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DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR)

28 August 2017

Air Force Office of Scientific Research
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This letter is in response to your Freedom of Information Act request for a *digital/electronic copy of a November 1966 report entitled "The Zoo and the Jungle – A comparison of the Information Practices of Intelligence Analysts and Scientists," by Harold Wooster.* Your request was assigned case number 2017-03782-F. We have determined the records you requested to be fully releasable.

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Sincerely

//SIGNED//

MONIQUE WILLIAMS
Freedom of Information Act Manager

FOIA Case 2017-03782-F

THE ZOO AND THE JUNGLE - A COMPARISON OF THE INFORMATION PRACTICES OF INTELLIGENCE ANALYSIS AND OF SCIENTISTS

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH BOLLING AFB ...

1967

The zoo and the jungle – a comparison of the information practices of intelligence analysts and of scientists

by HAROLD WOOSTER
Air Force Office of Scientific Research/Office of Aerospace Research
Arlington, Virginia

"Anyway, the actual workings of the Secret Service, like those of criminal investigation, hold a limited emotional appeal for most people."

KINGSLEY AMIS in *The James Bond Dossier*

PROLOGUE

The zoo and the jungle

The naturalist must always be careful to distinguish between zoo behavior—the behavior of animals in captivity—and the behavior of the same species in the wild state. He should also be continually aware of the effect of the observation upon the phenomenon observed.

In many ways—surprisingly enough, most of them good—the relationship of the intelligence analyst to his supporting information systems may be regarded as zoo behavior. He lives on the same premises; simple operant conditioning of both the analyst and the information system can bring the two into harmony. If he withers from lack, or bloats from excess, of adequate information the zoo-keeper has certain embarrassing immediate problems to face.

The scientist in the state of nature is another matter entirely. He has to be lured to the information system with salt blocks, strange scents and even more peculiar calls. The observer in his camouflaged blind sees only healthy, active specimens. By definition, the inactive are not observed, but can only be inferred.

INTRODUCTION

This paper is an attempt to explore and contrast two related areas—the information requirements of the intelligence analyst and the practicing scientist. "Intelligence" is used in this paper in a highly restricted sense. It is limited almost entirely to that information gleaned from open scientific and technical literature—difficultly accessible, perhaps, but at least in its country of origin, available to the nationals of that country.

Sherman Kent (Kent, 1965) has pointed out that there are areas of the world in which the phrase "overt intelligence" would be regarded as an oxymoron. For, as he writes:

"If in fact the Soviets engage in what we of the West call 'intelligence research and analysis' they have another name for it and a name bereft of the connotation of 'intelligence.' It is seemingly inconceivable to them that large numbers of people will be quite overtly engaged in something known as intelligence work, able to inform all and sundry that this is in fact their calling, and obliged to guard with secrecy only those matters having to do with their sources, methods, the foci of their attention and the content of their findings."

Or, to quote a Russian source (Orlov, 1963):

"According to the views of Russian officers, it takes a man to do the creative and highly dangerous work of underground intelligence on foreign soil; as to the digging up of research data in the safety of the home office or library, this can be left to women or young lieutenants who have just begun intelligence careers."

Or again, to quote Gen. William Donovan (cited in Orlov, *ibid.*):

"Intelligence is not the mysterious, even sinister thing people think it is, but is more a pattern of pulling together myriad facts, making a pattern of them, and drawing inferences from that pattern."

This is the intelligence pattern (*razvedka* or no) to be discussed in this paper.

The information practices of scientists

Study of the information habits of scientists has almost become the dermatology (the patient usually

does not die, and he never really gets well)* of the information sciences. One does occasionally hear of the experiments which fail, as in the letter in *Science* (Dray, 1966) recommending that the Information Exchange Group on Immunopathology be discontinued for nine apparently valid reasons. Failure to meet user needs is at least one of the many reasons why information systems totter and fall (see the author's *Post-Mortems Can Be Fun*) (Wooster, 1965a), but studies of user requirements seem to go on forever.

