SEQUENTIAL THEMATIC ORGANIZATION

OF PUBLICATIONS (STOP):

How to Achieve Coherence in Proposals and Reports

HUGHES — FULLERTON

HUGHES AIRCRAFT COMPANY

GROUND SYSTEMS GROUP

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CONTENTS

STOP: A BETTER METHOD OF ORGANIZING AND WRITING REPORTS AND PROPOSALS

STOP is a systematic method of organizing and writing the technical report and proposal which significantly improves outlining control and editorial caliber of the content. Essentially, the method spoon-feeds the reader in "bite-size", 2-page topics.

STOP stands for Sequential Thematic Organization of Publications. It is a new and unorthodox method that is surprisingly effective for outlining and writing technical reports and proposals, particularly the lengthy, detailed and technically complex publications prepared by teams under time stress. In a STOP report or proposal the subject matter is organized into a series of relatively brief themes, each presented in a "module" of two facing pages, complete with associated figure, if any.

Thus, you change the subject whenever you turn the page and your attention is occupied with only one message at a time. This framing of message "modules" in a STOP book increases the impact of each and makes it easier to comprehend. What makes STOP work as a practical method for all thematic types of technical writing is that it makes use of the more-or-less uniform topical structure that exists naturally in ordinary expository discourse, but which is hidden by conventional outlining practices. It can be shown statistically that this natural topical structure exists and that the topics, once you recognize them, fit the 2-page spread in an overwhelming majority of the cases. Therefore, recasting or boiling down is not required in the STOP technique.

Conventional outlining practices not only hide the natural topics of a discourse, they allow the thesis of the topics to remain unstated, and this makes it easy for the reader to miss the most important points the author wants to make, and for the author to miss making them in the first place. The conventional outline is "categorical" rather than topical, so it is essentially a one-man tool. To supplant the categorical outline, Storyboards are used in the STOP technique to prepare a detailed, "team-visible" outline for each theme module. The traditional but neglected Thesis Sentence, which is the key to coherent outlining and writing, guides the design of each Storyboard for maximum thematic unity. The Thesis Sentence shows the reader at a glance the essential argument of the theme body, and since the total shape of the theme body is readily apparent, the reader is relieved of the common vexation: "When will this passage end, and what point is the author driving at?"

STOP is based on the principle of Thematic Quantization, which asserts that proper recognition and treatment of topical units of discourse is the essence of "coherence," and that the best way to achieve topic recognition is the device of uniform modules. For a given subject area, the author always has the option of spinning off additional topics, provided each is treated in a unified manner, but he never exceeds a 2-page span of attention at any one moment. The topical segmentation of natural expository structure is thus taken advantage of: it replaces the arbitrary and artificial rules of "logical" categorizing as the issue of the "organizing" process.

Experience with STOP over a period of years has demonstrated the practicability of this seemingly brochure-like organizing method for detailed technical exposition. One hundred and twenty major STOP proposals and reports have been produced since November 1962. It is considered now to be demonstrated as a practical method for all types of subject matter, the usual mix of engineering writing talent, typical crash schedules, and conventional methods of multilith production.

As evidenced by reader reaction, increase in comprehensibility of STOP documents as compared to their River-Raft counterparts can only be described as dramatic. This has been especially true in the proposal field, where the quantizing methodology reveals company intention more plainly, and provides a standard "processing" framework for the evaluator, who is concerned with identifying points for scoring purposes, spotting areas of disagreement, and rank-ordering items for priority analysis.

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THE RIVER-RAFT CONCEPT

FIGURE

TEXT

THE STOP CONCEPT

TOPIC 1

SEQUENCE OF THEMES

CATEGORICAL OUTLINE OF THE RIVER-RAFT PROPOSAL
II. GENERAL SYSTEM CONSIDERATIONS
   1. BASIC CONSIDERATIONS
   2. COMPUTER SUBSYSTEM
     A. INTRODUCTION
     B. ORGANIZATIONAL CONCEPTS
      (1) CONFIGURATION A
      (2) CONFIGURATION B
      (3) TEST UNIT TIE-IN
   3. RADAR DATA CONVERTER
     A. GENERAL
     B. MAJOR FUNCTIONS OF RDC
     C. AZIMUTH CONVERSION
      (1) SYNCHRO METHODS,
      ETC.

TOPICAL OUTLINE OF THE MODULAR PROPOSAL
II. KEY SYSTEM CONCEPTS
   1. CHIEF PERFORMANCE TRADEOFFS
   2. AVOIDANCE OF SPEED SACRIFICE
     COMPUTER DESIGN GOALS
   3. ADVANTAGES OF SPECIAL-PURPOSE DESIGN
   4. LOW COST OF DRUM MEMORY
   5. IMPORTANCE OF AUTOMATIC TESTING
   6. DRAWBACKS TO CENTRAL CONTROL
   7. PROPOSED REMOTE PROCESSING
     SELECTION OF RDC TECHNIQUES
   8. CRITICAL NEED FOR MULTIPLE INPUTS
   9. VIDEO QUANTIZER MOVED TO COMPUTER
  10. ADVANTAGES OF ELECTRONIC AZIMUTH CONVERSION,
     ETC.

Figure 1. Page-by-page printing of the conventional "run-on" proposal tends to conceal the fact that it takes the form of a scroll or a river of words. Since the usage and location of figures are unpredictable, figures are referred to as rafts. The permissive character of the river-raft proposal is reflected in the categorical outline on the left, whose riddle-like headings may be compared to the pertinent topics of the same material treated modularly on the right.

CONCEPT OF THE TOPICAL MODULE

Because it has obvious boundaries (both physical and editorial) and an appropriate capacity, the self-contained theme of two-page proportions becomes a prescription for thematic coherence that is more objective to the author and reviewer, while being compatible with the natural behavior of the author and reader.

Application of Thematic Quantization to the printed document is illustrated in Figure 2. The reader is confronted with a self-contained and easily assimilated theme wherever he may open the document. Since all discourse on a topic ceases within the module boundary, turning the page means starting a new topic. The number of topics selected during initial outlining to cover a given subject category can be as few or many as desired, depending upon the emphasis intended and the overall page limit of the publication. The topic represents what could be called "unit thematic intention;" it is not predefined by subject matter. Different authors could obviously cover the same subject category with different arrangements of ideas within topics, according to the particular expository strategy of each. A theme may take up the same subject category as a previous theme, though from another aspect and therefore justifiably as another topic. Likewise, changes in topic coverage during writing can be effected by topic spinoffs or consolidations. The only absolute requirement is that each resulting theme must be coherent, pertinent and not in excess of two pages. Violations of thematic unity are easier to spot and therefore more likely to be repaired early in the game.

In the typical STOP publication, the text is placed on the left and the figures are placed arbitrarily on the right, but since the use of illustrations is not essential to the method, the text may "slop over" as desired. Conventional 8-1/2 by 11 reproduction methods allow about 500 words per page, for a maximum topic length of about 1,000 words without illustration. Multiple figures can be employed per page, to the limits of art-sizing ingenuity, as can foldouts in the customary way, which, however, must be "backed up" with the text for the subsequent module.

It will be shown that the engineer writing a report or proposal invariably starts a new topic after about 500 words on the average. This is fortunate because it means that the STOP format accommodates normal writing habits without a lot of copyfitting trouble as might be feared. Material does not have to be chopped up, boiled down, or superficialized in any way. The more detailed, technical and theoretical the better.

The reader is provided outline orientation at a glance by the categorical Section and Subsection headings; he does not have to remember or turn back to the table of contents to see where he is in the scheme of things. No room is provided for writing text under sectional headings because their function is only categorizing, but the categorical headings constantly reappear from theme to theme. The essential argument of the topic is crisply summarized for the reader by the printed out Thesis Sentence, which facilitates scanning, and the figure is always found right there, without the nuisance of page flipping to locate it.

If the topic does not completely fill the module, the remaining blank space is accepted as a mere aesthetic difference from the run-on format. However, it also becomes regarded as a beneficial signal to the reader that he can now begin to digest what he has just received, before confusing the issue with the next theme.

DEFINITE TOPIC BOUNDARIES STRENGTHENS COHERENCE

350 WORDS*   500 WORDS   1,000 WORDS   500 WORDS WITH FOLDOUT

COPYFITTING FLEXIBILITY

Section – Technical Approach
Subsection – Environment Control Techniques

ADVANTAGES OF THE EVAPORATIVE COOLING METHOD

Evaporative cooling is more effective than air cooling or cold plates because ambient liquid absorbs heat faster than circulating air, the constant vapor temperature is exploited, and the waste heat is positively discharged into the ship's water system – with less equipment weight and space.

(theme body)

Figure 2. The modular organization with printed thesis promotes stronger coherence and continuity within the topic simply because the point is more clearly defined and the space restriction prevents the author from over-reaching it unwittingly.

*Note: Most reports and proposals have about 12 percent blank space, regardless of format method.

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STOP: WHO NEEDS IT?

There is evidence that the technical report and proposal are failing to perform their intended functions because the methods of preparation don't cope with the characteristic changes this literature has undergone in modern times.

From a distance, any improvement of technical literature sounds fine. But who needs a method as radical as STOP? Don't our proposals win contracts, our reports get accepted? These questions arise as soon as the engineer-author working on a proposal or report tries STOP for the first time. Then he realizes that STOP imposes rules and constraints, requires more effort, harder thought, and is less "forgiving" than conventional, permissive methods of outlining and writing.

With practice, the engineer-author overcomes these annoyances and learns to appreciate the underlying compatability between the STOP discipline and his natural inborn habits of discourse. But STOP will always stand for more intellectual effort. Is it necessary? The answer can be seen in the situation of technical literature today. The widespread lack of comprehensibility and retrievability of the information content of reports and proposals is well known. The problem is made apparent by every final report left unread and unused, and by every contract settlement put off by delayed submittal of final reports. It is reiterated by every RFP which warns against "brochuremanship", pleads for "clarity and conciseness," dictates content paragraph-by-paragraph, or imposes stringent page limitations.

Accustomed to living with our technical information problems, we take them for granted, but a higher look at the situation will show that there are grave problems indeed, both for Hughes and the nation at large.

Vice President Hubert H. Humphrey called Congressional attention to the extent of the problems in 1962, when, as Subcommittee Chairman on Government Operations, he scored "the unsatisfactory management of scientific and technical information by the Department of Defense," leading to:

- "2 billion dollars a year needlessly lost in the yield of Federal research and development expenditures, and

- A year of time needlessly added to the average 5-year development cycle of a weapons system."*

As can be seen at Hughes, the typical report and proposal is prepared under terrific time stress by "nonprofessional" writers, e.g., the design engineer. Four characteristic features of this process (Figure 3) which tend to degrade editorial caliber are 1) multiple authorship, 2) increased size and complexity, 3) scheduling pressures, and 4) the impracticability of editing. Against these threats to coherence, our conventional approach to document development brings to bear the same "closet" procedures employed by the 18th century scientific essayist: categorical outlining, "River-Raft" drafting of manuscript, and post-facto reviewing.

The result, in general, has been a very low quality in content of documents, and a very high difficulty in their control and preparation.

If poor proposals win, and poor reports bring follow-on work, it happens despite inferior effectiveness of the document, that is, through the absence of competition. A more independent set of editorial criteria is suggested below. If you can score high on these, then you would not benefit from STOP.

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* U.S. Senate Scientific Research Study, the Department of Defense and Scientific and Technical Information, Memorandum S-3-11-62, March 26, 1962, from Hubert H. Humphrey to George H. Mahon, House Committee on Appropriations.

Is your document:

- Planned and written with clarity and harmony? (Do the contributors turn in write-ups that match the outline and intent of the document manager, or is there confusion and disappointments?)

- Easy to read, comprehend and evaluate? (Does the customer's behavior show he has received your key messages one way or another, or are additional oral presentations required to "sketch out the big picture"?)

- Answerable to trade-offs against stiff technical competition? (Is your technical edge clearly apparent, as it must be when the proposal outcome is not wired, or is it disadvantaged by editorial faults?)

- Innocent of the frantic, overnight "bash", in which large portions are thrown away or redone at the last minute?

- Useful as "program aids," for costing purposes, in-house orientation and training, follow-on efforts, etc. (Or do key members have to re-explain the program to newcomers and staff workers?)
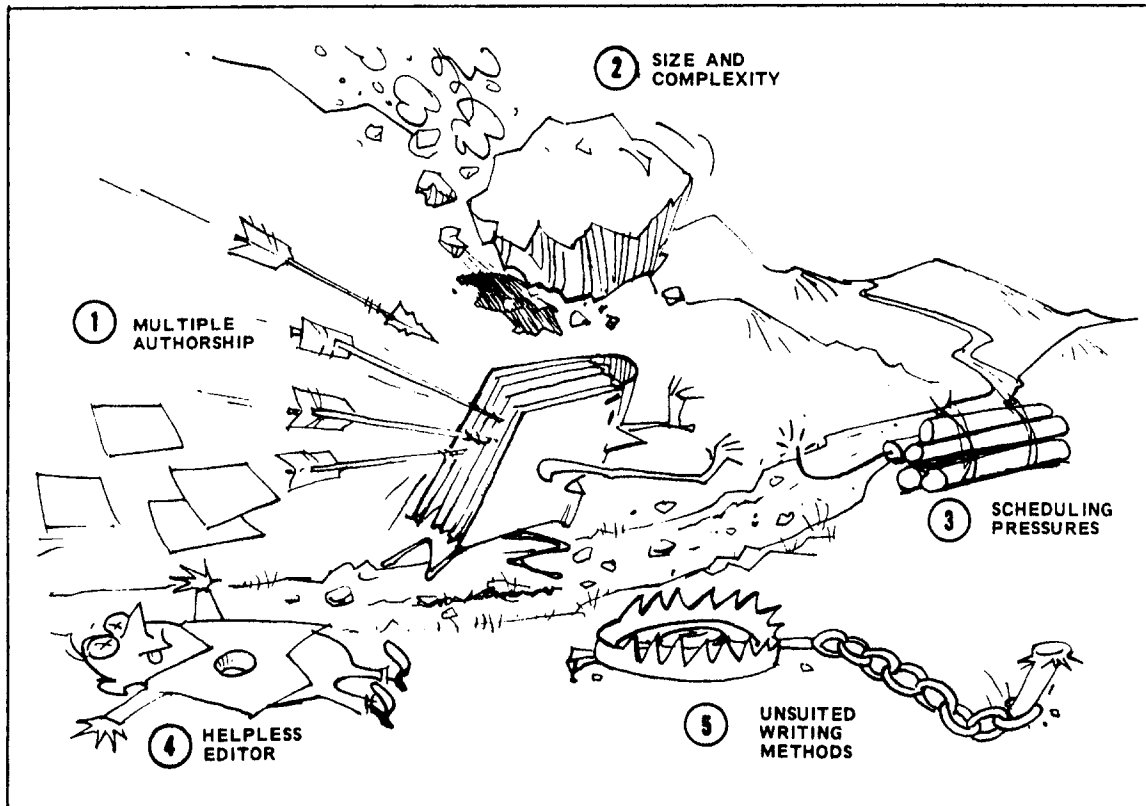

Figure 3. While the perils of the modern report and proposal clearly distinguish it from the 18th century essay, its techniques of preparation remain the same. Editor's role is professionally undefined. Frequently lacking the technical skills or time to operate, he reverts to format and language flyspecking.

PITFALLS IN THE CONVENTIONAL METHOD

The standard approach to document preparation has three ingredients: 1) a mysterious outline, 2) a long wait for manuscripts to be written, followed by 3) a last-minute crisis while the pieces are pulled together. Participants are in the dark until the document is completed.

The historic procedure for developing a proposal or report is shown in Figure 4. You make an outline, write the drafts, review the manuscripts, then make revisions, and so on. When problems develop, the standard complaints of the participants, culled from thousands of hallway comments, are as shown. Notice that each participant feels he is in the dark, which is the characteristic feature of the whole process, making it a veritable "trial and error" proposition. One reason for this is that the conventional outline says very little, except to the individual who wrote it. Another reason is the occurrence of the "long wait" after the outline is issued, while the manuscripts are being laboriously composed sentence by sentence. During this period, the document manager can only fret – and keep his fingers crossed.

Unfortunately, when manuscript submissions are finally made, the document manager is suddenly faced with a crucial task which he may not be skilled at handling, that is, critically reviewing the content, paragraph by paragraph, to see what is being driven at, judge whether it is acceptable, and decide what to do about it if it is not. The difficulties of performing a text critique are much greater than ordinarily appreciated. Analysis of technical significance is often obscured by literary and organizing defects, and so becomes entwined with editorial criticisms the manager would prefer to avoid.

Furthermore, the sentences and paragraphs are set up in a "concrete" of worked-out grammar and continuity. The necessary improvement is difficult to envision, and changes difficult to make, since the defects are seemingly "locked up" in a thematic aggregate of diction, syntax, paragraph structure, and rhetorical devices. The usual feeling is that "something is wrong but I don't know exactly what it is." Remember, too, that time is now running out. The upshot all too often is that the material is released regretfully "as is," or just nit-picked, or junked in wholesale lots.

The document manager at this point realizes that an awfully lot was contracted for when his initial outline was rather casually tossed off as the basis for making assignments to his engineers. But his resolve to do better the next time is quickly eroded away when he undertakes the baffling act of preparing a better outline for communicating his wants more specifically to his contributors. Strangely, it all reduces to more confusion, misunderstandings, and mere talk. The concensus is that it is easier to "bash it out", and make-do with poor inputs, than it is to face the frustations of attempting to correctly plan and control the content in the first place.

