Technology III.

A case in point: It has been suggested that we emulate the two established professions – medicine, and engineering (e.g., Clark, 1987) – so that we too may become a profession (or at least display the external trappings of a profession?) Can a cutting edge field determined to transform the status quo risk emulation of established professions? When the medical profession dedicates itself to a transformation – from the repair of malfunction to the creation of steady-state health – it may be worthy of emulation. When the engineering profession dedicates itself to a transformation from minor modifications of and improvements to existing environments to the creation of ideal environments for living – it too may be worthy of emulation. It may be a very long wait.

If others must be emulated, let it be those who have successfully applied systemic creation to the continual transformation of outcomes. Two that come to mind are film directors and athletic coaches. Both have demonstrated a capability to create a steady progression of new and improved, transformed systems from the potential system components at hand.

Part of the motivation for emulation, it appears (e.g., Heinich, 1984), stems from the fear of scaring off or eliciting defensive behaviour from those who have a vested interest in the status quo. While we, for example, are careful not to present educational technology as a panacea, our hope that it could be keeps us going; we are careful not to present educational technology as the revolutionary, transformational rebel that it is. Change is our game, but we act as if we are part of the establishment. The waves from a rocking boat caught in the undertow pass without notice.

The other part of the motivation stems from the loneliness and anxiety that come with being on the cutting edge. It is scary on the edge. A leader must look for direction and purpose from within and many times must gut it out on faith alone. Until the field accepts the systemic approach as the suprasystem/suprastructure that it is, educational technology will remain a craft or, at best, a technology with a science foundation, i.e., the systematic approach. To suggest that the systemic approach is scientific, is or should be based on the methods of science is folly. Educational Technology III, is a new breed which cannot draw on the principles of the status quo for its definition, operationalization nor evaluation

By limiting ourselves to the status quo structure, within which to fashion the means to our desired ends, we limit our findings to those of the status quo, for it is the status quo environment (in all its limited yet diverse applications) which has produced the status quo outcomes. Our ever-present dissatisfaction with such outcomes should force us to create our own viable systems rather than to emulate systematic models of proven insufficiency,

Legitimacy. Closely related to the trap of emulation is the trap of legitimacy. So intent are we at gaining and maintaining the reputation of a legitimate profession, we strive to look and act like the “legitimate” disciplines. The acceptable research in educational technology looks like legitimate research – legitimate, that is, for psychology, sociology, medicine. The journals of educational technology have the size and shape of legitimacy. Their contents, order, review procedures, presentational formats all strive for the look and feel of legitimacy. No matter that a very small percentage of educational technologists subscribe to these journals, they nonetheless convince us of their legitimate rigor, excellence, and worthiness. So, too, for the educational technology conferences, striving for the legitimate look and feel of an AERA or APA conference, forcing would-be presenters to take fewer chances and tow the party line. Is adherence to the Status quo in terms of legitimacy worth the price of losing sight of our systemic goal and mandate?

One problem in striving for legitimacy is that only that which has already been legitimated is legitimate. If educational technology adopts the posture of the legitimate within the status quo, it relinquishes the opportunity - nay, right - to create new and better-suited legitimate postures. What makes for legitimacy in fields that focus their energies on the systematic discovery of *what is* cannot be the same as that which makes for legitimacy in a field that focuses its energies on the systemic creation of *what could* be. The legitimacy of an educational technology posture, whether we are examining graduate programs, research, development, production, dissemination, or whatever, can only be evaluated by systemic criteria. Our potential legitimacy lies in the systemic approach of Educational Technology III. It seems that the time is right to create our own legitimacy – a legitimacy that is modeled after the true experts in educational technology (i.e., the risk takers, the rule breakers, the system creators) – for we need the creation of legitimate systems designed specifically for all aspects of our field: research, development, programs, etc. Until this has been accomplished, yet another trap looms – that of being absorbed by status quo legitimates.

Absorption. Educational technology has done very well with respect to surviving. But this survival has been at the cost of attachment to and absorption by other fields. Educational technologists have become, over the years, teacher educators, faculty development specialists, medical educators, training consultants, to name but a few. Not only has our field attached itself to existing, successful fields and been absorbed by them in the process – each time redefining its identity (and losing a bit more of its original identity) – but it has also attached itself to emerging fields promising the prospect of survival. Fields such as open learning, organizational development, distance education, cybernetics (general systems), and human resources development come to mind.

At the PIDT conference telling questions arose time and time again: “Where do we turn now?” (now that the business and industry market is close to saturation), “To whom do we attach ourselves?“. Trying to instill some optimism, many suggested that the time is ripe to look back to the public schools. After all, the predictions all suggest increasing enrollments. Here certainly is a chance to rebuild and restaff the media centers that flourished in the 60’s and 70’s, and to work with teachers and school boards on the reform and renewal of instruction and curriculum. Others put forth computer literacy within the university environment as the next obvious target. Still others suggested that educational technology needed to accelerate and increase its attachment with the military establishment. And perhaps the nonprofit sector (e.g., museums, libraries) holds some promise for attachment, absorption, survival.

Educational technology has unfortunately established itself as a field that can only survive via attachment to other fields. A potential cutting edge field has defined and redefined itself through a series of parasitic associations rather than through its own goals for learning transformation. Our field has allowed itself to be used and to be seen as a means for effecting the goals of other fields (however worthwhile) rather than as a means to the worthwhile and legitimate goals of educational technology.

As a vanguard field, educational technology must think in terms of leadership risk rather than parasitic survival. Among other things, a cutting edge field provides clear, desirable visions (if they still can be remembered) and means for achieving these. By reason, these visions are at best contrary to those imaged by non cutting edge fields. Hence, the risk. While the cutting edge is sharp and at times scary, the risk is far greater if someone else is allowed to hold the handle. While there may be untapped fields willing to absorb educational technology into an adjunct role, the ultimate consequence of the trap of absorption is the loss of the singular identity necessary to realize our unique potential to lead in the creation of ideals rather than to serve for the betterment of the status quo.

Status quo adherence has resulted in educational technology’s chameleonesque behaviour for the past 25 years. At first glance, this may appear to be the epitomization of a vibrant, dynamic field. In fact, by jumping from one survival attachment to another and losing identity to each in turn – instead of creating a dynamism of self-realization – educational technology is sowing the seeds of staticity. While each new attachment may bring the excitement and invigoration of another breath of life, temporary survival is insufficient and unfulfilling. Only iron-jawed adherence to the ideals of educational technology can guarantee long-term survival, mission realization, and the ultimate in excitement and invigoration.

The Trap of Solidification

> When, in education, the psychologist or observer and experimentalist in any field reduces his findings to a rule which is to be uniformly adopted, then, only. is there a result which is objectionable and destructive of the free play of education as an art. (Heinich, 1984, p. 87)

Reducing findings to a rule can be said to be characteristic of the systematic approach of Educational Technology II. When finally achieved, the free play of education as an art, on the other hand, will be characteristic of the systemic approach of Educational Technology III. Through continued reduction to uniformly applied rules, educational technology can solidify at the status quo, relinquishing the systemic dynamism necessary for transformation to the ideal. By accepting a caged existence within the traps of Compromised Integrity and Status Quo Adherence, educational technology has sampled the bait of the ultimate trap of Solidification – ultimate because once that trap has sprung, the potential realization of Educational Technology III will be lost forever.

Evidence of solidification is everywhere. At the most foundational level, educational technology has solidified as a field that has yet to proclaim, widely and loudly, its public philosophy. The focus continues to bypass the ends to spotlight the means the means of survival (of the field, of the sub-groups within), the means of research, the means of graduate programs, the means of educational technologists.

The energy needed to apply the intellectual techniques of educational technology to the betterment of humankind has been sapped by solidification within the mode of short-term survival. Thus the desired ends of our field are subverted to the desired ends of our survival benefactors.

The intent of the sub-groups within educational technology to survive as separate, meaningful entities has precluded the desirable (from the systemic point of view) synthesis of these sub-groups into a dynamic, purposeful whole, capable of elevating the field to its destiny. Within the subgroups there is solidification as well. In instructional design, for example, the models that are touted are, with rare exception (e.g., Bratton, 1977; Gentry & Trimby, 1984,, Goldman, 1984) systematic, rule-based, reductionist procedures, differing little one to another.

Graduate programs, too, have solidified – to a primary focus on instructional design models and procedures (Clark, 1984). The graduate programs of today appear to be clones of the cutting edge programs of a decade ago; in examining current graduate programs, one is struck with the overwhelming sensation of *deja vu.* The only originality found is within those programs which have 'had' to implement innovative solutions to survive in academia. Moreover, acceptance of proposed certification and accreditation plans could effect total program solidification.

Research in educational technology has come close to solidification as an inappropriate and limited method of inquiry. The cementing of reductionist, conclusion oriented, static, systematic research models precludes the needed study and realization of systemic entities. Systemic ends cannot be attained via systematic means.

The motto of the trap of Solidification could be: "Let's not reinvent the wheel". While educational technology will neither benefit from the reinvention of the known wheel nor from the novel application of existing wheels, the determination to create something *better* than the wheel will freeze the closing jaws of the trap.

To remain on the cutting edge, educational technology cannot enjoy the false comfort of solidification, cannot allow the devolution of artful systemic approaches to uniformly applied systematic rules. Only by embracing the amorphousness of the systemic approach can educational technology ensure its necessary, future existence.

As educational technologists have discovered, the traps of Compromised Integrity, Status Quo Adherence and Solidification are easy to fall into. They can be alluring and captivating. They can appear to be logical and rightful pathways to follow. They seem to offer security and comfort. It would be easy to suggest that educational technology just avoid the traps – easy, but misleading. For the traps to be successfully avoided, alternatives must be created alternatives that serve as pathways to Educational Technology III and subsequent realization of the ideal.

Pathways

As I see it, two things must be done in order to resolve the current educational technology dilemma: a) reaffirm and publicly proclaim the goal and philosophy of educational technology; and b) create systemic roles for educational technology, educational technologists, and research in educational technology.

Goal and Philosophy

In its quest for survival, educational technology has focused its energies on the means rather than the end. The goal of educational technology, and its philosophical base, have been momentarily obscured by attention to such means as designing graduate programs, implementing instructional designs for clients, maintaining a piece of the teacher education pie, conducting "legitimate" research, disseminating hardware and software, fashioning learning environments, and gaining acceptance and support from those in authority. The goal is still there; it has just not been recently attended to or sought after. While never formally stated as such (but often implied), I submit that the goal of educational technology is the transformation of learners and the learning process. Our goal is at once a goal of vision and proactivity.

Heinich (1984) suggested that "survival depends on establishing our own intellectual identity" (p. 73). The first step in this direction is the public affirmation and proclamation of our goal - the transformation of learners and learning processes. No other field shares this goal. Other fields are trying to discover what learning is, to determine how learning occurs, to facilitate learning. Our own intellectual identity awaits realization through public affirmation.

Just as the goal of educational technology has been kept under wraps, so too has the philosophical base of educational technology been implied rather than directly communicated. The philosophy is inherent in the voiced discontent with the field. Simply stated: We believe that all learners can be transformed to the highest level of cognitive ability. With such a lofty goal and supportive philosophical base, an extremely powerful means is necessary to effect goal realization. We have that too -the systemic approach.

Once we have reaffirmed our philosophy, goal and means to ourselves, and then publicly stated them to society, we can get on with the business of creating systemic roles for educational technology, educational technologists and research in educational technology.

The Role of Educational Technology

If educational technology is to have a viable, meaningful and identifiable place in society it must assume the role that others have not and will not assume - the role of idealizer (i.e., one who creates the means to realize the ideals of learning). The systemic approach enables us to serve as the problem-solvers of the learning process, the dreamers and creators of new and more effective learner systems.

Educational technology must also assume the role of conscience of learning in all sectors. Ours is the responsibility for ensuring the strengthening of individual value systems,, idiosyncratic uniquenesses. Ours is the responsibility for ensuring the realization of the ethical and value positions of educational technology. Since operating systemically requires control over all system components (including those of Educational Technology I and II) ours is the responsibility for management of learner and learning transformation.

The Role of Educational Technologists

If Educational Technology III is to emerge and work, every educational technologist must be capable of systemic operation, i.e., every educational technologist must be a scholar (in the broadest sense of the word), "someone prepared to examine his or her own field in terms of its basic premises, its status, and its place in the general scheme of things - a reflecting, thinking individual" (Heinich, 1984, p. 86). Beyond this, educational technologists should be creative, proactive individuals, always aware of the current systemic level of our dynamic, upwardly-spiraling field, and creating the next systemic level. The ideal educational technologist is not one who follows all of the known rules, not even one who follows all of the known rules well. The ideal educational technologist is one who breaks the known rules and creates new rules, thus enabling accomplishment of systemic creation, the type of creation not possible through the application of known, status quo, systematic rules.

Instead of spending time and energy training graduate students for specific, known jobs, as Clark (1984) suggested is occurring too frequently, educational technology could be preparing students, as Welliver (1987) suggested, for jobs that do not yet exist. For this to be possible, graduates must be equipped with a) altruistic skills that go beyond job acquisition and maintenance, to the satisfaction of learning needs of self, others and educational technology; b) systemic directorship ability, i.e., the ability to create (the way a good athletic coach or film director does) viable systems to transform learning, to direct, from conceptualization through evaluation and reconceptualization, toward successive approximations of systemic realization; c) the ability to control and manipulate given means (and create needed means) to effect desired ends; d) the skill to break known rules and create appropriate new rules as needed, the application of which will lead to higher, more inclusive, and greater integrative levels of performance -just long enough to break those newly created rules and create even newer ones; e) the ability to determine valid learning needs, above and beyond those perceived by the learner and/or the client; f) the ability to evaluate their own performance, the performance of learners, and the performance of educational technology; g) the skill to offer alternatives to the status quo by defining and redefining the ideal; and h) the ability to think and act systemically in all situations.

To the extent that our graduates master these skills, our long-term survival (without resorting to the short-term survival traps of Compromised Integrity, Status Quo Adherence and Solidification) will be assured. Whether educational technologists assume the traditional jobs of systems managers, producers, instructional designers, human resources developers, evaluators or professors, or jobs that do not yet exist, the role assumed and performed must be that of a transformer of learning if the field is to survive and thrive on the cutting edge. When all educational technologists have assumed the role of transformer, the artificial boundaries between the sub-groups within the field and between the researcher and practitioner will disappear, allowing educational technology to transform itself to the systemic field it must become.

A word about the intellectual colleagues of educational technologists: While the desired state for a cutting edge field is for every individual within to possess and exhibit the above-mentioned skills, in every field there are a few individuals who are always on the cutting edge and beyond. These are the mavericks (the geniuses, perhaps), able to define true needs, set desirable goals, create viable means, and evaluate the effectiveness of performance. It is these individuals – from any field – who must be our intellectual kin, our models, our support group.

The role of the educational technologist is one of catalyst of optimism, aligned, at least in spirit, with others who are proactively trying to raise the roof beams, to elevate the actualized potential of human performance. With the afore-mentioned skills in hand and with the intellectual kinship of these mavericks from other fields, each and every educational technologist will be drawn to and capable of systemic inquiry. But first the role of research in educational technology must be attended to.

The Role of Research

In keeping with the goal and philosophy of educational technology, the obvious role of research is to accept such charges as Bloom’s (1984) “2 sigma” challenge (an unfortunate norm-referenced concept), i.e., to create systems that effect learner performance two standard deviations above the mean. (The systemic researcher might prefer the challenge of creating systems to effect learner performance at the highest levels of affect and cognition.)

In order to accept this challenge, educational technology must first abolish the artificial distinctions between its subcomponents. With the systemic approach there can be no distinctions between research, development, evaluation, management, teaching, design, or learning. In Educational Technology III all are one system with one goal, one philosophy, one means, and one role to play. By fully incorporating all educational technology components into the research process, the problem of limitations and inappropriateness of systematic approach research to the study of dynamic systems is eliminated. In its place is a proactive, systemic approach with the high expectations that come with a strong goal orientation. The systematic exclusion and/or control of variables is replaced by the systemic inclusion of all variables. All educational technology components become proactive participants in the research process. The research question, “Let’s see what happens” transforms itself, through the systemic approach, to the challenge, “Let’s make it happen together”. (See Beckwith, 1984, for a fuller discussion of one possible systemic research methodology.)

Winn (1986) building from his earlier work (1975) and the work of Beckwith (1983) on open system models of learners, suggested that

> ... if we can create expert instructional design systems, it should be possible to create CAI systems that design themselves as they interact with students. In other words, the prescriptive principles embodied in an instructional theory would be discovered by the system as it became familiar with each student it was teaching. In effect, a separate theory of instruction would develop for each student, offering the ultimate in adaptive instruction, (p. 35 1)

Imagine such to include all of the components of educational technology – research, design, development, production, learners, teachers, evaluation, management, etc. – together operating as a system, to effect higher and higher levels of learning transformation. Imagine such a system to be the personal learning environment of your dreams – rich, vibrant, alive, dynamic, accelerating – an environment in which such as research and development, production and dissemination, and teaching and learning are fused so tightly together that transformation is activated and reactivated like coiled springs released from their solidifying compression. In rapid succession, the system knows, knows it knows, knows how it knows, knows how to control how it knows, knows how to improve how it knows, searches to know what and how it doesn't yet know, and knows how to improve what it knows (Ego, 1987).

And such a systemic research model is possible – but only if the current systematic form is abandoned. As Heinich (1984) suggested, “When the linear extension of a technological form” (in this case, the systematic approach) “reaches its limits, an increase in scale can only occur when the form itself is abandoned” (p. 76); “increasing the scale” (in this case by forcing evolution to the systemic approach) “increases the range of control” (p. 76). Increasing the range of control increases the likelihood of goal attainment, dream realization.

Conclusion

Educational technology has a powerful and worthy dream – a dream yet to be fulfilled. Resultingly, the discontent within the field is mounting. Centering on the inability of educational technology to transform itself from the systematic approach to the systemic approach, this pervasive discontent warns of three debilitating traps – Compromised Integrity, Status Quo Adherence, and Solidification.

It is suggested that the pathways leading out of the dilemma are: a) the reaffirmation and public proclamation of the goal (the transformation of learners and the learning process) and philosophy (that all learners can be transformed to the highest levels of cognitive ability) of educational technology; and b) the substitution of the traps of the systematic approach with a systemic recreation of the roles of educational technology, educational technologists, and research in educational technology.

This accomplished, the significance of educational technology will finally be grasped, and the educational future will belong to us. How significant is educational technology? It could be said that if educational technology were medicine, health could be realized; if educational technology were engineering, ideal living space could be realized; if educational technology were law, peace could be realized. Educational technology as itself can realize the highest levels of cognition and affect in individuals – individuals who, in turn, will be able to create health, ideal space and peace.

To fulfill its dream, educational technology must reclaim its rightful place on the cutting edge constantly pushing upward to the next level of transformation, applying constructionism to what needs to be. While life on the cutting edge is, at best, uncomfortable, this is where the systemic, transformational field of educational technology must reside to realize its destiny.

References

Becker, A.D. (1977). Alternative methodologies for instructional media research. *Audio- Visual Communication Review, 25, No. 2,18* 1- 194.

Beckwith, D. (1984). *A research methodology for studying the learner as a total system: A conceptual paper.* Proceedings of Selected Research Paper Presentations. Research and Theory Division, Association for Educational Communications and Technology, Ames, IA.

Beckwith, D. (1987). Group problem-solving via computer conferencing: The realizable potential. *Canadian Journal of Educational Communication,* 16(2), 89- 106.

Beckwith, D. (1983, Fall). The nature of learners as total systems, with implications for research and instructional development: A theoretical/conceptual paradigm. *Journal of Visual Verbal Languaging,* 9-28.

Bloom, B.S. (1984). The 2 sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher,* 13, 4-16.

Bratton, B. (1977, November). Instructional development and systems. *Audiovisual Instruction, 22, 60.*

Bratton, B. (1987, May). International Board of Standards for Training, Performance, *and Instruction.* Paper presented at the annual conference of Professors of Instructional Design and Technology. Shawnee Bluffs, IN.