The International Conference on Scientific Information, held in Washington in 1958, provides a convenient starting point to survey the literature in the field. Törnudd reviewed most of the information use studies published before 1958. Her bibliography cites 69 articles. (Törnudd, 1958)

That same year Mortimer Taube (Taube, 1958) attempted an evaluation of the then total existing literature of use studies, first pointing out that of the 69 studies cited by Törnudd only 15, dating from 1955, had not been listed in previous compilations by Shaw (Shaw, 1956), Henkle (Henkle, 1956) and Stevens (Stevens, 1953) dating back to 1953. Taube added to the 69 Törnudd citations the 12 papers on the subject given at the Conference itself, bringing the total to 81.

Menzel, in 1960 (Menzel, 1960) attempted to collate tables of findings from more or less comparable studies. His bibliography, admittedly more exclusive than those cited above, lists 26 articles.

In 1964, Davis and Bailey (Davis and Bailey, 1964) compiled an annotated bibliography of 438 "use studies" containing virtually every study of significance up to 1963. One reviewer (Paisley, 1965) has pointed out that "This is a difficult source to use because of the high proportion of chaff; about 350 of the citations are commercial periodical readership studies and library school research exercises," which would seem to leave a total of 188 valid papers.

This same reviewer (Paisley, *Idem*) cited some 75 relevant papers in his review of the literature.

Herner and Company in 1966 (Herner and Co., 1966) broadening the scope to include physicians, were able to locate "several hundred" papers dealing with information patterns in science, with 110 dealing specifically with the problem in biomedical sciences.

Some idea of the flavor of the field may be obtained from two papers. The first is the "classical" 1958 paper (the author is tempted to define classical as having been around long enough to pass into the Russian literature and then back out again via an English journal, the original source being lost in the process) of Russell Ackoff, then heading the Operations Research Group at Case Institute of Technology (Ackoff, 1958).

Ackoff et al. made 25,000 observations on more than 1,500 chemists chosen as a representative sample of the U.S. in 1957-1958. Out of a 90-hour week (including week-ends and evenings) the average chemist spends 16.5 hours in scientific communication, 10.4 hours with equipment, 6.7 hours in business communication, three hours in data treatment and all of two and one-half hours in thinking and planning. The average chemist spends more time in communicating (23.2 hours a week) than in all the rest of his professional activities combined (15.9 hours per week).

More recently the "Auerbach study" (Auerbach Corp., 1965) which lasted 16 months and cost almost $300,000 attempted to discover just how the 36,000 scientists and engineers in the Department of Defense actually got the information they needed to do their jobs. They found that half of these either consulted each other or went to individuals' personal files of information to meet their primary needs. In 39 per cent of these cases the particular information requirements were completely satisfied.

Equally discouraging, only half of the individuals interviewed knew of their own information services, which were rarely ever used as a first source of information. About one-fifth of them had never heard of the Defense Documentation Center (or its predecessor, ASTIA); nineteen per cent didn't know of the existence of any of 33 specialized Department of Defense information centers!

The job of the intelligence analyst

In contrast to the almost embarrassing wealth of information about the information requirements, uses and practices of scientists, the author has been able to find only one unclassified paper relating specifically to the information needs of intelligence analysts.

In fairly precise terms, much of the work of the intelligence analyst consists of the beneficiation of fairly low grade ore, or even tailings. For those of you who did not grow up in a mining community, "beneficiation" means to make richer; "tailings" are the residue from previous inefficient refining operations.

*Since the disease of Venus are, at the moment, of more interest to the dermatologist than, one would hope, to either the information specialist or the astronaut, the author's biomedical background compels him to warn of

"... the young man from Bombay
Who thought loss just went away
As a result he has tabes,
And bandy-legged babies
And thinks he is Queen of the May."

An inaccurate version of this medical mnemonic may be found in (Gordon, 1957).

To continue the mineralogical metaphor a little further, the sort of intelligence operation which makes the plot for best-sellers (either as paperbacks or proposals) could be defined as "high-grading"—"to steal rich ore from a mine, especially very rich gold ore." High-grading was very much a matter of individual enterprise—an individual with a lenient foreman could stagger out of a mine with several weeks' pay in his pants cuffs. Reworking tailings is a much duller factory process, calling for efficient high volume machinery, figuring profits in pennies per ton, instead of dollars per ounce.

So volume is the first item to keep in mind. One information installation alone, CIRC—Centralized Information Reference and Control, described by Ray Barrett (Barrett, 1965) is designed to process about 8,000 to 10,000 input reports per month, provide a retrieval capability for the total system holdings, and carry out weekly dissemination to a large number of user groups. By way of contrast, the Clearinghouse for Federal Scientific and Technical Information, responsible for the sale of U.S. Government sponsored R&D reports to the general scientific public, adds about 2,300 reports per month, plus an equal number of translations (Fry, 966).

These reports are then indexed, classified, abstracted, translated, stored and retrieved. These may or may not be treated as conventional library processes, with one major exception—the assignment of a subject classification according to one of several allowable hierarchical coding systems which have become more or less standard throughout the intelligence community. Amusingly enough, at least for one subject area in one agency, the European Universal Decimal Classification, an expatriated form of Dewey Decimal Classification, is used. Not for its merits which, with a few isolated exceptions such as the Engineering Societies Library, have been insufficient to overcome the chauvinism of American librarians but because Russia, in common with most European countries, has standardized on UDC to the extent of printing UDC classification numbers on journal articles. It turns out to be simpler to use the Russian classification system in this particular instance than to reclassify the articles.

Presumably a substantial portion of an agency's manpower resources are devoted to these more or less routine library operations. TDCK, the Netherlands Armed Forces Technical Document Center in The Hague, which resembles an intelligence agency at least to the extent that its preferred output is evaluated engineering reports rather than bibliographies, devotes 35 of its 65 manpower spaces to maintaining the library (Schüller, 1965). The Defense Documentation Center, which performs solely library operations in the sense of this paragraph, uses some 400 manpower spaces to process and retrieve perhaps 3,000 to 4,000 reper month.

Those of us concerned with the processing of scientific information would certainly contend that money spent in improving these operations is "leverage" money, that saving money on library operations is false economy, but I can certainly visualize some jim-dandy arguments on the score of analysts vs. librarians.

All of this has gone on, mind you, before we or the documents ever meet the intelligence analyst. The analyst sits at a desk and reads and writes. He has two major sorts of jobs; keeping *au courant* in a particular subject/geographical/language field—the breadth of the field varying directly with the grade level and the depth inversely—and preparing reports, known variously as "finished intelligence" and "evaluated intelligence."

These reports fall into three main classes:

Class	Synonyms
PAST	
Basic descriptive	Basic research
	Fundamental research
	Basic data
	Monographic data
	Encyclopedic data
PRESENT	
Current reportorial	Current intelligence
	Current evaluations
	Current appreciations
	Cable material
	Hot intelligence
FUTURE	
Speculative-evaluative	Estimates
	Strategic estimates
	Evaluations
	Staff intelligence
	Capabilities intelligence

(Kent, 1965)

The time allowed for preparation of these reports ranges, as one would expect, from the near-academic to the nearer-frantic.

The information from which these reports are prepared usually comes from three sources: the personal memory of the analyst (a practice facilitated by the tendency to minimize the usual scholarly apparatus of citations and foot-notes in intelligence reports); whatever personal files the analyst has looted from the input flowing across his desk and squirreled away against a time of need or obtained by "unsystematically canvassing outside sources of information" (Kent, 1965), and by subject searches of a central information file.

These subject searches range from the highly specific —"What was the rainfall in such and such a place on such and such a date?" to perhaps such general areas as metals *and* stress *and* cryogenics. The analyst differs slightly from the normal user in a greater tendency

to use such qualifying terms as "I don't want anything older than 1958" or "I don't want documents concerning American research" or he may even say "Documents must all be unclassified."

I have at times had the impression that analysts tend to ask very broad general questions, preferring to run barefoot through the windrows of paper in search of the needle of truth rather than trusting the information/system library to use a magnet. Tastes differ, of course. Some analysts say that they never use a subject search, since they know perfectly well what data are available in their areas! Others prefer to frame their searches in terms of authors, geographical locations, facilities and personalities. There are even those who have learned to use the indexing system itself as a rather sensitive indicator, spotting trends by unexpected increases or decreases in the use of certain indexing terms.