Cynical? No. Realistic? Yes – a recognition that outlines, as now built, can only be the sketchiest of predictions, and are not the specifications they should be to effect positive control over the elusive and heuristic process of writing.
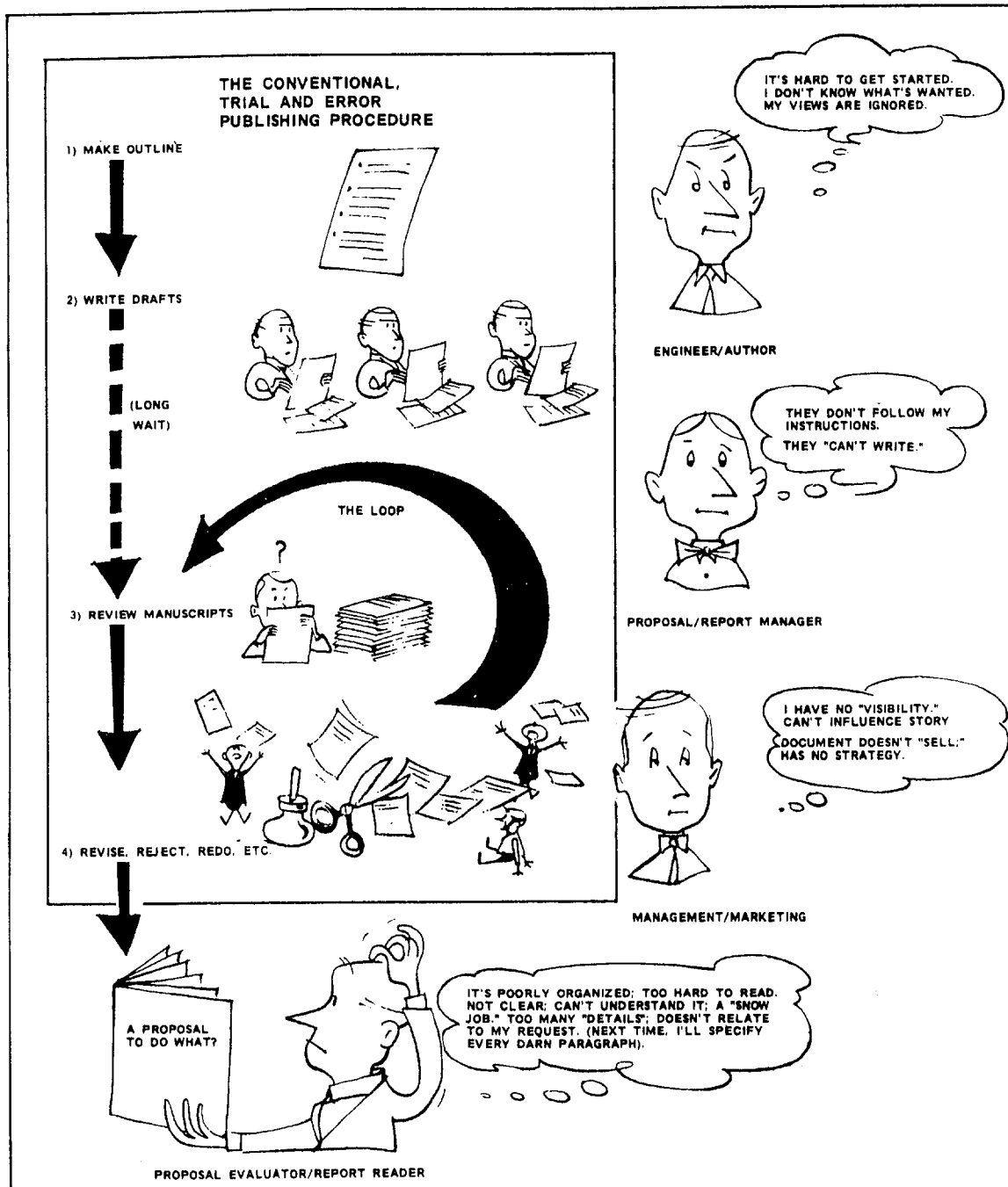
Figure 4. Laissez-faire writing and post-facto reviewing means that the course of the document can be observed and corrected only after the accident. Ineffective outlining method is the basic culprit, not lack of time or writing skill.

THE LOSS OF OUTLINING CONTROL

Achieving coherent thematic organization depends on writing thesis sentences at the topic level. Outlining without the thesis/topic concept reduces to mere categorizing, which practically guarantees team confusion and thematic incoherence.

If an outline is to effectively control the writing process, it must specify content in terms of topical points and lines of argument rather than categories of subject matter. Thus, the basic steps of outlining, as shown in Figure 5, require the writing out of a thesis sentence, or statement of proposition, before one can list and arrange the subject items meaningfully. While this fact has long been recognized by orthodox references on the craft of expository writing (e.g., J. Raleigh Nelson, Writing the Technical Report, McGraw Hill, 1940), the practice of writing out thesis sentences as part of outlining has become extinct in industry.

There are many compelling reasons for the general demise of orthodox outlining. They include: 1) the lag of technical incubation, discouraging early committments to story-line specifics, and 2) the growth of scope and complexity, exceeding one man's grasp of the content's essentials. In proposals another insidious reason is the assumption that the theses reside in the RFP and the proposal therefore only has to contain the "answer half of the dialogue." The fundamental reason, however, is the seeming lack of appropriate places or levels in the swollen outline at which to summarize the various propositions. Do you write a new thesis sentence for each chapter? Each heading? Each paragraph? We now detect a methodological oversight. In defining the Thesis Sentence 25 years ago, Professor Nelson had in mind the short technical report of 10 pages, or Theme paper of the classroom; he never envisioned the 100, 500 or 2,000 page proposal or program final report.

In any event, the elimination of Steps (2) and (3) in Figure 5 results in the tentative subject list, Step (1), becoming the sole mechanism of outlining. Thesisless, it soon takes on the characteristics of the "categorical" outline, Figure 6. The categorical outline is so named because its headings are preponderantly categories, such as "General Description," or "Introduction." Categorical outlining is preoccupied with regulations, with "official" nomenclature of subordination, "logical" rules like subordinate bifurcation, and literary conventions of form such as linguistic parallelism of headings and indentation symmetry.

As a text organizing tool, the categorical outline has several major methodological defects. First, the implication that greater degrees of indentation must systematically correspond to lower levels of detail. This leads to differences of opinion over absolute levels of given subject matters, and to generation of "false-front" headings to achieve outline alignment of given write-ups.

Second, the lack of distinction between the functions of categorizing and subordinating (both are shown by indenting). This leads to confused organizations by obscuring the fact that the true criteria of subordination is thematic dependence, not class membership.

Third, the lack of distinction between categorical headings (which cannot be written about) and topical headings (which are written about). This leads to generation of redundant or trivial copy under categorical headings (e.g., topical borrowings or editorialese), and disunified, partial write-ups under topical headings.

Fourth, the absence of quotas or limits on word length per heading entry. This leads to skimping on hard issues, over-elaborating on familiar detail, changing the subject without warning, and prevents the development of thematic unity through topical self-containment.

Fifth, the absence of thesis sentences, and the use of noun-type topic titles. This makes the thematic intent invisible, so each participant must resort to a personal, intuitive set of theses, and profound team confusion therefore ensues.

A nice thing about the categorical outline is that thesis development, being a troublesome intellectual chore, can be put off to the actual writing phase — indeed, the purpose of writing out the paragraphs becomes erroneously defined as a process of thesis seeking, rather than one of thesis presenting. This misconception fits nicely with the fact that writing is always more-or-less unavoidably heuristic (you don't know exactly what to say till you're in the process of phrasing it), so the categorical method seems to be a "natural" approach. Because the author can get going with an "organization" before he has worked out precisely what to assert, argue, prove, etc., the categorical method has become highly popular for the crash proposal and report.

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THE "CATEGORICAL" OUTLINE

I _____

   A _____

   B _____

      (1) _____

      (2) _____

   C _____

II _____

ENGINEER   PROPOSAL MANAGER

52092-5

OUTLINING BASICS

1) MAKE TENTATIVE LIST OF SUBJECT ITEMS

2) FORMULATE THE THESIS.

3) SELECT AND ORGANIZE THE SUBJECT ITEMS TO BEST DEMONSTRATE THE THESIS.
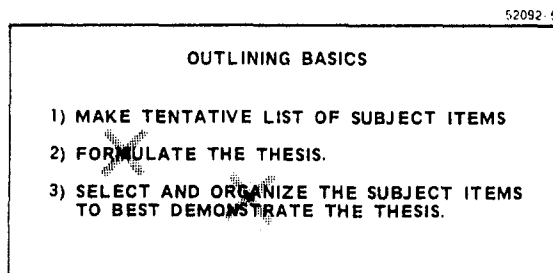
Figure 5. When the document grows larger than a single theme, there is no obvious place to write the thesis sentence(s), so topic-level "organizing", steps 2) and 3), is left undone until the actual writing is undertaken.
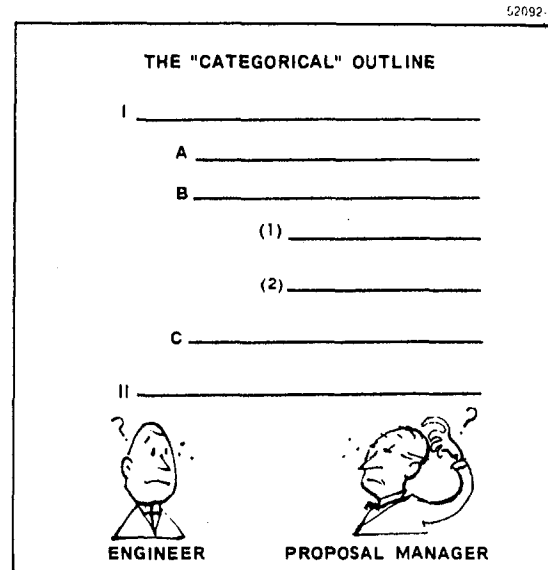
Figure 6. Skeleton of a categorical outline shows its reliance on the mechanism of subordination. With thesis sentences missing, each participant must read his own intuitive theses into the riddle-like noun headings.

9

THE RIVER-RAFT DOCUMENT

Categorical outlining results in the "discretionary" writing of the River-Raft document, so called because it follows the line of least thematic resistance. The story telling impunity of the categorical approach was borrowed from the novel tradition and is not suited to expository discourse.

The result of the categorical approach to writing (composition as thesis-seeking) is the "River-Raft" document (Figure 7). Unpredictable length of passage gives the text its scroll-like character, which is seen as a "river" of words. Unpredictable usage of figures suggests the analogy of "rafts," since the unexpected appearance of figures, and their loose relation to the text make them navigational menaces.

The ease of outlining the River-Raft production goes hand-in-hand with a tendency toward concealment and distraction when the author is pressured by scheduling and subject difficulties. The categorical heading doesn't seriously commit the author to a specific topic, so a weak point can be slighted or an extraneous point sneaked in without the reader being the wiser. Since the author is free to wander at his discretion, he will be tempted to follow the line of least thematic resistance, favoring preferred subject areas and avoiding hard ones, without concern for being called to account.

One consequence is falling for Parkinson's Law of the Trivial, writing more and more copiously the deeper one proceeds into the details of the subject. Another is the tendency to the lazy-man's circumlocation, the style that counts on there always being another sentence coming along which can be used to bolster the weakness or clarify the ambiguity of the last one. The most confusing consequence of "trusted" organizing is that changes of "subject", that is, changes of immediate topical focus, can occur without warning, e.g., the general description of the block diagram is interrupted by an equally long description of the special design technique for one part of the block diagram. Guided only by broad categories, neither the author nor the reader has a ready test for the condition of extraneity. It is strictly a matter of goodness of intent and skill whether the author avoids the temptations of "least resistance." The organizing rules are no help to him.

Figure usage is abused three ways in the River-Raft document: 1) the reader can't tell when a figure is about to be referred to, 2) he can't find it easily when a reference is made, and 3) the figures are often not discussed in an orderly way, but are thrown in as reference data on the basis of "figure it out yourself." It is not surprising to see figures treated as "attachments" in the River-Raft method. One must be working in the topic concept before the possibility is fully appreciated of handling figures as thematic elements of message units, rather than as official data submittals prepared by the drafting room and not to be tampered with. The chief offense of the River-Raft figure is that it covers too much ground topically, either in scope or level, when translated into a text discussion.

The catchall diagram or schematic conceived in equipment terms as a functional entity is fine as "engineering data," but not at all suited to the expository need for thematic, or lesson entities. Fitting figures into messages means breaking them down into topically unified dimensions, and perhaps creating others in verbal terms such as the key word list.

The characteristic trait of the River-Raft report or proposal is that at any given moment of reading, the reader usually can't tell where he is in the overall outline and what is being driven at in the present passage. The author, hopefully,

is "building up" to a conclusion, and the reader must hang on until he arrives at it. The psychology of the reader putting himself into the hands of the author, to be led to the promised land of comprehension, is a piece of cultural mythology called "The Assumption of the Wise Author." According to this literary convention, the role of the author is that of the omniscient story teller, as in the novel tradition. Its corollary is that if the reader becomes confused, he just wasn't paying attention.

The implication that the reader is not entitled to know beforehand where he's going is part of the enjoyment of being entertained, but is unworkable for the situation of instruction. Unfortunately, the technical report and proposal lack the plot structure that privileges the novelist and makes this concept of wise authorship reasonably valid for the literature of fiction.

52092-7

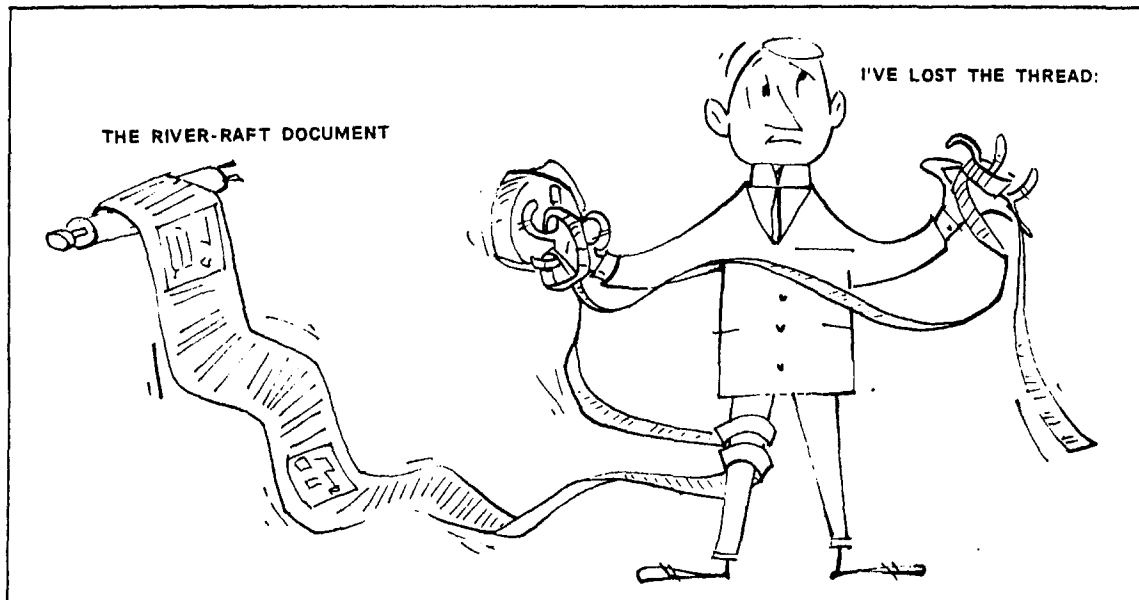
Figure 7. In the conventional run-on proposal, the text-scroll is a "river" of writing inhibited only by the author's good intentions. Figures are "rafts," guided by their own informational momentum. Confused reader's complaint is caused by author's misconception that continuity of whole narrative is the same thing as coherence. Rhetorical flow has been stressed over logical inevitability.

11

NATURAL TOPICAL STRUCTURE OF EXPOSITORY DISCOURSE

If you ignore the categorizing of existing headings in the text of technical literature, and search out the independent units of discourse on strictly thematic grounds (line of argument), you will discover a sequence of more-or-less self-contained topics having more-or-less uniform lengths.

Despite categorical outlining and the foibles of River Rafting that result, the conscientious author of expository material unconsciously follows a natural pattern of organization: the sequence of topical themes. A point is raised, then discussed; another point is raised and then discussed, and so on. What makes this observation significant is the surprising degree of uniformity in natural theme lengths, and the degree to which the topical content of the themes goes unrecognized in the system of categorical headings. These factors raise the possibility of a standardized, modular thematic structure of outline, wherein the precise object of the passage can always be kept clear for both the author and the reader through the device of the thesis sentence.

Natural topic structure can easily be shown to exist in any sample of thematic material provided that: 1) it is reasonably coherent to begin with; 2) the "subordinating" sign of categorical headings, if any, is correctly interpreted; and 3) the "topic" is understood to be any semantically discernable passage, which can be summarized in a thesis sentence that is thematically independent of the previous thesis sentence (thus ruling out the paragraph as topics). Studies of Hughes reports and proposals show the following statistical properties of the natural topic:

- Topic length ranges from about 200 to 950 words.
- The average topic length is about 500 words.
- The standard sample deviation is about 200 words.
- There appears to be a normal distribution about the mean.

In other words, topic range and variation is amazingly small, most authors exhausting a given theme in about 5 or 6 paragraphs on the average. This pattern is most pronounced in detailed technical exposition, where the author is motivated to make a full explanation of all that is significant about the subject, and is therefore most likely to change the subject on himself without realizing it, i.e., become "extraneous" to the original intention of his heading or opening salient.

A topic-structure analysis for a random sample of River Raft proposal material is shown in Figure 8. The number of words per heading is first plotted in bar-chart form. The text is then examined to determine where the "true" topic boundaries do not coincide with the system of headings. Topic boundary validity is determined (somewhat subjectively) by the rules of Thematic Unity and thesis independence, but not by length preconceptions. The author's own transitional devices and hints are used where possible to fix topic boundaries. That violations of unity in the semantic sense usually correspond to abnormal variations in length is the essential (though "mysterious") property and advantage of the modular technique. Where discrepancies exist, the valid topics are re-plotted, as shown by the dashed bars. Correctly subordinated passages are summed (by the brackets) to show intended topical total. Deviation about the mean is then calculated in the usual way.

Note that this analysis does not complete any editorial process of conversion. New topic titles, necessary categorical revisions, and leftover non-topical fragments (often editorialese of questionable significance) are yet to be accounted for.

OUTLINE HEADINGS
(TABLE OF CONTEN

FIGURES:
- ☐ SMALL
- ☐ 1 PAGE
- ☐ FOLDOUT

	0	1700	1800	1900	2000	2100	2200	2300

PROPOSAL FOR INDUCTIVE

STORAGE SWITCHING STUDY (FP64-14

SECTION IV PULSE SHAPING CIRCUITF

  A. CURRENT-FED PULSE-FORMIN

  B. MAGNETIC PULSE SHAPING C█ ☐ ☐ ☐ ☐

  (NEW MODULATOR CIRCUIT)

  (SQUARE LOOP METHOD)

  (ACHIEVING UNIDIRECTIONAL PUI

  C. SOLID-STATE PULSE SHAPING

  D. ACTIVE PULSE-SHAPING CIRC EAN, 0 WORDS

  E. RLC PULSE SHAPING

  (CONVENTIONAL MAGNETIC PULS

POSTULATED NORMAL DISTRIBUTION OF TOPIC LENGTHS. 68 PERCENT OF NATURAL TOPICS WILL BE BETWEEN 300 AND 700 WORDS (95 PERCENT BETWEEN 100 AND 1,000).