Caffarella, E.P., & Sachs, *S.G.* (1987, May). *Doctoral research in educational communication and technology: A directory of dissertations.* Paper presented at the annual conference of Professors of Instructional Design and Technology. Shawnee Bluffs, IN.

Canclos, J. (1987, May). *Educational technology: Intelligent life beyond the college of education.* Paper presented at the annual conference of Professors of Instructional Design and Technology. Shawnee Bluffs, IN.

Clark, R.E. (1987, October), *Media and technology: Their present and future roles in education and training.* Paper presented to the Faculty of Educational Technology, Concordia University, Montreal.

Clark, R.E. (1984). "Where's the beef': A reply to Heinich. *Educational Communications and Technology Journal, 32(4),* 229-232.

Clark, R.E. (1978). Doctoral research training in educational technology. *Educational Communications and Technology Journal, 26(2),* 165- 178.

Clark, R.E., & Snow, R.E. (1975). Alternative designs for instructional technology research. *Audio-Visual Communication Review, 23(4),* 373-394.

Davies, I. (1984). Instructional development: Themata, archetypes, paradigms and models. In R.K. Bass & C.R. Dills (Eds.), *Instructional development: The state of the art, IL* (pp. 9-17). Dubuque, IA: Kendall/Hunt Publishing.

Davies, I. (1978). Prologue: Educational technology: Archetypes, paradigms, and models. In J. Hartley, & I. Davies (Eds.), *Contributions to an Educational Technology.* London: Butterworths.

Ego (1987). *Groupthink: Consciousness.* Conferencing System (CoSy). Guelph, ON: University of Guelph.

Finn, J.D. (1955). A look at the future of AV communication. *Audio-Visual Communication Review, 3(4),*244-256.

Finn, J.D. (1964). The Franks had the right idea. *NEA Journal, 53(4), 24-27.*

Gentry, C.G., & Trimby, MJ. (1984). Interface analysis of ID systems. In R.K. Bass & C. R. Dills (Eds.), *Instructional development: The state of the art,* II (pp. 94- 107). Dubuque, IA: Kendall/Hunt Publishing.

Goldman, H.D. (1984). Instructional system development in the United States Air Force. In R.K. Bass & C. R. Dills (Eds.), *Instructional development: The state of the art,* II (pp. 470-495). Dubuque, IA: Kendall/Hunt Publishing.

Heinich, R. (1984). The proper study of educational technology. *Educational Communications and Technology Journal, 32(2), 67-87.*

Hlynka, D., & Nelson, B. (1985). Educational technology as metaphor. *Programmed Learning and Educational Technology Journal,* 22(l) 7-15.

Koetting, J.R. (1983). Philosophical foundations of instructional technology. *Proceedings of Selected Research Paper Presentations* (pp. 416-440).

Ames, IA: Research and Theory Division, Association for Educational Communications and Technology.

Middendorf, J., & Coleman, S. (1987, August). The 1987 PIDT Conference. *Newsletter of and Instruction.* Paper presented at the annual conference of Professors of Instructional Design and Technology. Shawnee Bluffs, IN.

Davies, I. (1978). Prologue: Educational technology: Archetypes, paradigms, and models. In J. Hartley, & I. Davies (Eds.), *Contributions to an Educational Technology.* London: Butterworths.

Ego (1987). *Groupthink: Consciousness.* Conferencing System (CoSy). Guelph, ON: University of Guelph.

Finn, J.D. (1955). A look at the future of AV communication. *Audio-Visual Communication Review, 3(4),244-256.*

Finn, J.D. (1964). The Franks had the right idea. *NEA Journal, 53(4), 24-27.*

Gentry, C.G., & Trimby, MJ. (1984). Interface analysis of ID systems. In R.K. Bass *& C.* R. Dills (Eds.), *Instructional development: The state of the art,* II (pp. 94- 107). Dubuque, IA: Kendall/Hunt Publishing.

Goldman, H.D. (1984). Instructional system development in the United States Air Force. In R.K. Bass & C. R. Dills (Eds.), *Instructional development: The state of the art,* II (pp. 470-495). Dubuque, IA: Kendall/Hunt Publishing.

Heinich, R. (1984). The proper study of educational technology. *Educational Communications and Technology Journal, 32(2), 67-87.*

Hlynka, D., & Nelson, B. (1985). Educational technology as metaphor. *Programmed Learning and Educational Technology Journal,* 22(l) 7-15.

Koetting, J.R. (1983). Philosophical foundations of instructional technology. *Proceedings of Selected Research Paper Presentations* (pp. 4 16-440). Ames, IA: Research and Theory Division, Association for Educational Communications and Technology.

Middendorf, J., & Coleman, S. (1987, August). The 1987 PIDT Conference. *Newsletter of the Division for Instructional Development, Association for Educational Communications and Technology, I7(* l), 3-4.

Rossett, A. (1987, May). *Forces affecting the development of the Department Of Educational Technology at San Diego State University.* Paper presented at the annual conference of Professors of Instructional Design and Technology. Shawnee Bluffs, IN.

Salomon, G., & Clark, R.E. (1977). Reexamining the methodology of research on media and technology in education. *Review of Educational Research,* 47,99-120.

Silber, K.H. (1970). What field are we in, anyhow? *Audio-Visual Instruction,* 21-24.

Silber, K.H. (1978). Problems and needed directions in the profession of educational technology. *Educational Communications and Technology Journal, 26(2),* 174- 185.

Torkelson, G.M. (1977). AVCR – One quarter century: Evolution of theory and research. *Audio-Visual Communication Review, 25(4),*317-358.

Torkelson, G.M. (1987). Perspective: Theoretical bases for research in media. *Canadian Journal of Educational Communication, I6(*1), 3-9.

Torkclson, G.M. (1980, April). *Research symposium.* A paper presented to the Research and Theory Division of the Association for Educational Communications and Technology, Denver, CO.

Winn, W. (1986). Trends and future directions in educational technology research from a North American perspective. *Programmed Learning and Educational Technology Journal, 23(4), 346-355.*

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Perspective

THE FUTURE OF EDUCATIONAL TECHNOLOGY IS PAST

P. David Mitchell
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Editor's Note: This Is the third In a series of Invited articles that are published In CJEC In Number 1 of each new volume. These articles are Intended to serve as a mechanism for addressing the broader issues in educational communication and technology and for challenging our assumptions about the underlying nature and current state of our profession and the professional activities in which we engage. In this year's Perspective P. David Mitchell argues that the traps referred to by Beckwith (Perspective. 1988) are unavoidable and that the in effect the promise of educational technology as envisioned by Beckwith and others is dead – killed largely by our inability or unwillingness to examine the underlying tenets of our own behavior and to affect change in the processes and practices that have become the field of educational technology. We must adopt a now perspective on the process of learning, the process of teaching and the process of doing research, he argues, If we are to revive the corpse before it is buried by someone else.

Prologue

Educational technology appears to be a successful field. Graduates are in high demand, working primarily in industrial training and the forma1 education system. Salaries and opportunities for advancement apparently are good. New and promising equipment appears on the market regularly, awaiting our exploitation. Educational technology journals and conferences abound. People in traditional disciplines and professions are using some of our 'tricks of the trade' and fellow academics recognize the value of educational technology – in short, educational technology seems to be in its prime and enjoying good health. What, then is the meaning of the title?

This paper is an attempt to share my concern about the value of the field of educational technology to our society, especially to those currently in school and university, and to the global society within which we function. It also is an attempt to expand upon the cogent analysis and hopeful prescription of Beckwith (1988), an expansion which will show the impossibility of escaping the traps which he describes. I write as an insider, one who has devoted two decades to helping fulfill Kenneth Richmond's prediction that "educational technology is destined to emerge as the central humane discipline of the future" (Richmond, 1967, p. 106). And I write as one who has worked within the philosophical and systemic perspective that Beckwith insists we adopt, as well as within a graduate programme preparing educational technologists.

Despite my frequent attempts to maintain a balanced perspective on issues, I'm not always antifloccinaucinihilipilificationistically inclined. So it is with regret that I now conclude that educational technology has no future because it is dead (though not yet buried). Any hope for its resuscitation is likely to be misplaced because there is so little understanding of why it died. I hope that this postmortem analysis will reduce our lack of understanding and perhaps contribute to a new life.

In preparing this paper I attempted to raise many questions and to suggest few answers. Moreover, I am aware that most complex problems have many solutions – or none – and that suggested answers are not final. Some comments are deliberately provocative and are intended to stimulate critical discussion; others appear so in the absence of elaboration.

To illustrate, I intend to show that we have failed to tackle the most pressing educational problems and have settled for routine applications more characteristic of a craft. Moreover we have developed virtually no theoretical models (those we use tend to be borrowed) nor do we produce graduates who are likely to do so. The underlying reasons are complex but center on our adopting a world view that is, if not obsolete, incomplete and useless for understanding the complex problems that need to be solved. Many have argued that we need a new paradigm but this calls for each of us to transform ourselves. We lack the requisite psychotechnology to make this easy. Paradoxically we need this paradigm in order to acquire it.

The Future Of Educational Technology

In his paper portraying the Future of Educational Technology, Beckwith argues that, "If we are to survive, purposefully, as the cutting-edge field of our original vision, there are some solution-related traps that must be avoided" (Beckwith, 1988, p. 8). These he classifies as the traps of "compromised integrity"; "status quo adherence" and "solidification."

In the first trap, we are distracted from actually achieving our educational goals by, for example, dazzling products, pursuit of money, or our employer's goals. In the second, we seek credibility by emulating established professions inertia. Thus we avoid recommending significant changes in any educational system which employs us to solve a problem. And our notion of acceptable research or conferences is governed by the norms established by others (e.g., psychology).

In the trap of solidification, "The energy needed to apply the intellectual techniques of educational technology to the betterment of humankind has been sapped by solidification within the mode of short-term survival" (Beckwith, 1988, p. 13). The purpose of educational technology becomes lost within the mists of routine applications of standard (though not necessarily valuable) procedures. Thus graduate programmes focus on instructional design and research comes "close to solidification as an inappropriate and limited method of inquiry. The cementing of reductionist, conclusion-oriented, static, systematic research models precludes the needed study and realization of systemic entities" (p. 14). Is there any hope? Beckwith thinks so.

His solution is deceptively simple. We need to publicly proclaim our goal to be "the transformation of learners and learning processes" and we need to transform our field into a systemic field which itself could become "the personal learning environment of your dreams – rich, vibrant, alive, dynamic, accelerating-an environment in which... research and development, production and dissemination, and teaching and learning are fused so tightly together that transformation is activated and reactivated (Beckwith, 1988, p. 17). Having suggested similar ideas myself (Mitchell, 1970; 1971; 1975; 1978; 1982) I must admit that this vision is appealing. But is it realistic?

Actions Speak Louder Than Words

These are not traps to be avoided; they are symptoms of incurable terminal illness. Moreover, the problem is not confined to educational technologists. For most organizations that employ educational technologists, education is no longer the system's purpose; what happens to students is just a by-product of the activity of its professional and bureaucratic core. This is a startling comment to which I'll return later.

Have you ever stopped to consider that perhaps what some of us are doing ought not to be done at all? And other things might be accomplished better by technicians, paraprofessionals and sundry other assistants. How are we to prepare ourselves for future developments (e.g., in micro-electronics, political struggles for declining budgets, cybernetics) when we don't even know what to anticipate? Are some of us failing to do what ought to be attempted and, if so, how do we identify the requisite capability in order to transform the field and to prepare new practitioners of educational technology to undertake these important tasks?

Earlier I asserted that in most organizations that employ educational technologists *education is no* longer *the system's purpose;* what happens to students is just a by-product of the activity of its professional and bureaucratic core. What do I mean? Simply put, a system's purpose can be better discerned by asking what the system *is doing*, not what it was intended to do or what its spokesmen claim it's doing.

Typically, the system's core is devoted to self-perpetuation of their roles and functions (no matter how well-meaning the people are). What they do defines the system's purpose (cf: Beer, 1986). Thus, teaching becomes defined by philosophers and teachers as what teachers do regardless of whether students learn or even attend school (truancy rates run as high as 30% in some places). Health care becomes defined as what doctors provide (despite findings that nearly half the medical problems may be produced by doctors). Education is defined as happening in schools and colleges despite the prevalence of near illiteracy and limited knowledge or skills amongst students and even graduates. And what about educational technology? There is a dangerous precedent for defining it as what practitioners do; function becomes purpose.

Is this radical approach to purpose reasonable? How realistic is it to think that education is a high priority in the typical school or university? If a visiting scientist from Mars were to visit your institution and attempt to infer that system's purpose by observing how people spend their time and how money is allocated, would he infer education to be its primary purpose? Or would he take the extreme view that, "Universities are machines created by their gods, the faculty, primarily to provide them with the quality of work life they desire. Education of students is the price they must pay for this privilege. Teaching is largely devoted to inculcating students with a vocabulary that enables them to speak authoritatively on subjects they do not understand" (Gharajedaghi & Ackoff, 1985, p. 22). These authors go on to conclude that, "Schools in general, and universities, colleges and departments in particular are organized bureaucratically, that is, mechanistically. They strongly resist innovation. They restrain their employees with rigid rules and regulations." (Gharajedaghi & Ackoff, 1985, p. 23).

Let me give you a humorous but true example which illustrates my point that its purpose is what a system *does.* A Ph.D. student registered at a certain American university filled out an application form and indicated her first languages were Arabic, Armenian, English, French and Turkish. Later, when the second language requirement for the Ph.D. had to be satisfied – an educational objective intended to guarantee that the student could read work written in another tongue – she was told that since all of these were first languages she must take a second language. Undaunted, she pointed out that computer languages could count and she knew both COBOL and FORTRAN. Equally undaunted, bureaucracy said that they did not count because she had studied them as an undergraduate and already had received credit for them. So she had to study and pass an exam in German! "What is the point?," you may wonder. Just this: too frequently educational technologists behave unwittingly like this bureaucrat.

We do so when we try to improve the operation of an existing system without considering its actual and intended purpose; (Do your administrators and colleagues *really act* as if education were the prime purpose of your school, college or training unit? Does the Ministry of Education? Do your students? Do you? Would your time be better spent doing something else?)

We do so when we try to operationalize important educational intentions by composing and writing behavioral objectives, the sum of which falls short of the envisioned end-stage (e.g., the “good doctor” or the “good educational technologist” is a person who is far more than the component objectives of his professional courses).

We do so when we decide that we will produce a film or a series of TV programmes and look around for a topic rather than looking for an educational problem that needs to be solved and undertaking analysis to see which media/methods/content mix is most propitious.

We do so when we design so-called individualized instruction that fails to take into account the idiosyncratic background and learning styles of students and the network structure of knowledge in the discipline that would allow a student to build better conceptual links between what he knows and what he needs to know.

We do so when we design research projects that contribute little or nothing to the theory or practice of education but simply show our prowess as surveyors or experimenters.

And most pertinent here, we do so when we think a common preparation for educational technologists would look like the course of study we followed. What is the intended purpose of a system that produces educational technologists? What kind of person do we hope to turn out and what will that person need to know, believe, hope, fear, love and do? Expressed otherwise, what can an educational technology program do for society?

The Challenge To Educational Technology

Educational technology must be dedicated to the efficiency of education as a whole and not simply to specific operations. An operational and philosophical analysis of educational technology, calls for a consideration of overall problems of education which educational technologists may be able to tackle before proceeding to the lower-order problem of designing a curriculum for them. The field of educational technology – in its concern for the optimal organization of education – must not be limited to time-honoured structures. Nor should it perpetuate failures. We might serve our stewardship better by devising activities and forming environments which permit people to live fully and intensely both within and outside so-called educational institutions.

While rich countries provide tax-supported schooling for 12 to 20 years, half the world’s children cannot attend school. This paradox underscores the need for change. The world's education system grinds on, consuming ever increasing amounts of money in response to demand for educational services regardless of whether education is the outcome. But school costs in both affluent and penurious nations rise more rapidly than enrollments or national incomes. No country in the world can afford to satisfy its educational needs by schooling alone. Does educational technology offer any hope?

The Sisyphean educational imperative is to provide access to stored human experience – ideas, knowledge, skills – and opportunities to develop what is needed for personal and cultural development.

Enormous problems must be solved if mankind as a whole is to share in the potential for human comfort, achievement and eudaemonia now restricted to a tiny minority. To refurbish our ideas about how to implement man's educational aspirations we need to develop the requisite theory and practice of educational technology along the lines suggested by Beckwith, but going much farther. Then educational technology can achieve the lofty ideals ascribed to by many of us.

The concept of lifelong education provides an altered perspective of profound significance for educational technology. Changing from dedication to efficiency of instructional activities to dedication to the effectiveness of human existence – which is what education entails – may reflect less a change in intellectual and communications technology than in priorities. But it calls for a new paradigm too.

Education refers to certain activities concerned with the intentional organization of ideas and learning opportunities by which successive generations are encultured and trained to sustain themselves and contribute to society. Continuing education presents two challenges. How can each nation enhance its collective intellectual capacity and skills? How can each person develop his personality and meet his educational and cultural aspirations?

Two currents of thought, the one emphasizing education as a productive investment for development of society and the other emphasizing personality development need to be combined. What is the scope of education today?

What Is An Educational Problem?

If educational technology is to contribute to the solution of educational problems, we must first come to grips with the scope and purpose of education. Educational technology then may be in a position to identify worthwhile solutions.

The essence of technology, and therefore educational technology, is knowledge about relationships. Thus if we perform action X, there is a probability, *P*, that a given outcome, Y will occur. Alas in education and training it seldom is clear what action X is most likely to produce the intended result Y, especially without also producing unintended and conflicting outcomes. Moreover, Y is seldom unambiguous and confounds different, even incompatible, goals (e.g., attempting to optimize the state of interacting subsystems). Recall that the term education incorporates at least two different concepts; the personal experiences of someone coming to understand or appreciate or reflect upon the world; and the organized attempt to produce those experiences in a number of other persons. How can we optimize both? (Operational research holds some promise for systemic analysis in this area but we have yet to see much in the way of results.)

The Scope of Education

An educational problem may be far greater than the restricted vision of many observers. Thus an instructional design problem may be considered in isolation but the instructional system itself is embedded in an organization (school, corporation) that has other subsystems with different goals, priorities and resources that interact with it. And this organization, in turn, is embedded with other interacting subsystems in a larger system. To complicate matters even more, each learner has his/her own system of knowledge, values, goals, etc.

In short, the notion of an educational problem or system should be expanded to include more systems and subsystems. And the boundaries between activities that are labeled educational and those that are not, should be pushed back to encompass informal as well as directed learning. Think for a moment about where you learned most of your attitudes, knowledge and skills. Was it exclusively, or even largely, within institutions labeled educational? Our classical methods of dealing with educational problems cannot be expected to be of much use in tackling such systemic problems.

A Larger Perspective

The world is in a critical phase of its evolution. Astonishing changes in micro-electronics and information technology presage new structures in many areas. We are promised that robots will produce half of our manufactured goods, displace human labour (including cheap in the third world) and send countless adults back to school. The opportunity for untold wealth is nigh; so is the possibility of disaster. Various reports suggest that continuous education soon will be a form of universal occupation. Opportunities for educational technology seem endless. Yet most people in the world live in the stick age; they get their energy from burning sticks and their life style centres on hand hoe agriculture. Their children die from malnutrition and disease (both of which are linked to poverty as well as to inadequate education) or military action. They strive for self-sufficiency constrained by their environment. We, in Canada, confront what some fear could herald a return to that life style (insofar as massive unemployment might reduce our economy to a shambles) and others hope could offer a culturally rich and personally rewarding life style. Surely there are real and challenging problems for us to attack. Perhaps, as Schwen suggests, "Our conceptual process traditions will be the most sustaining or enduring approach to solving problems" (1988, p. 25).

Our leaders in government, industry and education face many complex, inter-locking problems and possibilities. We are immersed in an era of unprecedented changes in what is possible and in the physical and psychological environment as a result of our decisions. Perhaps most significant is the increasing rate of change. We have just become accustomed to the silicon chip and now must adapt to a protein chip that promises to increase the density of a chip by 100,000 times. Add to this the possibility of neural net computers. Can we even conceive of the potential impact of such a development on education and training? The need for educational technology (in Beckwith's sense) has never been greater. Yet educational technology probably cannot be revived to tackle- these complex problems. Computer scientists will be asked to do so.

Toward A Systemic Perspective

The Input-Output Model

Most definitions of educational technology assert that it is concerned with applying knowledge, systems and techniques to improve the process of human learning. But virtually all educational technology research and applications have attempted instead to improve instruction, especially through information display systems and clarification of objectives as observables. Even interactive systems over-rely on information retrieval and display rather than responding to what the learner understands about the subject. Educational technology has turned the learner into a programmable machine rather than developing support systems to improve the quality of learner/subject matter interactions. This is primarily because we have failed to reject the notion that teaching causes learning and adhere to a simple cause-effect paradigm.

If we consider the various paradigms that have influenced educational technology, we see that they have been analytic and reductionistic even though different on the surface. Whether we consider the audio-visual, behavioural, neo-behavioural or cognitive models, all treat the learner as an input-output system which somehow responds to information displays by means of (potentially) measurable changes in capability. When we notice differences in learners' behaviour we attempt to relate these to factors under our control (e.g., message design, reinforcers) or uncontrolled variables (e.g., internal vs. external locus of control, gender, learning strategy).

For each of these paradigms the over-riding problem is how the educational system ought to work, both in general and specifically for an identifiable group of learners. This, in turn, leads to the notion that some human being (e.g., educational technologists, trainers, teachers) are expected to apply these causative factors (objectives, advance organizers, instructional materials, rewards or punishments) to other human beings. This is not as simple in practice as one might wish.

Experimental research controls the influence of the environment in order to predict events; a complex, adaptive environment confounds such models. Thus if we perform action X, not only is there a probability of outcome Y but this action, in turn, generates a cascade of events, some of which may alter X- and thereby alter Y – until the loop is broken. The traditional cause-effect model is useful only up to a point. The environment-free concept of explanation fails to provide an understanding of complex systems of the sort that educators deal with. But there is another problem with the cause-effect model.

Goal-Directed Feedback

What does it mean to be “in control?” In order for a teacher or instructional system to teach (i.e., to control a student’s behaviour) the controller must be able to generate or select a desired outcome (e.g., a set of behavioural objectives), discriminate between what is observed to happen and what is intended to happen, and select actions which reduce the discrepancy. This is easier to imagine with a human teacher or computer aided learning than with a book or television program but the principle still applies in a modified form.

The model case is a control system designed by an engineer. He knows that there is a control system and knows what it controls. Moreover, he knows that the controlled system can be controlled because of the way it is designed. In other words, the controlled (cf. Powers, 1973). While this may be appropriate for inanimate systems, how useful is it when considering humans? Are we justified in using two models of human behaviour, one for those who control and one for the persons being controlled?

In most educational technology research and practice this seems to be exactly what happens. Perhaps this trap is a legacy from psychological research where the experimenter is presumed to be controlling the organism’s behaviour (despite the dim awareness, albeit in cartoons, that the rat pressing a leer is controlling the food-giving behaviour of the psychologist). Or perhaps it is a legacy from the days of birch and leather teaching aids. Control theory offers an escape from this trap.

Control System Theory

Control theory seems to have originated four decades ago though its roots are ancient. Norbert Wiener’s (1948) seminal work on cybernetics introduced a new paradigm for understanding human nature, indeed all organisms, whether we view them as agents or objects of control. Cybernetics, he showed, was concerned with control *in,* not control of, the organism or machine. Because "control" sounds manipulative, even authoritarian, we may wish to substitute "regulation" for it. But control theory has emerged as the theory of systems which control rather than a theory of how to control other systems. The distinctions not as subtle as the wording might suggest. Indeed the fundamental ideas of control theory have the potential to produce the transformation in our thinking about education, indeed of society, that Beckwith insists is needed. More important it can alter our own perspective on education.

In the first place, if we begin to take into account the controlling behaviour of the people previously thought of only as objects to be controlled, whether in experiments, in the classroom or by a computer tutor, we immediately can see that learners' ability to control themselves is essential to education. Moreover, the fundamental observable is not the simple cause-effect sequence initiated by the controller but the reciprocal control of each by the other.

This reciprocal communication and control "dialogue" may be verbal or mediated in some way but as long as it continues we can think of the two persons as coupled together to form a new system which develops its own characteristic behaviour. Whether or not this resembles the intended outcome of either controlling subsystem is problematical.

Let-me illustrate. If you were asked by someone to explain or teach something to him, what would you do.? Would you establish performance objective, devise a special sequence of statements to make to him, or insist on special audiovisual displays? What would you look for in order to infer that he understands you?

I conjecture that you might ask him to explain, evaluate or use the relevant knowledge or perhaps to criticize it. You might ask if he has any questions. I doubt if your conversation would be punctuated by multiple choice questions or monosyllabic responses. I suspect you would probe for evidence of his grasping related concepts or principles. In short, you would function as a supportive conversational system, building on this student's strengths, clarifying misconceptions and linking it into a rich, intricately connected conceptual structure. In the end, both you and the learner have learned something about one another and the subject.

Why do designers of so-called interactive video/CAL systems seldom address these fundamental issues? They proceed instead to present more and more information based on an exceedingly crude inference system that seldom constructs a model of the learner's understanding or permits dialogue. "Right" and "wrong" responses often determine what happens next. But knowledge is more than information. It is complex, relativistic and open to interpretation.

The act of reaching a shared understanding involves agreement (e.g., on explanations, derivations) that one's perception of what the other is saying is an adequate representation of one's own concepts. In short, the structure of knowledge represented by the subject matter expert (as presented through verbal or other media) appears to be congruent with the learner's knowledge structure insofar as they both can perform similar operations of derivation, explanation, identification of counter-examples, application, etc. This dialogue demonstrates reciprocal control by two yoked systems. Such reproducible conceptual representations may be called understanding; a sequence of understandings defines a conversation or, in an educational context, a tutorial (cf. Pask, 1976). Our computer-based tutoring systems have yet to achieve this level of dialogue but eventually may approximate it (Mitchell, 1988).

Now consider the possibility that an instructional system is intended to control or regulate the (educational) behaviour of a large number of students simultaneously. One model case is the teacher in a classroom discussion with 25 or more students, each of whom may attempt to control the behaviour of others (as well as themselves). Except under very special circumstances the teacher cannot control the verbal, not to mention the internal behaviour of her students; each responds to others as well as to internal factors. Another model case is the provincial education system which stipulates a set of intended learning outcomes for all students in a particular age group, regardless of individual differences in general or specific knowledge, motivation, etc. and heedless of differences in teachers, learning resources, etc. The typical approach to instructional control is to restrict the student's alternatives (rather than to enhance his possibilities).

Even more compelling is the implication of control systems theory that there are fundamental organizing principles in living systems and organizations whereby the observed behaviour is simply the process by which these systems control their sensory input. In other words, the purpose of a system's action is to control the state of its perceived world. This also has some interesting implications for the actions of the researcher as observing system and we must recognize that the observing and the observed system interact; there can be no objective observer.

The Cybernetic Systems Age

The complexity of inter-related systems with many feedback loops requires us to develop new tools to cope with them. Some relevant tools appear to exist within the trans-disciplinary domain of cybernetics and general systems research.

One of the most impressive aspects of conferences about cybernetics and general systems research is that experts from disciplines as diverse as anthropology and economics, engineering and family therapy, medicine and psychology, natural science and philosophy not only share a meta-discipline that amplifies and transcends their own specialty but also feel no compunction in tackling the most challenging and vital problems of the day... believing sincerely that they have, in cybernetics, a powerful inter-disciplinary weapon for solving the most baffling social, economic, and political problems of civilization (Robinson & Knight, 1972, p. 2).

What is the most important attribute of their approach? Central to the cybernetic or systemic approach is that it considers the *total system,* with all its interacting elements, as one inseparable organism. This holistic approach represents a paradigm shift from the reductionistic approach which we have inherited from the logical positivist movement. Though the holistic perspective has a strong intellectual background, the word "holism" was invented only in 1925 by Smuts who wrote, "Instead of the animistic, or the mechanistic, or the mathematical universe, we see the genetic, organic holistic universe" (Smuts, 1925).

Synthetic thinking is needed (in addition to analytic) to explain or understand system behaviour. A system is essentially an observer's model which attempts to link a set of inter-related entities or their attributes into a coherent pattern, one that is perceived to cohere and to be distinct from other entities. This model can be physical, mathematical, verbal or procedural. And the system represented may be physical or conceptual. Indeed it could be argued that all models are fundamentally conceptual and that epistemological issues (e.g., What shall count as information? How can knowledge be represented most usefully?) are central.

The performance of a system as a whole is different from the performance of all its parts. As Gharajedaghi and Ackoff point out, "A system is a whole that cannot be divided into independent parts; the effects of the behaviour of the parts on -the whole depend on the behaviour of other parts. Therefore, the essential properties of a system are lost when it is taken apart... and the parts themselves lose their essential properties" (1985, p. 23). Thus analysis cannot lead to understanding of the system as a whole.

Analysis is very useful for revealing its structure, how it works, but not why it works. Systemic thinking is needed to understand why the system functions as it does. Such synthetic thinking means that we must conceptualize a system as part of one or more larger systems. This calls for seeking understanding of the larger system which, in turn, may be explained in terms of its function in yet another system. This expansionist approach, in contradistinction to the reductionist approach, assumes that ultimate understanding can be approached but that it flows from larger systems to smaller rather than the reverse. Obviously, environmental problems frequently are involved. So are systems that may be called purposeful and human.

Wiener's (1948) use of "cybernetics" to denote the science of control and communications in the animal and the machine, can be restated to omit communications because communications is simply the vehicle for control. Moreover we have seen that regulation maybe a less offensive and misleading word. Thus cybernetics is concerned with regulation (i.e., the achievement of goals and objectives of some entity). As Robinson and Knight (1972) conclude, "the central problem remains optimization of the organization and operations of the organism itself to maximize achievement of its goals and objectives" (p. 5). Moreover, "Any lack of understanding of the nature of this total systems approach results in focus on individual parts of the whole, inability to find much new in cybernetics, and skepticism that cybernetics can add anything worthwhile (p. 5).

In considering the total system, with interacting systems and subsystems, as one inseparable organism, cyberneticians deny the validity (for a complete solution) of optimizing a component subsystem separately. "The approach insists that the analysis be *comprehensive* and *simultaneous.* Thus, it considers the total organism... maximizing achievement of its goals and objectives in its total environment" (Robinson & Knight, 1972, p. 5). But how do we manage this at the level of society, a university or even a class?

Cybernetics therefore makes possible, explanations of goal-seeking behaviour, whether in the human or in organizations. It also permits us to investigate how it is that successful complex systems regulate themselves, in the hope that we may discover principles that can be generalized (cf. Beer, 1986). Equally important for educational technology, we can investigate cybernetic systems with a view to finding out what people or computers are good at and what they are not, thus learning more about how to design expert systems or automated teaching/learning aids.

Can We Redesign Societal Cybernetic Systems for Education?

Our problem is not to portray ideal states of man in the manner of Plato's *Republic.* The best we can hope for, I suspect, is to find out how to regulate a system, in which we are interested, by holding it within its natural boundaries. That is, by monitoring the system's own changes of state as it responds automatically to environmental disturbances, we may be able to control it. On the other hand, if we try to monitor environmental changes we shall fail. Thus the input-output model is obsolescent.

As for our own organizations, Warfield offers this conclusion, "What is needed is the redesign of the decision-making, consensus-building machinery itself, deliberately and carefully employing cybernetic system principles and practices" (1985, p. 80). To do so requires that we design self-correcting cybernetic feedback loops into the structure itself if we wish to produce or manage a viable system (i.e., one that will survive).Beer(1986)offers a model.

Finally we need to recognize that the Conant-Ashby theorem states that the controlling system has to have (e.g., to contain or simulate) a model of the controlled system in order to be able to exert any regulatory control. In the context of educational technology, we must be able to have workable model of our students, the organizations within which we work (or install our solutions), indeed, of our society within the global community. This is a mind-boggling task and our collective failure to do it is one of the reasons for the fatal illness of educational technology.

Perhaps some of us are predisposed to accepting a cybernetic or systemic world view; others may not be. But if educational technology is to become a viable enterprise, I think we will need a massive shift in this direction. Are we prepared? How can any of us acquire this new paradigm if we are not already part of it?

Interaction Within and Between Complex Systems

Beckwith's insistence on a systemic perspective is not misplaced even though his optimism maybe. When dealing with systems as complex as human systems at a global, or even an institutional level we must recognize and cope with the fact that everything interacts with everything else (at least in principle), thus in validating the traditional analysis and reduction of problems into isolated sub problems. This is not meant to be a banal statement.

C. West Churchman, a philosopher of science, expressed it thus:

> When we are dealing with systems as complex as human ones, we need to consider: That everything interacts with everything else, thus invalidating the traditional reduction of problems into separate sub problems; That the observer cannot be objective, thus necessitating the development and utilization of an observer-inclusive epistemology;
>
> That ethical and aesthetic variables must be explicitly and effectively integrated into the analysis, design, and decision-making process;
>
> That use of only quantitative data and model-based modes of inquiry is not satisfactory in analyzing and designing human systems; and
>
> That current cross-cultural and culturally specific measures of performance are semantically impoverished.
>
> In order to develop inquiring systems which will produce results that help to improve the human condition, new approaches, rather than mere extensions and refinements of old ones, are needed. We are convinced such approaches are now available and should be applied to the urgent problems we face (Churchman, n. d.).

Restated, we have to recognize that we cannot describe (e.g., in a mathematical model) any system whose behaviour we wish to regulate because the value of each component's contribution to the overall performance is a function of the current and past activities of all other components as well as of other systems in the environment. If we alter only one factor (or even several) to which the system responds, we may not be able to predict or regulate the outcome. At the cognitive level, virtually every concept is related to others which, in turn, are linked more. But these maybe influenced by quite unrelated events.

To illustrate, the academic performance of students may be influenced not only be what the educational technologist does but also by many other factors, (e.g., their genetic endowment, early nutrition and environmental stimulation, previous exposure to information and opportunities to learn and solve problems, psychological stress at home or with peers, blood sugar level, TV viewing, whether or not the nation is at war or experiencing a depression, perception of the subject matter and fellow students – or even of school itself – study skills and decision to select and deploy them, proximity of exams, current events in the community, or the presence and arrangement of specific textual and pictorial messages embedded in salient media). Can we develop an explanatory model to portray this?

To complicate matters, control system theory (Powers, 1973) shows that even when we can relate observed behaviour to observed stimuli, we must expect to be wrong most of the time! Yet our dominant research paradigm (and that of psychology) shows no sign of change.

Control Theory: A New Paradigm For Behavioural Research

Suppose that a visiting scientist from Mars observes an earthling driving a car and decides to investigate the relationship between driving behaviour and the complex pattern of stimuli coming from a twisting, hilly road that is subject to gusts of wind and snow. Suppose moreover, that with his sophisticated methods he found that the stimulus pattern predicted the rate and amount of angular rotation of the steering wheel. Would you be comfortable with this as an explanation of driving behaviour? Or would you, as the driver, insist that in fact it was your intention to drive in the centre of your lane and, because you were successful at it, the visiting scientist failed to notice that there was no deviation of the car’s position from this reference trajectory. And if we accept your operational definition of driving behaviour, controlling the perceived deviation from the centre of the lane, then we should expect no relationship between this essentially unobservable behaviour and the complex pattern of stimuli.

What is controlled then is controlled only because it is detected by a control system, compared with a goal or reference, and affected by compensatory behaviour based on the perceived discrepancy. Thus a control system controls only its own sensory representation. In this case the control system is controlling an internal representation of the position of the moving vehicle. But note that what is controlled is defined strictly by the behaving system’s perception and sensory representation; it may or may not be identifiable as an entity in the external milieu (cf. Powers, 1973). Therefore it may not be identifiable by an observer, especially if it is a perceived discrepancy.

As Powers shows, "In general an observer will not.... be able to see what a control system is controlling. Rather, he will see an environment composed of various levels of perceptual objects reflecting his own perceptual organization and point of view (p. 233). What will he observe?" He will see events taking place, including those he causes, and he will see the behaving organism acting to cause changes in the environment and (his) relationship to the environment. The organism's activities will cause many changes the observer can notice, but what is controlled will only occasionally prove to be identical" with any of them (p. 233).

Complexity Of Goals And Norms

To complicate matters for the observer (alias researcher or instructor), human behaviour is not confined to one controlled quantity nor is a fixed reference level the norm. A person, indeed any system, can have multiple objectives and variable reference levels, changing from one to another without warning.

Education, according to philosophers, is concerned with initiating students into instrumentally and intrinsically worthwhile activities. Embedded in this statement is the hint of a narrowly interpreted means-ends concept that seems to permeate educational technology. Let me explain.

We usually think of an end or objective as a positively valued outcome likely to result from some means selected with the intention of producing it. In educational technology the value of a means (e.g., teaching/learning method A or B) generally is equated with the probability of its producing an end. Criteria for selection are based on instrumental and cost/benefit decisions. On the other hand, the value of an end is taken to be intrinsic, rather than instrumental. Thus completing my degree may be an end and an educational technologist may use instrumental, extrinsic means to help me to achieve it. But for me, being graduated may be a means to a new job or higher income. And for the educational technologist, the selection of means may be related to personal ends (i.e., intrinsic value for him). In short, every end is also a means and vice versa; they are relative concepts.

Note, that preferences amongst means may not be based on efficiency but on intrinsic values of the educational technologist. Equally this is true of the student. Each may select means because they are satisfying. Now what if there exists a persistent preference for a particular kind of activity? (Anyone familiar with video game players has seen such behaviour.) Psychologists refer to these as traits. Half a century ago, Gordon Allport identified nearly 18,000 traits. So it is apparent that we can expect to find an exceedingly high variety of ends in any observation of human behaviour except where nearly all of them are eliminated by virtue of the artificial environment of an experiment.

A final note. If we accept that every consequence to some activity is in turn a means to additional consequences, continuing to some ultimate consequence, then we might find an end that is intrinsically worthwhile. This is essentially a theoretical definition of an ideal. But it is likely that there are many routes to a given ideal and, equally, that a given means-ends activity could eventually be linked to more than one ideal. Given the complexity of human traits and the possibility of many ideals, it is no wonder that observers have considerable difficulty making sense of empirical observations of students' behaviour.

Thus the concept of behaviour as a feedback control process organized around one's perceptions has to be extended to include those perceptions that pertain to ends and means thought likely to maintain one's ideals.

How do we deal with the behaviour of a learner, whether in the laboratory or in the classroom? Are we to conclude that what is observed may not count, that the learner is behaving to reduce a discrepancy perceived by him – not by us – to exist between his current state and some desired state? If so, then it may be incumbent upon educational technologists not merely to have educational (or, more narrowly, behavioural) objectives but to attempt to share responsibility for these with the learner as a control system. More importantly, if we can ascertain the learner's objective we may be able to adapt our instructional activities to support him or her. Truly individualized instruction now might be possible.

Self-Regulation For Self-Instruction

A closed chain of causal relationships may characterize the learner who is actively studying some subject. Control theory suggests that the learner's behaviour (of attending to and interacting with images and semantic information that may be perceived in the external or internal reference. Any discrepancy "produces" further behaviour intended to reduce this discrepancy, either by re-structuring knowledge and images or by altering the goal. Such control cycles tend to continue until a limiting resource (e.g., time) is used up.

A profound insight reveals the most powerful aspect of feedback: the organism actually "causes" its own behaviour. Sometimes it does so in an environment designed to promote such learning, but educational technology lacks the sophistication needed to develop them. Moreover, the absence of universal reinforcers in educational settings underscores the observation (of such investigators as Kelly, Rogers or Snygg & Combs) that behaviour is a function of individuals' personal frame of reference, their perception of themselves and their environment and the meanings they attribute to them. In cybernetic terms, the person's behaviour controls their perception in relation to their intentions.

Tutoring

Thus tutoring educational technology can shift from an input-output model to a control theory model dominated by feedback which the observing system uses to control its own behaviour and thereby to attempt to control the behaviour of another system. Note that feedback monitors goal-directed behaviour (i.e., the system begins with some desired state or goal which is compared with its perception of the actual state during or following a behaviour episode). In effect, environment is what the receptors and brain perceive (i.e., an internal representation). Not only objects and events, but also symbols and relations may be represented by these internal models. Internal events probably are represented in the same way and we assume that behaviour (overt or covert) acts on the inner as well as the outer environment.

Powers (1973) demonstrated that what we control is our own input; our behaviour is the means of control and the purpose of our students' action is to control their internal models of the perceived world. This is a powerful insight for educational technologists to exploit. It opens the door not only to design of intelligent CAL but also to the design of new organizational structures for education.

In a tutorial conversation, two cybernetic systems become coupled (until a resource, e.g., time or attention, is used up) to form a new interacting system in which each begins with goals that it attempts to satisfy by monitoring the effects of its own behaviour on the other. Similarly, an adaptive equilibrium occurs between a nation and its education system.

Instead of the input-output model, educational technology could conclude that behaviour is not so much a function of the environmental input as of a self-conscious "I" of each person in interplay not with his environment per se but with his perceptual model of that environment. The would-be regulator of all this, a human or an intelligent CAL system,' mirrors the same process; the instructional system must have minimally a model of the subject matter, a model of the student's knowledge and conceptual style, and a model of communications and control strategies to respond to the student's behaviour (Mitchell, 1982).

What are the implications for educational technology if it's to be rejuvenated? If one's perceptual field determines his behaviour, it seems reasonable to conclude that educational technology has two options. We can continue to implement schemes that limit opportunities for individual differences, developing representations of knowledge that omit much of the richness of a subject in their emphasis on achievement of specifiable objectives in a limited time. Or we can recognize individual differences and attempt to promote the optimal development of each person, providing opportunities to extend the self regulatory capacity of the person both within a subject domain and in general.

To do this, the regulatory system itself will need trainmg. Thus each person, and educational technologists, must learn how to express models of their own activities that have sufficient alternative courses of action from which to choose. Once again I wonder if educational technology has the capacity to do this.

A cybernetic model of the learner, based on Stafford Beer's (1982; 1983; 1984) pioneering work, may prove useful. This model is consistent with research in psychology and education, but begins with a different perspective. At its heart is a perceptual field or set of relationships which determines that this is "oneself'. Beer identifies the intrinsic regulatory mechanism that holds everything together, maintaining one's identity, and suggests that Education should enhance the regulatory variety of each person rather than delimit it (as often occurs). This injunction applies equally at the level of the person and society. Therefore, it may have resuscitating powers for educational technology.

Oneself, Self – Control And The Enhancement Of Human Potential

If the purpose of one's action is to control the perceived world, a cybernetic model of oneself as learner deserves scrutiny. At its heart is a perceptual field or set of relationships which determines that this is "oneself." Think of a human being not as mind, body, spirit or social unit but as "an entire and interactive system ." Oneself is an exceedingly complex, probabilistic system that maintains stability and integrity by virtue of an organizing principle, a set of relationships which determine that this is Oneself, not another self. Beer labels the intrinsic regulator which holds invariant the set of internal relationships that maintains the identity of Oneself, cybercyte.

Goals and Their Achievement

The self-regulatory capacity of the body seems automatic but what if one aspires to be different (e.g., run a marathon, read 5,000 words per minute, solve a complex problem)? As Beer shows, such pursuits require extending the self-regulatory capacity of both body and mind (i.e., of the cybercyte). Thus I may have the potential to run a marathon or to read at 5,000 wpm or to solve that problem, but I lack the regulatory model required. If Oneself sets goals and aspires to achieve them, then Oneself must change one's model of oneself. Why? Because things one is only potentially capable of doing are not initially included in one's regulatory model. There is a spectrum of options from which to choose (e.g., actions, models, beliefs and aspirations).

Recall that the purpose of human action is to control the perceived world by comparing this model with an internal model of a desired end-state. It is essential therefore, that the person (whether learner, researcher, planner or educational technologist) establish a goal-state, believe it can be achieved and will be achieved, and visualize oneself already in the goal state – and then to act accordingly. At this point the regulatory system should respond to perceived deviations from that goal.

Beer's concept of selfhood thus advocates self-improvement – and, by extension, education and societal improvement – based on the existence of autonomous regulatory mechanisms that permit self-control. However, the rules which govern the effectiveness of this self-control require the regulatory process to generate new states and detect and store patterns that can reduce discrepancies. Another principle is that "the recognized self exists within a potential self, the realization of which constitutes its fulfillment" (Beer, 1982, p. *20).*

Beer (1984) has tested this model at various recursive levels of selfhood within the context of corporations, society and religion. Surely these principles both address the enhancement of human potential and lie at the core of learning and therefore educational technology. As Beer suggests, Education should enhance the student's regulatory capacity rather than delimit it. But educational technology traditionally has restricted students' regulatory capacity And our own.

The Death Of Educational Technology

The preceding discussion of our self-regulatory capacity is central to my analysis of why educational technology cannot escape Beckwith's traps and the major reason for its demise.

Despite Beckwith's (and others') visions of educational technology's potential, the field itself is not a cybercyte and cannot have goals. Individuals can; so can organizations that are established for that purpose. But despite the existence of professional associations, there is no organizing principle that binds and regulates the research, practice and theory development which we identify as educational technology.

Therefore, Beckwith's insistence that educational technology transform itself is misplaced. We who think of ourselves as educational technologists may choose to transform ourselves and even attempt to transform others (e.g., students or colleagues). But even then we may need assistance, perhaps of a kind that does not now exist. We know little of control theory's regulatory models and how to alter the self-regulatory capacity of ourselves or others. Research is needed but who is capable of carrying it out? It may even be that this is one of the most crucial areas for instructional design if we wish to enhance human potential for learning how the world works and how to get along in it.

Graduate programmes in educational technology, too, need to be able to communicate relevant insights and research findings to students and, through continuing education and publications, to others. But how can they communicate what they know little about, especially when so many courses address tactical issues at the level of instructional design and media production? Can graduate programmes be transformed along the lines suggested by Beckwith or any other way?

At the same time we function in collaboration with other systems whose perception of educational technology regulates their interaction with us. Do they perceive us to be competent?

Needed: A Re-Orientation Of Focus

What stands in our way? Walt Kelly, the creator of the comic strip Pogo, had the main character say: We have met the enemy and he is us."

Educational technology had a short life. By the 70's it had gained academic respectability and widespread acceptance in training circles. As with another new, transdisciplinary field, operational research, "Survival, stability and respectability took precedence over development" (Ackoff, 1979, p. 242). And following Ackoff, I, too, hold academic educational technology and the relevant professional societies responsible for the decline and fall of educational technology. I hasten to point out that I have been involved in both and therefore share this responsibility.

Consider for a moment what educational technology has contributed to ameliorating existing messes.

Which educational technologists or educational technology programmes have attempted to solve these common problems? (I omit the more complicating systemic implications here.) Reports abound of illiterate and innumerate students graduating from high school. Half the world's children do not go to school. One third of the adult population in the USA (and nearly as many in Canada) is functionally illiterate. Most schools teach children to use computers but not to touch-type so that they can use them more efficiently. Neither teachers nor schools nor ministries of education insist on improved methods of teaching and learning, to say nothing of radical transformation of the curriculum. Our socioeconomic future will require a massive shift in education (and training) just for survival. A typical educational technology course differs little (except in content) from other courses on campus.

Are educational technology professors or research students tackling such problems? What are the burning issues in educational technology graduate programmes?

Suppose a school of educational technology to be a system organized to produce practitioners for this field. If we were to analyze such a professional school using control theory, what might it look like? Recall that in ordinary behavioural situations the controlled quantity is not immediately obvious and that in a system that operates with the complexity and time span of a graduate programme we can expect a very large number of intended outcomes or reference trajectories. Some of these might even be considered to be ideals. Moreover the professional school may attempt simultaneously to contribute to several related goals: to improve society (though its graduates' efforts to improve education); to improve educational systems; to help individuals to increase their knowledge and understanding; to excite in their students a desire and ability to learn and to solve problems.

To the external observer, all that is obvious is the relationship between various "disturbances" applied to the learners and some output of their reorganizing systems. Clearly we should expect to see a share division (amongst faculty if not students) of what is desirable but reports from several such programmes suggest that this is not always the case. Then, too, we might expect some creative approaches to the problems of teaching and learning.

For instance, one might test the hypothesis that, "An educational system should (1) facilitate students' learning what they want and need to learn, (2) enable them to learn how to learn more efficiently, (3) motivate them to want to learn" (Gharajedaghi & Ackoff, 1985, p. 24). One approach may be to assume that the best way to understand a system is to design it (or at least a model of it). To do so, students will need to learn how to solve problems, how to identify what they do not know, how to acquire what they need to know, how to use what they know.

Gharajedaghi and Ackoff suggest a radical departure from standard course-based graduate programmes: their principal instruments are learning cells and research cells which integrate faculty members and students who work jointly to integrate and extend theoretical themes and to design systems or to work on general theoretical, conceptual or methodological problems related to practical problems. The fundamental assumption is that graduate students do not need to be taught but may need guides and mentors. Such an approach clearly permits, indeed encourages, a systemic approach to identifying solving problems. Are we, in educational technology, willing to design radically different approaches to our curriculum and instruction system?

Though I may be mistaken, I think it is fair to say that most educational technology courses are taught by faculty members who have never, or hardly, practiced as educational technologists, except for occasional consulting. They – more accurately, we and our students are textbook-bound and use the language but not the experiences of dealing with real educational problems, whether we consider complex design problems or simple concepts. By real educational problems I refer not to needs analysis or product development for corporate training (which may indeed be important to the company) but to fundamental problems such as illiteracy, innumeracy, intolerance or lack of caring. To illustrate, I am struck by the blind faith which most of my students have placed in textbook definitions of central concepts, including, for example, "learning." I refer to books which repeat the silly statement that learning is a relatively permanent change in behaviour (as if behaviour of a complex organism is confined to what the observer noted, and – moreover – remains static after learning, thus prohibiting further learning). When asked about their own-learning experiences such students invariably discuss the concept from a very different perspective, one that is conceptually more useful and defensible. I detect a similar withholding of common sense too frequently in journal articles and textbooks. Something is wrong.

Perhaps because of our being trapped in a state of emulation of an out-of-date model of science borrowed from psychology, our journals and professional meetings fail, too, to come to grips with very real educational problems. Who is writing (in the educational technology literature) about the messes which we find all about us in the vast domain of education and training?

Is there any hope? Where can we go from here? I am tempted to liken our situation to that of the traveler who asked a farmer how to get to his destination; the farmer replied, "If I were you, I wouldn't start from here." But where can we start from?

Future Planning

Some of us in this disparate field have attempted to act and write as if it were possible to predict future behaviour of a system if only we knew all the cause-effect relations that apply to it. Then, according to this viewpoint, we can design, produce and install some instructional system or materials in such a way as to produce the intended behaviour. Aside from the lack of insight into control system theory which this paradigm reflects, it also fails to take into account the fundamental fact that we operate within constraints that limit our choice just as our clients' choices are limited. Perhaps the most constraining of all is the system within which we function as critical components.

For those in academic educational technology, George Grant warns, "We are unable seriously to judge the university without judging its essence, the curriculum; but since we are educated in terms of that curriculum it is guaranteed that most of us will judge it as good. The criteria by which we could judge it as inadequate in principle can only be reached by those who through some chance have moved outside society... (but then) one's criticisms will not be taken seriously" (Grant, 1968, p. 67). Surely it is this curriculum which has schooled us to believe that certain kinds of theses, publications or papers are somehow more acceptable (albeit to promotion and tenure committees) than others. Research productivity is an ambiguous concept. What counts as research?

The research required to ameliorate some of the pressing educational messes will take many years with little to show for it. What university would give tenure to the modem equivalent of the young Isaac Newton? "To arrive at the simplest truth, as Newton knew and practiced, requires years of contemplation. Not activity. Not reasoning. Not calculating. Not busy behaviour of any kind. Not reading. Not talking. Not making an effort. Not thinking. Simply bearing in mind what one needs to know (Brown, 1969, p. 110). For tackling complex educational problems such "bearing in mind' certainly is consistent with control system theory even if it is not with contemporary education or our universities. I suspect that this applies to training departments also.

How can those of us who prepare future educational technologists do what is necessary to support these learners in more sustained groping, exploration, synthesis and evaluation as part of their attempts to identify and solve important educational problems? What do we need to contemplate ourselves in order to provide such support? Is research and development in the area of intelligent tutoriig systems a useful direction or a dead end? How can we even identity what we need to know so that we may bear it in mind? And how to help our students to do likewise?

One thing is clear to this observer; the corpse called educational technology appears to have died because it lacked a cybernetic systemic paradigm and an organizing principle to give it life as a viable system dedicated to improving education. And even though this field cannot itself easily be a viable system it can contain many viable systems which could even cohere to form such a metasystem. One such component system could be you; I could be another. If we all work together we may just be able to save educational technology and thereby education. But we shall all have to struggle with our regulatory systems. This will require allocation of scarce resources to do the job resources such as care, creativity, commitment and love. Perhaps these are the only assets educational technology has left.

Conclusion

We may be able to revive the corpse of educational technology but not without a radical transformation in a number of inter-related domains: our professional associations; our graduate programmes preparing future practitioners; our schools, colleges, universities and ministries of education; our media of mass communication; our governments; our corporations; our society and – most important ourselves.

Albert Rosenfeld expressed our educational need thus: "In any planning of society, the structure and function of educational institutions (with education soon to encompass a lifetime) will be at the heart of it; and we are less likely to go wrong in our choices if we keep in mind what it is all to be designed for: the whole human being and his fulfillment in a regulated but free society."

"The educational establishment's major challenge will be to turn out people of high quality; people capable of constantly improving the quality of their own lives and interested in improving the lives of others; people who possess the necessary technical know-how, intellectual prowess, sensory awareness, personal and social responsibility to face cheerfully the unending ambiguities of the new age; people who are incapable of bestiality toward their fellow men, who have no use for personal power unless it offers an opportunity to enhance the quality of life on earth for all mankind" (Rosenfeld, 1969, P. 311-3 12).

To this I would add that these paragons will need a solid foundation in cybernetics and system thinking as well as in the relevant design sciences. Such educational engineers are likely to become very valuable members of society – if we are able to help prepare them.

If our graduate programmes in educational technology, inter alia, can turn out such men and women then we shall realize Kenneth Richmond's prediction (that this will become *the* central humane discipline of the future) and Beckwith's dream that we will help "to create health, ideal space and peace." The last reported resurrection required only three days. How long will it take to resuscitate and transform educational technology?

References

Ackoff, R. L. (1979). The Future of operational research is past. *Journal of the Operational Research Society, 30 (2), 93-* 104.

Beckwith, D. (1988). The future of educational technology. *Canadian Journal of Educational Communication, I7(* l), 3-20.

Beer, *S.* (1986). *Diagnosing the system for organizations.* Toronto, ON: Wiley.

Beer, *S.* (1982). *Man in a garrulous silence.* Unpublished manuscript.

Beer, *S.* (1983). The will of the people. *Journal of the Operational Research Society, 34(5), 797-S* 10.

Beer, *S.* (1984). *The cybernetics of selfhood.* Plenary address to Seventh European Meeting on Cybernetics and Systems Research, Vienna.

Brown, *G. S.* (1969). *Laws of form.* London: George Allen and Unwin

Grant, George (1968). *The university curriculum.* In H. Adelman & D. Lee (Ed.) *The university* game. Toronto: Anansi.

Gharajedaghi, J., & Ackoff, R. L. (1985). Toward systemic education of systems scientists. *Systems Research, 2(1),* 2 l-27.

Mitchell, P. D. (1970). Educational technology: Panacea of placebo?, *Aspects of Educational Technology IV.* London: Pitman.

Mitchell, P. D. (1973). The professional development of educational technologists, *Aspects of Educational Technology* V. London: Pitman.

Mitchell, P D. (1975). The discernible educational technologist. *Programmed Learning and Educational Technology, 12(5), 306-325.*

Mitchell, P. D. (1982). Representation of knowledge in CAL courseware, *Computers & Education, 6, 6* l-66.

Mitchell, P. D. (1988, June). *Evaluation of understanding in intelligent interactive systems: An application of conversation theory.* Paper presented to the, Fourth Conference on Development of Effective Interactive Instruction materials, Stanford, CT.

Pask, *G.* (1976). *Conversation theory.* Amsterdam: Elsevier.

Powers, W. T.(1973). *Behaviour: The control of perception. New* York, NY:

Richmond, W. K (1967). *The educational industry.* Methuen, London.

Robinson, H.W., & Knight, D.E. (Eds.) (1972). *Cybernetics, artificial intelligence and biology.* New York: Spartan Books.

Rosenfeld, A. (1969). The second genesis: The coming control of life. Englewood Cliffs, NJ: Prentice Hall.

Schwen, T. M. (1988). An organizational analysis of the future of educational technology. *Journal of Instructional Development, 1 1(3) 2* l-27,

Smuts, J. C. (1925). Quoted in the supplement to the Oxford English Dictionary, 1971.

Warfield, J. N. (1985). Developing a design culture in higher education: Some laws and principles of design. *Proceeding of the 198.5 International Conference of the Society for General Systems Research, Vol. II,* (pp. 725-729). Seaside, CA: Intersystems Publications.

Wiener, *N.* (1948). *(Cybernetics.* Cambridge, MA: M. 1. T. Press.

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TELEVISION: THE MEDIUM THE MESSAGE AND NUTRITIONAL HEALTH

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Abstract: This paper presents a review of research linking nutritional health and body image attitudes with television viewing. Cultivation Theory and Social Learning Theory provided the basis for a discussion of socialization of health-related attitudes by television broadcasts. Health-enhancing and health-detracting behaviours related to heavy television viewing have been highlighted in the literature. The physiological effects of viewing, including obesity, fitness level and serum cholesterol level, have led some researchers to term television a chronic disease risk factor. Content analyses of television portrayals of nutrition and body image messages have studied both advertisements and programming. These studies have indicated that television presents a paradoxical view of food – snacking on higher energy, lower nutrient dense foods abounds and yet few characters have or develop weight problems or chronic diseases. The need for health and education professionals to improve media literacy levels is evident.

Résumé: Cet article présente une revue des recherches qui établissent un lien entre la nutrition et les attitudes de perception de soi avec le visionnement de la télévision. Les théories culturelle et de socialisation sont à la base de la discussion de la socialisation des attitudes reliées à la sante par la programmation de télévision. Le développement de certains comportements nuisibles ou favorisants la santé relié au visionnement de la télévision ont déjà eté soulignes dans la littérature. Les effets physiologiques reliés au visionnement de la télévision tels que l'obésite, le niveau de forme physique ainsi que le niveau de cholestérol ont mené certains chercheurs a nommer la télévision comme étant un facteur de risque pour maladie chronique. Le portrait véhiculé par la télévision en ce qui à trait a la nutrition et à l'image de soi à ete analysé à l'intérieur de la programmation et de la publicité télévisées. Ces études indiquent que la télévision présente une vision paradoxale de la nourriture: la collation basée sur de la nourriture élevée en énergie; la nourriture faible en valeurs nutritives abonde mais peu de personnages développent des problemes de poids ou des maladies chroniques. Le besoin pour les professionnels de la santé et de l'éducation d'améliorer le niveau de connaissance des médias est évident.

This paper discusses the reported and purported effects of television viewing on nutrition, body image and general health. Nutrition and body image related research have extensively studied mass communication, particularly that of television. This body of research will be reviewed in terms of audience use research, media effects research and media content analysis.

Background

Recent research concerning the amount of time people spend viewing television has garnered much attention. Children spend more time in front of the television than they do in school an estimated 28 hours weekly (Comstock and Paik, 1987). Each week, adult males and females watch 29 and 34 hours, respectively. After retirement, this figure increases (Black & Bryant, 1992). In the average household, the television is turned on about 55 hours each week (Comstock & Paik, 1987), indicating that families don't always view together. So, it seems that besides work or school and sleep, television occupies the greatest proportion of viewers' time (Black & Bryant, 1992). It has been estimated that over the period of one year Americans collectively spend 30 million person years viewing television (Murray, 1993).

Comstock (1993) suggested that these viewing time statistics have a certain folklore quality about them. He noted that typical television viewing is not marked by constant attention to the screen, but is discontinuous, often interrupted and is not the sole activity engaged in by the viewer. Viewing tends to be characterized by 'content indifference', 'low involvement' and 'monitoring"' (Comstock, 1993, p. 126). Thus, the estimated viewing hours, and those reported to ratings companies, define the upper limits of possible attending to the screen only (Comstock, 1993). However, while viewers may not be actively engaged in viewing while in the room with the television set, they are aware of the content at a lower level of consciousness; that is, they are monitoring the programming. Thus, the brain may still recognize all that is broadcast.

On average, a child views 22,000 commercials annually (Signorielli, 1990). Advertisements for food products constitute at least 5000 of these ads, over half of which are for low nutrient dense foods (Signorielli, 1990). As well, data from the long-term cultural indicators project showed that a typical viewer of prime-time welcomes about 300 stable characters into their homes each week (Gerbner, 1985). Often the foods consumed by these characters are of low nutritional quality and the foods are used to soothe unsettled emotions or as socialization tools rather than to curb hunger (Weinberg, 1993).

Audience Uses of Television

In spite of the common misconception that television is solely an entertainment medium, many studies of viewers have uncovered a multitude of other uses. Much research has pointed to the informal educational ability of the medium – not only with children, but with adults, too. While, television has the ability to lay foundations for attitude and behaviour adaptations, it also validates existing attitudes and behaviours.

For many viewers, television provides them with information, both factual and fictional (Singer, 1983). In a study of 100,000 French school-aged children, 70% reported that most of their science knowledge was obtained from the television (Dan, 1992). General Mills conducted a study which presented respondents with a list of 16 health information sources. Television was cited as the main health information source by 3 1% of the respondents, second only to doctors and dentists, a group that was chosen by 45% of the sample (Signorielli, 1990). A recent Canadian survey (Tracking Nutrition Trends, 1994), found that SO-70% of respondents obtained their nutrition information from the mass media, both print and electronic. This same study showed that only 30-40% of respondents reported obtaining such information from a dietitian/nutritionist.

Other uses for television have been noted in the literature. Singer (1983) alludes to the use of television as a babysitter or companion for children when caregivers are busy with other tasks. The role of companion or social support is also likely to occur with the socially isolated, such as the elderly or unemployed, since it has been noted that television viewing hours increase in these groups (Huston, Donnerstein, Fairchild, Feshback, Katz, Murray, Rubinstein, Wilcox & Zuckerman, 1992). As well, a study by Tarasuk and Maclean (1990) suggested that owning a television set and VCR and subscribing to basic or expanded cable services not only provided the low-income family with entertainment and escapism, but it added to their sense of financial security due to the high resale value of the hardware.

Audience uses of television are many and varied. But, what effect do these uses have on the audience?

Television Viewing Effects

Television as Reality

An area which has received much attention is that of perceived reality of television by the viewer. Concepts about reality begin early in life. Children aged two to three years do not comprehend the representational nature of television (Fitch, Huston & Wright, 1993). A bizarre example of this from the literature involved a 3-year-old boy who presented to the physician with constipation. The child refused to sit on the toilet and had reverted to using a diaper after viewing a television commercial in which the toilet bowl turned into a monster with the lid making a biting movement (Pilapil, 1990). While this commercial was targeted towards adults, and was likely found amusing by adults, it was perceived very differently by a child. Such unrealistic portrayals are not likely to be understood until around seven or eight years of age when children are able to distinguish between active and symbolic events (Blosser & Roberts, 1985). Around age 10 years, children seem to judge factuality similarly

Perception of message intent research has largely centred on child viewers of commercials. In studies of children aged 4 to 11 years, increasing age has been directly related to improved ability to recognize message intent (Blosser & Roberts, 1985; Robertson & Rossiter, 1974). The most apparent increase in this ability occurred between eight and nine years of age (Blosser & Roberts, 1985). Robertson & Rossiter (1974) proposed that such improvement was due to both cognitive development and the cumulative experience with commercial messages.

Socialization of Attitudes and Television

Its ubiquity, visual appeal and the minimal skills required to use it, make television an ideal socialization agent. Based on the concepts of social learning theory, this medium assists viewers to acquire the values, beliefs, attitudes and mores of a culture – both their own and those of others.

Signorielli (1993) states that the "story-telling" function of television is paramount to viewers' learning of the world and its social structures. The images and popular culture portrayed by this medium tell the viewer about life. It is this same function which can be potentially damaging by misshaping perceptions of the real world through stereotyping (Rubinstein, 1983). In terms of gender role images on television, the majority of female characters in prime-time maintain traditional roles, tend to be younger than their male counterparts, are outnumbered by men by a ratio of two or three to one (Signorielli), and are slimmer than male characters (Silverstein, et al., 1986).

Recent research has pointed to the effect of awareness of advertising, not merely exposure, on development of beliefs. Grube and Wallack (1994), in a study of fifth and sixth grade children, concluded that children who were more aware of beer advertisements held more favourable beliefs about drinking, had a greater knowledge of beer brands and slogans, and reported a greater intent to drink as adults. A British survey of over 7000 children aged 11 to 16 years, found that when asked for their favourite commercial, the most popular choices were beer and lager products (Nelson & While, 1994). These commercials were significantly more likely to be chosen as favourites by children who claimed to drink alcohol (Nelson & While, 1994). Thus, it is possible that attitudes and beliefs formed by television viewing may affect behaviour. This is of major concern since prime time televised alcohol consumption portrayals have been reported to appear twice as often as those of coffee or tea, 14 times as often as soft drinks and 15 times as often as water (Tucker, 1985).

Television, Body Image and Self Esteem

Of interest to nutrition and health professionals is the psychological research of how individuals construct mental models of themselves called self-schemas. One such self-schema is body image, the view of body shape, size and physical ability as compared to the perceived norm (Ikeda & Naworski, 1992). It is closely linked to self-esteem, physical changes in the body (puberty, pregnancy, menopause), socialization, prevailing social values and judgments or feedback from others (Rice, 1993). Research in this area combines social reality concepts with socialization theory.

Originating in feminist critique research, the notion of body image as a basis for health-detracting behaviour has focused on female bodies. Yet, adult males tend to express their ideas of health in terms of their own or others' bodies (Watson, 1993). Thus, television could affect the personal body image of males as well as their images of women.

It has been estimated that viewers see over 5,000 attractiveness messages each year through televised commercials (Downs & Harrison, 1985). As well, in prime-time programs, a much smaller proportion of overweight characters is portrayed than would exist in the non-mediated world (Gerbner, Gross, Morgan, & Signorielli, 1981; Kaufman, 1980; Silverstein, Perdue, Peterson & Kelly, 1986). For example, Silverstein et al. (1986) found that while 25.5% of males portrayed on television were rated as heavy, only 5% of female characters were so rated. At the same time, high energy foods are often referred to, giving the impression that eating excess calories is not associated with weight gain (Weinburg, 1993). Stereotypical male body images portrayed in the print media have been viewed negatively by males, who saw the body-builder image as an inappropriate and unattainable cultural representation (Watson, 1993). A cumulative effect of these messages may exist where "each of these body image messages is just one more strike on a chisel sculpting the ideal body inside a . . . mind" (Myers & Biocca, 1992, p.111). Again, based on social learning theory and cultivation analysis, heavy viewing of television could cultivate the belief that few women are overweight in the non-mediated world.

Myers and Biocca (1992) described the concept of "elastic body image" which points to the non-static nature of self body image and its susceptibility to change based on environmental cues. They found that a woman's body image is responsive to televised ideal female body images. The researchers concluded that viewing less than 30 minutes of televised messages concentrated on the socially-accepted slim female body ideal resulted in the young women feeling thinner than they did usually and slightly more euphoric. Another study found that after viewing commercials for diet food, women at high risk for developing anorexia nervosa reported more negative than positive appearance statements compared to a group of lower risk women (Kaltenbach, 1990). In terms of cultivation theory, these short-term changes in self perception could be attributed to the adoption of the presented views of social reality by the viewer.

Low self esteem, a concept closely related to negative body image, may be reinforced by television viewing. Lonely people viewing television to pass the time have reported increased boredom, passivity and withdrawal (Weinburg, 1993). These feelings, in turn, can lower self esteem. Adolescent males who were light television viewers (2 h/day) compared to moderate (2-4 h/day) or heavy (4+ h/day) viewers were more outgoing, self-controlled and emotionally stable and were less neurotic, frustrated or troubled (Tucker, 1987). In nutritional health terms, boredom, frustration, low self esteem, loneliness and lack of control have been reported reasons for overeating (Weinburg, 1993). Thus, another behavioral component is added to the body image model.

Television and Health Behaviours

The scientific understanding of the possible roles television plays in human physical health status has little value alone. Unless behaviour is affected and, in turn, understood, causal links cannot be made and prevention strategies cannot be effectively implemented. The effect exerted by television on viewers is a function of the time spent viewing, the accumulation over time of what is seen (American Academy of Pediatrics, 1990) and the qualities and intentions of the viewer (Huston et al., 1992).

Purchasing and Product Choice Behaviour

Television commercials implicitly and explicitly influence viewers to purchase products. In children, the effect manifests itself as either a direct product purchase or a request of the caregiver to purchase the product (Clancy-Hepburn, Hickey & Nevill, 1974).

With an interviewer-administered questionnaire for parents, the viewing habits and food requests of children aged 3 to 8 years were gathered (Taras, Sallis, Patterson, Nader & Nelson, 1989). Foods requested reportedly due to a television commercial were similar in frequency to the televised rates of the commercials themselves. Also, a significant positive correlation was found between viewing hours and television influenced purchase requests made by the children. In a laboratory setting, children who worked harder, by pressing a button, to keep commercials rather than program material on a television monitor, were observed to make a greater number of purchase-influencing attempts at the grocery store (Galst & White, 1976).

First grade children viewing commercials for highly sugared foods tended to choose more sugared foods as snacks when compared to controls or children who saw pro-nutrition public service announcements (PSAs) (Goldberg, Gorn & Gibson, 1978). In a later study, Gorn and Goldberg (1982) exposed campers aged 5 to 8 years to one of four commercial treatments over 14 consecutive days. The treatments included candy commercials, fruit commercials, pro-nutrition PSAs and no commercial messages. Children exposed to the fruit commercials chose the most fruit juice as a snack while those exposed to the candy commercials chose the least orange juice as a snack. As well, less fruit was chosen by the candy commercial group than any other group. Unlike most previous studies, this research attempted to improve the validity of any association found by using a longitudinal design and exerting some control over food choice and television viewing behaviour through the choice of a summer camp setting.

While most of the research relates children's food choices with televised commercials, Goldberg and colleagues (1978) investigated the effect of a pro-nutrition episode of Fat Albert, an animated half-hour program with Bill Cosby appearing intermittently to emphasize points. The results indicated that viewing the program, which dealt with the problems of eating excessive amounts of low nutrient dense foods, changed short-term food choices even when accompanied by commercials for snack and breakfast foods with high sugar contents. Thus, television programming also can affect behaviour and perhaps even counteract commercial content.

Research with adults has shown similar effects of television advertising on food product choices. Marketing research surrounding the Kellogg All Bran(R) advertising strategy of 1984, has shown a major impact on product purchase. Levy & Stokes (1987) reported on the televised media campaign targeted to the 35-year-old and over audience. This All Bran(R) campaign presented the fibre-cancer prevention message and was endorsed by the National Cancer Institute of the U.S. National Institutes of Health. Market share was tracked using computerized purchase data from grocery store check-outs from 16 weeks prior to the campaign to 48 weeks following its initiation. In the first 24 weeks of the campaign, sales for all high fibre cereals (particularly Kellogg cereals) rose sharply. The growth in sales continued over the next 24 weeks, but this was due mainly to increased sales of non-Kellogg high fibre cereals (Levy & Stokes). At the end of the study, high fibre cereal sales had increased to 8.4% of all ready-to-eat cereal sales, an increase of 2.3% (Levy and Stokes). It is interesting to note that this seemingly small increase was of major importance as a 1% market share was equal to over $40 million (Levy & Stokes).

This advertising campaign by Kellogg gave impetus to a review of U.S. government policy towards health claims in food advertising and a suspension of the ban against health claims while the issue was being considered. Between 1984 and 1986, surveys reported an increase in public knowledge regarding the link between cereal fibre and cancer prevention from 9% to 32% (Ippolito & Mathios, 1990). Lifting the advertising ban created a more accessible information source for consumers which resulted in their behaviour change. Televised cereal commercials and placement of health promotion messages on product packaging were better able to reach a wider audience than previously available information sources (Ippolito & Mathios, 1990). In terms of social marketing theory, their evidence suggested that this form of communication reduced the cost of obtaining information for broad sectors of the population.

Health-Enhancing Behaviour

The transmission of positive health messages is well suited to the television medium. It offers a route to population segments which are generally though of as 'hard-to-reach', such as older adults, lower income groups, those with lower education levels and other socially isolated persons (Dan, 1992). A recent Canadian campaign demonstrated improved knowledge by the public of the risk of alcohol consumption during pregnancy in a pre-test/post-test design (Casiro, Stanwick, Pelech, Taylor & Child Health Committee, 1994). Respondents reported that television was their main source of this information significantly more often after the campaign than before the campaign (Casiro et al., 1994).

Health programming rather than PSAs has been used successfully in Finland (Weinberg, 1993). Five series of 15 segments each were aired between 1978 and 1985. The programs helped viewers develop the skills needed to make and sustain behavioral changes and encouraged a supportive social environment for the changes. Viewers reported smoking cessation, weight loss and reduced dietary intakes of fat, sugar and sodium (Weinberg, 1993).

In North America, health professionals are beginning to work cooperatively with the television industry to promote health-enhancing behaviours (Montgomery, 1990; Weinberg, 1993). The Centre for Health Communications at the Harvard School of Public Health launched a campaign to increase the awareness of the dangers of drinking and driving. After the first year, the program took credit for scenes or entire programs devoted to the topic in 25 television programs (Montgomery, 1990). This project has expanded to include technical consultation to the producers of Beverly Hills 90210 for a story line involving body image and dieting in teenage women (Weinberg, 1993). Specialty programs promoting positive health behaviours have begun to be collaboratively created – work which is based largely on the agenda setting concept of social marketing theory.

Health-Detracting Behaviour

Heavy television viewing has been related to increased low nutritional knowledge and increased perceptions of validity of nutrition claims in commercials (Signorielli, 1990). Many health-detracting behaviours may occur in persons who rely heavily on television as a source of health information as well as those who view heavily (Signorielli, 1990).

A TV Guide survey in 1992 showed the extent to which television and eating habits have become linked (Weinberg, 1993). Two-thirds of respondents reported viewing television while eating their evening meal. In the 18- to 24-year-old segment, three-quarters of respondents reported this behaviour. In a study of pregnant adolescents, it was reported that subjects consumed 38% of their energy intake while viewing television (Goldberg, 1990). This change in the social aspects of mealtime may have an effect on the mental health of viewers and their families.

Klein and associates (1993) reported that adolescents aged 14 to 16 years who were heavy viewers of music videos and televised movies were more likely to engage in health-detracting behaviours such as smoking cigarettes or marijuana, drinking alcohol or engaging in high risk sexual activity. In a study of adolescent males, Tucker (1987) found that subjects viewing less than two hours of television daily were significantly more physically fit than those viewing two or more hours each day, indicating that they likely were more physically active.

The portrayed ideal body image in the mass media has become slimmer since the 1960s (Myers & Biocca, 1992). The health effects of this societal ideal may be seen in the large numbers of people dieting to lose weight. Of adult Canadians who fall within a healthy weight range, 45% wanted to lose weight, while 7% of those who were already below a healthy weight range wanted to weigh less (Health and Welfare Canada, 1988). An American study showed that in a university population, 35.5% of all smokers, (39% of female smokers and 25% of male smokers) reported using smoking as a weight loss strategy (Health and Welfare Canada, 1988).

As a perpetuating factor in these behaviours, television transmits the thin ideal for females and the muscular ideal for males. These messages, as dieting to lose weight, are not exclusive to adults. Fear of becoming overweight affects children as early as age 6 to 9 years (Czajka-Narins & Parham, 1990). Weight loss dieting behaviours, including binge eating, have been reported in children aged 9 to 12 years (Michaud & Terry, 1993). Recent reports of increased anabolic steroid abuse by adolescents males have been linked to difficulties with body image (Turner, 1994; Yesalis, 1992). Teenage males seem to be turning to these drugs to help them achieve the socially represented ideal body not to enhance performance in sport. Such behaviours compromise growth, reduce vital body nutrient stores, decrease resistance to infection and perpetuate distorted body images (Michaud & Terry, 1993).

Signorielli (1990) reported that heavy viewers of television reported not being concerned about body weight and that they ate or drank whatever they chose, whenever they chose. Thus, television viewing can be linked to a complacency about positive health attitudes and behaviours. Gerbner and associates (1981) termed this the "cultivation of complacency." This effect was based on the unrealistic belief held by the viewer in the "magic of medicine" perpetuated by television programming and commercials. The authors felt this belief resulted in continued unhealthy lifestyle choices by viewers who felt that modern medicine would fix them if problems arose. In light of the present health care system reforms, this continued reliance on the traditional view of medicine, or the illness-care model, will have far-reaching and perhaps devastating effects. There not only is a threat to personal health but a threat to an already over-burdened health care system.

Television Viewing as Chronic Disease Risk Factor

Television viewing has been linked to body image distortions, reduced fitness levels, increased consumption of low nutrient dense foods and changes in social eating patterns. But, what are the personal and public health impacts of these behaviours?

Obesity

A recent report stated that 1 in 5 U.S. teenagers was overweight ("Prevalence of overweight," 1994). The prevalence has increased from 1 in 7 which was reported for the 1970s. An increased prevalence of adolescent obesity will lead to a future increase in obesity of the adult population ("Prevalence of overweight," 1994). Canadian figures have estimated that the increased prevalence of obesity since 1980 has been a 50% increase in children aged 6 to 11 years and a 40% increase in adolescents aged 12 to 17 years (Lechky, 1994). Of these overweight youth, 40 - 90% will become overweight adults (Lechky, 1994). The health risks of this future obesity include increased hypertension, cardiovascular disease, non-insulin dependent diabetes, orthopedic disorders, gallbladder disease and sustained self esteem and body image problems (Groves, 1988; "Prevalence of overweight," 1994), to name only a few.

Cross-sectional studies to estimate the association between viewing times and obesity in both adult males and adult females, found that for subjects viewing three or more hours of television daily, adjusted estimates showed over twice the prevalence of obesity as seen with lighter viewers (Tucker & Bagwell, 1991; Tucker & Friedman, 1989). A dose-response effect was seen in both studies as risk increased with increased daily viewing times. Second only to prior obesity, television use has been termed the strongest predictor of obesity in children (Boyle & Morris, 1994). Using food frequency data, Taras and co-workers (1989) found a significant correlation between caloric intake and the number of hours spent viewing television. Dietz and Gortmaker (1985) were able to find strong associations between obesity and television viewing in a study utilizing cross-sectional data from the National Health Examination Surveys (NHES II and III) on 6965 children aged 6 to 11 years and 6671 children aged 12 to 17 years. As well, a longitudinal component was present as data from the NHES III included information on 2,153 children previously seen in NHES II. For both age groups, there was a significantly greater prevalence of obesity and superobesity in those who spent more time viewing television. Gortmaker, Dietz & Cheung (1990) supported a causal connection between daily television viewing duration and obesity in youth based on both cross-sectional and longitudinal data. Their study identified a 2% increased obesity prevalence with each additional hour of television viewed by children and adolescents, after controlling for possible confounding variables. From longitudinal data, these authors reported that television viewing was associated with development of obesity, with an increased incidence rate of 1.3% for each additional hour of television viewing. As well, rates of remission of obesity decreased by 6.3% for each additional hour of viewing (Gortmaker, Dietz & Cheung).

A cyclical model for the association between television viewing and obesity has been proposed (Dietz & Gortmaker, 1985; Weinberg, 1993). Television appears to affect both energy intake and energy expenditure. Energy expenditure may be reduced as viewing television requires little energy and also as it displaces more active pursuits. While viewing television, high energy, low nutrient foods are advertised and portrayed within programs. Snacking behaviour increases when viewing television and often takes the form of the lower nutrient dense foods promoted. These factors can result in viewer weight gain. In turn the weight gain may result in less motivation to exercise on the part of the viewer which leads to greater time spent viewing television, and the cycle continues (Weinberg, 1993). To compound this obesity problem, Klesges Shelton and Klesges (1993) found that in normal weight and obese children aged 8 to 12 years, viewing television resulted in a metabolic rate significantly lower than during rest. Other researchers have found a reduced activity level and hence a reduced energy expenditure during viewing compared with sitting quietly or reading (Dietz, Bandini, Morelli, Peers & Ching, 1994; DuRant, Baranowski Johnson & Thompson, 1994). Thus, television viewing may contribute to obeisity through a reduced rate of energy expenditure while viewing.

Fitness

A study to relate television viewing to obesity and physical fitness in adolescent males found light viewers scored significantly better on tests of fitness level than did heavy viewers (Tucker, 1986). A cohort study of adolescent females found only weak associations between adiposity, activity level or a change in either over a two year period, and television viewing time (Robinson et al., 1993).

In almost 9,000 adults, Tucker (1990) investigated the association between television viewing and cardiovascular fitness level. Adults who viewed television for more than four hours each day were only less than half as likely to be tit compared with adults viewing for less than one hour daily and were about three-quarters as likely to be as fit as those viewing three to four hours daily.

A cyclical mechanism for the television viewing association with fitness level, similar to that noted for obesity, was proposed by Tucker (1986).

As television viewing time increases, physical activity tends to decrease. As physical activity declines, physical fitness tends to decline. As physical fitness declines, attraction to passive recreation tends to increase (p. 803).

Increased television viewing is a likely form of passive recreation to be adopted. Thus, a major impact of television is not only the behaviour it promotes but also the behaviour it prevents (Tucker, 1986).

Serum Cholesterol Levels

The association between time spent viewing television and the prevalence of hypercholesterolaemia was studied in a sample of almost 12,000 employed adults (Tucker and Bagwell, 1992). Results indicated that adults viewing television for three or more hours daily were almost twice as likely to have a serum cholesterol level in excess of 6.02 mmol/L (240 mg/dL) than adults viewing less than one hour daily. Moderate duration viewers (l-2 h/day) were almost one to five times as likely to have hypercholesterolaemia. Neither group was more likely to suffer moderately increased serum cholesterol levels (5.2-6.2 mmol/L; 200-240 mg/dL). The researchers concluded that excessive television viewing may be an important lifestyle factor linked to cardiovascular disease risk (Tucker & Bagwell, 1992).

In a study of over 1000 children aged 2 to 20 years, Wong and co-workers (1992) found that excessive television viewing strongly predicted an elevated serum cholesterol level of 5.2 mmol/L (200 mg/dL) or higher. Compared to infrequent television viewers, children viewing more than four hours daily were 4.8 times as likely to have an elevated cholesterol level. For moderate television viewers, this risk was 2.2 times that of infrequent viewers. While 88% of the children viewing two or more hours daily did not have cholesterol levels over 5.2 mmol/L (200 mg/dL), this high false-positive rate should not overshadow the implied association between excessive television viewing and other behavioral factors which impact on the serum cholesterol levels of children (Wong et al., 1992).

Nutrition and Body Image Messages on Television

Media effects research has concluded that television viewing can exert a variety of effects on viewers. These effects, though, are dependent on the televised content to which the viewer is exposed (Potter & Ware, 1989). Content analyses of television broadcasts have suggested that the airwaves are saturated with overt and subtle health and nutrition messages.

Food Related Messages

Early studies indicated that Saturday morning television commercials promoted highly sugared breakfast cereals, snack foods and low nutrient dense beverages (Brown, 1977; Gussow, 1972). More recent analyses have found very few changes have occurred during the intervening years (Cotugna, 1988; Kotz & Story, 1994). Cotugna (1988) reported that on Saturday mornings, 80% of food commercials aired on the major U.S. television networks were for foods of low nutritional quality and that ads for high sugar products still prevailed. She also reported that the proportion of commercials for high fat fast foods, high sodium canned pastas and high sugar cereals had increased. Kotz & Story (1994) reported that 56.6% of all commercials on Saturday morning U.S. network broadcasts were for food products. Of these, 43.6% were for foods high in fat and/or sugars. Again, highly sugared breakfast cereals were the most frequently advertised product.

Studies of Canadian network commercials on Saturday morning television found similar content concerns (Ostbye, et al., 1993; Wadsworth, 1992). Breakfast cereal ads comprised 25% of all food ads with 57% of these being for high sugar cereals (Wadsworth, 1992). Other major product categories advertised included sweets, low nutrient dense beverages and canned pastas (Ostbye, et al., 1993; Wadsworth, 1992). Significant differences between networks were found, with 71.6% of the commercials on YTV being for food products (Wadsworth, 1992) and neither CBC-English nor CBC-French airing any food commercials (Ostbye, et al, 1993; Wadsworth, 1992). As well, Ostbye and co-workers (1993) reported that Much Music aired a significantly greater proportion of commercials for low nutrient dense beverages. Such differences suggest both targeting of particular audience groups by the food industry and dissimilar advertising policies amongst the networks.

Byrd-Bredbenner (1994) took this Saturday morning television research one step further by analyzing nutrition related incidents in the programming itself. She found that food and body image incidents occurred an average of six times per hour. Program characters ate to socialize or to cope with emotions. When a food pyramid was constructed based on the frequency of televised food portrayals, it was nearly opposite to the U.S. Food Pyramid (Byrd-Bredbenner 1994). A similar effect had been produced using only advertised food product; (Kotz & Story, 1994).

The nutritional messages contradictory to current nutritional guidelines are not exclusive to children's programming. Research results have indicated that prime time television is far from immune to these pervasive messages. Studies have reported that 25% to 30% of prime time commercials were for food products (Kaufman, 1980; Ostbye et al., 1993; Signorielli, 1990). Ostbye and co-workers (1993) found that food products represented the largest single category of advertisements on Canadian prime time television. They found the most common foods advertised were beverages, including alcoholic beverages, complete meals, breakfast cereals and french fries. Significant network differences were evident with beverage commercials being heaviest on Much Music – 66% of total advertisements on the network with 41% of total advertisements being for soft drinks.

The practice of "product placement", which consists of the paid, prominent placement of brand-name products within program content (Black & Bryant 1992), has resulted in much greater exposure to brand-name food items for the viewer. This, coupled with the possible nutrition messages embedded in programs, led to the analysis of prime time program content. Kaufman (1980) reported that references to food occurred two to three times in each 30-minute segment analyzed. She also found more food references in program content than in commercials. Despite the obvious bias evident in terms of actual minutes of programs versus commercials, this finding pointed to the importance of television programs as sources of nutrition messages.

Way (1983), in a study of 5 1 ongoing prime time series, found food related behaviours occurred at a rate of 1.77 per character, 5.3 per program and 7.67 per hour of programming analyzed. As well, food related behaviours which involved foods of higher nutritional quality almost equaled behaviours related to lower nutritional quality foods. Upon closer inspection of the behaviours, though, Way (1983) discovered that foods which were eaten were of lower nutritional quality than foods which were purchased, prepared, served or requested.

Higher televised rates of food references had been reported by Gerbner and co-workers (198 1). In a study of one week of prime time broadcasts, they found an average of 9 incidents per hour. A more recent study found similar aired frequencies - 4.8 incidents per 30 minutes (Story & Faulkner, 1990). Difficulties in comparisons between studies exist, though, due to the lack of standardized definitions of food incidents and differences in data collection procedures (Sylvester, Achterberg, & Williams, 1995). This is a common complication encountered with content analysis methodologies which often use different data sets, recording instruments and recording procedures (Krippendorf, 1980).

Since major motion pictures are often broadcast on television, knowledge of the nutrition messages they contain would be useful information for the nutrition educator. An analysis of 71 of the top 100 dollar grossing films of 1991 for food and nutrition related messages found that 76% of the films contained at least one major food scene. Portrayal of higher nutrient density, lower fat foods was related to higher socioeconomic and educational status of the characters.

The context surrounding food related behaviours has received some attention. Portrayed eating incidents have emphasized snacking (Gerbner et al., 1981; Kaufman, 1980). Episodes involving drinking were predominated by alcoholic beverages followed by coffee and tea (Gerbner et al., 1981). Kaufman (1980) found television characters were portrayed as happy in the presence of food, snacked often and rarely ate alone, indicating the emphasis on social aspects of eating.

The “prime time diet” appears to consist of foods of lower nutrient density with an emphasis on low nutrient beverages, sweets and snack foods. These portrayals have been likened to the typical North American consumption pattern (Ostbye et al., 1993; Story & Faulkner, 1990). This eating pattern is lower in fibre and complex carbohydrates and higher in fat, sodium, simple carbohydrates, caffeine and alcohol than current nutrition recommendations suggest (Health & Welfare Canada, 1990).

Body Image Messages

Kaufman (1980) investigated the body image portrayed in the ten top ranked prime time programs on U.S. network television. Of persons portrayed in food related situations, 88% were rated as being of thin or average body size and 12% as being overweight or obese. More men (15%) than women (8%) were rated as overweight or obese (Kaufman, 1980). This trend towards portrayal of larger male body types more often than larger female body types was confirmed by other researchers (Signorielli, 1990; Silverstein et al., 1986). Overweight persons were deemed to be under-represented in box office films, as well (Sylvester, Achterberg & Williams, 1993).

Children, adolescents and young adults were rarely portrayed as overweight or obese (Kaufman, 1980). This study also found disproportionate obesity among racial minority characters. Personal characteristics of overweight and obese persons tended to be more negative than for their thin counterparts (Kaufman, 1980). Thus, the dramatic functions of larger body sizes seem to be limited.

It seems, therefore, that television provides a paradoxical view of food. Slim characters abound, yet they continually eat high energy foods. Eating is portrayed as a “consequence-free” activity (Byrd-Bredbenner, 1994).

Content analyses of television programs and commercials have indicated many subtle nutrition and body image messages are continuously portrayed. According to social learning theory principles, with time, repeated viewing of such messages may affect viewers. As lower nutrient dense food was often presented as a prop or to give characters something to do with their hands (Byrd-Bredbenner, 1994), it may be a result of writers and producers not understanding the potential such scenes may have on viewer learning or their not being aware of higher nutrient dense food substitutes. As well, these portrayals may be due to a contract situation with a food manufacturer.

Media Literacy Strategies

With the expected future growth of cable television, VCR use and the integration of the television and the home computer, increases in television viewing may occur. “If there is any chance that our current unscrutenized enslavement to TV can affect [the health of viewers], now is the time to do something about it” (Wadsworth, 1993). Several calls for increased efforts to improve media literacy levels of the television viewing public have been made (Kotz & Story, 1994; Kubey, 1994; Taras & Gage, 1995; Tucker, 1990).

The need for television viewers to become responsible and informed consumers is clear. Improving the media literacy skills of viewers of all ages should reduce the impact of negative nutrition and body image messages broadcast by television. Emphasis on skill development will assist viewers with their critical appraisal of health related messages.

There is a need for development of updated media literacy tools for use with community nutrition programming and health curricula. Interdisciplinary efforts of nutrition, communications and education specialists would maximize the effectiveness of such educational tools. Media literacy skill development should be included in all new nutrition education and healthy weight programming. Of equal importance is the addition of media literacy components to existing programming. It is recommended that such components

(1) foster and develop awareness of the detrimental health effects of excessive television viewing, especially as they pertain to healthy eating, exercise and body image, and

(2) provide the opportunity to develop skills for critical viewing of television programming and advertisements in order to identify persuasive techniques which could adversely affect healthy eating, exercise and body image attitudes and behaviours.

When discussing the sociocultural determinants of nutritional well-being with their clients, nutrition professionals should emphasize the possible effects of television viewing on food choice behaviour and body image attitudes. Workshops on these topics, held with adult, adolescent and child viewers, will increase awareness of the link between television viewing and nutritional health status.

To advocate for healthier television viewing habits, communications, education and nutrition professionals may adopt several strategies. As possible approaches, professionals could:

- encourage viewers to set a limit on television viewing time and to substitute an alternative physical activity.
- encourage parents and caregivers to view programming with children and to discuss the concepts of advertising and entertainment programming.
- foster discussion and facilitate skill building for interpretation of imagery viewed on television in order to recognize underlying messages, not only of advertisements but of programming, as well.
- encourage discussion amongst viewers regarding foods and eating styles portrayed and those not portrayed on television.
- encourage discussion amongst viewers of the body image attitudes and stereotypes promoted through television broadcasts.
- identify local and national organizations to which viewers can direct concerns over televised message content.

Strategies such as these may improve media literacy levels of television viewers and increase awareness of the potential health hazards associated with heavy viewing. However, there is a need for the evaluation of these strategies and educational components to determine their effectiveness in increasing recognition of persuasive techniques and in changing health related attitudes and behaviours over time. As well, such components and strategies will need to be tested and adapted for use with various population groups. Again, these efforts would benefit from an interdisciplinary approach with input from both field level practitioners and researchers.

Summary

There is no question that television viewing is a powerful and pervasive lifestyle factor in present day society. The sheer magnitude of leisure time devoted to television viewing along with the multitude of health related messages portrayed by the medium, influence health attitudes and behaviours. It seems that the widespread use of this medium by all sectors of the population may contribute to maladaptive health habits and hence, affect chronic disease risk.

Several researchers have begun to work with television rather than against this form of popular culture. The need to consider the environment within which the television industry functions is beginning to be recognized. This shift away from research based on a single aspect of a complex communication process should lead to a greater understanding of the social and cultural contexts of television - a vision of the totality of television viewing.

Further research needs to look at the nutrition related messages portrayed in television programs and commercials and the effects these have on food behaviours and body image attitudes. At the same time, however, the nutrition community must continue to build working relationships with producers, directors and writers, to assist in the presentation of positive nutritional messages, both in eating scenes and scenes where food is merely a prop.

It is imperative that the environment of the television medium, as well as the messages it carries, be understood by viewers, researchers and the television industry itself. Also, communications, education and nutrition specialists should join forces to strengthen media literacy skills of television viewers. Without such efforts, as Tucker (1990) feared, the effects of television viewing could outweigh those of health promotion campaigns.

References

American Academy of Pediatrics Committee on Communications. (1990). Children, adolescents, and television. *Pediatrics, 85,* 119-l 120.

Black, J. & Bryant, J. (1992). *Introduction to mass communication* (3rd ed.). Dubuque, IA: Wm. C. Brown Publishers.

Blosser, B. J. & Roberts, D. F. (1985). Age differences in children's perceptions of message intent. Responses to TV news, commercials, educational spots and public service announcements. *Communication Research, 12,* 455-484.

Boyle, M. A. & Morris, D. *I-L* (1994). *Community nutrition in action: An entrepreneurial approach.* St. Paul, MN: West Publications.

Brown, J. (1977). Graduate students examine TV ads for food. *Journal of Nutrition Education, 9,* 120- 122.

Byrd-Bredbenner, C. (1994). What is television (TV) trying to make children swallow? A content analysis of nutrition-related incidents (NRI) in TV programs viewed heavily by children aged 2-l1 years. (abstract). *Journal of the American Dietetic Association, 94(9),* A- 10.

Casiro, 0. G., Stanwick, R. S., Pelech, A., Taylor, V. & Child Health Committee, Manitoba Medical Association. (1994). Public awareness of the risks of drinking alcohol during pregnancy: The effects of a television campaign. *Canadian Journal of Public Health, 85(*1), 23-27.

Clancy-Hepburn, K., Hickey, A. A. & Nevill, G. (1974). Children's behavior responses to TV food advertisements. *Journal of Nutrition Education, 6,* 93-96.

Comstock, G. (1993). The medium and society. The role of television in American life. In G.L. Berry & J.K. Asamen (Eds.), *Children and television. Images in a changing sociocultural world.* (pp. 117 - 131). Newbury Park: Sage Publications.

Comstock, G. & Paik, H. J. (1987). *Television and children: A review of recent research.* Syracuse, NY: Syracuse University.

Cotugna, N. (1988). TV ads on Saturday morning children's programming - What's new? *Journal of Nutrition Education, 20,* 125- 127.

Czajka-Narins, D. M. & Parham, E. S. (1990). Fear of fat: Attitudes toward obesity. The thinning of America., *Nutrition Today,* January/February, 26-32.

Dan, B. B. (1992). TV or not TV. Communicating health information to the public. *Journal of the American Medical Association, 268,* 1026- 1027.

Dietz, W. H, Bondini, L. G., Morelli, J. A., Peers, K. F. & Ching, P. (1994). Effect of sedentary activities on resting metabolic rate. *American Journal of Clinical Nutrition, 59, 556-559.*

Dietz, W. H., Jr. & Gortmaker, S. L. (1985). Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. *Pediatrics, 75, 807-S* 12.

Downs, A. C. & Harrison, S. K. (1985). Embarrassing age spots or just plain ugly? Physical attractiveness stereotyping as an instrument of sexism on American television commercials. *Sex Roles, 13,* 9-19.

DuRant, R. H., Baranowski, T., Johnson, M. & Thompson, W. 0. (1994). The relationship among television watching, physical activity, and body composition of young children. *Pediatrics, 94,449-455.*

Fitch, M., Huston, A. C. & Wright, J. C. (1993). From television forms to genre schemata. Children's perceptions of television reality. In G.L. Berry

J.K. Asamen (Eds.), *Children and television. Images in a changing sociocultural world* (pp. 38-52). Newbury Park, CA: Sage Publications.

Galst, J. P. & White, M. A. (1976). The unhealthy persuader: The reinforcing value of television and children's purchase-influencing attempts at the supermarket. *Child Development, 47,* 1089- 1096.

Gerbner, G., Gross, L., Morgan, M. & Signorielli, N. (1981). Health and medicine on television. *The New England Journal of Medicine, 30.5,* 901-904.

Gerbner, G. (1985). Children's television: A national disgrace. *Pediatric Annals, 14* (12): 822-823,826-827.

Goldberg, D. L. (1990). *Determining the effects of television, parents, and peers on the food choices of pregnant adolescents (Adolescent pregnancy diets).* [CD- ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9121716

Goldberg, M. E., Gorn, G. J. & Gibson, W. (1978). TV messages for snack and breakfast foods: Do they influence children's preferences? *Journal of Consumer Research, 5,73-81.*

Gorn, G. J. & Goldberg, M. E. (1982). Behavioral evidence of the effects of televised food messages on children. *Journal of Consumer Research, 9,* 200-205.

Gortmaker, S. L., Dietz, W. H., Jr. & Cheung, L. W. Y. (1989). Inactivity, diet, and the fattening of America. *Journal of the American Dietetic Association, 90,* 1247-1252, 1255.

Groves, D. (1988). Is childhood obesity related to TV addiction? (Part 2 of 2). *The Physician and Sportsmedicine, 16,* 117- 118, 120- 122.

Grube, J. W. & Wallack, L. (1994). Television beer advertising and drinking knowledge, beliefs, and intentions among school children. *American Journal of Public Health, 84 (2), 254-259.*

Gussow, J. (1972). Counternutritional messages of TV ads aimed at children. *Journal of Nutrition Education, 4, 48-52.*

Health and Welfare Canada. (1990). Action towards healthy eating . Canada's guidelines for healthy eating and recommended strategies for implementation. Report of the Communication/Implementation Committee. Ottawa, ON: Minister of Supply and Services Canada.

Health and Welfare Canada, Health Services and Promotion Branch. (1988). *Promoting healthy weights: A discussion paper.* Ottawa, ON: Minister of Supply and Services.

Huston, A. C., Donnerstein, E., Fairchild, H., Feshbach, N. D., Katz, P. A., Murray, J. P., Rubinstein, E. A., Wilcox, B. L. & Zuckerman, D. (1992). *Big screen, small world. The role of television in American society.* Lincoln NE: University of Nebraska Press.

Ikeda, J. & Naworski, P. (1992) . *Am I fat? Helping young children accept differences in body size.* Santa Cruz, CA: ETR Associates.

Ippolito, P. M. & Mathios, A. D. (1990). Information, advertising and health choices: A study of the cereal market. *RAND Journal of Economics,* 21(3), 459-480.

Kaltenbach, P. A. (1990). *Effects of diet advertising on women at-risk for the development of anorexia nervosa (Television commercials).* [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9104387

Kaufman, L. (1980). Prime-time nutrition. *Journal of Communications, 30 (3),* 37-46.

Klein, J. D., Brown, J. D., Childers, K. W., Oliveri, J., Porter, C. & Dykers, C. (1993). Adolescents' risky behavior and mass media use. *Pediatrics, 92,* 24-3 1.

Klesges, R. C., Shelton, M. L. & Klesges, L. M. (1993). Effects of television on metabolic rate: Potential implications for childhood obesity. *Pediatrics,* 91,281-286.

Kotz, K. & Story, M. (1994). Food advertisements during children's Saturday morning television programming: Are they consistent with dietary recommendations? *Journal of the American Dietetic Association, 94,* 1296-1300.

Krippendorf, K. (1980). *Content analysis. An introduction to its methodology.* Beverly Hills, CA: Sage Publications.

Kubey, R. (1994). Media implications for the quality of family life. In D. Zillman, J. Bryant & A. C. Huston *(Eds.), Media, children, and the family. Social scientific, psychodynamic, and clinicalperspectives.* (pp. 61-69). Hillsdale, NJ: Lawrence Erlbaum Associates

Lechky, 0. (1994). Epidemic of childhood obesity may cause major public health problems, doctor warns. *Canadian Medical Association Journal,* 150,78-81.

Levy, A. S. & Stokes, R. C. (1987). Effects of a health promotion advertising campaign on sales of ready-to-eat cereals. *Public Health Reports, 102,* 398-403.

Michaud, K. K. & Terry, R. D. (1993). Body image and dieting behaviors among school-aged children. *Topics in Clinical Nutrition, 8,45-50.*

Montgomery, K. C. (1990). Promoting health through entertainment television. In C. Atkins & L. Wallack, *(Eds.), Mass communication and public health. Complexities and conflicts.* (pp. 114-128). Newbury Park, CA: Sage Publications.

Murray, J. P. (1993). 1. The developing child in a multimedia society. In G. L. Berry & J. K. Asamen *(Eds.), Children and television. Images in a changing sociocultural world.* (pp. 9- 22). Newbury Park, CA: Sage Publications.

Myers, P. N., Jr. & Biocca, F. A. (1992). The elastic body image: The effects of television advertising and programming on body image distortions in young women. *Journal of Communications, 42 (3),* 1 OS- 133.

Nelson, E. & While, D. (1994). Humour and alcohol: Children's favourite television advertisements. *Health Education Quarterly, 51,64-67.*

Ostbye, T., Pomerleau, J., White, M., Coolich, M., & McWhinney, J. (1993). Food and nutrition in Canadian "prime time" television commercials. *Canadian Journal of Public Health, 84 (6), 370-374.*

Pilapil, V. R. (1990). A horrifying television commercial that led to constipation. *Pediatrics, 85, 592-593.*

Potter, W. J. & Ware, W. (1989). The frequency and context of prosocial acts on primetime TV. *Journalism Quarterly, 66,359- 366.*

Rice, C. (1993). Understanding and responding to the range of body image problems. In C. Rice (ed.) Promoting healthy body image – A report and resource list for program directors based on a workshop held in October 1993 for the Best Start demonstration sites. Toronto, ON: Ontario Prevention Clearinghouse.

Robertson, T. S. & Rossiter, J. R. (1974). Children and commercial persuasion: An attribution *theory* analysis. *Journal of Consumer Research, I,* 13-20.

Robinson, T. N., Hammer, L. D., Killen, J. D., Kraemer, H. C. Wilson, D. M., Hayward, C. & Taylor, C. B. (1993). Does television viewing increase obesity and reduce physical activity? Cross- sectional and longitudinal analyses among adolescent girls. *Pediatrics, 91,273-280.*

Rubinstein, E. A. (1983). Television and behavior. Research conclusions of the 1982 NIMH report and their policy implications. *American Psychologist, 38, 820-825.*

Signorielli, N. (1990). Television and health: Images and impact. In C. Atkin & L. Wallack (Eds.), *Mass communication andpublic health. Complexities and conflicts* (pp. 96 - 113). Newbury Park, CA: Sage Publications

Signorielli, N. (1993). Television, the portrayal of women, and children's attitudes. In G.L. Berry & J.K. Asamen (Eds.), *Children and television. Images in a changing sociocultural world* (pp. 229-242). Newbury Park, CA: Sage Publications.

Silverstein, B., Perdue, L., Peterson, B. & Kelly, E. (1986). The role of the mass media in promoting a thin standard of bodily attractiveness for women. Sex *Roles, 14, 5 19-532.*

Singer, D. (1983). A time to reexamine to role of television in our lives. *American Psychologist, 38, 8* 15-8 16.

Story, M. & Faulkner, P. (1990). The prime time diet: A content analysis of eating behavior and food messages in television program content and commercials. *American Journal of Public Health, 80,738-740.*

Sylvester, G. P., Achterberg, C. & Williams, J. (1995). Children's television and nutrition: Friends or foes? *Nutrition Today, 30,* 6- 15.

Sylvester, G. P., Achterberg, C. & Williams, J. (1993, July). *Food and nutrition messages in film.* Paper presented at the meeting of the Society for Nutrition Education, St. Paul, MN.

Tams, H. L. & Gage, M. (1995). Advertised foods on children's television. *Archives of Pediatric & Adolescent Medicine, 149, 649-652.*

Tams, H. L., Sallis, J. F., Patterson, T. L., Nader, P. R. & Nelson, J. A. (1989). Television's influence on children's diet and physical activity. *Journal' of Developmental and Behavioral Pediatrics, IO, 176- 180.*

Tarasuk, V. & Maclean, H. (1990). The food problems of low-income single mothers: An ethnographic study. *Canadian Home Economics Journal, 40 (2), 76-82.*

Tracking nutrition trends - Then and now - 1989-1994. (1994, Fall). *National Institute of Nutrition Rapport, 9 (4), 1, 4-5.*

Tucker, L. (1985). Television's role regarding alcohol use among teenagers. *Adolescence, 20,593-598.*

Tucker, L. A. (1986). The relationship of television viewing to physical fitness and obesity. *Adolescence, 21,797-806.*

Tucker, L. A. (1987). Television, teenagers and health. *Journal of Youth and Adolescence, I6,4* 15-425.

Tucker, L. A. (1990). Television viewing and physical fitness in adults. *Research Quarterly for Exercise and Sport, 61 (4), 3* 15-320.

Tucker, L. A. & Bagwell, M. (1991). Television viewing and obesity in adult females. *American Journal of Public Health, 81,908-911.*

Tucker, L. A. & Bagwell, M. (1992). Relationship between serum cholesterol levels and television viewing in 11,947 employed adults. *American Journal of Health Promotion, 6,437-442.*

Tucker, L. A. & Friedman, G. M. (1989). Television viewing and obesity in adult males. *American Journal of Public Health, 79, 5* 16-5 18.

Turner, R. (1994, July 27). Steroid abuse taking alarming twist. *The Swift Current Sun,* p. 20.

Wadsworth, L. A. (1992, February). *Food advertisements on Canadian children's television programming: The Couch Potato Kid's Diet.* Poster session presented at Child Health 2000 - First World Congress and Exposition on Child Health, Vancouver, BC.

Wadsworth, L. A. (1993). Couch potato kids. *Organization for Nutrition Education Bulletin, 13, 8.*

Watson, J. M. (1993). Male body image and health beliefs: A qualitative study and implications for health promotion practice. *Health Education Journal,* Way, W. (1983). Food-related behaviors on prime-time television. *Journal of Nutrition Education, 1.5,* 105- 109.

Weinberg, L. (1993). Television and obesity: The medium or the message? *The Journal of Gastronomy, 70* (l), 89-98.

Wong, N. D., Hei, T. K., Qaqundah, P. Y., Davidson, D. M., Bassin, S. L. & Gold, K. V. (1992). Television viewing and pediatric hypercholesterolemia. *Pediatrics, 90,*70-79.

Yesalis, C. E. (1992). Epidemiology and patterns of anabolic-androgenic steroid use. *Psychiatric Annals, 22(1),* 7- 18.

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NAVIGATING BACKWARD: CONCRETE VS. ABSTRACT REPRESENTATION IN HYPERTEXT BUTTONS

Elizabeth Boling
Kira S. King Dale Avers
Yu-Chen Hsu
Jiunde Lee
Ted Frick

Abstract: The users of instructional hypertext programs must rely on the mechanisms provided by designers for access to the functions of the programs, including functions typically called "navigation," or moving between the various displays and states offered by the program. Such access is often provided by means of "buttons," or selectable hot spots on the display, and the design of these buttons cari either help or hinder users' efforts to navigate the program. When navigation involves returning to a previously visited display or state, or navigating backward, users are particularly prone to misinterpret the meaning of navigation buttons.
Two preliminary studies are discussed, one showing that designers of 130 surveyed HyperCard (TM) stacks make less consistent choices for "specific" navigational functions than they do for "general" navigational functions, and the other demonstrating that subjects make fewer errors in choosing navigation buttons for "specific" navigational functions when the representation of the buttons is concrete (i.e.., a miniature image of the destination for the navigational move) than when the representation is abstract (i.e.., a form of arrow).

Résumé: Les utilisateurs de programmes hypertexte doivent se fier aux instructions données par ses dessinateurs pour accéder aux fonctions des programmes comme la fonction 'navigation', soit le déplacement entre différentes pages de présentation. Ce déplacement est souvent effectué par l'utilisation de boutons. Le modèle du bouton peut soit aider ou nuire aux efforts de l'utilisateur lors de la navigation. Lorsque la navigation implique le retour aux pages de présentation précédentes, les utilisateurs sont particulièrement portés à mal interpréter la signification des boutons.
Deux études sont présentées ici. La première démontre que les dessinateurs de 130 cartes HyperCard TM font des choix de façon moins constante lorsqu'ils effectuent des fonctions de navigation spécifique que lorsqu'ils effectuent des fonctions de navigation génerale. La seconde étude démontre que les sujets font moins d'erreurs de choix de boutons de navigation lors de fonction spécifique de navigation lorsque le bouton est représente de façon concrete (image miniature qui illustre la destination) que lorsque le bouton est représente de façon abstraite (une forme de flèche).

Hypermedia and Navigation

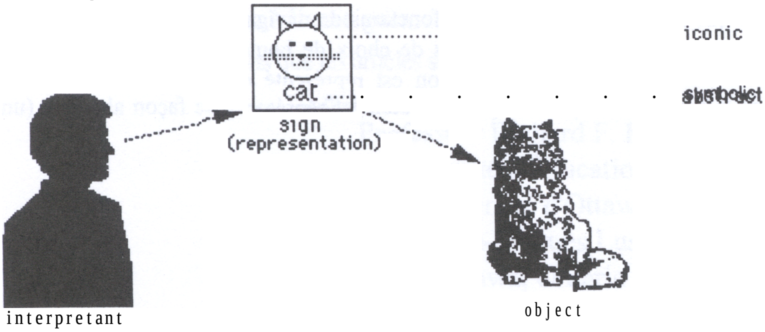
Even though people using hypermedia programs are usually sitting still in front of computer displays, they are said to be "moving through" the programs and sometimes "getting lost!' in them (Apple Computer, 1989; Edwards & Hardman, 1989). They are observed to use strategies similar to those people use in physical wayfinding, including using "landmarks", or easily recognizable screen displays, in order to orient themselves in relation to the rest of the available information (McKnight, Dillon & Richardson, 1993). Although legitimate questions have been raised concerning the sufficiency of physical wayfinding terminology to describe interactions between humans and hypertexts (Landow, 1990; Stanton & Baber, 1994), such terminology is nevertheless useful for designers who must provide the means by which users interact with hypermedia programs.

Designers of instructional hypermedia often focus on the teaching and learning aspects of such programs to the exclusion of considering the navigational task facing the learners who will use the programs (Fry & Soloway, 1987), but the visual elements that operate as intermediaries between the program and the learners comprise a sign system that must be understandable if the programs are to be usable (Mullet and Sano, 1995).

Representation and Hypermedia Sign Systems

A sign is a representation of a thing, tangible or intangible, called an *object.* The object of a sign is called its *referent,* since it is the thing to which the sign refers. .See figure 1. A sign only functions as a sign when someone, called the *interpretant,* recognizes that sign as a representation of the object (Noth, 1990). In a hypermedia program the *sign* may be an arrow on the screen, the *object* may be a concept ("moving forward through the displays in this program"), and the *interpretant* will be the user of the program.

Figure 1: Sign, object and interpretant relationship.



By definition signs are representations, and representations may take different forms, of which Bruner (1966) defines three: enactive, iconic and symbolic. Although Bruner discusses the representation of knowledge, not specifically of signs, his definitions of the three forms of representation will help clarify our discussion of the forms of signs.

Enactive Representation

Enactive representation is used when we must represent "things for which we have no imagery and no words" (Bruner, 1966, p. 10), like playing tennis or riding a bike. Enactive representation is most applicable to discussions regarding the interaction of hardware and hypertext (Kay, 1989), and to animated icons (Baecker, Small & Mander, 1991), both beyond the scope of this study.

Iconic Representation

Iconic representation "depends on visual or other sensory organization and upon the use of summarizing images" (Bruner, 1966, p. 10-11), or pictures. In the case of computer interfaces, we may describe pictures as any visual representation which is not a part of some existing symbol system used for writing.

At this point the terms used for describing representations of knowledge and the common terms used to describe elements of computer sign systems become confusing. Iconic representation is the form used for computer icons when the computer term "icon" is used correctly, but not every iconic representation (even in the computer interface) is an icon (Horton, 1994). The authors of this study do not presume to coin new terms either for computer interface elements or for iconic representations. Instead we will use the term "pictorial" to refer to iconic representations on hypertext navigation buttons.

Symbolic Representation

Symbolic representation is "representation in words or language" (Bruner-, 1966, p. 11). In the case of computer interfaces all elements drawn from existing symbol systems for writing are symbolic representations. Text labels on navigation buttons are the examples of such symbolic representations with which we are presently most concerned. Function and Form in Hypermedia Sign Systems

The function that a navigation button performs when it is selected is distinct from the form, or representation, of that button on the computer screen. Once a hypertext designer has made the decision that users of the program will be able to return to the screen display just previously viewed, he has decided on a *function,* or capability for action -- in this case, navigation -- to be offered to the user. That function may be represented in any number of ways, not all of them visual (e.g., a recorded voice might recite the options available and prompt users to press certain keys to select one as happens in the currently ubiquitous telephone menuing systems.) In the event that a function is represented visually, it may take one of the types of forms discussed above or a combination of those types (in the case of buttons containing both pictorial representations and text labels, or symbolic representations). It is clear that the form of a navigation button influences the ease with which users may perceive its function (Boling, Beriswill, Xaver, Hebb, Kaufman & Frick, 1996; King, Boling, Anneli, Bray, Cardenas & Frick, 1996), apart from whether or not the function was well-conceived.

Consistency in the Forms Designers Use for Navigation Buttons

In a prior study (King, et al., 1996) we discovered that people who had some experience using HyperCard (TM) stacks were not always able to perceive the functions of navigation buttons displaying "standard" pictorial representations (the ones available in the HyperCard authoring system). Subjects' performance was significantly better when the buttons displayed text labels, either alone or in conjunction with the pictorial representations. We speculated that part of the trouble might be that different designers choose different pictorial representations for the same functions. If users of instructional hypermedia programs often see different images on buttons that have similar functions, or see the same image on buttons that perform different functions, they might not develop any reliable background knowledge for guessing at the function of a button in an unfamiliar program, even if they have encountered the image on that button before. We conducted a survey to discover whether or not most designers of the instructional HyperCard stacks we reviewed were using pictorial representations consistently or inconsistently with other designers of similar products.

Methodology

Collecting and Classifying the Buttons

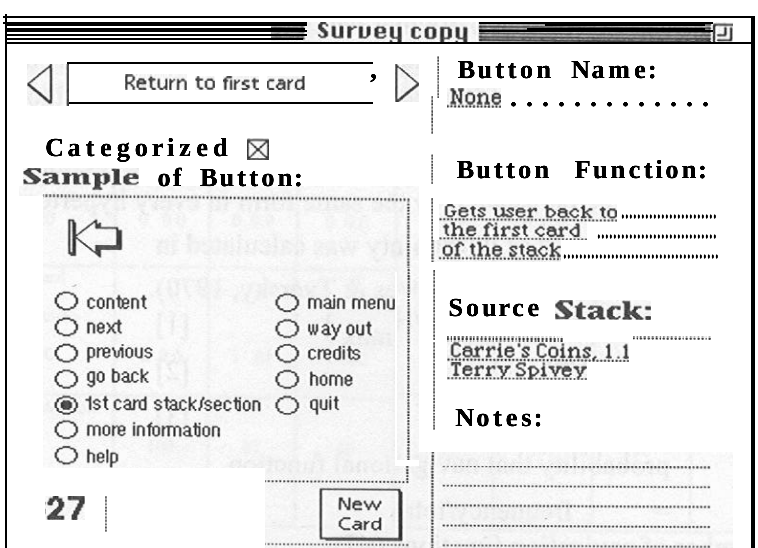
We collected 130 readily available HyperCard stacks from the School of Education computing environment at Indiana University. The majority of these stacks were ones classified as "educational" from a large collection of shareware widely disseminated across the Internet. Electronic mail messages alerting students to the presence of this shareware collection had been circulated through the network in the months before our prior study (King, et al., 1996), and since the subjects for that study were drawn from the School of Education we reasoned that some of the HyperCard stacks with which they had experience would have been these, or ones similar to these.

One sample of every button from each of the 130 stacks was collected into a single HyperCard stack which was created for this purpose. As each button was collected the researcher also entered into the data stack a description of the function that button represented in the stack from which it came was collected. Two researchers reviewed this collection individually, then reviewed and discussed the collection together to develop a definition list for the major functions represented by the buttons (as they had been described at the time of their collection).

A second stack was created in which all the collected icons appeared. The nine navigational functions were listed on every card.

To establish interrater reliability a third researcher, who had not participated either in gathering the icons or in developing the navigational function list, went through this second stack and classified each icon into a single function using a definition list. Following the third rater's classification, all three raters agreed that two functions, "home" and "quit," were identical. Those functions were collapsed into the single function "home," after which interrater reliability was .97. Of the discrepancies remaining those involving navigation were all related to confusion in the backward navigation functions and were resolved through clarification of the definition list,

Figure 2: Classification stack into which buttons were copied for Study I, showing a collected button, its original description, its origin and the reviewer's classification of the button.



Determining Consistency

From the original 1111 buttons collected we selected only those which had been classified as navigational. Of those, we selected the ones using pictorial representations in the form of arrows. We chose to focus on arrow forms since they fit Easterby's description of "figural goodness" (1970), they are used across cultures and time to represent directional motion (Dreyfuss, 1972), and they were selected for use by designers on nearly 40 percent of the buttons in our sample. This selection process left us with a total of 427 buttons in the final study.

These 427 buttons fell into seven functional categories: 1) "next," 2) "previous," 3) "home," 4) "main menu," 5) "way out," 6) "go back," and 7) "1st card of section." These same buttons fell into eight formal categories: (see Table 1) 1) right-facing arrow (A), 2) left-facing arrow (B), 3) upward-facing arrow (C), 4) downward-facing arrow (D), 5) right-facing arrow with vertical bar (E), 6) left-facing arrow with vertical bar (F), 7) curved left-facing arrow (G), and 8) doubled left-facing arrow (H). The formal categories are illustrated in Table 1. All variations of a certain formal type were categorized together; e.g., black arrows and white arrows and arrows shaded to look dimensional were all classified as type "A" providing they had a straight stem and the head faced to the right.

We determined the consistency with which designers chose pictorial representations for navigational functions by measuring the reduction in uncertainty for a user faced with a particular button displaying an arrow. Uncertainty regarding the function of a particular navigation button is maximum for the user of multiple hypertexts if different forms (or types of arrows) are used to represent the same function, like "go back," in every one of those hypertexts. Uncertainty is somewhat reduced when navigation buttons with the same function share the same form across hypertexts, and uncertainty is entirely reduced if the same function is represented by the same form in every hypertext. Formulas 1 - 5 show how reduction of uncertainty was calculated in Table 1, where H = uncertainty (Coombs, Dawes & Tversky, 1970).

$$H_{red} = 100\ [(H_{max} - H_{obs})/H_{max}] \quad [1]$$

$$H_{max} = -\log_2 (1/n) \quad [2]$$

$$H_{obs} = -\sum Pi\ (\log_2 Pi) \quad [3]$$

Pi = probability that navigational function i occurs = frequency/total [4]

n = number of navigation functions (=7)

Table 1: Summary of reduction in uncertainty for 8 arrow forms representing 7 navigational functions (n = 427).

FORM	A  n =	B  n =	C  n = 5	D  n = 2	E  n = 2	F  n = 11	G  n = 50	H  n = 3
	f P	f P	f P	f P	f P	f P	f P	f P
Function								
next n = 124	105 1.0	0 0,0	0 0.0	2 1.0	2 1.0	0 0.0	0 0.0	0 0.0
previous n = 97	0 0.0	91 .95	2 0.4	0 0.0	0 0.0	2 .19	0 0.0	0 0.0
home n = 96	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	2 .04	0 0.0
main menu n = 69	0 0.0	2 .02	2 0.4	0 0.0	0 0.0	3 .27	5 .30	0 0.0
way out n = 26	0 0.0	2 .02	0 0.0	0 0.0	0 0.0	0 0.0	7 .14	0 0.0
go back n = 20	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 .09	13 .26	3 1.0
1st card of section n = 40	0 0.0	1 .01	1 .02	0 0.0	0 0.0	5 .45	13 .26	0 0.0
% reduction in uncertainty	100	87	46	100	100	36	25	100

Results

Of the eight forms, we discovered that four displayed no uncertainty (or 100 percent reduction in uncertainty) within our sample. Of these, three forms

(D, E and H) were infrequent in the sample (less than 1 percent each). The remaining form, the right-facing arrow (A), accounted for almost one fourth of the total sample. Another form, the left-facing arrow (B), displayed an 87 percent reduction in uncertainty and was represented in the sample almost as frequently as was the right-facing arrow (A).

The remaining three forms (C, F and G) displayed low reduction in uncertainty, or a high probability that users encountering these forms would have seen them used to represent different functions before. Of these forms, the left-facing arrow with vertical bar(F) and the doubled left-facing arrow (G) are the same forms that accounted for 75 percent of the total error in our previous study (King, et al., 1996).

Discussion

We had expected to find that designers, especially designers of shareware and non-commercial stacks like those in our sample, would be inconsistent in their choices of forms to represent navigational functions. Instead we found them to be 100 percent consistent in some cases and very inconsistent (a low of 25 percent reduction in uncertainty) in others. We had also speculated that designers might be less consistent representing backward navigational functions, or functions involving a return to some location, than in representing other kinds of navigation (Nielsen, 1995). However, although all the forms displaying less than 15 percent reduction in uncertainty in this sample were forms representing backward navigation functions, the left-facing arrow (B) was a notable exception in that it was used almost as consistently as the right-facing arrow (A) in a similar number of instances.

To explain the difference between our expectations and our results, we speculated that some of the functions designers are trying to represent may be more difficult to match with forms than are other functions. Maccia (1987; 1988) distinguishes between "knowing that," or general knowledge, and "knowing that one," or specific knowledge. In the physical wayfinding analogy we have already discussed, "knowing that" would be equivalent to the knowledge that my destination is "someplace where I can buy food." In contrast, "knowing that one" would be. equivalent to the knowledge that my destination is "the little yellow grocery store on the comer." Since hypertexts are. defined by links between nodes, neither of which have true spatial equivalents in the physical world, and since users perceive themselves to be moving between those links McKnight, Dillon, &Richardson, 1993), a user in our analogy could very well end up in one location wanting to' return to "the little yellow grocery store" but be presented only with the choice to go to "some one of the places where you were last week."

Applying the concepts of specific and general knowledge to the design of forms, we may draw upon Wileman's (1993) "ways to represent an object." These range from concrete, in which the image attempts to mimic its referent as faithfully as possible, to abstract, in which the pictorial elements are simplified and reduced until they bear little resemblance to the referent and eventually become verbal symbols, or words. An abstract pictorial representation ***must*** be used for general knowledge, ***since*** "knowing that" has no visual or physical presence of its own from which to draw the concrete representation. Abstract pictorial representations may also be used for specific knowledge, but in the case of "knowing that one" the designer does have another choice -- concrete pictorial representation. The designer may represent the function, "return to the little yellow grocery store," as a concrete image of the little yellow grocery store.

Concrete versus Abstract Representations for Backward Navigation

It may be that the conscientious attempts many designers make to be consistent in creating the forms of navigation buttons for hypertext lead them to make inconsistent choices in the forms of buttons for specific navigation because it is difficult to match a specific function like "Go back to that menu that I saw just after I got into this section," with an abstract, or general, form like an arrow.

There is precedence both for questioning consistency in the interface (Grudin, 1989) and for using concrete pictorial representations as navigational aids in hypertext, called *miniatures* (Nielsen, 1990). In addition several principles of visual perception argue for the possibility that concrete pictorial representations will offer usability advantages for navigation. Humans are known to have impressive recall over extended periods of time for images they have seen previously (Paivio, 1971). We are likewise able to recognize objects even when they have undergone considerable transformation (Winn, 1993), although this facility is specifically described for transformation of viewing angle rather than for reduction in overall size of the image. Since the miniaturization of an image involves no angle transformation, recognition may be expected to be high until the resolution of the image deteriorates significantly. If recognition and recall of the destination screen is relatively easy, we might expect users to call on their "landmark" knowledge to select the appropriate concrete pictorial representation for backward navigation more effectively than they could interpret an abstract representation for the same navigation.

We decided to conduct a second, preliminary study to test the merits of pursuing our line of reasoning regarding concrete and abstract representations. This second study was designed to discover whether users of hypertext would make fewer errors in selecting navigation buttons when those buttons contained concrete representations, or miniatures, than when they contained abstract representations -- in this case arrows.

Methodology

Instrument

A paper instrument consisting of a series of screens from a hypertext program was created. Although the program did not actually exist, the researchers drew up a program structure diagram and created simulated screens to represent the main menu, two subsection menus, and content screens from the two subsections.

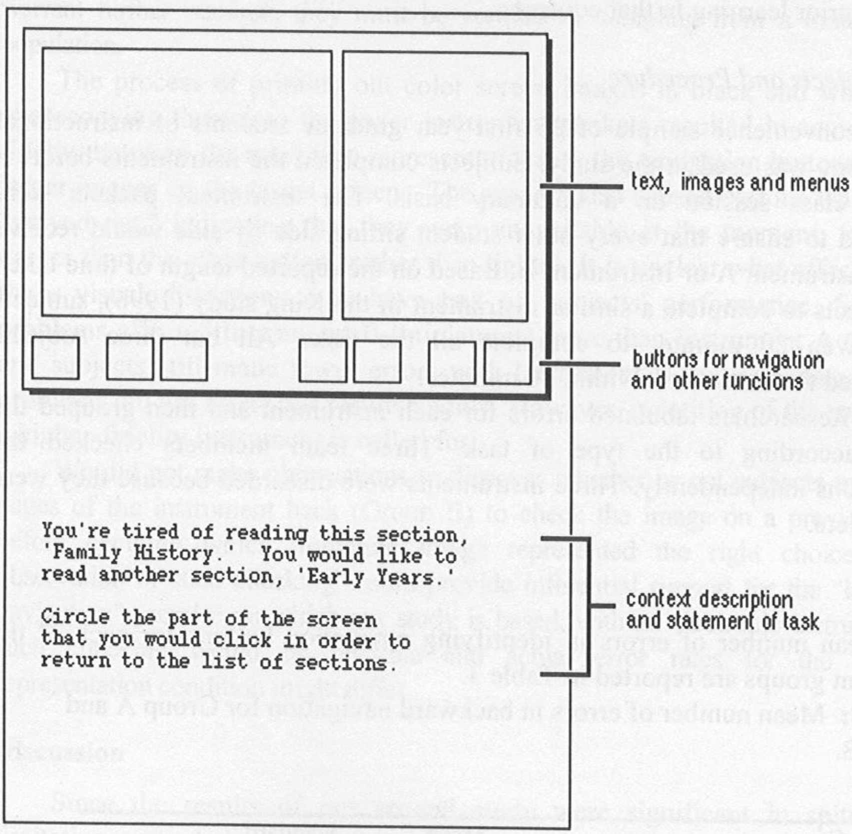
Navigation buttons representing the functions "quit," "more information," "help," "main menu," "go back," "previous," and "next" were included on each screen. Two versions of the instrument were prepared, Instrument A and Instrument B. In Instrument A every navigation button displayed abstract pictorial representations. In Instrument B concrete representations (miniature versions of the destination screens) were substituted for the "main menu" and "go back" arrows on those buttons. Since we hoped to observe the effect of concrete versus abstract pictorial representation without the demonstrated error reduction resulting from the inclusion of text labels (Boling, et al., 1996; King, et al., 1996), the navigation buttons in both Instruments A and B contained pictorial representations only (see Table 2).

Table 2: Summary of functions, functional definitions, and the concrete and abstract pictorial representations used on instruments A and B.

Form	Functional Definition	Concrete Representation (instrument A)	Abstract Representation (instrument B)
quit	leave the program	(same as instrument B)	
more information	view a display with more detail regarding the information the user is seeing now, including content-related help	(same as instrument B)	
help	view instructions for using the program itself (non-content-related help)	(same as instrument B)	
main menu	return from the current display to the primary menu display of the program		
go back	return from the current location to the primary menu display of the current section		
previous	return to the most recent display viewed	(same as instrument B)	
next	advance to the next designated display in the program sequence	(same as instrument B)	

One screen was depicted on each of 28 pages of the instrument with text below describing the user's context, a specific task to be completed, an the instruction to circle the part of the screen that would help perform that task. For example, "You're tired of reading this section, 'Family History.' You would like to read another section, 'Early Years.' Circle the part of the screen that you would click in order to return to the list of sections" (see Figure 3).

Figure 3: Diagram of the layout for each page of the instrument used in the concrete versus abstract buttons study.



Tasks requiring the use of all navigation buttons were included in the instrument, although we intended to measure only errors in backward navigation tasks (those requiring selection of the "main menu" or "go back" buttons). The additional tasks were included so that subjects would not begin to focus on backward navigation and so that they had a chance to see certain screens before they were asked to try and navigate back to those screens. Through an error in assembling the instrument packets, 3 out of the 16 backward navigation tasks appeared in the packets *before* the subjects saw the screens to which they were navigating. These tasks were not included in the final count of backward navigation data.

A paper instrument was selected over a "live," computer-based hypertext program in order to reduce the potential confounding effects of subjects getting lost when they made incorrect choices of navigation buttons (McNight, Dillon & Richardson, 1993), and to ensure that data could be collected on a sufficient number of controlled backward navigation instances. A simulated program was used to ensure that our subjects would be exposed to a program they had never seen, and would, therefore, be attempting to perceive the functions of buttons without prior learning in that context.

Subjects and Procedure

A convenience sample of 35 first-year graduate students of instructional technology was used in the study. Subjects completed the instruments before a regular class session on a voluntary basis. The instrument packets were presorted to ensure that every other student sitting side by side would receive either Instrument A or Instrument B. Based on the reported length of time taken by subjects to complete a similar instrument in the King study (1996), subjects were given 20 minutes to complete all the tasks. All but three subjects completed the instrument within 20 minutes.

Researchers tabulated errors for each instrument and then grouped the errors according to the type of task. Three team members checked the tabulations independently. Three instruments were discarded because they were incomplete.

Results

Mean number of errors in identifying navigation buttons for each of the treatment groups are reported in Table 3.

Table 3: Mean number of errors in backward navigation for Group A and Group B.

Group	Mean	Standard Deviation
Group A - abstract pictorial representations (arrows): n = 18	9.61	3.759
Group B - concrete pictorial representations (miniatures): n = 14	6.92	4.340

A one-tailed t test revealed a significant difference between Group A and Group B ($t = 1.838$, $p. < .05$), with the subjects who saw concrete representations (miniatures) making significantly fewer errors in identifying buttons for backward navigation than subjects who saw abstract representations (arrows).

Limitations of the Study

The sampling technique used in this study is sufficient only for a preliminary exploration of the issues. Although the results of the study are encouraging enough to warrant further research, they must be verified by sampling from a more general population.

The process of printing out color screen images in black and white, then photocopying them into the paper instrument packets resulted in some loss of fidelity between the miniature representations on the navigation buttons and the larger images on the target screens. The process also caused buttons which were "grayed out," indicating that they were unavailable at the moment, to appear darker than the other buttons rather than lighter. It is unclear what effect, if any, these visual distortions may have had on subjects' performance. Since the problems affected Instrument B (miniatures) more than Instrument A (arrows), and subjects still made fewer errors with Instrument B, we speculate that the problems did not affect our results unduly. However, repetition of the study with a higher-fidelity instrument is called for.

We did not make observations to discover whether or not subjects turned the pages of the instrument back (Group B) to check the image on a previous page before deciding which miniature image represented the right choice. While observation of such checking would provide inferential support for the "landmark navigation" premise on which our study is based, with an electronic instrument no such checking would be possible and actual error rates for the concrete representation condition might differ.

Discussion

Since the results of our second study were significant in spite of its limitations, we believe there is reason to investigate the use of concrete representation in hypertext navigation more closely. Such an investigation would include a larger and more precise version of this study, as well as studies focusing on the design issues and alternatives for such concrete representations.

Implication of the Use of Miniatures for the Design of Screen Displays

Given the current and continuing size and resolution limitations of computer displays, screen images used for representing navigation functions must be reduced to as little as 100th or less of their original size in order to be useful as buttons. The problems of creating miniature images that are simultaneously discriminable one from another and sufficiently like the original to be recognized easily are known to designers (Nielsen, 1995; Rubens, 1989), and faced the researchers in this study as well. The primary implication for designers of using miniatures for navigation is that the original screens, particularly "landmarks" screens, will have to be designed with respect to the properties they will exhibit in miniature as well as those they exhibit at full size.

For this study we reduced the entire screen display for use on a given button. An alternative strategy would be to choose a small portion of the original display, probably an easily recognized visual element, and reproduce it full-size on the navigation button. Providing such visual elements were not simply symbols (which would move them into the abstract, or general knowledge, category of representations), such elements might take advantage of users' "landmark" knowledge to facilitate navigation without the drawbacks associated with creating viable miniatures of full screens.

Interaction of Concrete Representation and Text Labels on Navigation Buttons

The use of text labels has been shown to improve users' performance in all navigation functions, including backward navigation (Boling, et al., 1996; King, et al., 1996). The combination of miniature screen representations and text labels might yield greater improvements than the use of either on alone, or the use of text labels with abstract pictorial representations.

References

Apple Computer, Inc. (1989). *HyperCard (TM) stack design guidelines.* Reading, M. A. Addison-Wesley. Baecker, R., Small, I., & Mander, R. (1991). Bringing icons to life. *ACM SIGCHI Conference Proceedings: Human Factors in Computing Systems, 1-6.*

Boling, E., Beriswill, J., Xaver, R., Hebb, C., Kaufman, D. & Frick, T. (1996). *Hypermedia navigation buttons: The case for text buttons and labels* Manuscript submitted for publication.

Bruner, J. (1966). *Toward a theory of instruction.* Cambridge, MA: Harvard University Press,.

Coombs, C., Dawes, R., & Tversky, A. (1970). *Mathematical Psychology.* Englewood Cliffs, NJ: Prentice-Hall.

Dreyfuss, H. (1972). Symbol sourcebook: *An authoritative guide to international graphic symbols* New York: Van Nostrand Reinhold.

Edwards, D. M. & Hardman, L. (1989). 'Lost in hyperspace': Cognitive mapping and navigation in a hypertext environment. In R. McAleese (Ed.), *Hypertext theory into practice* (pp. 105-125). Nor-wood, NJ: Ablex.

Fry, D. & Soloway, E. (1987). Interface design: A neglected issue in educational software. *ACM SIGCHI Conference Proceedings: Human Factors in Computing Systems, 93-97.*

Grudin, J. (1989). The case against user interface consistency. *Communications of the ACM,* 32(10), 1164-1174.

Holmes, *N.* (1985). *Designing pictorial symbols.* With R. DeNeve. New York: Watson-Guptill.

Horton, W. (1994). The icon book: Visual symbols for computer systems and documentation. New York: John Wiley & Sons.

Kay, A. (1989). User interface: A personal view. In B. Laurel (Ed.), *The art of human-computer interface design,* (pp. 191-207). Reading, MA: Addison-Wesley.

King, K. S., Boling, E., Anneli, J., Bray, L.M., Cardenas, D., & Frick, T. (1996) Relative Perceptibility of HyperCard buttons using pictorial symbols and text labels. *Journal of Educational Computing Research, 14* (1) 67-81.

Landow, G. P. (1990). Popular fallacies about hypertext. In D. H. Jonassen & H. Mandl (Eds.), Designing hypertext/hypermedia for learning. (pp. 39-59). Heidelberg, Germany: Springer-Verlag.

McKnight, C., Dillon, A., & Richardson, J. (1993). Space -- the final chapter: Or why physical representations are not semantic intentions. In C. McKnight, A. Dillon, & J. Richardson (Eds.). *Hypertext: A psychological perspective,* (pp. 169- 171). New York: Ellis Horwood.

Maccia, G. (1987) Genetic epistomology of natural systems, *Systems Research,* 4 (3), pp. 213-218.

Maccia, G. (1988). Genetic epistomology of intelligent systems: Propositional, procedural and performantive intelligence. Paper presented at the Fourth International Conference on Systems Research, Cybernetics and Informatics, Baden-Baden, West Germany, August.

Mullet, K. & Sano, D. (1995). *Designing visual interfaces: Communication oriented techniques.* Mountain View, CA: SunSoft Press.

Nielsen, J. (1990). Miniatures versus icons as a visual cache for videotex browsing. *Behaviour and Information Technology, 9 (6), 44* l-49.

Nielsen, J. (1995). Multimedia and hypertext: The Internet and beyond. Boston, MA: AP Professional.

Noth, W. (1990). *Handbook of semiotics.* Bloomington, IN: Indiana University Press.

Paivio, A. (197 1). *Imagery and the verbal process.* New York: Holt, Rinehart & Winston.

Rubens, P. (1989). Online information, hypermedia and the idea of literacy. In E. Barrett (Ed.), *The society of text,* (pp. 3-21). Cambridge, MA: The MIT Press.

Stanton, N. A. & Baber, C. (1994). The myth of navigating in hypertext: How a 'bandwagon' has lost its course. *Journal of Educational Multimedia and Hypermedia, 3 (3/4), 235-249.*

Wileman, R. E. (1993). *Visual communicating.* Englewood Cliffs, NJ: Educational Technology Publications.

Winn, W. (1993). Perception principles. In M. Fleming & W. H. Levie (Eds.), *Instructional message design: Principles from the behavioral and cognitive sciences*, (pp. 55- 126). Englewood Cliffs, NJ: Educational Technology Publications.

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