At last-Confrontation!

It is plausible, if rash, to attempt to compare the information practices of intelligence analysts and scientists in the following table, remembering that the separation is nowhere near as clean as the device of two columns would indicate and that in fact one class of scientist—there is no convenient American term for this class, but the English one, "information scientist" should suffice—is almost indistinguishable in his work habits and information needs from the intelligence analyst.

Table I

Designatum	*Intelligence Analyst*	*Scientist*
Use of oral/informal information	Seldom, outside his own agency	Preferred mode of obtaining current information. Auerbach, (1965)
Attendance at open scientific meetings	Usually vicarious	Avidly (Korchin & Clarke, 1959)
Use of library	Heavy	Light
Preferred place of reading	Desk	Office, laboratory or home—very little in library
Percentage of time spent in information processing	>75%	<50% (e.g., Ackoff 1958)
Languages	English + (1-4)	English ± 0.5
Prefer translations	Usually	Always
Use of foreign sources of information	Up to 100%	Less than 2% (Syracuse U., 1966)
Maintain personal file	Usually, in office	17-100%—in home or office (Jahoda, 1966)
Good Housekeeping Seal of Approval for literature	TOP SECRET	Publication in referred journal (Pasternack, 1966)
Use of microfilm or microfiche	Readily	Only in desperation
Leads to information	Reference services	Gossip, hot tips from friends, scanning (not reading) 5-10 current journals. Little use of abstracting services (Gerard, 1958)
Bibliographic sophistication, e.g., ability to use standard reference tools	High	Negligible to fair
Use of mechanized current awareness services, e.g., KWIC and SDI	Good, if available	Good if chemists, biologists, ACM, and/or NASA contractors. Otherwise, fair to poor. (Sprague, 1965)
Use of extra-mural information sources, e.g., specialized information centers	Good	Good if in in-group; otherwise only if led gently by the hand or touted by a buddy.

Table I, *continued*

Designatum	*Intelligence Analyst*	*Scientist*
Number of full-scale, retrospective literature searches per year	1-12	0-2
Availability of mechanized, automated, computer-based, etc. information systems:		
Past	Poor	Zero
Present	Fair	Poor
Future	Good	Fair
Principal product	Reports	"New scientific knowledge": gossip; journal articles to maintain status; reports to maintain sponsor.
Attitude toward writing	Evil necessity	Necessary evil
Ambience—feed back on products	Anechoic	Resonant
Output processing methods	Early Bronze Age	Late Stone Age
Barriers between author and ultimate consumer	3 to 10	1 to 2; journal referees and/or editor.
Average cost of information services per user	$200 to $2,000 and	$10 to $200. In certain rare instances, e.g., pharmaceutical firms, as high as $1,000.

Discussion of Table I

I would hope that the high face validity—which is a fancy word meaning superficial plausibility—of the statements in this table require only exegesis to convince the doubter that, no matter how wrong I may be about his group (analyst or scientist), I have fairly anatomized the group to which he does not belong. I can provide documentation for most of the statements in the scientist column—the volume of literature is large enough to prove almost any point. Contrarywise, I can document none of the statements in the intelligence analyst column, and welcome any documented disproof.

Use of oral/informal information

This would seem to be the scientist's favorite mode of communication—in his own corridors, by telephone, or at meetings held in pleasant, distant and preferably overseas, locations. It is quite clear from the literature that corridor gossip is the best part of such meetings—that papers are attended only in desperation or inclement weather.

It is my impression that in intelligence processing such oral/informal communications are reduced to writing at the earliest possible stage, and that the strict compartmentalization mandatory because of security tends to discourage casual subject-oriented conversation in-house.

Use of library and place of reading

The frequency of a user's contact with his library/information center tends to be inversely proportional to his distance from it. The curve is not, however, monotonic—as those who have listened to arguments about, say, departmental libraries versus centralized libraries know, there seems to be a forbidden zone, with the lower edge dimensioned in hundreds, or at best thousands, of feet within which a scientist will not travel to get information from a library. The upper edge, at least in days of grantsmanship and easy travel funds, is probably in the order of thousands of miles. The intelligence analyst with a library on the premises has a considerable advantage over the scientist, on, say, a campus like UCLA where the library is too far to walk and parking is almost impossible if he drives. It might even be possible to distinguish between information-oriented and lab-oriented scientists by releasing suitably marked specimens at varying distances from a library.

A good university library can, either from its own holdings or through the informal but highly effective library community, provide the user seeking an iden-

tified item with a copy, a reasonably legible surrogate or, in the case of incunabula and similar rarities, identification of the physical location of almost every book and scientific journal ever published. It can also provide a descriptive catalog of every bibliographic item that should be on its shelves. But its subject cataloging of its own holdings, let alone those of other libraries, lags far behind. (Perhaps because books are more fun to buy and hold than catalogs, and especially catalogers.) In effect, the bargain that a library makes with its more sophisticated users is, "If you can tell me what you want, I'll get it for you (if you're prepared to wait) but it's up to you to find out what you want."

The precise converse of this situation may occur in intelligence installations which have concentrated on mechanizing their bibliographic reference system, perhaps even to the point of providing abstracts of documents of interest, without making equally good provisions for providing full-text copies of the documents on which the bibliographic apparatus is presumably based. Analysts become very unhappy when the computer tells them about documents they can't get; many analysts say that 90 per cent of their time is spent in getting their hands on the document they want after they have found out they want it.* Perhaps the implicit promise of delivery should be made more explicit.

Or, if the traditional library resembles the traditional Hollywood librarian, hiding all sorts of interesting physical resources behind a dowdy facade till the last reel, the unwisely mechanized information system may resemble a fan-dancer—all index and no delivery.

Maintain personal files

Jahoda (Jahoda, 1966) in work done for AFOSR has found that 46 of a sample of 75 research workers maintained personal files. This seems to be in accord with values reported in the literature of from 45 to 100 per cent. Wallace (Wallace, 1964) has described the preparation of personal indexes, printed with the aid of computers for professional and administrative personnel at Systems Development Corporation. To the best of my nowledge, most discussions of mechanization of intelligence information processing have concentrated on mass processing at the central facility. It would seem entirely possible that perhaps more computer support could be given in maintenance of individual analysts' files. There must be something better than the present untidy hoards.

*By way of contrast, a worker in a fairly specialized information center in the nuclear field tells me that his time is spent as follows:

Finding and retrieving references	10-15%
Finding and retrieving documents	10%
Retrieving data from the above sources	50%
Comparison, evaluation and report writing	30%

Good Housekeeping Seal of Approval

Pasternack (Pasternack, 1966) editor of *The Physical Review*, is the latest journal Brahmin to point out that the primary purpose of the journal is to, and I am paraphrasing wickedly, substitute the value judgments of the referees and editor for that of the individual scientist. "If you read it in *Physical Review*, you can be almost sure it's true—but if it's in a report, you'd better be ready to snort." (Anonymous, 1966)

The scientist given a paper to evaluate would be quite unhappy if all descriptive information were deleted. Before he ever reads it he wants to know who wrote it, where he worked (both laboratory and country), where and when it was published, perhaps even what agency supported the work. There are certain internal tests he can and does apply: Are the curves given without any experimental points or, even worse, do all the points fall precisely on the curves? Does the author recognize and explain any inconsistencies? Are there a reasonable number of references, and is the purpose of including each reference clear, or are they just the window dressing of a pseudo-erudition? (Perhaps the same pseudo-erudition which drives me to mention Goedel's theorem on formally undecidable propositions—that it is impossible to demonstrate the non-contradictoriness of complex systems without going outside those systems.)

Apparently there are times when intelligence finds it necessary to deprive the analysts of these useful clues, and interpose a middleman between the collectors and the analyst:

"The middleman grades the data for reliability of source and accuracy and reliability of content. . . . (He) according to standard practice, is restricted to a very narrow language in making his evaluations. He is permitted to grade the reliability of the source according to the letters A, B, C, D, and the content according to the numbers 1, 2, 3, 4. Thus A-1 would designate a report of unvarnished truth that was straight from the horse's mouth. . . . If the data happen to have come from a document, a newspaper or press release or some such, one school of evaluators simply designates their value with the single word 'documentary.' . . . Often middlemen have no independent line on the reliability of the source, and instead of admitting as much, will proceed to grade the source on the apparent reliability of the content. This movement in vicious circles is neither helpful nor valid." (Kent, 1965)

I am told that, all other factors being equal (or unavailable), the value an analyst places on an item tends to vary directly with the classification of that item.

Use of mechanized current awareness services

Descriptive cataloging, that phase of the process of

cataloging which concerns itself with the identification and description of books, is a deceptively simple process. Most non-library oriented beginners in the field of information tend to discover descriptive cataloging like Napoleon discovered Russia—the first steppes are easy, but it gets tougher the further you go. The title of a publication is part of its descriptive cataloging. If this title is key-punched, it can be manipulated in various ways to give indexes known as KWIC (Key Word In Context), KWAC (Key Word And Context) and KWOC (Key Word Out (of) Context).

A review by Stevens (Stevens, 1965) found more than 40 examples of KWIC and its congeners as of February 1964. Perhaps 8 of these, especially those produced by Chemical Abstracts Service, Biological Abstracts and, of course, that of the ACM, have passed the test of the marketplace even if they are not, perhaps "the miracle of the decade." (Baker, 1960)

As the co-designer of one such system, WADEX (Ripperberger, Wooster and Juhasz, 1964), I am keenly aware of its limitations—an almost inescapable bulkiness, caused by the necessity of replicating titles as many times as there are significant words, and the miserable inadequacies of titles as written by the average author. Later forms of WADEX, especially WADEX III, and presumably its rivals, have learned to handle enriched titles—primitive subject terms added to the author's original title—and class numbers. I would imagine that any installation, intelligence or no, that key-strokes descriptive cataloging information and adds a classification number might find some form of KWIC index, sorted by class numbers, a cheap and not too nasty method of setting up a current awareness system.

A full Selective Dissemination of Information system is something else again. Luhn's original concept (Luhn, 1958, 1961) assumed that both documents and users would be indexed by some form of coordinate indexing, and that the abstracts chosen by machine matching of terms would be distributed to individual, named users. It is my impression that there is a growing tendency to drop this personalized service and substitute the distribution of sets of abstracts to classes of users. Barrett, for example (Barrett, 1965), in describing CIRC, says that: "A user profile is a list of topic tags, or descriptors, which describe the scope of a user group's interest. Note that I said *group*. All of our dissemination is based upon unit profiles. We discovered early on that individual profiles had a very high degree of duplication, and that it appeared more economical to talk in terms of a profile serving a unit rather than an individual. Such a unit might have two, three, five, or even 10 people in it working on closely associated subject areas."

I see no reason why a perfectly good SDI system could not be made to work based completely on an hierarchical subject classification system, assigning classification numbers to documents and to user groups.

Ambience—feed-back on products

Perhaps the principal difference between the intelligence analyst and the scientist lies in their ambience. A scientist lives in a highly resonant environment. He talks to his peers informally, he presents papers at meetings, he publishes papers and receives reprint requests, people write him letters of praise or otherwise. If he is as much of a schnook as most of us are, he judges other people's papers and bibliographies by whether or not they have cited his own papers. (Advanced cases read other's papers as they read the newspapers, only instead of turning to the comics they turn to the bibliography.) Certainly in the village community that science was, if not in the concatenation of conurbations that it has become, the scientist continually received feed-back on his work.

Not so the analyst. He finishes writing a report, turns it in to his supervisor, has it bounced once or twice on general principles, OKs the final copy and turns it loose. And that's that. Period, paragraph. Time to start a new report. If he has been allowed to retain a strong prose style and a gift for felicitous phrasing, he may recognize sentences or whole paragraphs of his own in reports prepared by others, but will search in vain for quotation marks or proper bibliographic citation. He knows he wrote it, but so what?

Once upon a time the old Air Research and Development Command had a problem like this. Scientists and engineers working on classified projects envied their unclassified colleagues who got to present papers at meetings. ARDC's solution was the invention of the ARDC Science Seminar. Held under proper security safeguards, it provided a classified forum for classified papers, with perhaps a trace, but only a trace, of Air Force hoop-la in panels of judges, and awards for the best papers and best presentations.

I'm not quite sure that it takes a Herman Kahn to think of the unthinkable, and visualize intra- and perhaps even (shudder) inter-agency competitions for the best intelligence reports. We had amazing luck with a similar problem in our workshop on "Working with Semi-Automatic Document System" by inviting only those people who never gave papers at meetings, but stayed home and did the work while their bosses took the credit. To the best of our ability it was an all-Indian conference. (Those chiefs who muscled their way in usually wound up out of harm's way in a session on system design and evaluation.)

I understand that there are two classified scientific-

technical journals in the intelligence field with the usual editorial paraphernalia and that one of them in fact does award yearly prizes for the best papers. This is fine as far as it goes, but publication without reader feed-back (the average author of the average article in a scientific journal usually receives 10-15 reprint requests; that same article is unlikely to be read by more than 7 per cent) tends to be a fairly harmless form of solitary vice. In presenting scientific results, as in several other matters, there really is no substitute for a live audience.

Output processing methods

As I have pointed out elsewhere (Wooster, 1965b, c) the basic problem in technical writing is to put it off till the last possible minute, meanwhile building up vast untidy heaps of reference material and the requisite nervous tension, and then converting sources and tension into finished manuscript as quickly as possible.

Whatever the potentialities of reactive typewriters, little is actually being done to ease this private ordeal. I tend to regard those who do not know how to use a typewriter as hopeless. I am sure that anyone who really wanted to curb the "information explosion" could cut the production of papers in half by outlawing lined pads, ball-point pens and paleographic secretaries. I am indebted to Project INTREX (Overhage, 1965) for pointing out that the average scientist does not know how to type well enough to use a computer console adequately for information retrieval. I am not overly fond of solution which presupposes dictating—such as the long anticipated voice-operated typewriter. If *cacoethes scribendi* is bad, *cacoethes loquendi* is 10 times worse.

Given a candidate who is willing to learn how to type, though, it should not be impossible to devise an inexpensive writer's work station, complete with keyboard, display screen, and my own invention, the "plagiarist's pencil," which hangs alongside the light pen but is actually a print reader, with the capability of tracing passages in text and transferring them to my manuscript.

And while you're at it, be sure to put wheels on it. I want something that can be wheeled into my cubbyhole when I need it, and rolled back to the storeroom when I don't. And the last thing in the world I need is a large, expensive, monocular conscience glaring at me when I'm not ready to start writing. And, since creation should be at least as solitary as procreation, the last thing in the world I want to do is to load my bookshelves onto a wheelbarrow and trundle them off to a brightly-lit central facility with one-way glass windows to show me off to visitors whenever I write a paper.

SUMMARY

Both the scientist and the intelligence analyst are concerned with converting the information from scientific and technical documents into written manuscripts. Although the scientist devotes a large percentage of his time to information processing this is only incidental to his overt goal, gaining new knowledge and insight, and his covert goal, enhancing his stature in the scientific community by peer group recognition. The scientist, *qua* information processor, is an untrained, part-time amateur. The intelligence analyst is a trained, full-time professional. The scientist deals largely with unwritten informal information sources; the analyst is usually confined to formal, written sources. The analyst labors under certain handicaps which are inescapable concomitants of the information with which he deals and the uses to which it is put. Mechanization can provide a partial, but only a partial, amelioration of some of these handicaps.

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13. ABSTRACT

Both the scientists and the intelligence analyst are concerned with converting the information from scientific and technical documents into written manuscripts. Although the scientist devotes a large portion of his time to information processing this is only incidental to his overt goal, gaining new knowledge and insight, and his covert goal, enhancing his stature in the scientific community by peer group recognition. The scientist, our information processor, is an untrained, part-time amateur. The intelligence analyst is a trained, full-time professional. The scientist deals largely with unwritten informal information sources; the analyst is usually confined to formal written sources. The analyst labors under certain handicaps which are inescapable concomitants of the information with which he deals and the uses to which it is put. Mechanization can provide a partial, but only a partial, amelioration of some of these handicaps.

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