SECT. III SWITCHING DEVICES

  A. CONTROLLED-CONDUCTION D

    1. VACUUM TUBES

    2. TRANSISTORS   2

    3. SILICON CONTROLLED SWIT WORDS

  B. TRIGGERED (UNCONTROLLED)

  C. TRANSFER SWITCHES

SECT. VIII RF GENERATORS

DISTRIBUTION OF ACTUAL TOPIC LENGTHS FOR SAMPLE OF 256 NATURAL EXPOSITORY TOPICS.

  A. OVER-COUPLED TESLA COIL

  B. RESONANT STRUCTURES

    1. CAVITIES

    2. DISTRIB. PARAMETER CIRC

  C. NON-LINEAR CIRCUIT ELEMEN

    1. FERRITE DEVICES

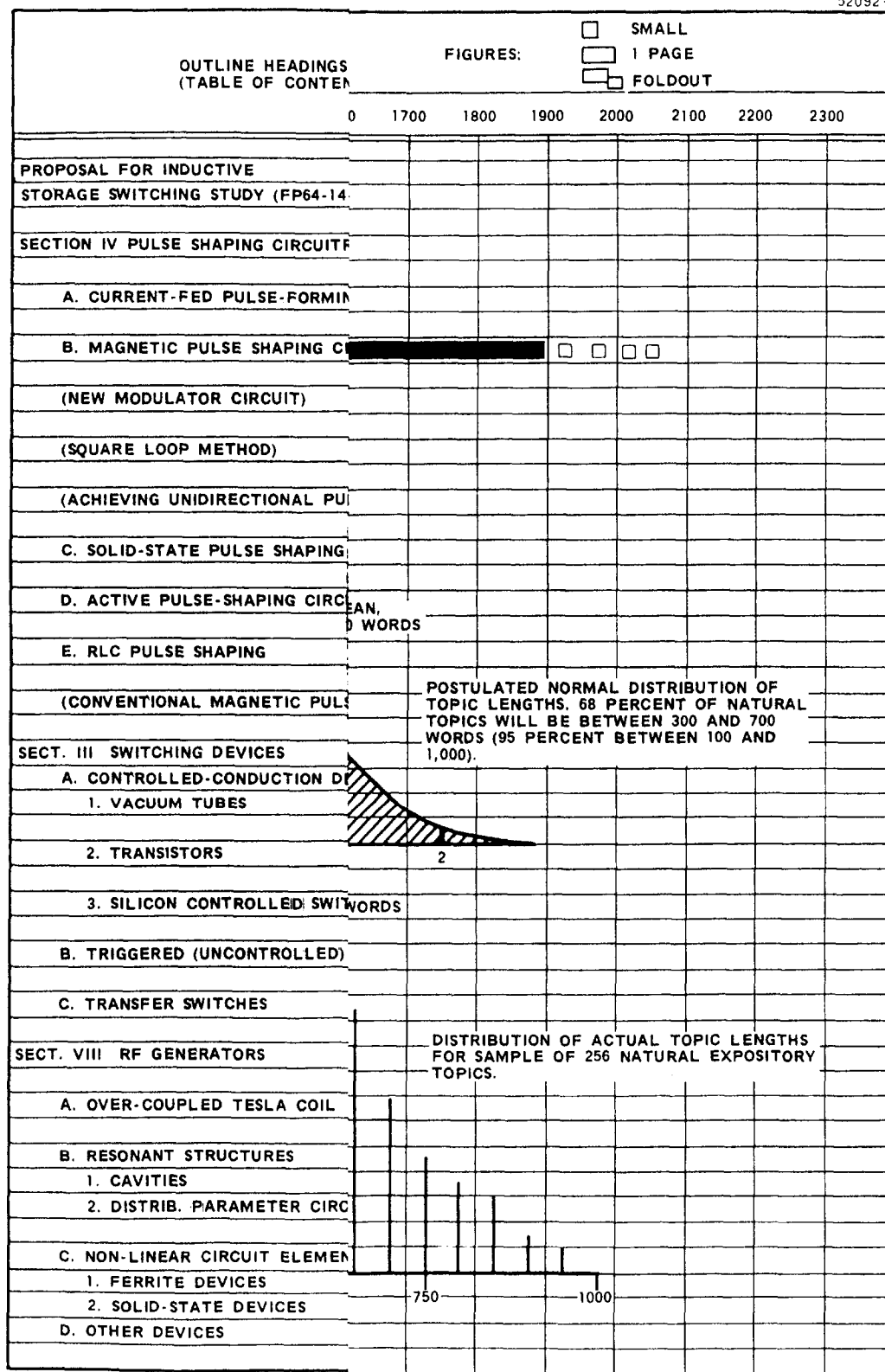   2. SOLID-STATE DEVICES   750   1000

  D. OTHER DEVICES

Figure 8. Theme Structure Profile.

13

THE CONCEPT OF THEMATIC QUANTIZATION

Recognition of topics in the writing treatment is very important to thematic coherence. Since there is a surprising uniformity in natural topic lengths, the device of a standard topic module can be used to implement and insure topic recognition.

STOP's recognition of natural topic boundaries in the heading structure would seem to be an obviously desirable reader aid. Modern technical literature already attempts to do this. The River Raft document makes liberal use of outline headings which try to show thematic content, but true topic structure is concealed by the use of nonindicative categorizing headings and nonretreivable subordinate headings. Development of thesis sentences for each topic is a logical extension of topical recognition, and has the further advantage of re-instituting the thesis sentence as an outlining aid. STOP goes one step further by standardizing the module dimension, with a capacity that accomodates the upper limit of the natural range of topic lengths, thus physically embodying the topical rules of organizing as a distinct and systematic format feature. Topic recognition through modularity is illustrated in Figure 9.

This rationale behind STOP is called "Thematic Quantization." As a principle of written communication it states:

"Recognition of topical structure as distinct from categories is essential to elicit the correct responses in writing and reading known as coherence. The most reliable and objective way to insure such recognition and co-response for both author and reader is to communicate in message frames of uniform size. "

Aside from the basic question of joint author-reader coherence, the beauty of Thematic Quantization is that it obliges the author to search out and identify his key points more specifically and clearly before writing. Thus, in addition to Thematic Unity, it tends to elicit greater pertinence during the planning of the sequence and the actual construction of the individual themes. It therefore results in improved comprehensibility of the whole document (which is the product of coherence and pertinence, if you wish). All of which is a good deal more important than its most obvious benefits: the mechanical improvements in readability, such as the insured figure/text relatedness.

It is important to note that Thematic Quantization works as an organizing tool, that is, despite individual differences in writing and reading skills. Usage of the principle is ubiquitous; it can be seen in numerous forms such as flip-chart presentations, tutorial booklets, brochures, junior textbooks, etc. That it has not been applied to complex technical material before is probably due to our unfortunate categorical misconceptions about the nature of theme structure, and the general fear of losing the privileges of wise-authorship.
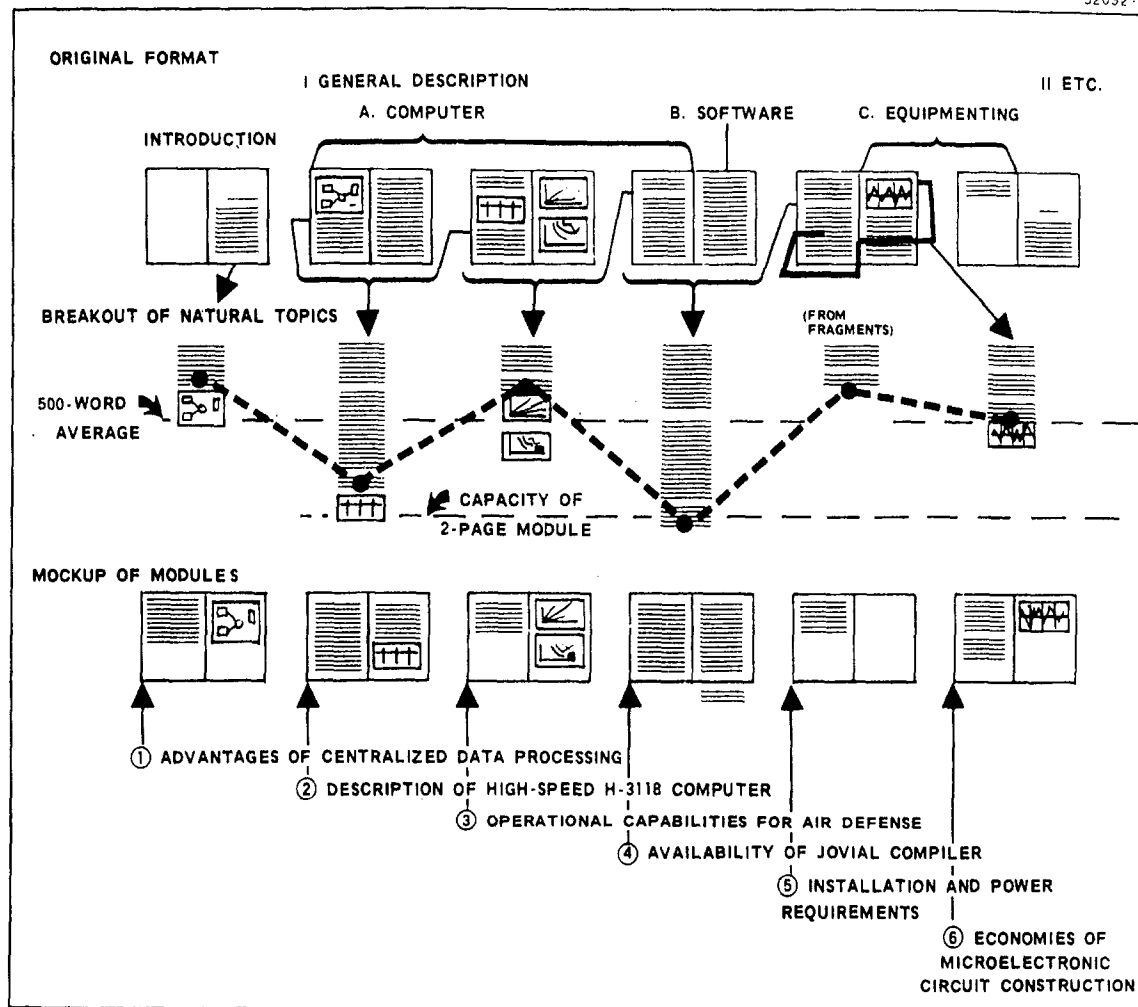
Figure 9. Thematic Quantization forces recognition of topic structure by a uniform modular format. The standard 2-page spread is conveniently available for use as the module. Capacity of the 2-page module, fortunately, is sufficient for more than 95 percent of natural topics. Note that the fragments making up Topic 5 don't really belong in Section I. Topic 4 has copy fit problems, but would probably make into two topics with considerable reader advantage.

EXAMPLES OF HOW QUANTIZATION REVEALS THE THESIS

When River Raft material is converted to topical form, the various theses of the topics "float out" from under the categories, giving the reader quicker insight into the line of argument.

As an illustration of natural theme structure and the effects of Thematic Quantization in facilitating comprehension, it is instructive to observe what happens when categorically outlined material is converted to topical form. This conversion is illustrated for three real-life cases in Figure 10. The basic criteria behind the conversion is the module limit. Each topical heading on the right (all caps) stands for no more than 2 pages of copy; headings on the left stand for unknown amounts. Assuming coherent original copy, no re-write is performed; hence in converting, the existing material rearranges itself into the topical units shown, dictating their own topical titles in the process, also just as shown. Thus, in Case 2 "Introduction" naturally and orginally consisted of two roughly equal portions covering general advantages of the design and low cost of the drum memory.

Note that the subheadings within the topics would still be employed in the modular form. They just don't show in the outline, since being thematically dependent they are not considered a retreivable item. Thus, in Case 3 the passage on apportionment of subsystem reliability goals is buried under the setting of goals in general. This is justified because, while it could have been treated independently by the author, it wasn't, either in terms of its own thematic unity or length.

Note also that the loss of outline orientation (context of subordination) at any given point in the topical outline is only apparent. The reverse is actually true in the printed text. Thus, in Case 3 the reader of the categorical copy might face a page carrying only the subhead "Electronic Components." The topical reader would see: "Missile Reliability, Effects of Storage and Handling on Components, Electronic Components."

Incidentally, the double topic on "Effects of Storage and Handling . . ." is a typical instance of the non-topical "strung-out" module, consisting of a list of items with no basis for thematic unity other than categories. The "continued" option is selected when attempts to achieve a useful distinction fail. This is a defect in the conversion process, and the case is fortunately infrequent since the various solutions take extra effort.

Two observations should be made about these examples. First, there is a significant and valuable increase in thesis visibility. Thus, in Case 1, the "CNFAR Quantization" label turns out to be hiding both a design approach and a set of test data (incorrectly lumped). Also, Case 2 is a good example of thesis-revealing all the way through it. The revelation is only hinted at in the more specific topic titles. One must imagine the improvement effected by written out Thesis Sentences summarizing what is actually being said.

Second, the independent "theme level," i.e., the point to which the material actually addresses itself (above the subordinate passages) wanders back and forth unpredictably in the categorical outline. It is this absence of the straight-line theme level which causes so much confusion to both the author and the reader in the River Raft approach.

Original Categorical Outline	Topical Outline after Conversion

Case 1

I. Automatic Detection

  A. Introduction

  B. Automatic Detection Techniques

    1) Introduction

    2) External Radar Phenomena Considerations

    3) CNFAR Quantization

    4) Multilevel Thresholds

    5) Adaptive Environment Control

      a. Parallel Channels

      b. Adjustments

    6) Pattern Analysis

I. Design Approach for Automatic Detection

Automatic Detection Principles

  TECHNIQUES FOR AUTOMATIC TARGET DETECTION

  CONSIDERATIONS OF RADAR ENVIRONMENT

  HUGHES VIDEO PROCESSING METHODS

Adaptive Control Methods in Automatic Detection

  THE STATISTICAL VIDEO QUANTIZER CONCEPT

  ABILITY TO VARY CNFAR THRESHOLD WITH RANGE

  PERFORMANCE DATA ON MODEL STATISTICAL QUANTIZER

  { USE OF PARALLEL CHANNELS FOR AUTOMATIC SEE-THROUGH

  { MEANS OF COMBATING FRIENDLY INTERFERENCE

  { ADJUSTING FALSE ALARM RATE TO OBTAIN SEE-ABOVE

  { ADJUSTING DETECTION CRITERIA FOR BROKEN-UP CLUTTER

Pattern Analysis Methods in Automatic Detection

  { PREVENTING FALSE TARGET REPORTS BY HIT-PATTERN ANALYSIS

  { AUTOMATIC REPORTS WITH MOVING-WINDOW DETECTOR

Case 2

III. General System Considerations

  A. Basic Considerations

  B. Computer Subsystem

    1) Introduction

    2) Organizational Concepts

      a. Configuration A

      b. Configuration B

      c. Test Unit Tie-In

  C. Radar Data Converter

    1) General

    2) Major Functions of RDC

    3) Azimuth Conversion

      a. Synchro Methods

      b. Digital Methods

      c. Accuracy Comparison

III. Key System Concepts

Summary of Approach

  { CHIEF PERFORMANCE TRADE-OFFS

  { AVOIDANCE OF SPEED SACRIFICE

Computer Design Goals

  ADVANTAGES OF SPECIAL PURPOSE DESIGN

  LOW COST OF DRUM MEMORY

  IMPORTANCE OF AUTOMATIC TESTING

  DRAWBACKS OF CENTRAL CONTROL

  PROPOSED REMOTE PROCESSING

Selection of RDC Techniques

  CRITICAL NEED FOR MULTIPLE INPUTS

  VIDEO QUANTIZER MOVED TO COMPUTER

  ADVANTAGES OF ELECTRONIC AZIMUTH CONVERSION

Case 3

1. Missile Reliability

  1.1 Introduction

    1.1.1 Summary

    1.1.2 Requirements to be Achieved

    1.1.3 Missile Sub System Reliability Apportionments

  1.2 Missile Storage and Handling

    1.2.1 Missile Use Sequence

    1.2.2 Storage and Handling of Components

      1.2.2.1 Hydraulic Subsystem

      etc.

      1.2.2.9 Electronic Components

    1.2.3 Quantitative Storage Reliability

  1.3 Missile Flight Reliability

    1.3.1 Missile Reliability Block Diagram

    1.3.2 Missile Reliability Math Model

    1.3.3 Launch and Flight Reliability Predictions

  1.4 Total Missile Reliability

  1.5 Evaluation and Conclusions

1. Missile Reliability

  SETTING OF RELIABILITY REQUIREMENTS AND GOALS

  ASSUMPTIONS ABOUT MISSILE STORAGE AND HANDLING

  EFFECTS OF STORAGE AND HANDLING ON COMPONENTS

  EFFECTS OF STORAGE AND HANDLING ON COMPONENTS (Cont.)

  CHOICE OF FLIGHT RELIABILITY DIAGRAM & MATH MODEL

  LAUNCH AND FLIGHT RELIABILITY PREDICTIONS
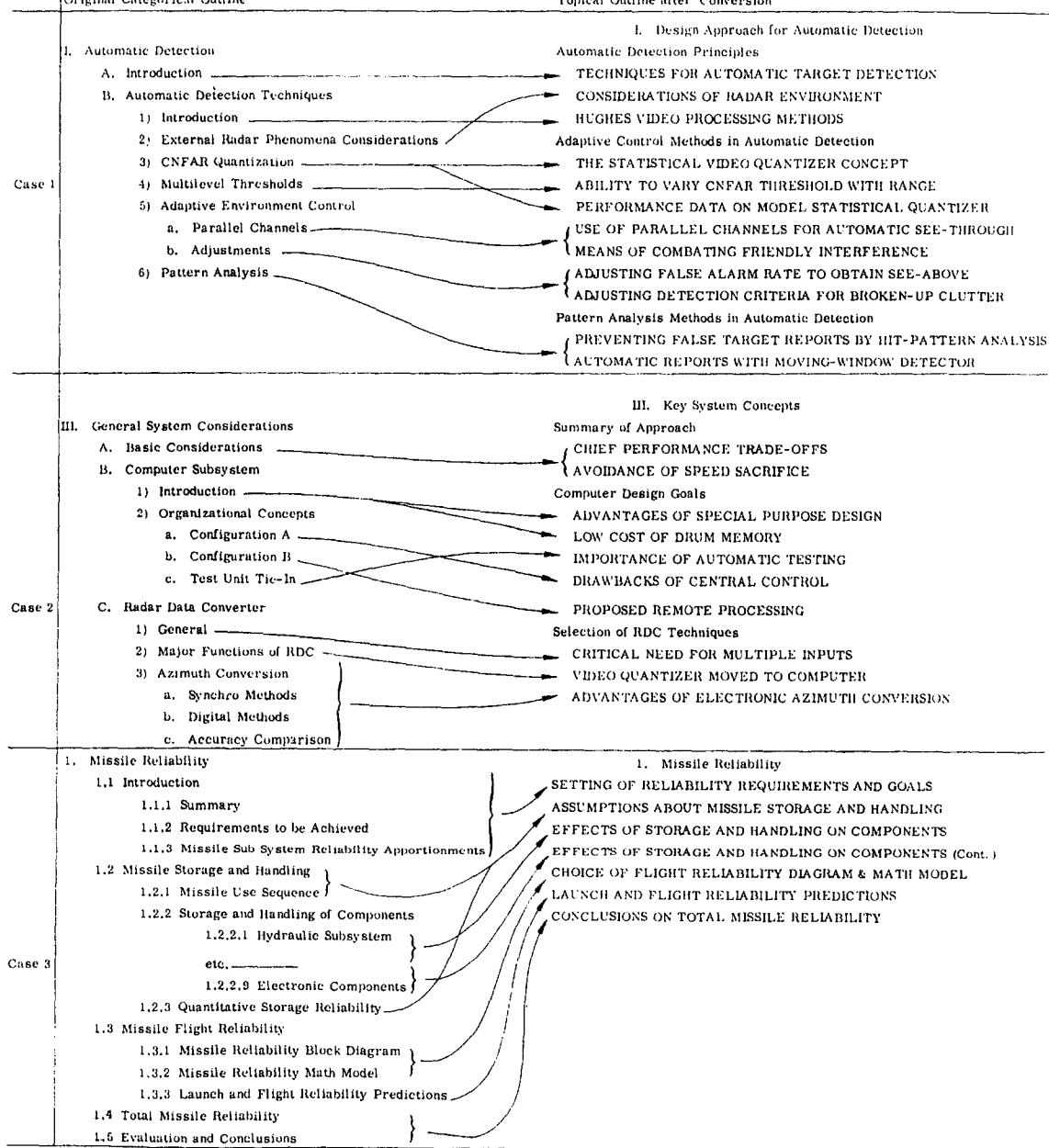
  CONCLUSIONS ON TOTAL MISSILE RELIABILITY

Figure 10. When River Raft copy is converted to a topical organization, three things happen: 1) the different purposes of the categorical and topical headings become apparent, 2) the common level and scope of the self-contained theme becomes distinguishable, and, 3) the theses become more visible. The result is a dramatic increase in the reader's ability to predict content.

STORYBOARDING: A NEW WAY TO OUTLINE

The STOP publication is planned, reviewed, and revised before it is written. This is necessitated by the topical organization and is made possible by the Storyboarding technique. Organizing control and ultimate manuscript content are improved simultaneously.

In sharp contrast to categorical outlining, the author of a STOP manuscript has to think in terms of developing finite passages of argument or descriptions. He can no longer merely arrange headings in various patterns and classes that seem to be logical. Since topical organizing means metering out the story in definite message modules, it becomes a problem of enumerating and quantizing the ideas of the subject matter dimensionally. Such an exercise elicits an immediate and salutary concern for isolating the most important points, for apportioning the number of points to best achieve relative emphasis, for sequencing the points to get maximum inevitability of story build-up, and for subordinating dependent considerations in the most coherent packaging. These concerns represent the essence of organizing because they relate most directly to the intended strategy of discussion.

The topical organization is achieved by planning the whole publication page by page in advance. This is done on "scribble sheets" called Storyboards. Each Storyboard represents one two-page spread; it requires the preparation of a topic title, thesis sentence, some notation of content for each paragraph, and a rough sketch of the illustration if one is used. The combination of 1) explicit thesis formulation, and 2) common assumptions being made by team members about what can be said on the limited two pages which the Storyboard respresents, results in less misunderstanding and confusion over the "outline." Enough detail is probed by the Storyboard to trigger the heuristic "think-symbolize-think" loop which is so necessary to arriving at optimum message structure, and which doesn't begin to happen in the conventional approach until actual sentence composition (as opposed to scribbling) is laboriously undertaken.

By enabling mutual visualizations of content before writing, Storyboarding tends to eliminate the last-minute program "bash." The tag-end review and revision cycle of the River-Raft approach bumbles along as shown in Figure 11, building into a crisis, until the manuscript is ripped from the hands of the document manager and rushed to the printer's — often half-baked. Earlier injection of the review and revision energy into the system by the Storyboard method smooths out the program "curve", as well as resulting in a more consistently treated and well-cured product.

Figure 12 shows the assembly technique of reviewing Storyboards. The sheets are spread out, or pinned on a wall, to facilitate browsing and comparisions between topics. This way, the essential strategy of whole sections can be visualized and appreciated in concrete terms, quickly, yet in substantial detail. Improved responsiveness to RFP requirements, or to report end purpose, is one result. Another is the discovery and elimination of redundancies and repetitions. Errors and misunderstandings in technical approach frequently come to light. Since Storyboards are speedily worked up, new approaches can be tried out and discarded for difficult topics until the most effective presentation is agreed upon by interested parties, including higher management if desired.
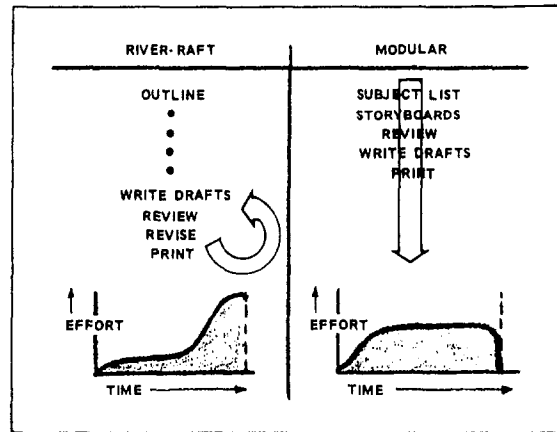
Figure 11. Revising before writing is the secret of better STOP control over document preparation. The categorical outline is still used, but properly treated as only a tentative subject list preparatory to thesis formulation via Storyboards.
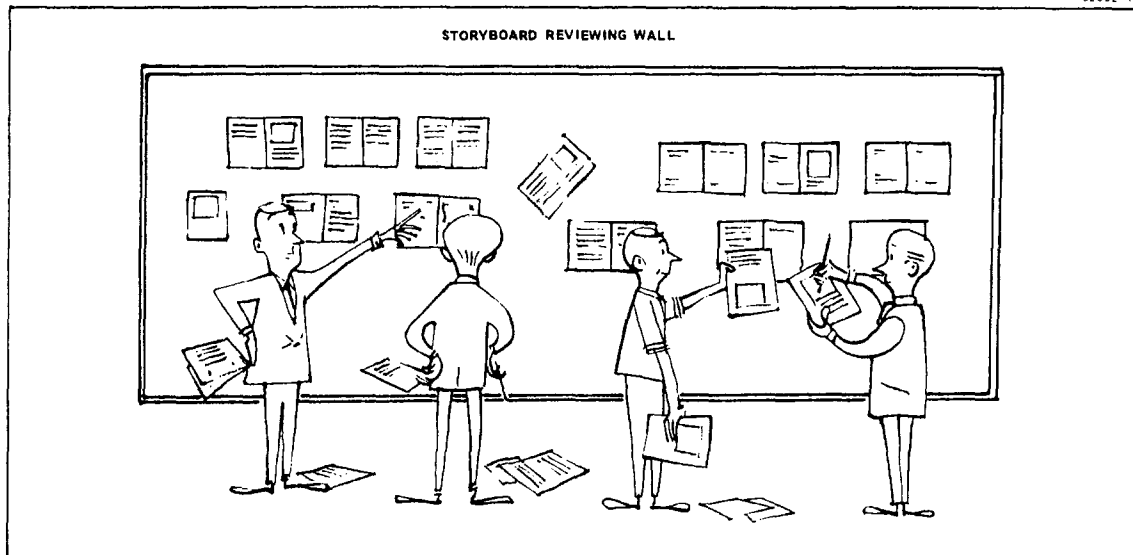
STORYBOARD REVIEWING WALL

Figure 12. The Storyboard technique was borrowed from the motion picture industry. Each sheet is brought to life with just enough detail, and means the same thing to all viewers because of its limited thematic dimensions. Gallery effect shows whole strategy, spots loopholes and overlaps.

WRITING TO STORYBOARDS

The Storyboard acts as a "writing supervisor" during the process of composition. It sets a story goal to compare results against, thus evoking the author's critical "editing" faculty as he creates. Meanwhile, coherence is encouraged by the modular "frame of reference."

Composing a given passage according to a categorical outline has a high probability of promoting the spectrum of faults referred to as "rambling, wordy, diffuse," etc., since concision depends on the author's internal resolves. In contrast, writing to a thematically unified, agreed-upon and limited Storyboard instills by external means the attitude that an important issue is at stake, that a definite point must be made, and that every word counts in making it.

Since the author's efforts are checked and regulated by a pre-established thesis, his work is more purposeful and confident. He is less concerned with thesis-seeking, so the "bright afterthought" intrudes less frequently, and must earn entry to the module by force of truly superior importance. Survival of the fittest thus becomes the criteria even for authors not professionally trained in verbal self control. Also, the engineer finds that the space constraint of the Storyboard does not "cramp his style." Like most conventions of form, it unleashes greater creativity by setting up an orderly discipline and keeping out distracting organizing anxieties.

An over-optimistic Storyboard will sometimes have to be expanded into additional topics when the author begins to actually write out the ideas in paragraph form. The author always has this option of dividing growth material into additional mod-ules, provided that he builds them into separate, unified topics in their own right, and that page limitations or other book strategies are not violated. Conversely, write-ups may collapse during composition, thereby prompting a combination with other topic material to avoid inappropriate emphasis. Since this cut-and-try pro-cess can never be entirely avoided, no matter how detailed the outline, it is im-portant to regulate it by the rules of modular unity during the composition phase, just as during original Storyboarding. Once the author develops the knack for handling the inevitable content changes and shifts in emphasis by additional Story-boarding as he composes, the full utility of the modular convention begins to be exploited.

Two further important aspects of STOP come about while writing to Storyboards. The first is that the physical self-containment of the module creates an editorial "frame of reference" which tends to induce thematic unity, or coherence, by common-sense reactions to the module contents. The four rules of thematic unity are listed in Figure 13. Violations of the first three make up the most common errors of everyday communication: 1) beating around the bush, 2) not finishing what's started (or not coming to a conclusion), and 3) going off on tangents. Being expected to stand on its own feet, the modular write-up is far less prone to these basic defects than is the River-Raft narrative.

The second aspect of modular writing is the greater attention it focuses on perti-nence. Exposure of the topic as a thing apart from the others implants the attitude that each topic must pull its own weight, by contributing something significant to the overall document purpose. More lively and interesting documents result, as soon as the engineering teams gain a little practice and familiarity with the method.
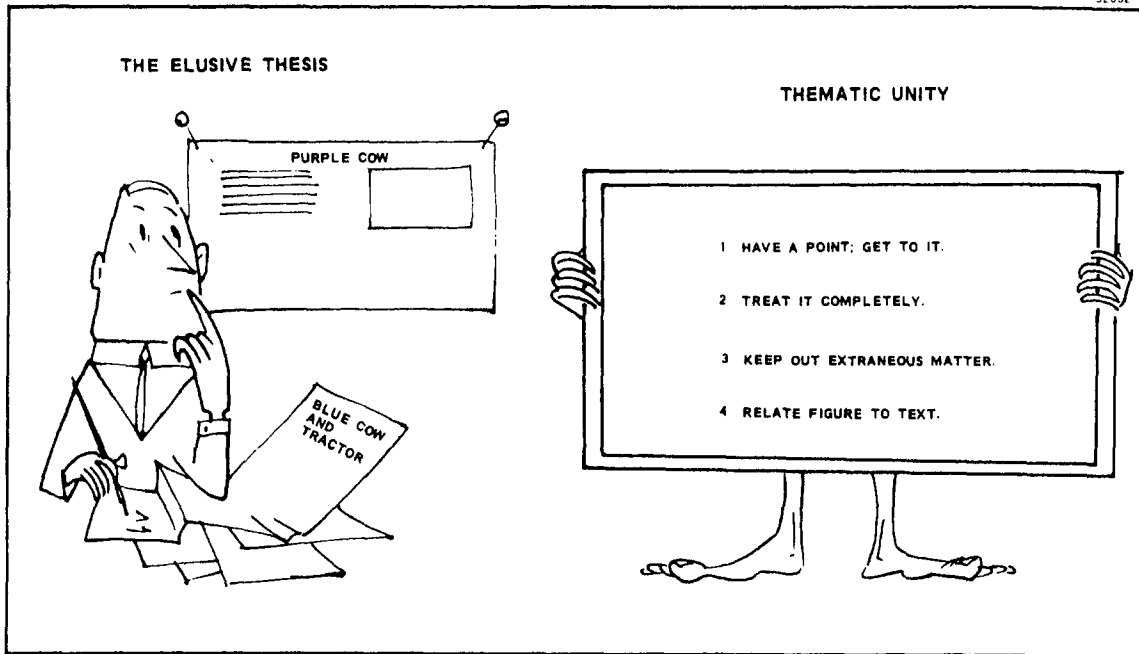
Figure 13. The author checks his writing progress against his original intention by comparing his results against the Storyboard. Before he's through, either or both may have to change, but he will end up with a thesis sentence and theme body that match, i.e., "cohere". The effect of the frame of reference helps him "null out the loop" by making any disunity more apparent.

SAMPLE STORYBOARDS

The idea of a Storyboard is that it can be planned very quickly, once you know your technical approach, yet shows enough detail that others can see what you're driving at. The thesis should be a specific, arguable point, or contention, and the plan for the paragraphs should show a "build up" in the proof of the point, or otherwise clearly mirror and substantiate the opening proposition.

informatics media PROPOSAL STORY BOARD EXTENSION *3711*

TOPIC Survival of
A UNDER WATER SUBSYSTEM
OPERATING CHARACTERISTICS

SECTION *Reliability Assurance Program*
SUBSECTION *Requirements Analysis*
NAME *E. Hoyle*

THESIS SENTENCE
Present technology is capable of meeting 90% survival requirements for the proposed underwater subsystem
— BASED ON FIELD DATA

STATE POINT OF EACH PARAGRAPH IN COMPLETE SENTENCES

Require reg'mts for 90% survival — need to relate reliab. in terms of MTBF

Intro. & explain fig.: given MTBF, more prob. spec. no. will fail

Indicate (from curve) how 90% surviv. allied to xxx hours MTBF

Refer to proposed design parameters assuming 90% — i.e., show part-by-part support, etc.

40
36   Failed Units
2
0   xxx UNIT MTBF. →

99%
90%
50% prob

Too much detail HM.
— Also subsystem MTBF?

FIGURE NO. 3-12 CAPTION Relation predict, present and actual nos. failed units

---

informatics media PROPOSAL STORY BOARD EXTENSION

TOPIC DESIGN OF A.U.
FOR MAX. SPEED

SECTION *Major Elements*
SUBSECTION *Computer*
NAME *FAROLLA*

THESIS SENTENCE
A.U. will accept 2 15-bit operands along with commands but avoids extra equip. penalty by storing partial answers in decode register

STATE POINT OF EACH PARAGRAPH IN COMPLETE SENTENCES

Required operating speed — severity in tracking mode

Staggering of operand registers (1st step in solution)

Hi-Speed Adder

Dual-purpose on decode flip-flop (tracking only)

HOW FEASIBILITY ALREADY
PROVED OUT?

A REGISTER
B REGISTER
LOAD CONTROL
ADDER
INSTRUCTIONS
DECODE & EXECUTE
BUFFER TO CORE

FIGURE NO. _____ CAPTION _____

HOW TO WRITE TOPIC HEADINGS

It is important to recognize that the topic title must characterize and introduce the thematic content, not merely categorize (label) the theme body. Topic titles are more likely to be representative and topically faithful if they are (1) constructed as sentence fragments, and (2) rewritten after composition of the theme. Title-writing guidelines are summarized here.

1. Since they are not written to, Section and Subsection headings are OK as plain noun groups:

   - System Tradeoff Analysis
   - Data Processing Equipment Description

2. But, the author, reviewer and reader all need to know "what about?" the Topic Heading:

   - "Receiver Design" — what about it?
     TRANSISTORIZATION OF RECEIVER DESIGN

   - "Target Tracking" — what about it?
     NEED FOR REALISM IN TARGET UPDATING

3. Hence, the Topic Heading should be a phrase (a sentence fragment of 4 to 8 words), containing prepositions:

   - DESIGN OF TOW CABLE FOR LOW DRAG
     (not "Tow Cable Design")

   - REDUCTION OF NONSYSTEMATIC ERRORS
     (not "Nonsystematic Errors")

   or infinitives:

   - THREE WAYS TO SIMPLIFY ANTENNA DESIGN
     (not "Antenna Design")

   or "ing" verbs:

   - CONTROLLING CHARACTERISTIC IMPEDANCE
     (not "Characteristic Impedance")

4. If you can take a position, show your attitude with qualitative words:

   - ADVANTAGES OF INTERLACING INSTRUCTIONS
   - LIMITATIONS OF ANALOG AZIMUTH CONVERSION
   - PITFALLS IN PROGRAM SCHEDULE CONCURRENCIES

5. If at first you don't know "what about?" the topic heading, go back and revise it for greater pertinence after you have written out the Storyboard (or rough draft).

Working out the thesis sentence of each topic is a crucial step in the STOP technique; it confirms the intuitive ideas and feelings (thematic intention) which led to the Storyboard selection. The thesis sentence will serve as a backstop for composition, and in its final version will serve as a thematic window for the reader. Many authors are already in the habit of writing conclusion statements near the ends of various text passages; these often can be converted into good thesis sentences with the addition of any needed summarizing amplifications. Basic rules for thesis-sentence writing are listed here.

1. The Thesis Sentence should state your proposition concisely, and it must boil down the theme body to 25-30 most informative words, showing the whole proposition and proof (or substance otherwise) at a glance.

2. Make the Thesis Sentence an argument, or arguable hypothesis:

   - Irrefutable, weak: "TRL gating circuits have been designed to meet the requirements."

   - Refutable, strong: "TRL gating design has been adopted because active circuits are the best way to achieve increased fan out at the required speeds."

3. There is a "design thesis" behind every block diagram or circuit write-up. So, no matter how low the level of detail, you never have to write equipment descriptions that merely describe. Contemporary proposal evaluators consider straight descriptions tedious and nonpertinent. Since important technical detail must be included, find the original design issue, or invent a point (even if it's "advantages of using a conventional and proven design").

4. The purpose of a unit, especially if difficult, makes a good thesis sentence for some block-diagram discussions because it reveals why the unit is organized the way it is:

   - "The telemetry system must be capable of multiplexing the outputs of 20 hydrophones and transmitting the information without degradation in a form suitable for time-compressed signal processing."

5. If the topic merely embraces a collection of ideas or items unrelated by a single, definite proposition, then either summarize all the facts, or call attention to one or two most important and noteworthy ideas. Go back and check the Thesis Sentence for its summarizing function after you have filled in the Storyboard (or written the draft).

6. Tests for a good Thesis Sentence:

   - Does it state an issue in such a way that it can be refuted? (i.e., expose its own rationale).

   - Does it repeat the key words of the theme body?

   - Does it embrace the major substance of any accompanying figure?

   - Does it contain adverbial conjunctions which show a train of reasoning (because, since, so, therefore, however, but moreover, etc.)?

   - Does it contain comparative adverbs and adjectives which show attitude and conclusions (more, least, highly, almost, too, very, good, better, only, etc.)?

THE OVERALL STOP PROCEDURE

Doing a modular publication for the first time takes some daring and faith. Two points to re-
member: 1) focus the effort on Storyboarding and Storyboard reviewing, 2) get advice from STOP
veterans as a check on your progress.

Making a Subject List — It is possible to make out Storyboards directly, but the
easiest way to do a large STOP book is to start by making a subject-list outline in
the usual way. This should take less than a day. Don't worry about topics at first.
Concentrate on understanding the categorical requirements imposed by the RFP or
contract report clauses. Sift out the subject coverage demands and jot them down;
use headings supplied by the RFP and throw in known "worry-list" items along the
way. Next, work out a grand strategy of response. Blend your side of the story in-
to the list; let the customer still see his categories. Now weight the subject areas
for desired relative emphasis within an arbitrarily decided maximum page limit.
Allot the corresponding number of topics (pages divided by 2) to each outline head-
ing, roughly at the section level, and you are ready to start storyboarding.

Storyboarding — Storyboards can be filled out either by the proposal or report
leader or the contributing authors, usually the latter. Work against the topic allot-
ment to find a strategy that highlights your technical approach most advantageously
while incorporating the required subject areas, e.g., "What are the 2 or 3 impor-
tant points that should be made (or 5 or 6) in the subsection on Antenna Description
covering Feed, Phase Shifters and Array Elements?" Take special care in writing
the Topic Titles and Thesis Sentences; these enable other team members to appre-
ciate what you will be driving at, not to mention yourself.

Group Review — It is most crucial that the proposal leader or document manager
go through every Storyboard. Unless he tries to pick them to pieces the desired
mutual understanding won't come about. Convene the authors in one large group,
or smaller groups for the various sections; have each Storyboard read outloud and
receive group-wide criticism. Does it cover the ground, have the right slant, point
up the significance of its approach to the company's advantage? Is it internally co-
herent, or do the paragraph notations start to lead into other points not included in
the Thesis Sentence? Often the "real" thesis is buried in the 4th or 5th paragraph
where it emerged after "author warm-up;" see if you can spot it. Make changes
now, otherwise the incoherencies you miss will certainly return welded into the
final draft.

Try to overcome the conditioned apathy which automatically sets in whenever you
look at someone else's outline. The Storyboard is not an outline; it's the finished
product. Overcoming this disbelief is half the battle of STOP. Timing is also im-
portant (Figure 14).

Begin Writing — Storyboarding including review should be given several energetic
days, but take less than a week. Start writing after you are satisfied with the exact
construction of the whole document. Any changes that occur later will be improve-
ments, not degradations.

Converting River-Raft Input — Some material always turns up in River-Raft form
on a STOP project. No problem; it can be easily and profitably converted into mod-
ular form by the process of "Topicizing." This process takes advantage of the in-
nate topical structure of theme matter to sharpen up the presentation and detect
thematic weaknesses. It brings about topic visibility so that modules can be con-
structed and the input slid into place along with the storyboarded material.

Any good technical editor with some experience with STOP can do this as a service, including the writing of the thesis sentences ex post facto. The document manager should review and confirm the topicized modules (mock-ups), or better yet have the author review them with him. No editor can detect theme structure perfectly in badly organized River-Raft copy. When he errs in spotting the true thesis or topic boundary it's because the reader would have stumbled there also. Using the editor's pratfalls to uncover those of the author is practical because the thematic alternatives show up quickly against the topical framework — it's the next best thing to storyboarding in the first place.

Paving the Way — Participants should be carefully briefed on the STOP methodology lest they misconstrue the whole thing as some trivial format gimmick and react with the stung resentment of wise authorship. Get professional support for a briefing where objections and questions can be aired by team members. Have the right stock of materials, forms and instructions. If this is your first attempt, be sure to seek help from experienced STOP editors during Storyboard and final draft reviewing, or for converting assistance. Above all, make sure your Publications service area understands and is prepared for the changeover in technique.

52092-15

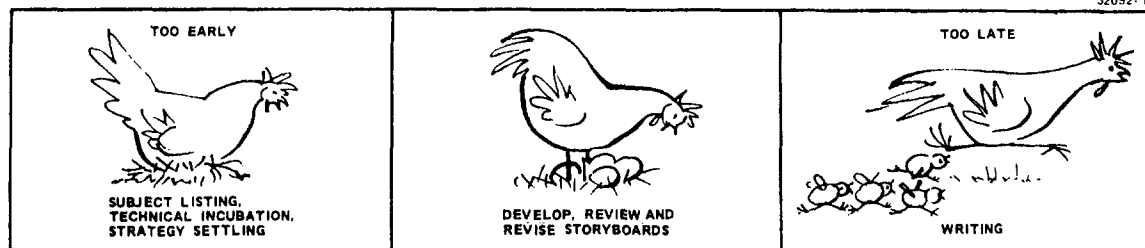| TOO EARLY		TOO LATE
SUBJECT LISTING, TECHNICAL INCUBATION, STRATEGY SETTLING	DEVELOP, REVIEW AND REVISE STORYBOARDS	WRITING

Figure 14. The trick in managing a STOP project is feeling out the right moment to concentrate on the Storyboards. It can be incremented over piecemeal submittals, it may vary for different authors, but it must not be forgone.

27

STORYBOARD REVIEWING

The meaning of Storyboarding is that a large and complex publication can be planned and controlled without the suppressed confusion that builds up into a last-minute crisis. Many recent proposals and reports have proven this technique.* Figures 15, 16, and 17 illustrate storyboard review.
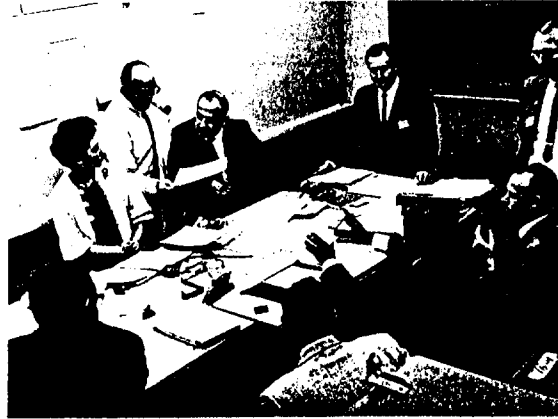

Figure 15. Team review of storyboards encourages cross-fertilization and shows each contributor where he fits in and where he doesn't. The document manager can point to where the writer is going off the track, and contribute definite fixes, instead of just talking about objectives, slant or desired emphasis in vague generalities.
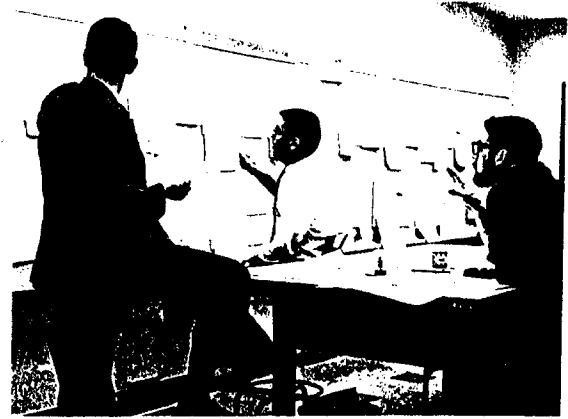
Figure 16. Team review of topicized mock-ups, converted from River-Raft material, is another good technique. Topical mock-ups give quick insight into essential propositions of a proposal. Obvious rules of Thematic Unity help team members reach agreements fast, try new gambits easily, control transition and continuity effects. One can achieve final coherence without a mastery of "literary" skills.

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* Including ADAR, Colossus, NADGE, ASMS, and ARIA. On ASMS 2,000 pages were converted to modular form in 2 weeks by the "topicizing" process, the reverse-storyboarding technique for manuscript analysis. It received compliments from the Navy evaluation team.

Figure 17. Storyboard review session shows that theme content can be observed and influenced by others in some detail before it becomes locked up in a weighty manuscript.

CONVERTING FROM RIVER-RAFT TO MODULAR

"Topicizing" a River-Raft manuscript into modular form is a powerful technique for editorial analysis. It provides instructions for optimum revisions by "mechanical" means, which insure good results by enforcement of Thematic Quantization, thus is relatively free of subjective bias.

Because of its innate topical structure, conventional report and proposal manuscript can be converted for River-Raft to modular form by an editing process called "topicizing." Topicizing lays bare the inner segments of discourse, brings the theses to the surface, and while doing so, reveals the topical disunities and other thematic or rhetorical weaknessess of the original organization with a clarity that is fascinating. It is a method for treating existing run-on material for STOP publication, and an excellent method for editing and revising copy regardless of ultimate format. Topicizing is essential in many STOP productions, since some amount of River Raft material is always being plagiarized, submitted, or otherwise on hand in non-modular form and in need of blending with Storyboarded modular material. The larger and more incomprehensible the pile of manuscript is that needs the treatment, the more effective and valuable the topicizing process becomes.

The topicizing procedure is diagrammed in Figure 18. Its first three mechanical steps are important: 1) spreading out the manuscript pages is essential for scanning back and forth rapidly; 2) careful marking of the figure and table references must be done to accurately define the art/topic relationships; 3) the figures (or copies of them) must be obtained for treatment along with the text. If printed text is being topicized, two copies must be employed so that it can be treated as one-side-only material. Establishing a routine pattern for physically handling the material may sound sophomoric, but greatly facilitates the editorial decisions that follow.

The next step (4) is locating the topic boundaries, which is done by scanning very rapidly, not for total content, but to determine where the author "changes the subject," i.e., leaves one topical phase and enters the next. This process is more or less intuitive, depending on the author's original clarity of organizing, but the ability to spot the break lines that demarcate units of thematic independence comes with some practice (and faith in their existence). The author's transistional hints help, but cannot be depended upon since this is not the age of literary courtesy. Categorical headings frequently do not help and have to be ignored. Sometimes a brute-force 500-word measurement will put you close to the boundary in doubtful cases, believe it or not.

The copy is then cut apart on the topic lines and reassembled as integrated units on mock-up sheets large enough to accommodate both the text and art ("C" size). These modular mock-ups represent a tentative interpretation of the "true" topical content of the text. Critiquing is then performed, which includes writing new topic titles, extracting a thesis from the discussion by close reading and expressing it in sentence form, then examining the whole effect of the theme body for defects in the four rules of Thematic Unity, continuity, pertinence, correspondence to the Thesis Sentence, and copy fit within module dimensions.

Topicizing invariably results in significant organizational changes. Passages are moved to new positions or arranged in different combinations for stronger coherence, or improved logic of topic sequence. Fragments are discovered and expanded, combined or eliminated. Missing links in overall strategy and technical oversights come to light and prompt the generation of new material. The "buzz-saw" analytical power of topicizing, which at first seems an almost mechanical procedure, is amazing to witness and testifies to the effectiveness of Thematic Quantization as an editorial principle.

SPREAD OUT THE TEXT (1)

SPOT THE RAFTS (2)

ASSEMBLE FIGURES WITH REFERENCES (3)

FIND THE TOPIC BOUNDARIES (4)
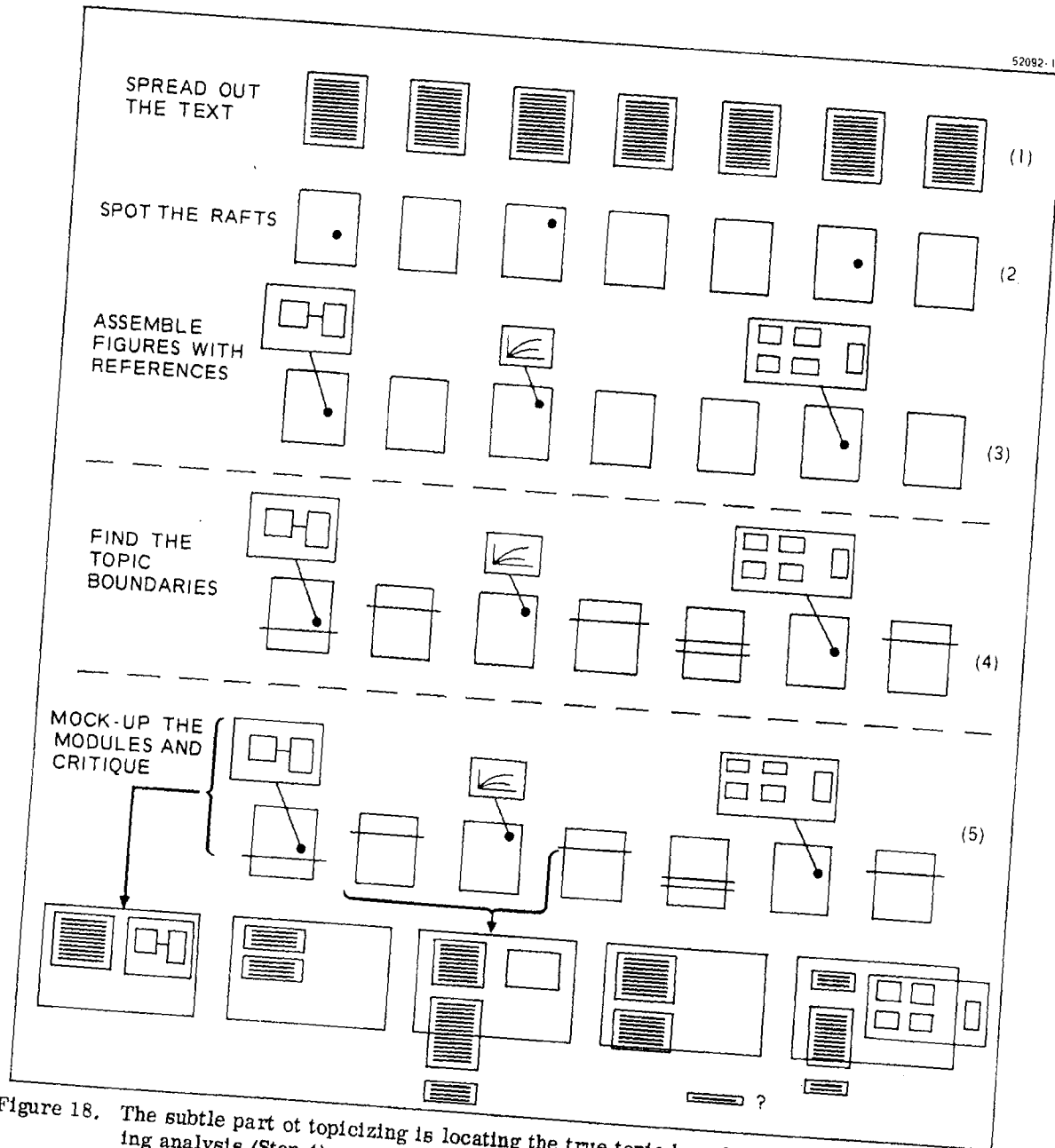
MOCK-UP THE MODULES AND CRITIQUE (5)

Figure 18. The subtle part of topicizing is locating the true topic boundaries. Conventional reading analysis (Step 4) can come close, but full critiquing of the tentative mock-ups by topical principles is needed to confirm it. Any defects in Thematic Unity are glaringly spotlighted. By the time these are corrected, 95% of all that could be wrong with the manuscript has been cured (the rest is a language or style problem).

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THE TOPICIZING OPERATION

If the document manager is stuck with a large pile of River−Raft input that is so difficult to fathom it would cause embarrassment with the customer, the best way to "bash it out" is to convert to modular topics (see Figure 19). With some fast author confirmation of topic titles, sequence, and thesis sentences, one good technical editor can topicize about 75 pages a day.
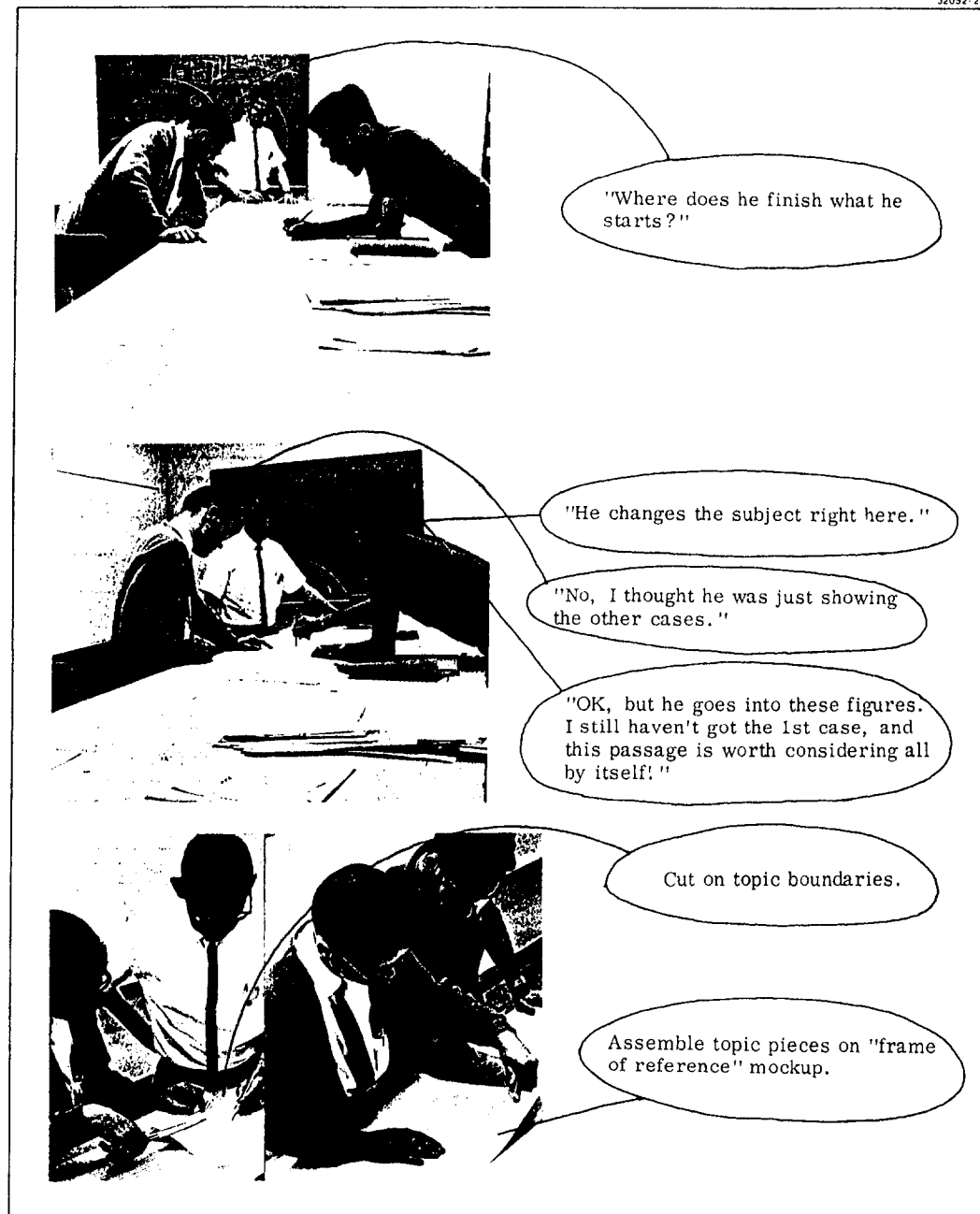
52092-21

Figure 19. The conversion process is started by finding the topic boundaries, cutting and mech-anically rearranging the material into tentative topic modules.
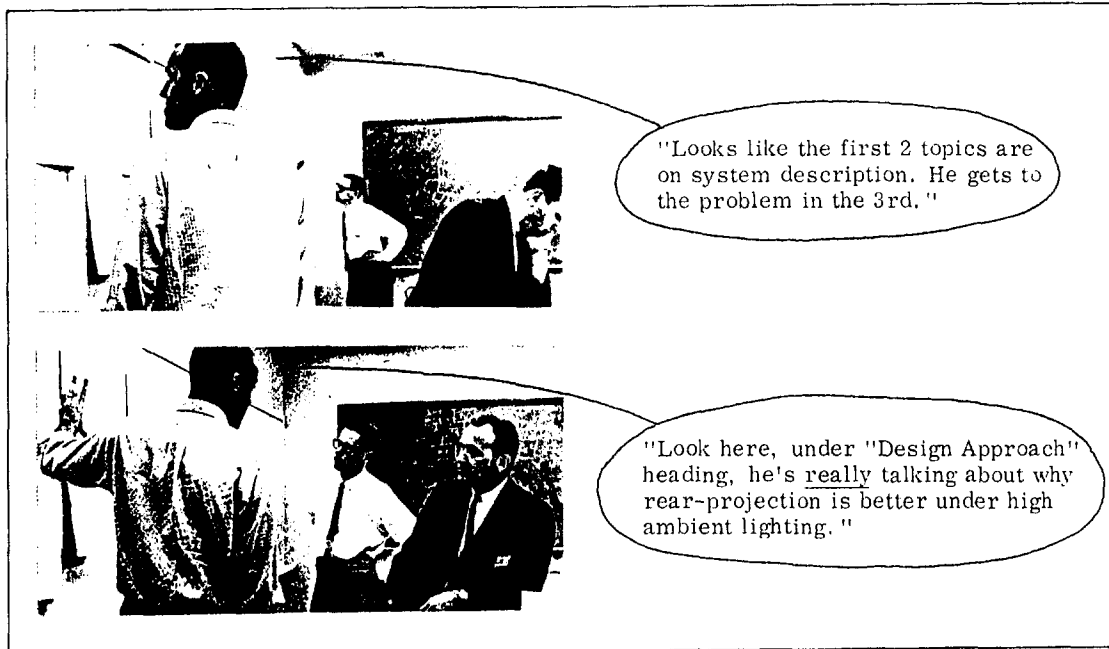
Figure 20. Critiquing. Analysis of material as self-contained topics uncovers the strategy of argument and buried theses.
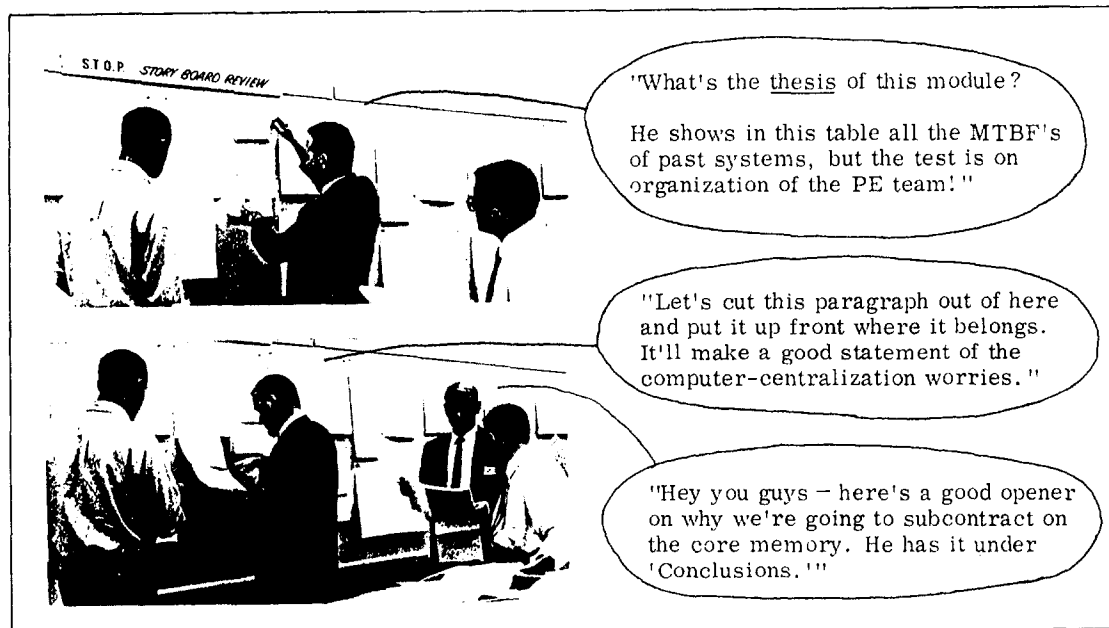
Figure 21. More Critiquing. Organizing defects show up under the "black light" of thesis – unity constraints.

THE "AUDIO-VISUAL" TECHNIQUE FOR MATH WRITE-UPS[1]

Math write-ups can be modularized to great advantage if an "audio-visual" approach is used which translates the important equations, states the reasons for the derivations, and separates the equations from the words.

There is a common misconception that long math derivations in proposals must be treated as narrative continuums without topical divisions. It is fostered by page spacing requirements and the assumption that the proposal reader is a design engineer or mathematician willing and able to supply missing reasoning. Most engineers, for example, think of a mathematical discussion as a continuous and uninterrupted stream of propositions because of the stepwise interdependence of the expressions. So the usual assumption is that a "mathematical subject" cannot be thematically quantized, but it turns out that if thesis sentences are prepared and the resulting text holes filled in accordingly, the material can be topically divided.

The wide-spacing requirement for equation derivations is thought to be another reason why math topics can't be fitted on two-page spreads as feasibly as linguistic topics. This can be overcome by recapturing the large amounts of space that are wasted on the typical math page.

There is a fundamental way in which the topical import of the discourse could be made more visible in math write-ups as written conventionally. According to a UCLA mathematics professor, Dr. L. D. Kovach,

> "Symbols can be used to greater advantage by the engineer if he realizes that they are intended to convey visual information. The aural information accompanying the symbol should be provided by a translation of the symbols, to provide the certain amount of redundancy that is necessary to good written communication."[2]

The need for translation is especially acute in the report and proposal. Raw equations state relationships well to your co-worker who will work out design consequences from them, but they can't substitute for the linguistic explanation to the report and proposal reader who just wants to hear about your design. For him, equations work best when they are used as illustrations of what is being said in sentences.

But the math problem takes more than adding aural "redundancy" so the verbal steps of the argument will be easier to "hear." Steering must also be given so that the end purpose of major stages of the discouse can be foreseen and appreciated. Math write-ups and equation derivations invariably are justifications or supporting evidence for design decisions which can (and should) be grasped in verbal terms. One of the most valuable things the tutorial passage can include is statements of purpose like: "This approach (or conclusion) is justified (or required) by the such and such relationship, which will now be illustrated." These statements steer the reader by showing him what to look for, pace his reading by holding up "mileage posts," and keep his attention on the subject.

Whether he is a military evaluator or Hughes task manager, the proposal reader faces a constant question at every moment of reading: "Why am I reading this?"

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[1] For further examples and details, see How to Handle Math Write-Ups in STOP Proposals and Reports, ID 65-10-5, Nov. 64.

[2] "Sign Language in Engineering," at IEEE Engineering Communications Symposium, Michigan State University, 1961

schedule is naturally disinclined to invest unnecessary time and effort in writing amplifying remarks. It is often not recognized that very little is actually required to satisfy the reader's constant question — a hint about forthcoming logical uses of the relationship is as good as any earth-shaking consequence to the technical strategy. What helps is the recognition of topical boundaries within the discussion (that is, the application of STOP principles). Arranging the material into a theme sequence gives a limited set of definite places for stating the end purposes. The purpose statements become part of the Thesis Sentence for each topic. The Thesis Sentence tries to cover neither too much nor too little. Hence the author is not faced with explaining the perambulations of umpteen pages, just the few major stages of the discourse.

The need for both aural translations and narrative steering is well served by separating the equations from the text altogether to create a two-channel, text-versus-equation format. The topic is developed in straight sentence-and-paragraph form on one page; the equations, together with any list of definitions, are displayed by themselves on the facing page — with little wasted space on either side. The result is to encourage more self-sufficiency in the text. Dr. Kovach's "aural information" is provided with less hesitance over condescending. The need for end-purpose statements stands out more clearly. The spectrum of readership levels is more equally accommodated.

A sample math topic illustrating this audio-visual approach is given in Figure 22 and 23 in the following module. In the sample (see following spread), note that the discussion covers Equations (13) through (20). All steps in a derivation are not equally important. Here the author has broken out a logical phase (covering eight equations) out of a 38-equation section. The section was treated in five such topics, averaging 7.6 equations each, and each with a definite thesis.

SAMPLE AUDIO-VISUAL MATH TOPIC

52092-24

DERIVATION OF SEARCH AVERAGE POWER

By recognizing the search rate as a primary system performance requirement, a design equation can be derived in which search rate figures as an independent variable, and which is insensitive to transmit array design factors.

The search function is basically different from the track function in that each transmission illuminates an area of space, whereas in track the transmitted pulse ideally illuminates only the object being tracked. This difference means that the RF power required must be insensitive to the number of transmit elements or the design of the transmit array.

The search function is specified in terms of the search rate in steradians per second (see Table 2-XX). The search rate is defined in Equation (13) (see Table 2-XXI) to be the product of the area illuminated per look times the number of looks per second. The area illuminated per transmission is further defined in Equation (14) as the product of a beam-stacking factor times the solid angle per transmit beam. This relation applies only for a fixed beamwidth and a correction must be introduced to allow for the effects of beam broadening resulting from scanning off broadside. Equation (15) relates the transmit beamwidth to array diameter and to the number of transmit elements in Equation (17) using the relation given in (16).

The solid angle illuminated per transmit beam is expanded by substitution of Equation (18) into Equation (14). The resulting expression is combined with Equation (13) to give Equation (19), in which search rate is related to the radar design parameters. The search rate is contained implicitly in Equation (6) as derived in the previous topic. Combining Equations (6) and (19) allows the average generated RF power to be expressed explicitly in terms of the search rate, as demonstrated in Equation (20).

An investigation of Equation (20) indicates that the RF power generated is independent of the number of transmit elements and area per transmit element, and is inversely proportional to the first power of the number of receive elements and area per element. The appearance of the λ^2 term in the denominator of the expression implies an advantage in lower frequencies of operation. This advantage does not materialize except for very long wavelengths, as will be shown when the target cross-section variation with frequency is analyzed in a later topic.

Figure 22. The "audio-visual" technique of writing math topics separates the equations from the words so that the text becomes more self-sufficient and has better continuity. The proposal/report reader is "spoken to" in the text channel on the left; the author's technical design peer is "shown" in the figure channel on the right.

TABLE 2-XXI. ANALYSIS OF SEARCH AVERAGE POWER

$$(13) \quad \rho_s = \psi_t \frac{F_d}{\tau}$$

$$(14) \quad \psi_t = F_s^2 \theta_t^2$$

$$(15) \quad \theta_t = \frac{\lambda}{D_t}$$

$$(16) \quad D_t^2 = \frac{4}{\pi} N_t \Delta_t \lambda_s^2$$

$$(17) \quad \theta_t^2 = \frac{\pi}{4} \frac{\lambda^2}{\lambda_s^2} \frac{1}{N_t \Delta_t}$$

$$(18) \quad \psi_t = F_s^2 \frac{\pi}{4} \frac{\lambda^2}{\lambda_s^2} \frac{1}{N_t \Delta_t}$$

$$(19) \quad \rho_s = F_s^2 \frac{\pi}{4} \frac{\lambda^2}{\lambda_s^2} \frac{1}{N_t \Delta_t} \frac{F_d}{\tau}$$

$$(20) \quad P_s = \frac{k\, T_e\, R_s^4\, (S/N)_s}{N_r\, \Delta_r\, \bar{\sigma}\, \lambda_s^2\, F_s^2} L_s\, \rho_s\, 16$$

TABLE 2-XX. PARAMETERS FOR SEARCH AVERAGE POWER ANALYSIS

ρ_s = search rate in steradians per second

F_d/τ = number of transmissions per second

ψ_t = steradians of space illuminated per transmit pulse

F_s = beam-stacking factor or beam spacing normalized to a rectangular beam lattice with one beamwidth spacing

θ_t = transmit 3-db beamwidth

D_t = diameter of the transmit array (equivalent diameter for noncircular arrays)

Figure 22. Continued.

USE OF THE THESIS SENTENCES TO WRITE THE SUMMARY

A good summary can be created easily by compiling and editing the thesis sentences. This can be a significant advantage to the proposal/report manager on a large or hurried publication.

The modular document should begin with a summary just as any report or proposal — even though the reader is less in need of avoiding the text body. It is often advised to write the summary last. This is good advice because the summary falls heir to the same thematic ills as does the body of the document, namely, lack of clear lines of argument, empty sales exhortations, starting new stories, and imbalanced detail, but suffer more as a result. These problems are cured easier in the summary if taken as the last step. The existence of the well-abstracted set of thesis sentences makes summary writing easy and their review serves as a double check on the document contents.

The thesis sentence can be compiled by a typist to create the rough draft of the summary. Appropriate editing will then produce a summary which is guaranteed to cover all major issues. An example of this technique is shown opposite (Figure 23); circled numbers refer to the thesis list given on the next spread (Figure 24). Note the shifting of topic 19 to a front position, and the use of 18 to support 8. These outline changes are in keeping with the summary's appropriate emphasis on selling and its higher level of generality, respectively.

If an expanded version is desired, for the very long publication, the Summary title can be run as a subsection heading, then thesis sentences can be grouped by appropriate category (e.g., Technical Approach, Management Plan, etc) and each treated as a topic with its own new thesis sentence.

SUMMARY

HUGHES' PROPOSED PROGRAM WILL PRODUCE THE DESIGN CRITERIA AND DETERMINE THE TYPES OF PHYSICAL DESIGN VARIATIONS NECESSARY TO OPTIMIZE THE RESISTANCE OF TRANSISTORS TO SPACE RADIATION; THIS WILL BE ACCOMPLISHED BY DEVELOPING AND EXPERIMENTALLY VERIFYING A 3-DIMENSIONAL TRANSISTOR MODEL
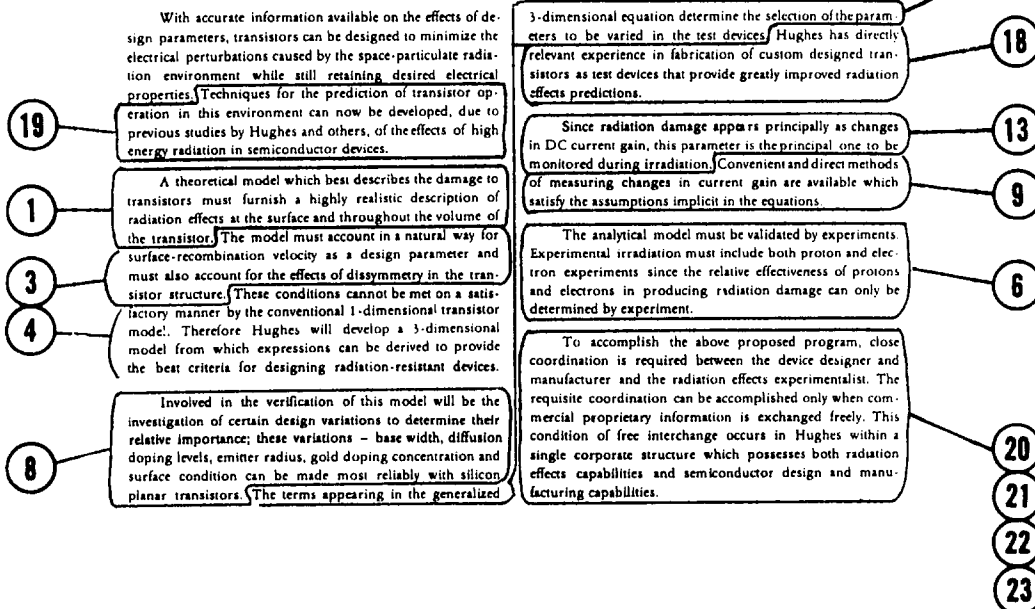
With accurate information available on the effects of design parameters, transistors can be designed to minimize the electrical perturbations caused by the space-particulate radiation environment while still retaining desired electrical properties. Techniques for the prediction of transistor operation in this environment can now be developed, due to previous studies by Hughes and others, of the effects of high energy radiation in semiconductor devices.

(19)

A theoretical model which best describes the damage to transistors must furnish a highly realistic description of radiation effects at the surface and throughout the volume of the transistor. The model must account in a natural way for surface-recombination velocity as a design parameter and must also account for the effects of dissymmetry in the transistor structure. These conditions cannot be met on a satisfactory manner by the conventional 1-dimensional transistor model. Therefore Hughes will develop a 3-dimensional model from which expressions can be derived to provide the best criteria for designing radiation-resistant devices.

(1) (3) (4)

Involved in the verification of this model will be the investigation of certain design variations to determine their relative importance; these variations – base width, diffusion doping levels, emitter radius, gold doping concentration and surface condition can be made most reliably with silicon planar transistors. The terms appearing in the generalized

(8)

3-dimensional equation determine the selection of the parameters to be varied in the test devices. Hughes has directly relevant experience in fabrication of custom designed transistors as test devices that provide greatly improved radiation effects predictions.

(12) (18)

Since radiation damage appears principally as changes in DC current gain, this parameter is the principal one to be monitored during irradiation. Convenient and direct methods of measuring changes in current gain are available which satisfy the assumptions implicit in the equations.

(13) (9)

The analytical model must be validated by experiments. Experimental irradiation must include both proton and electron experiments since the relative effectiveness of protons and electrons in producing radiation damage can only be determined by experiment.

(6)

To accomplish the above proposed program, close coordination is required between the device designer and manufacturer and the radiation effects experimentalist. The requisite coordination can be accomplished only when commercial proprietary information is exchanged freely. This condition of free interchange occurs in Hughes within a single corporate structure which possesses both radiation effects capabilities and semiconductor design and manufacturing capabilities.

(20) (21) (22) (23)

Figure 23. Compilation of Thesis Sentences to Form Basis of Summary
(Numbers Refer to Topics Shown on Next Page)

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**Section 2
TECHNICAL
DISCUSSION**

THE NEED TO EXTEND THE 1-DIMENSIONAL RADIATION DAMAGE MODEL TO 3 DIMENSIONS ①

A 3-DIMENSIONAL THEORETICAL MODEL FURNISHES THE MOST REALISTIC REPRESENTATION OF RADIATION EFFECTS AT THE SURFACE AND THROUGHOUT THE VOLUME OF A SEMICONDUCTOR DEVICE

LIMITATIONS OF 1-DIMENSIONAL MODELS ②

A 1-DIMENSIONAL MODEL DOES NOT PROVIDE REALISTIC DESCRIPTIONS FOR CERTAIN IMPORTANT TYPES OF TRANSISTORS

USING A 3-DIMENSIONAL MODEL TO SHOW THE EFFECT OF SURFACE RECOMBINATION ③

A 3-DIMENSIONAL MODEL, EVEN IN A SIMPLE CYLINDRICAL FORM TAKES INTO ACCOUNT IN A NATURAL WAY SURFACE-RECOMBINATION VELOCITY AS A DESIGN PARAMETER

ADVANTAGES OF A MODEL THAT ACCOUNTS FOR DISSYMMETRY IN TRANSISTOR CONFIGURATIONS ④

TO OBTAIN THE MOST REALISTIC REPRESENTATION OF TRANSISTOR BEHAVIOR IN A RADIATION ENVIRONMENT, A 3-DIMENSIONAL MODEL THAT ACCOUNTS FOR THE EFFECTS OF DISSYMMETRY IN TRANSISTOR STRUCTURE SHOULD BE USED

DERIVATION OF REALISTIC EXPRESSIONS TO PROVIDE OPTIMUM DESIGN CRITERIA ⑤

USING THE MORE REALISTIC MODEL, EXPRESSIONS CAN BE DERIVED TO PROVIDE THE BEST CRITERIA FOR DESIGNING RADIATION RESISTANT SEMICONDUCTOR DEVICES

THE NEED FOR EXPERIMENTAL COMPARISON OF PROTON AND ELECTRON RADIATION EFFECTS ⑥

THE RELATIVE EFFECTIVENESS OF PROTONS AND ELECTRONS IN PRODUCING SPACE RADIATION DAMAGE CAN ONLY BE DETERMINED BY IRRADIATION EXPERIMENTS

ADVANTAGES OF HUGHES' EXPERIMENTAL APPROACH OVER PREVIOUS RADIATION EFFECTS PROGRAMS ⑦

THE HUGHES PROGRAM OF EXPERIMENTS WITH CUSTOM-DESIGNED TRANSISTORS IN SPECIFIED RADIATION ENVIRONMENTS WILL RESULT IN GREATLY IMPROVED RADIATION EFFECTS PREDICTIONS

DESIGN VARIATIONS IMPORTANT TO RADIATION RESISTANCE ⑧

CERTAIN DESIGN VARIATIONS MUST BE INVESTIGATED TO DETERMINE THEIR RELATIVE IMPORTANCE IN DESIGNING A SEMICONDUCTOR DEVICE FOR RADIATION RESISTANCE. THESE VARIATIONS - BASE WIDTH, DIFFUSION DOPING LEVELS, EMITTER RADIUS, GOLD DOPING CONCENTRATION, AND SURFACE CONDITION - CAN BE MADE MOST RELIABLY WITH SILICON PLANAR TRANSISTORS

METHODS OF MEASURING RADIATION-INDUCED CHANGES IN DC CURRENT GAIN ⑨

CONVENIENT AND DIRECT METHODS OF MEASURING RADIATION-INDUCED CHANGES IN CURRENT GAIN ARE AVAILABLE

IMPROVEMENT OF RADIATION RESISTANCE OF MAJORITY CARRIER DEVICES ⑩

THE FIRST STEP TOWARDS IMPROVING THE RADIATION RESISTANCE OF FIELD EFFECT TRANSISTORS IS IDENTIFYING THE SUSCEPTIBLE PARAMETER

**Section 3
PROPOSED
PROGRAM**

DEVELOPMENT OF THEORETICAL MODEL (PHASE I) ⑪

A GENERALIZED EQUATION, BASED ON A 3-DIMENSIONAL MODEL, AND COMBINED WITH AN EMPIRICAL RELATION FOR MINORITY CARRIER DEGRADATION, IS A MORE ACCURATE EXPRESSION OF THE DEPENDENCE OF CURRENT GAIN ON RADIATION FLUX

FABRICATION OF TEST DEVICES (PHASE II) ⑫

THE TERMS APPEARING IN THE GENERALIZED 3-DIMENSIONAL EQUATION DETERMINE THE SELECTION OF THE PARAMETERS TO BE VARIED IN FABRICATING TEST DEVICES

Figure 24. Contents of proposal (covered by sample summary, p. 39) can be appreciated in depth by scanning compilation of topic titles and thesis sentences.
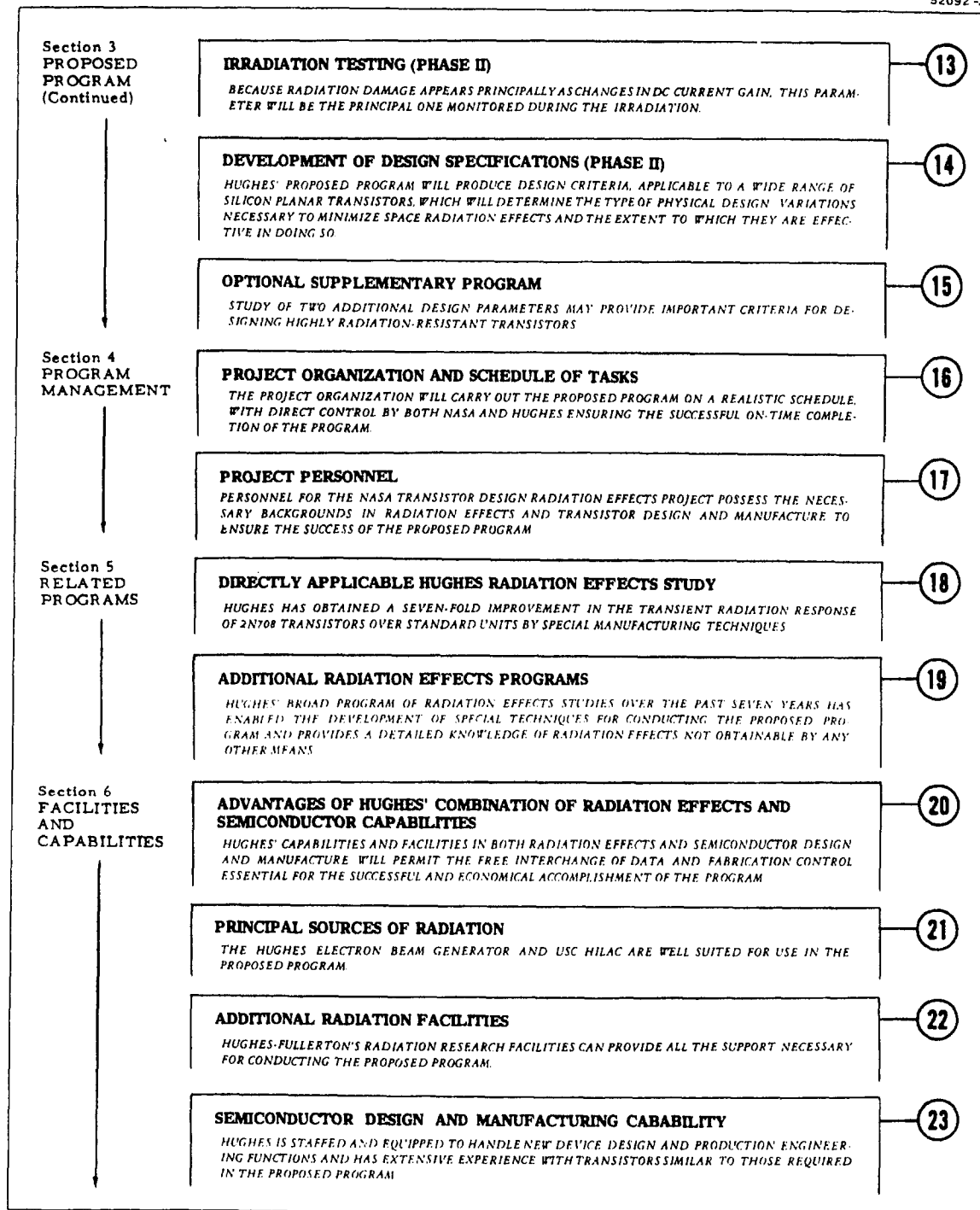
Section 3
PROPOSED
PROGRAM
(Continued)

IRRADIATION TESTING (PHASE II) —⑬

BECAUSE RADIATION DAMAGE APPEARS PRINCIPALLY AS CHANGES IN DC CURRENT GAIN, THIS PARAMETER WILL BE THE PRINCIPAL ONE MONITORED DURING THE IRRADIATION.

DEVELOPMENT OF DESIGN SPECIFICATIONS (PHASE II) —⑭

HUGHES' PROPOSED PROGRAM WILL PRODUCE DESIGN CRITERIA, APPLICABLE TO A WIDE RANGE OF SILICON PLANAR TRANSISTORS, WHICH WILL DETERMINE THE TYPE OF PHYSICAL DESIGN VARIATIONS NECESSARY TO MINIMIZE SPACE RADIATION EFFECTS AND THE EXTENT TO WHICH THEY ARE EFFECTIVE IN DOING SO.

OPTIONAL SUPPLEMENTARY PROGRAM —⑮

STUDY OF TWO ADDITIONAL DESIGN PARAMETERS MAY PROVIDE IMPORTANT CRITERIA FOR DESIGNING HIGHLY RADIATION-RESISTANT TRANSISTORS

Section 4
PROGRAM
MANAGEMENT

PROJECT ORGANIZATION AND SCHEDULE OF TASKS —⑯

THE PROJECT ORGANIZATION WILL CARRY OUT THE PROPOSED PROGRAM ON A REALISTIC SCHEDULE, WITH DIRECT CONTROL BY BOTH NASA AND HUGHES ENSURING THE SUCCESSFUL ON-TIME COMPLETION OF THE PROGRAM.

PROJECT PERSONNEL —⑰

PERSONNEL FOR THE NASA TRANSISTOR DESIGN RADIATION EFFECTS PROJECT POSSESS THE NECESSARY BACKGROUNDS IN RADIATION EFFECTS AND TRANSISTOR DESIGN AND MANUFACTURE TO ENSURE THE SUCCESS OF THE PROPOSED PROGRAM

Section 5
RELATED
PROGRAMS

DIRECTLY APPLICABLE HUGHES RADIATION EFFECTS STUDY —⑱

HUGHES HAS OBTAINED A SEVEN-FOLD IMPROVEMENT IN THE TRANSIENT RADIATION RESPONSE OF 2N708 TRANSISTORS OVER STANDARD UNITS BY SPECIAL MANUFACTURING TECHNIQUES

ADDITIONAL RADIATION EFFECTS PROGRAMS —⑲

HUGHES' BROAD PROGRAM OF RADIATION EFFECTS STUDIES OVER THE PAST SEVEN YEARS HAS ENABLED THE DEVELOPMENT OF SPECIAL TECHNIQUES FOR CONDUCTING THE PROPOSED PROGRAM AND PROVIDES A DETAILED KNOWLEDGE OF RADIATION EFFECTS NOT OBTAINABLE BY ANY OTHER MEANS

Section 6
FACILITIES
AND
CAPABILITIES

ADVANTAGES OF HUGHES' COMBINATION OF RADIATION EFFECTS AND SEMICONDUCTOR CAPABILITIES —⑳

HUGHES' CAPABILITIES AND FACILITIES IN BOTH RADIATION EFFECTS AND SEMICONDUCTOR DESIGN AND MANUFACTURE WILL PERMIT THE FREE INTERCHANGE OF DATA AND FABRICATION CONTROL ESSENTIAL FOR THE SUCCESSFUL AND ECONOMICAL ACCOMPLISHMENT OF THE PROGRAM

PRINCIPAL SOURCES OF RADIATION —㉑

THE HUGHES ELECTRON BEAM GENERATOR AND USC HILAC ARE WELL SUITED FOR USE IN THE PROPOSED PROGRAM.

ADDITIONAL RADIATION FACILITIES —㉒

HUGHES-FULLERTON'S RADIATION RESEARCH FACILITIES CAN PROVIDE ALL THE SUPPORT NECESSARY FOR CONDUCTING THE PROPOSED PROGRAM.

SEMICONDUCTOR DESIGN AND MANUFACTURING CABABILITY —㉓

HUGHES IS STAFFED AND EQUIPPED TO HANDLE NEW DEVICE DESIGN AND PRODUCTION ENGINEERING FUNCTIONS AND HAS EXTENSIVE EXPERIENCE WITH TRANSISTORS SIMILAR TO THOSE REQUIRED IN THE PROPOSED PROGRAM

Figure 24. Continued

HOW STOP INDUCES REFORMS IN FIGURE USAGE

To achieve a message structure based on topical unity, figure content must be treated as inform-
ation quanta along with the text. Thus, STOP induces the author to tailor, interpret and create
graphic material in systematic support of the text body.

In the River-Raft document, figures are thought of as separate entities from the
text: charts, diagrams, schematics, and so forth, which is to say, oversize "ex-
hibits" that can't be produced on the typewriter. These exhibits are then attached
for reference. Since there is no thematic selection criteria, any number of figures
may be amassed for a given passage or for a given juncture between passages. The
reader's problem is to find the figures when he comes across the text reference,
or find the text reference when he comes across the figure. Often he must guess
why they were selected and figure out what they mean, as there is no convention
other than commandments of courtesy to regulate degree of correspondence between
text message and figure content.

The "data submittal" concept of figure usage is reinforced by the production oper-
ations of the publications service areas. Art work is called for early, edited (or
as likely not) in graphic terms, prepared separately, and bought off independently
from the manuscript. Figures are therefore divorced from the story in everyone's
minds, and remain so until they surprisingly appear in the printed book.

In the STOP method, on the other hand, the author must construct space-limited
message modules that have unity of message. Whether the message elements are
diagrammatic or linguistic is secondary, so long as they contribute to the story
and elucidate it. Dealing in this message philosophy means that that author will be
encouraged to:

● Select and tailor the diagrams to meet topical and space constraints rather than
  drafting-room conventions.

● Explain and interpret the charts and diagrams to more fully exploit them as in-
  gredients of particular messages.

● Use linguistic displays as figures to help "visualize" the topical points (e.g., key
  word lists, simple summary tables, etc) when diagrammatic products are not
  involved, thus capitalizing on the presentational character of the modular format.

As a goal, balancing of text and art within the message unit is valid because, gen-
erally, text length varies proportionally with figure density, but there are exceptions.
Equations and lists occupy more space than sentences. In reports and proposals,
there is usually less of significance to be said about complete schematics than there
is about simplified schematics showing design approach only.

While a consistency in graphical balance is unnecessary, the gross thematic im-
balances which abuse message unity ought be avoided on grounds of preserving
coherence. Common thematic imbalances of text and art which are brought to light
by topicizing are shown in Fig. 26. The STOP technique draws attention to these
problems and suggests the best cure: that the figure content be tailored for topical
unity along with the text as a prerequisite to its inclusion in the message.
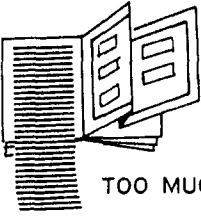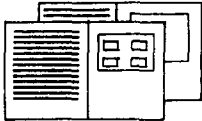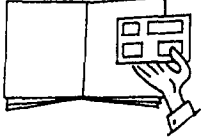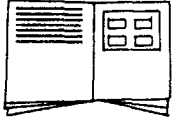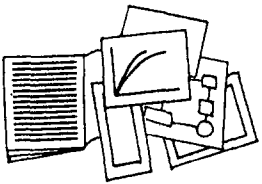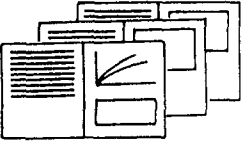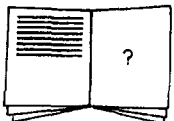
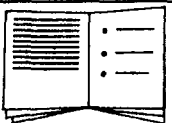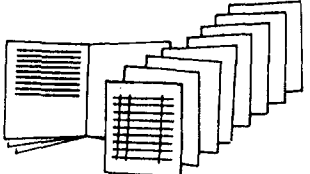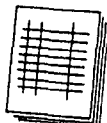| PROBLEM	CAUSE	CURE
TOO MUCH TEXT	FIGURE TOO COMPLICATED FOR TOPIC UNITY	BREAK FIGURE INTO 2 OR 3 TOPICS
NO TEXT	NONCOMMITTAL ATTITUDE TOWARD FIGURE	CREATE A MESSAGE WITH TEXT
TOO MUCH ART	INADEQUATE DISCUSSION, OR MESSAGE STUFFING	EXPAND TO MORE TOPICS / SUBORDINATE BY FIGURE REVISION OR ELIMINATION
NO ART	NONPRESENTATIONAL ATTITUDE (FAILURE TO CAPITALIZE ON GRAPHICS FOR SUCCINCTNESS)	CREATE KEY WORD LIST, TABULAR SUMMARY, CONCEPTUAL DIAGRAM, ETC.
"A LOT OF REQUIRED FORMS OR DATA SHEETS"	NONCHALANCE TOWARD MESSAGE STRUCTURE	PUT IN APPENDIX TO PRESERVE TOPICAL COHERENCE IN BODY

Figure 26. Topicizing to STOP principles brings to light salutary problems of balancing text and art. The author is encouraged toward construction of message units rather than the periodic attachment of official drawings

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IN-HOUSE ADVANTAGES OF STOP METHODOLOGY

STOP makes publications easier to do and improves their quality. It also utilizes human resources better because it casts contributors in cooperating roles.

The STOP methodology offers three in-house advantages:

1. Easier project control
2. Improved editorial caliber as a design feature.
3. Harmonization of differing project skills.

Improvement in project control via Storyboarding has been described previously: it moves the "pull-it-together" struggle up front where there is time to contend with it. The editorial design features conducive to better books are listed in Figure 27. These factors help supervision police readability without recourse to literary or "style" debates.

STOP enhances cooperation between the report/proposal manager, the contributing engineer, and the technical editor because the role of each is differentiated and the unique contributions maximized.

The major role of the manager is to direct the construction of the book contents so that it represents the unified effort of one mind. STOP enables him to visualize the desired result at the beginning and affords him an objective means of making editorial instructions to insure it, i.e., he can influence content without colliding with the engineer's pride of authorship so much. He can put himself in the shoes of both the author and reader at any time, and since he is using the "cookie-cutter" rather than the "grab-bag" technique, can change the approach without wholesale rejection of written drafts.

The contributing engineer needs both the freedom to create theme bodies and the discipline which respects the reader's basic needs; this is well served by the "black-box" concept of the modules. He is given clearer instructions but at the same time is less dependent upon them. He will present his ideas better and in thesis-searching, will get better ideas to present. Effort will not be wasted on writing up the wrong things.

The technical writer/editor is given the opportunity to apply his literary-presentational skills to the hilt. Much is to be done in critiquing Storyboards, policing Thematic Unity, improving topic titles, creating thesis sentences, converting River Raft material, and finding better ways to illustrate the message modules. The editor can go at the theme bodies with a compelling sense of purpose and challenge, since he gets involved with much more than comma-polishing and the shuffling of headings, and his contributions to higher editorial caliber becomes apparent to even the most skeptical engineering staff.

Likewise, the Publications service community, including the typists, technical artists and printers, can feel assured that their contributions (and occasional heroics) are most meaningful in terms of lifting actual reader comprehension of the end product, not just for aesthetics or customary practice grown out of mechanical convenience. There is an immense satisfaction in doing a job right when everyone is certain that the right thing is being done.

ORDINARY GOOD WRITING PRACTICE REQUIRES:	STOP PROVIDES
Communication by succinct issues, not rambling discussions.	A theme level to deal with main points as thematic units.
Organizing to a definite thesis rather than to vague categories.	Early and explicit declaration of thesis as a sentence on the Storyboards.
Not to drift from one topic into another without warning.	Topic titles as mandatory headings; systematic use of topical format.
Accurate ("honest") steering of the reader through the body and into the topics.	Recognition of topic titles as having a different purpose than categorical headings.
Clear identification of the present point of discussion.	Thesis sentences as the abstract of the theme body.
Unified and complete treatment of each main point.	Frame of reference to expose any thematic disunity.
Logical continuity.	Spotlight on discontinuities within the themes; distinction between continuity and transistion to avoid confusing the two.
Variable emphasis to show relative importance.	Standard unit of emphasis as objective measure of relative importance.
Provisions for skimming, browsing, retrospective reading.	Topic titles, thesis sentences, obvious topic boundaries, fig-text relatedness.
Step-by-step exposition and learning.	Sequence of "bite-size" themes.

Figure 27. These thematic design factors are built in. Coupled with better project control and clarified roles of contributors, they make STOP a good choice when communicating to the customer is "imperative" but still not worth the internal struggles to achieve it.

ADVANTAGES TO THE READER

Since reading is studying, the reader basically shares the needs of the student. The student characteristically learns step by step, and sees each proposition before its proof. Only when his learning needs are satisfied will the reader become confident that following the rules of the "lesson plan" will result in comprehension.

The contemporary report/proposal reader is the one person who has greater pressures applied to him than the report/proposal writer. He must assimilate and make decisions from a prodigious amount of information, so he is in a tremendous hurry as well as in a constant state of anxiety over reaching the wrong conclusions. The time will never come when he can relax and appreciate the niceties of a wise author's subtle outline or polished rhetoric, least of all his grammatical style of expression.

The "technical" reader has three first-order needs:

1. What is the point? — Until the reader knows what is being driven at, he can take little interest in what the author is driving through. The idea of "conclusions," i.e. the practice of placing them always somewhere down stream, is a consequence ˙ the "methodological fallacy" (that discourse should trace the conduct of the research). It is replaced in STOP by the concept of "instantaneous heading."

2. What is the place? — The reader is not a machine that cuts evenly with one pass; he operates as iteratively as the author. Natural reader "hunt" needs momentary reminding of where the present discussion fits into the whole scheme of things ("what category am I in?"), as well as what points of equal status come immediately before and after. While the interminable subordination of the categorical outline and the River-Raft "page-flipping" format defeat this search, orientation headings and theme levels are constantly reiterated by STOP.

3. One Bite at a Time — Thematic modularity respects the finite limits of the reader's attention span. Spoon feeding lets the reader take in and digest with ease, or just sample and move on with greater ease. He can proceed as fast and selectively as his own circumstances warrant, without fear of missing out on a critical issue. Or, he can build up his comprehension in stages, focusing great amounts of concentration on each self-contained topic in turn. (Readers have commented on the relief of letting the rest of the book lie while they take in one topic in depth. Authors have made the same point about the advantage of concentrating exclusively on one topic.)

From various comment and observation, it can be surmised that when the reader feels his basic needs are being respected and that some rules are on his side for a change, a transformation occurs in his attitude:

Confidence — He feels able to understand and follow. He loses his traditional fear of the "snow job," is less defensive about his technical qualifications.

Interest — His interest shoots up when he realizes he is being offered something to shoot down, in the undisguised thesis. The tedium of weasle-wording and hedging is less in evidence, being less permissible.

Participation — Fault-finding leads to truth-finding. When the reader is able to take the author to task (Figure 28) for obvious goofs in thematic unity or logic, made more apparent by the modular rules of the road, he becomes more sympathetic despite himself. He becomes more willing to take the trouble of comparing the author's conclusions with his own experience, which is the essence of receptive communication, even if for the purpose of rebuttal.
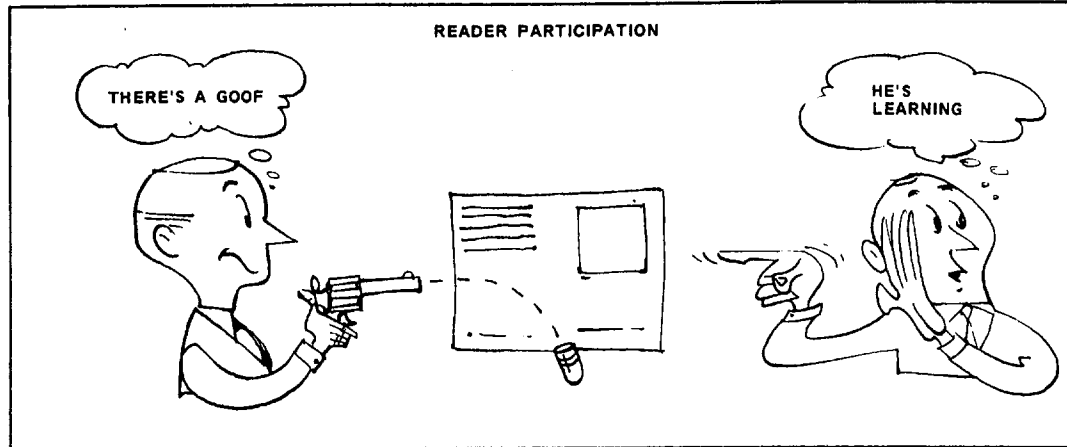
Figure 28. Tremendous relief at bilateral "rules of the road" brings a surge of learning confidence, followed by a critical awakening. More active and systematic participation means better communication, increased respect for the author.

ADVANTAGES TO THE EVALUATOR

Programs cannot be evaluated through documents of obscure expertise. The evaluator's method is to break the contents down into logical, comparable elements. Topical structure helps by stressing discreteness of argument elements.

It goes without saying that the reader is often a program evaluator or administrator whose decisions will affect the course of future business with the authors. The evaluator's problem is to separate the factors of editorial caliber from those of technical appròach and competence. Unless the editorial caliber is sufficiently high to "include itself out" as a determinant, the evaluator will be in trouble selecting between competing documents.

The special need of the reader/evaluator is to analyze and make judgements. To do this he must first be able to recognize issues for comparing and ranking (as in Figure 29), both individually and in various combinations. Dismay over River-Raft obstacles to analysis has led to the dictatorial RFP, which spells out the contending classifications. But itemizations don't convey a response, so the author must still work at organizing to facilitate analysis and influence comparisons in his favor.

The modular organization has a standard level of retrievability which is highly useful in this regard — especially to the proposed evaluator. One thing it does is to make the author's intended emphasis relatively clear. If the subject area has warranted a series of worked-out themes, it must be as important as it is long. Excesses of boring detail can't be shrugged off with the excuse that it's a "complicated system." (One evaluator said the reason he liked STOP was because of his feeling that the authors couldn't pad and plagiarize so much without any intention of standing behind it.) Thesis sentences make intention clearer by serving as a "double check" on what the contractor is committing himself to in the theme body; there is less interpretation and guesswork involved for the evaluator.

Proposal evaluators have been enthusiatic over STOP. The big reason is the improved coherence and pertinence, since mere comprehension is a problem in large proposals, but that's not the whole story. The enumerating, sequencing and individuating properties of Thematic Quantization facilitate the discrete, "digital" nature of analysis and judging. (Many agencies use numerical scoring systems which derive a concensus by statistical means.) Topic uniqueness helps, especially when the author has combined subject details differently than the RFP.

Also, the administrator must justify his decisions to his chain of command, and STOP's features help this to be done methodically and objectively. He can work up a case for his position with "pointable" issues, at the thesis sentence level, does not have to be so much of a translator.
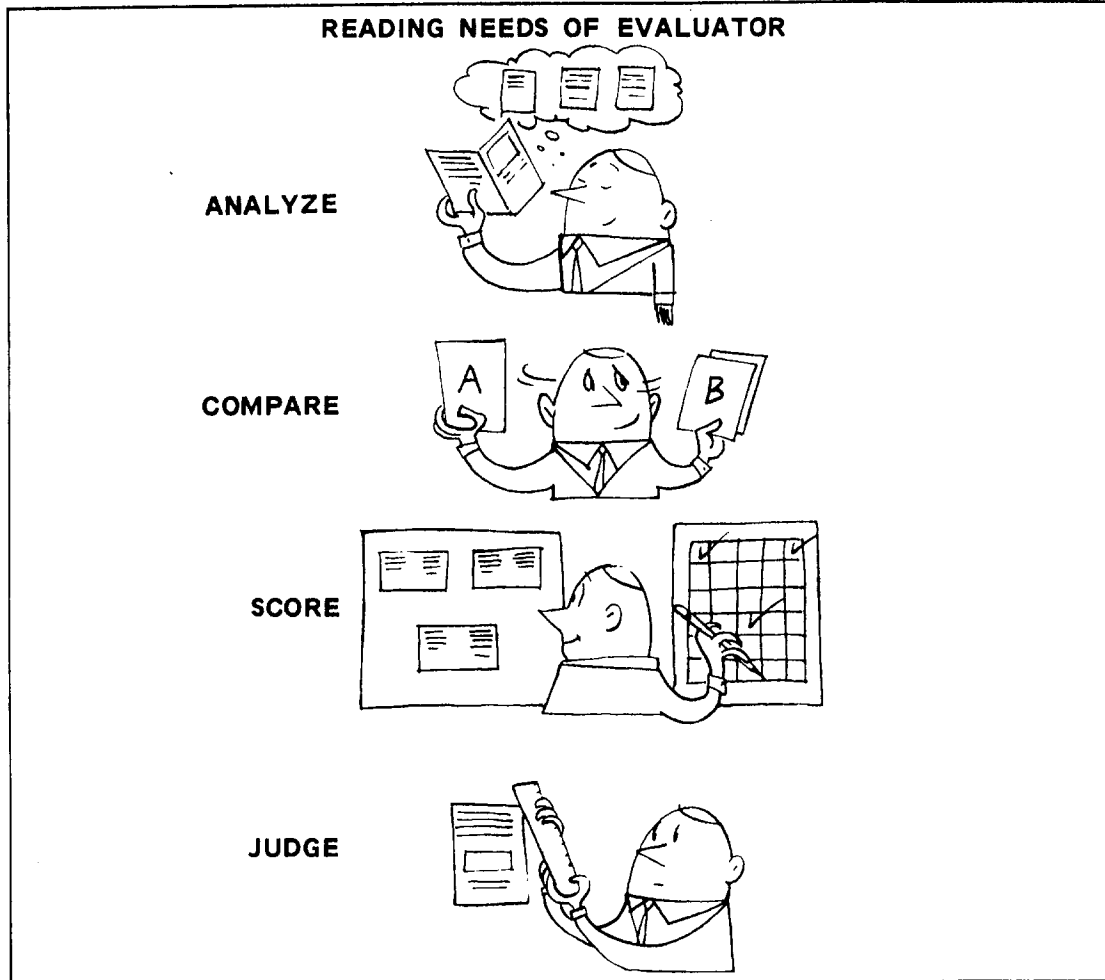
Figure 29. Evaluators are impressed most when "aura of finesse" is created by simplicity of understanding. Quantum features of STOP serve the intellectual needs of analysis and are compatible with numerical scoring procedures. Literary skill and brochure-manship intrude less.

APPENDIX

SECOND THOUGHTS ABOUT STOP

Answers are offered for the misconceptions that STOP is merely an "optional approach", lacks "organizing" flexibility, or is suited only to equipment descriptions.

Misconception: "STOP is just another way to go. There are many equally good ways to organize a document."

Answer: There is really one good way to organize a given discourse: coherently. It is true that slant, story line, subject coverage, etc., may differ according to strategy, but regardless of content selection, theme structure must be understandable to the reader in all cases. Achieving coherent theme structure, or content presentation, is the purpose of the communication process called organizing.

The conscientious and skilled author working alone can achieve coherence by following a categorical outline bolstered by his intuitive theses (the resulting copy will be innately topical and subject to the 500-word pattern), but the team of unskilled writers trying to cooperate under pressure apparently cannot. Furthermore, the more the lone author ignores or hides his inevitable topicality, through a system of noninformative headings or through format dispersion, the more the reader must struggle to follow, so it would seem better that even a sound (topical) discourse in River-Raft format be converted to modular format, when considered from the reader's point of view.

Misconception : "It's hard to organize a STOP publication."

Answer: The process of deciding upon the topical points and their sequence, finding the thesis for each topic, and visualizing the theme treatment is admittedly an intellectual chore, but it should not be shirked by adopting a categorical approach. Topicizing simply means deciding what you want to say (as exactly as you can) and finding an objective presentation of it. This is the essence of organizing, and it is hoped that STOP justifiably obliges the author to face up to it in a responsible and systematic manner.

Some authors feel cramped if they don't have an unlimited number of indentations to play with in categorizing their material, but simplicity of outline is an overruling advantage to the reader. Four levels of headings are adequate to structure the most involved expository discourse. They are: Section, Subsection, Topic, and Subhead within the topic (see Figure A-1). Only the latter shows subordination (thematic dependence) since Sections and Subsections are mere classifying devices. Experience shows that two levels of classification will handle reports and proposals nicely, provided that the Subsection level is properly worked to make technical distinctions rather than editorial divisions, the topic headings are used when necessary to show minor class memberships by the device of parallelism, and Volumes or Parts are employed to show larger book divisions when such is required.

However, note that the topical organization sets up a definite and fixed hierarchy around the absolute topic level. