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ABSTRACT

A great deal of knowledge acquired through scientific research does not get through to the people who are in a position to use them. When it does, it is often tardy. In the past, the consequences of this have been sometimes scandalous, sometimes tragic. Science grows at a prodigious rate, and the situation today is dismal, the outlook for tomorrow too awful to contemplate unless the problem is confronted. Knowledge is communicated through a message. A message may do one or all of three things: inform, motivate, facilitate. The dissemination of a message is intertwined with the character of channels, knowledge producers, middlemen, audiences and systems. There are ten stages between a message and its ultimate effectiveness, and they are: awareness, attention, exposure, comprehension, retention, motivation, pre-trial evaluation, trial, post-trial evaluation, and complete adoption. Thought that takes these considerations into account must be invested in messages if knowledge is to get quickly to the people who can utilize them. (GO)

PERSPECTIVES ON THE UTILIZATION OF KNOWLEDGE[1]

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"We are now living," says Derek Price (1961), "in a high scientific technology, in which the material repercussions of science shape our daily lives and the destinies of nations." Alvin Weinberg (1967) thinks that the public standing of science in the post-war era is "possibly analogous to that of religion in the era before the separation of church and state." Weinberg continues, "As science has become big, it has acquired imperatives ... to expand and to demand an increasing share of public resources." Indeed, Big Science, that curious child of 19th century Utopianism and wartime necessity, has increased its claim on national wealth and manpower more spectacularly than any comparable

1. Invited Address, Division E, American Educational Research Association, Los Angeles, February 6, 1969.

activity in this century. For example, Table 1 shows the trend in federal spending for research and development, as well as the trend in manpower active in "knowledge-producing occupations."

Table 1. Federal spending for research and development, and percentage of the workforce in "knowledge-producing occupations," by decades.

Year	Federal spending (millions of dollars)[a]	"Knowledge-producing" percentage of workforce[b]
1900	--	10.7
1910	--	14.6
1920	80	18.3
1930	130	21.6
1940	377	23.4
1950	2,870	28.3
1960	13,700	31.6 (1959)
1968	25,000	--

[a]Source: 1920-1950, Machlup (1962); 1960 & 1968, NSF (1967).

[b]Source: Machlup (1962).

The raw dollar value of federal spending for research and development is about 325 times greater today than it was 50 years ago. Its share of the Gross National Product has increased more than 30 times. In short -- to return to Derek Price -- "science has been growing so rapidly that all else, by comparison, has been almost stationary." Whereas "all other things in population, economics, nonscientific culture, are growing so as to double in roughly every human generation of say 30 to 50 years, science in America is growing so as to double in only 10 years -- it multiplies by eight in each successive doubling of all nonscientific things in our civilization." Price extrapolates the growth curve whimsically to predict that soon our entire workforce will be serving Big Science.

There are other indices of the growth and present extent of knowledge production in our society. I won't take your time to quote them. All indices show the same picture -- past, present, and future. Furthermore, since the real explosion in scientific effort has taken place in less than three decades, we don't need statistics to tell us what we have observed for ourselves. To borrow just a phrase from Harold Lasswell (1965), we have become a "data-rich civilization."

Yet much of the knowledge we have produced is stranded on the shipping docks, waiting for transportation and a customer. The prophecy of Vannevar Bush in 1945 has come true: the post-war crisis has not been one of supporting science, nor of organizing scientists to meet any challenge, but of communicating the "growing mountain of research."

As Bush foresaw the problem: "Mendel's concept of the laws of genetics was lost to the world for a generation because his publication did not reach the few who were capable of grasping it and extending it; and this sort of catastrophe is undoubtedly being repeated all about us, as truly significant attainments become lost in the mass of the inconsequential. ... The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships."

We may or may not be disturbed by the disappearance of Mendelism for a generation in the 19th century. After all, what was the hurry? Even if we are aware of the impact of Mendel's laws on agriculture and animal husbandry, we may argue that people ate as well then as now, or perhaps better.

Many, many other times, however, knowledge has arrived late, with costly consequences, or has had to be rediscovered. No matter what resources we value most -- money, time, talent, the public welfare -- there have been examples of unutilized knowledge that must seem regrettable to us, and possibly scandalous and tragic as well.

There was, if you will, the Cranberry Fiasco of 1959 (reported in SCI, 1968). In 1957 and 1958 cranberry growers began to use in their bogs a herbicide, aminotriazole, originally used as a weed-killer along highways. When it was found that aminotriazole left a residue in the berry, chemical manufacturers petitioned the Food and Drug Administration for a 1.0 ppm tolerance. By May of 1959 the FDA, evaluating test data, concluded that aminotriazole was a carcinogen. At that point the chemical manufacturers withdrew their petitions.

However, "some of the cranberry growers continued to use aminotriazole into the 1959 season, presumably with the expectation that a tolerance would be granted." No evidence was found "that the growers were aware of the significance of the tests being conducted."

In November, just before the weeks of greatest cranberry sales, HEW Secretary Arthur Flemming called a television news conference to announce that the FDA had found some cranberries in the current crop contaminated with a cancer-causing weed-killer, aminotriazole. The FDA quickly set up a certification system, so that cranberries could be inspected and, if free of aminotriazole residue, released to the market. Nonetheless, to quote a report of this incident (SCI, 1968), public fear of cranberries was such that "the cranberry industry was unable to sell its 1959 crop, the price of cranberries dropped, and the industry floundered." Ultimately the federal government had to pay indemnities to cranberry farmers. Thus, because knowledge that was available in May was not announced until November, the tax-paying consumer lost twice: no cranberries in the holiday season, and less money in the federal treasury.

One more example will have to suffice. It could be the case of the hospital pathologist in Bethesda, Maryland, who found, after much searching and six months delay, that the abnormally high incidence of cyanosis in premature babies was attributable to methemoglobinemia, which in turn was caused by nitrates in the laundry detergent used to wash diapers and that, incredibly, the soap manufacturer had failed to disclose to its customers that it had already "received complaints from other hospitals concerning induced methemoglobinemia that they suspected was attributable to the soap," (SCI, 1968). It could be many other cases.

Let me choose one recent case that I like particularly, perhaps because tens of millions of dollars have a nice ring. This is the technology of "float glass," developed at the Pilkington Glass Works, Ltd., in England. Float glass is a fine glass (that is, suitable for display windows) that is produced much less expensively than conventional plate glass because, unlike plate, no grinding and polishing is required, hence no glass is wasted and no grinding wheels are used up. Instead, molten float glass is extruded between rollers onto a long trough of molten tin. As the glass floats toward the cooler end of the trough, where it will slide off hard and finished, it is burnished on its top surface with hot gases.

The float process was conceived by Alistair Pilkington, apparently one night when he was helping his wife with the dishes. When the Pilkingtons tried to patent their "revolutionary" idea, however, they found that float glass had been discovered and patented twice before. The English inventor of the blast furnace, Henry Bessemer, received a float glass patent in 1848, and two Americans, William Heal and Halbert Hitchcock, received another float glass patent later in the 19th century. In fact, because of these prior patents, just one clause in the Pilkington patent application had to be revised 53 times.

The patent, once issued, was a gold mine for the Pilkingtons. The firm decided to license the process rather than invite glass-making giants like Pittsburgh Plate Glass to begin competitive research to reduce the cost of plate. Pilkington has received $26 million in royalties since 1962, and they themselves operate the world's largest float glass production line. (From Wierzynski, 1968)

In the century since Henry Bessemer first thought of float glass, how many billions of dollars were wasted in the production of conventional plate glass? How might the architecture of the late 19th and early 20th centuries have been different, given a much cheaper plate glass for construction? Perhpas no one has answers for questions like these, but will someone in the future know the costs of our failure to utilize our available knowledge? In every field of knowledge, including (or especially) education, our successors will wonder at our slowness in bringing knowledge to bear upon our many problems. Were we unmotivated, they might ask, or just ignorant of the value of knowledge we already possessed?

We can answer the last question for them. The answer is that we were sometimes unmotivated and sometimes ignorant. But, more important than both these explanations, we were stopped by barriers in information systems and in social systems. We were stopped by an attitude that, while knowledge production needs to be force-fed, knowledge utilization will somehow take care of itself.

Messages, Channels, Producers, Middlemen, Audiences, Systems

In recent years many behavioral researchers, plus a handful of historians, economists, and others, have focused on knowledge utilization as an important and researchable problem. Several research "traditions" have grown under the rubrics of research on the diffusion of innovations, research on the flow of scientific information, research on technological change in industry, research on the continuing education of professionals, the history of science, and the sociology and psychology of science. Now, with the founding of the Center for Research on the Utilization of Scientific Knowledge (CRUSK), at the University of Michigan, and with such

CRUSK products as Ronald Havelock's Bibliography on Knowledge Utilization and Dissemination (1968), I feel there exists a field of "knowledge utilization research" that draws upon many source fields but has distinctive ways of treating concepts from those fields.

In the remainder of my time this afternoon, I want to review some perspectives that help *me* to make sense of what happens, and fails to happen, in knowledge utilization.

Messages. The message is to knowledge utilization research what currency is to economics. A message is the knowledge producer's output. It occupies a channel. It receives the attention of middlemen. It is the audience's input. It is facilitated and impeded by a number of social, political, and economic systems in which producer, middleman, and audience are caught up together.

There are many ways of characterizing differences in messages. In science, message content may concern theory, method, data, opinion, etc. The function of a message (as seen from a neutral vantage point, apart from the particular purposes of producers and audiences) may be to inform, to motivate, or to facilitate. The permanence of a message concerns the records, if any, that will give it time duration, from unrecorded speech through blackboard notes and dittoed papers to publication in an encyclopedia of record, like the Britannica. The message may lie at any point along a continuum of comprehensiveness, from mere bibliographic citation through annotation and abstract to a long full text. The message may possess more or less surprise value, or novelty, relative to other messages that are generically similar.

This last characteristic distinguishes information from all message content, of which information is a subset. Turning back to the mathematical theory of communication (Shannon and Weaver, 1949), we can restrict the label "information" to those messages that tell the receiver something he didn't know before. That is, there is no information value in repeating the previously known, the perfectly predictable. Yet messages can be filled with such non-information. Knowledge, in turn, is a subset of information. The little fillers at the bottom of each newspaper page are very informative; they tell us facts we didn't know before, such as the weight of the biggest elephant in captivity. However, we do not bother to take over this information, to appropriate it. Only the information we do choose to appropriate becomes knowledge. Such information is then not only remembered, as is much trivia also, but is richly interconnected with previously gained knowledge in a cognitive array. We glimpse paths or vectors through this array when we free-associate from one fact to another fact, from one image to another, from one experience to another, etc.

I'd like to return to the functions that messages serve. There are important differences, for the utilization of knowledge, between messages intended to inform, to motivate, and to facilitate. A message intended to inform must provide details about the origin, or development, or composition, or distribution, or action of a phenomenon, or about relationships among phenomena. Translated to the terms of applied science, a message intended to inform must tell the receiver how something came about, what it is like, how it works, or how it meshes with other things. A message intended to motivate must turn the receiver's attention to rewards, or the avoidance of undesired alternatives, in conjunction with an advocated belief or behavior. It is not necessary in such a message to inform; sometimes the advocated belief or behavior is so simple that little information was ever necessary (e.g., when riding in a car, always wear a seat belt). A message intended to facilitate assumes that informing and motivating have taken place, and that the receiver now needs specific guidance in moving toward the advocated belief or behavior.

As an example of all three functions served by one long message, we might imagine a principal's or superintendent's guide to computer-assisted instruction, with major sections as follows:

What is Computer-Assisted Instruction?

-- What is meant by the "hardware"?

-- What is meant by the "software"?

-- How does a system work in practice?

-- Has the teaching efficacy of CAI been shown?

-- What kinds of installations are now found?

-- How costly are they?

-- What future developments are expected?

-- How do school boards usually react to CAI?

-- How do teachers react to CAI?

-- How do children react to CAI?

Why Should You Consider Trying CAI?

-- Prestige of school or district

-- Personal credit

-- Student morale

-- Teacher morale

-- Eventual cost savings

What Do You Do to Get Started?

-- List of consultants

-- List of funding agencies with detailed instructions on proposal writing

-- Suggested strategies for "breaking in" teachers, school board members, etc.

-- Accessible sources for further information on CAI

In an extensively documented field like educational research, messages will be found serving one, two, or all three functions, but very few messages are designed with forethought to find the receiver with given levels of information, motivation, and facilitation support, then to move him to desired new levels on all three dimensions of message effect. Until such thought is invested in messages, knowledge utilization will continue to be "the process that somehow takes place after knowledge is produced."

Channels. It is only recently that we have begun to distinguish between "horizontal" and "vertical" flow of scientific information and specialized knowledge in general. We have long recognized that some information derives from "basic" research and some from "applied" research, but that is another dimension of difference. Basic research knowledge can be transferred both horizontally and vertically, and the same is true of applied research knowledge.

By horizontal knowledge transfer I mean utilization of knowledge at the same level of expertise at which it was produced. If an expert in educational testing adopts a procedure developed by an equally expert colleague, that is horizontal knowledge transfer. If the procedure is adopted by an educational researcher who is not expert in that area, then the transfer is still mainly horizontal but also somewhat vertical -- that is, there is utilization at another, usually lower, level of expertise.

Perhaps in only one other field -- public health -- is the distinction between horizontal and vertical knowledge transfer as significant as it is in education. Public health and education are unique in their deep, stratified audiences for information. Beginning with the small group of equally expert researchers, we move down one step to researchers expert in other, adjunct specialties and to graduate students working to develop expertise in the field. Then there are non-researching professors and consultants. Below them we find practitioners of various kinds. Then public decision-making bodies. Finally, the general public, very remote from the new knowledge that will affect it in many ways.

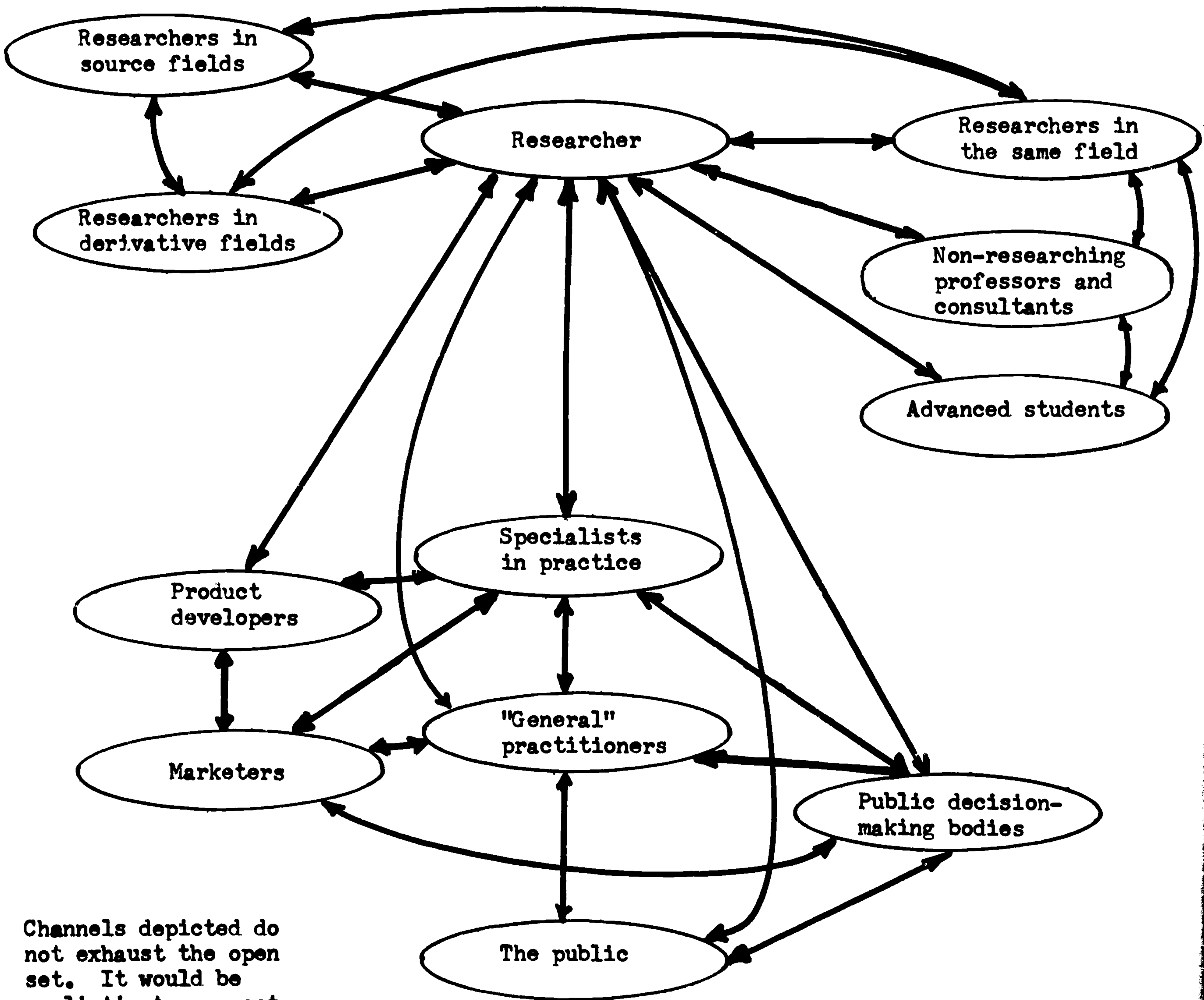
Down a different path comes information of interest to product developers. Proof that they have utilized the knowledge is the product they have to sell. Their agents, the marketers, seek to motivate groups of practitioners and to facilitate adoption of the product by them. In many cases, because of a close correspondence between knowledge elements and product attributes (e.g., as in a workbook based literally on the Bloom Taxonomy), adoption of the product implies acceptance of the knowledge that led to its development.

Figure 1 illustrates the horizontal and vertical channels of a deep, stratified field like education or public health. Such channels as are shown only suggest the full interconnection of the network, in which no group can be regarded as cut off from any other group, although the frequency with which some channels might be used for knowledge utilization is very low.

It is important to add that knowledge can originate anywhere on the vertical ladder and can be utilized at that level or at any other level. For example, a teacher's experiences and insights are also knowledge in the system and may travel up the ladder as well as down. Without this observation, we might be tempted to think of knowledge as emanating ex deus, and filtering down channels to ordinary people who, if they are perceptive enough, will make use of it.

Almost every channel, in addition to its role as a connector of groups, has a structure and life of its own. Unlike simple links in a network, most channels that carry knowledge have a richer definition than "the connection that exists between nodes A and B." In the present information system of science, it is worth noting that channels are either oral or written (which refers, of course, to the messages they convey) and either personal or impersonal. Although personal channels are more likely to be oral, and impersonal channels written, the other combinations occur. That is, dialogue usually is a personal oral channel, just as most convention presentations require a more impersonal use of the oral channel. Correspondence is a personal written channel, while journal articles and books and most other channels encompassed by libraries and information centers are written and impersonal. The four kinds of channels, which can be sub-divided many ways if "packaging" differences are considered, are each best used either for one-to-one or one-to-many

Figure 1. The horizontal and vertical flow of knowledge.



Channels depicted do not exhaust the open set. It would be realistic to connect almost every group with every other group.

communication.

Channels also serve certain message functions better than others. One-to-one channels, like the personal oral channel, are better adapted to the motivation and facilitation functions than to the information function. Motivation and facilitation, handled well, require adjustment of message content to audience, with allowances for local potentials, limitations, and prejudices, whereas the information function is relatively neutral, in the sense that few allowances need to be made for audience sensitivities. Therefore information can be packaged in all-purpose messages and disseminated through impersonal, written, one-to-many channels. This contrast is not symmetrical: information could be conveyed well by personal channels, except for the waste of time and effort, but motivation and facilitation lose their edge when packaged in all-purpose messages and disseminated through impersonal channels.

These differences among channels help to explain why the information content of innovations often reaches the potential adopter early and adequately through impersonal written channels, but adoption is delayed until personal oral channels close to each person have rounded out the message with motivation and facilitation content.

Knowledge producers, middlemen, audiences, and systems. It is fair to say that rural sociologists, diffusion researchers, communication researchers, and others studying knowledge utilization once regarded producers, middlemen, and audiences as three separate and relatively non-interpenetrating groups. Certainly they were expected to interact, but they were not conceptualized as a single system for analysis. In Everett Rogers' excellent summary of diffusion research (1962), we see audiences receiving about two-thirds of the attention and one kind of middleman, the "change agent," receiving about a fourth, with very little attention left over for knowledge producers. At the other extreme, there is a literature on knowledge production and documentation that almost completely ignores users. In fact, this literature reflects a bookshelf attitude toward the organization of knowledge resources, in which the middlemen -- in this case librarians -- seek to have little personal contact either with knowledge producers or knowledge users.

Drawing more upon the diffusion-of-innovations tradition than upon the library science tradition, knowledge utilization researchers like Ronald Havelock now explore models in which multiple kinds of knowledge producers interface with multiple kinds of middlemen (or as Havelock calls them (1968b), "knowledge linkers") who serve multiple kinds of audiences. Such expanded models are of great value to us. Beyond the research they stimulate, they remind us, first, that the production and utilization of knowledge is an intensely personal activity, rich with person-to-person links from the "purest" researcher to the least informed audience member. Second, these models remind us of a healthy pluralism in the system -- multiple ways in which knowledge can be produced, disseminated, and utilized. Pluralism challenges the dogma that there is only one right way to perform each of these activities.

Ten systems surrounding the knowledge producer, middleman, and user. Although it is expedient for us to differentiate roles and to speak of producers, middlemen, and users or audiences, we should remember the large extent to which one person, in certain positions, alternates among the three roles. In the first place, all knowledge producers are the most eager customers for their own product. The researcher "discovers" something or simply manages a better organization, for his purpose, of knowledge largely in existence before he came along. In either case he combines existing knowledge with fresh inputs of his own, in proportions that vary according to the balance of discovery to drudgery, and the result is his own, unique knowledge product. If he did not become a user of existing knowledge at one phase in his research, it is most unlikely that there would ever be a product.

Furthermore, researchers are excellent middlemen, and some of them develop information brokerage into a second specialty. One enormous value of "invisible college" membership, as described by Derek Price in Little Science, Big Science (1963), is that one's colleagues in this far-flung network serve as information middlemen for the good of the college. In a research environment in which invisible colleges are not really possible -- the industrial R&D laboratory -- Thomas Allen (1966) found that certain researchers in each lab became middlemen (in the tradition of mass communication research we would call them "gatekeepers") and monitored external information sources to a greater extent than their co-workers, so that they could relay into the laboratory useful knowledge from outside.

Only in a few "frozen" positions is a middleman only and always a middleman, and a knowledge user only and always a user. In all other cases, we create a fiction if we think that people stay in these roles and thus have a fixed place, and possibly status, in the system.

Whether each person involved in the production, dissemination, and utilization of knowledge has alternate roles or is frozen in his position, it is useful to realize that his performance -- shall we say as a "knowledge handler" -- is affected by constraints that are felt by others in the system as well. That is, there are forces apart from the system of knowledge production, dissemination, and utilization that profoundly affect what happens in that system. These forces originate in other impinging systems.

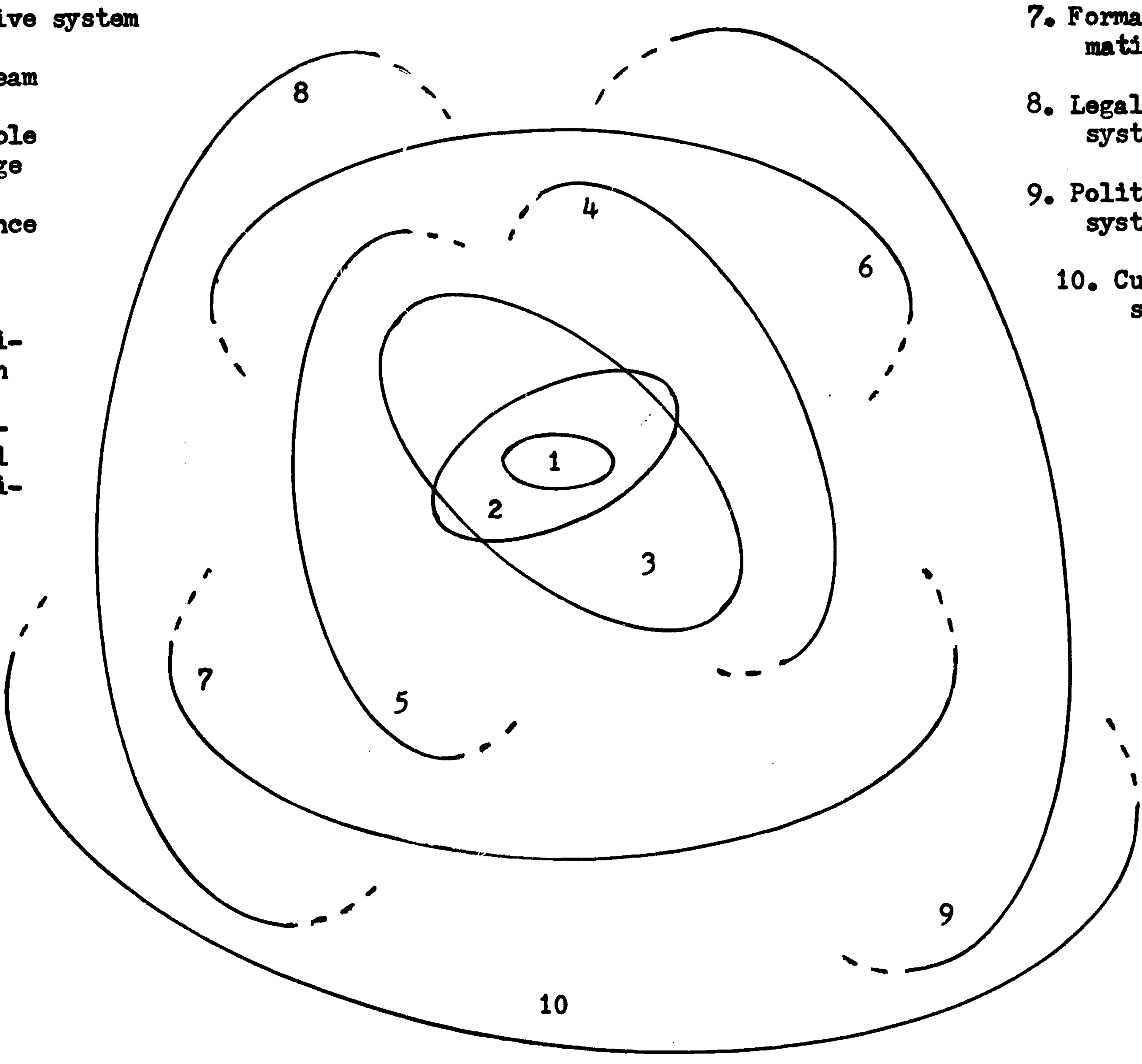
The multiple effects of other systems on the knowledge system are easily exemplified by going back to 15th century Italy. Much science was bankrolled by princes and dukes who sought more effective war machines. Simultaneously the church was suppressing other research, as best it could. Since the two impinging systems were not perfectly countervalent -- that is, they did not deadlock, trapping the knowledge system in between -- their joint effect on knowledge production could be read as the consequent vector in a parallelogram of forces.

Let me paraphrase something I have recently written on this topic (Paisley, 1968) in order to mention ten systems that impinge on the knowledge system and collectively affect its equilibrium and, if you will, its "vector of development." Let me also limit my remarks to knowledge production, although you will see that forces impeding or facilitating research must have effects on dissemination and on utilization, although not necessarily in the same direction (as when basic research funds are cut back to emphasize utilization of existing knowledge, in a retrenchment).

Figure 2 invites you to visualize the ten systems as a set of ellipses more or less encircling the researcher. The largest ellipse represents the culture itself. However little control we have over it,

Figure 2. Ten systems impinging on the knowledge system.

1. Cognitive system
2. Work team
3. Invisible college
4. Reference group
5. Formal organization
6. Professional association
7. Formal information system
8. Legal/economic system
9. Political system
10. Cultural system



we should not underestimate the cultural system, both as a tradition and as an ambient spirit. The effect of the cultural system is so pervasive as to be overlooked. It is the cultural system that awards Nobel Prizes, emphasizes priority of discovery, establishes great private foundations, and supports universities.

Somewhat more transitory than the cultural system is the political system. Three contemporary political factors powerfully affect the American researcher. One is a scientific nationalism in many fields that causes him largely to ignore foreign research. A second is the present strength of scientific federalism; the money begins in Washington. A third is the role of the Department of Defense. With the possibility of DOD support for projects they would like to do, researchers are drawn to available funds, frustrated by security restrictions on the flow of information, and distressed by moral issues.

Both within and beyond political systems and the culture, but a smaller system in the number of people affected, is the membership group. When the researcher answers "What do you do?" by saying "I'm a psychologist", he is locating himself within a professional membership system. Other systems may command greater loyalty, but the membership system probably controls the "official" information channels of his field. The membership system may govern the researcher's appearance on its convention programs, may appoint him to the editorial board of its journals, etc.

Then we have the reference group, which includes other researchers with similar specialization, similar training, quality of work, and other characteristics. Whereas the researcher might not attempt to save every paper or reprint received from others in his membership group, he might maintain a file for his reference group. Reference-group identification for our researcher above might be "social psychologist studying human information-processing behavior." A reference group need not be contained within a membership group. A reference group may control a journal or two, but it rarely controls an entire information system.

A subsystem of the reference-group system is the invisible college. This curious system brings together elite researchers at the forward edge of each field and provides them with social support, information, and the exchange of privilege vis-a-vis the political system. I suspect there are also non-elite invisible colleges, and invisible colleges conducting no research.

Let me continue to the formal organization. This system emphasizes roles, lines of responsibility, and products, rather than people themselves. Both in the facilities it provides and in the policies it sets, the researcher's formal organization (that is, his employing organization) opens or blocks channels of information to him.

A subsystem of the formal-organization system is the work team. This is a most important information system. It is tuned to the researcher's problems. It documents the history of its projects in an informal and idiomatic way. Knowing what he does not need to be told, the researcher's work team provides him with rich, nonredundant information through conversation.

In this regress of systems, we come finally to the researcher's own head. This is the system of motivation, of intelligence and creativity, of cognitive structure, of perceived relevance of information inputs and uses of information outputs. Ultimately, all other systems support this one. If nothing happens in this system, then nothing happens.

Two other, rather depersonalized systems cut across these eight. That is, we must also consider the legal/economic system. This is a system of copyrights, patents, corporate secrecy, competitive research and development, etc. -- all profoundly affecting the flow of information. In addition, the economic system determines the quality and quantity of information that other systems, such as the membership group and the formal organization, can afford to buy.

The obvious omission thus far has been the formal information system -- libraries, technical information centers, etc. In most fields of science, the formal information system is actually a marketplace of competing information systems. Each information system finds a unique function and audience. Much like commercial air service, a network coalesces from competitive elements.

The researcher is found within many other systems, but these ten, I believe, have the greatest effect on his production and utilization of knowledge.

Back into the cognitive system, briefly. I feel there is more to be said about the key system in knowledge utilization, the cognitive system. Clearly, if this system remains intransigent or indifferent, a perfectly free flow of information will still not lead to utilization. If this system locks onto an idea, then we have history as our witness that some of the big, powerful systems may be shaken.

Everett Rogers (1962) cites five stages of adoption: (1) the potential adopter is aware of the new idea; (2) it interests him; (3) he evaluates it to see what its probable advantages and drawbacks are; (4) he gives it a trial; (5) if the outcome of the trial is satisfactory, he adopts the new idea.

I have found it useful to expand this paradigm into ten steps, which I call ten phases of message acceptance. There is no theoretical issue separating five steps from ten, but each person who thinks about the progressive acceptance of an idea or message sees in it a different number of discrete cognitive, affective, and behavioral elements.

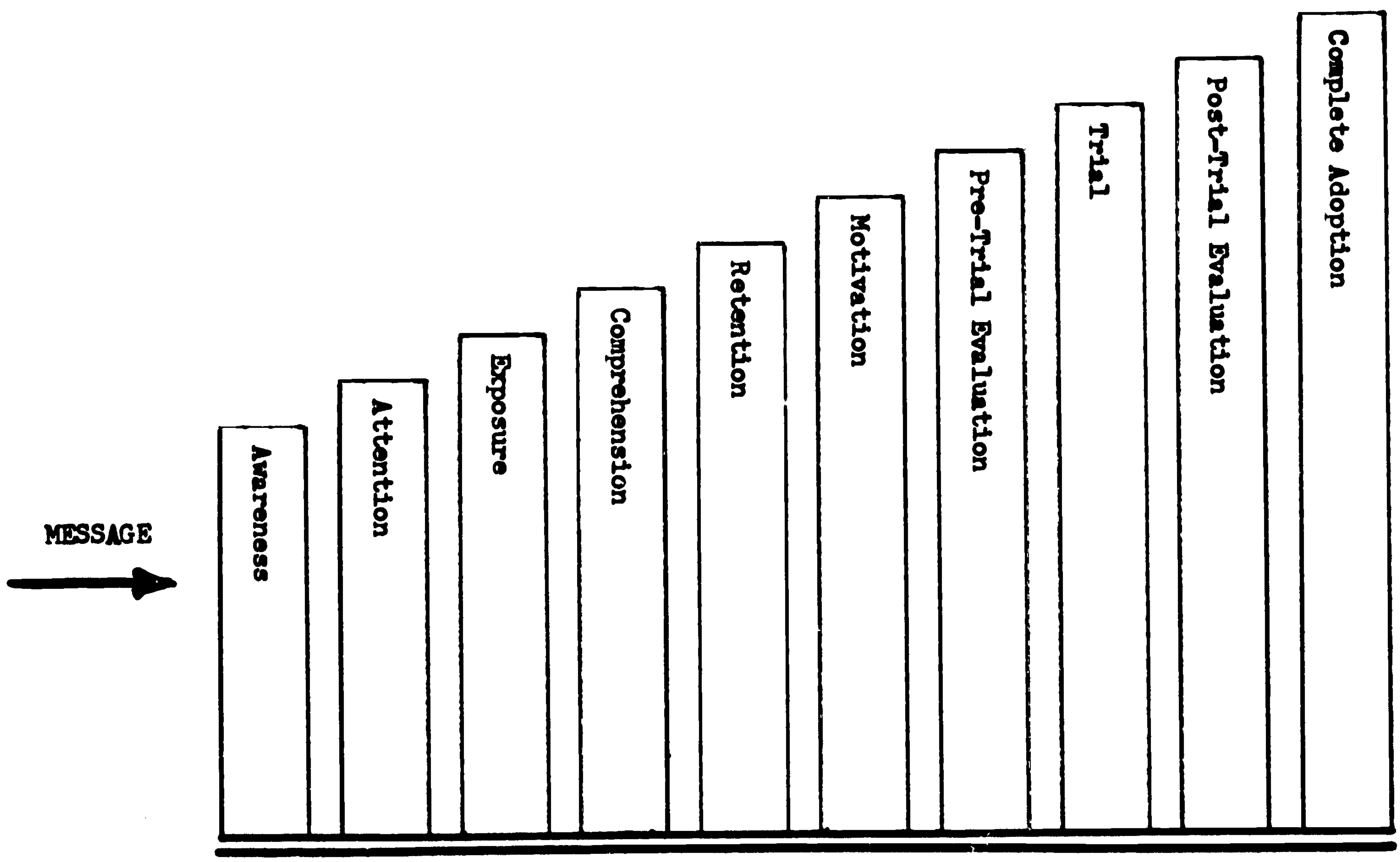
Figure 3 illustrates the challenge any message -- hence, all knowledge -- faces in attaining acceptance. First of all, the message must penetrate to awareness. The receiver must distinguish signal from background noise and realize that a message is being sent. This is not a facetious or pseudo-technical way of putting it. Most days I scan my junk mail without expecting to see a message for me; I scan essentially without awareness.

Second, the message must achieve attention. If awareness is a little flashing light, telling you that a message is being sent, then attention is a tuning-in to the message. Attention begins, we might say, when the eyes focus or the ears cock and the string of words begins to make sense.

Third, there must be exposure. Exposure implies that the message is transferred, via sense organs, into the receiver's head. Exposure requires continuing attention, so that the logic of connected ideas can be followed.

After awareness, attention, and exposure, the fourth phase is comprehension. Whereas the first three phases were primarily sensory, this is the essential cognitive phase. Here the message's semantic content is crucial. If a message advocates a certain belief or behavior, this is the phase, if ever, when the receiver learns what is being advocated.

Figure 3. Ten phases in the acceptance of messages.



If the comprehension hurdle is cleared, the message can try for retention. In this "data-rich civilization," the incredible number of messages competing for attention make it inevitable that most will disappear without a trace -- that is, without a memory trace.

When a message has been understood and remembered, a potential for acceptance begins to exist. Next we must ask whether motivation is sufficient to bring about acceptance. Resistance to change of all kinds is rooted in a preference for the permanence of the present. The message may either suggest a new motive, or it may invoke old, familiar ones.

The seventh phase of message acceptance is pre-trial evaluation. The receiver has combined information embodied in the message with pre-existing or new motivations. There is now a blueprint for change and some energy or force to bring about the change. The receiver is considering a trial of the new belief or behavior, and he is evaluating its probable impact on other beliefs and behaviors that have already earned their place in his cognitive system and in his ways of doing things. Relatively powerful drives, such as the drive to maintain cognitive balance and the drive to minimize effort, give the new belief or behavior a tough examination.

The eighth phase of message acceptance is trial itself. The diffusion researchers have learned that it makes a difference in the success of the trial stage if the new idea or practice can be tried a little bit at a time rather than swallowed whole.

As soon as the results or consequences of the trial become evident in various kinds of feedback, internal as well as external, we enter the next-to-last-phase of post-trial evaluation. This can be a sticky phase for the message, particularly if it won a trial for itself on the basis of glowing promises. Now the returns are in, and the evaluator has first-hand knowledge of his profit or loss.

The tenth and final phase of message acceptance must be, of course, complete adoption. Since all human behavior is constantly subject to change, the difference between trial and adoption is one of attitude rather than externally visible differences in practice. In the trial phase, the person feels that discontinuation will be the natural course, but that continuation depends on positive evidence. In the adoption phase, continuation is expected and discontinuation will occur only if negative evidence begins to appear. Thus adoption is the steady state that can be upset only by a recapitulation of most or all of the ten phases, with a new message running the gauntlet.

The range of perspectives discussable under the heading of "knowledge utilization" could be extended, but not, I'm afraid this afternoon. I think it's a healthy sign that paradigms and models have been introduced to this field from sociology, psychology, communication research, etc. These approaches complement each other in the same way that the color plates of color printing complement each other -- recognizably so only after all the impressions have been made on the same sheet of paper.

I think we all want to see greater utilization of existing knowledge for a number of reasons, from the welfare of man to the good humor of Congressional committees. After many impressive rearrangements of bulky objects -- for example, the modernization of library resources --

that seem to have only the smallest effect on knowledge production and utilization, some of us suspect that greater success will be achieved when we turn from the system's artifacts, especially its paper artifacts, and look more closely at the people themselves. Each of these perspectives has its special appeal for some aspect of that closer look.

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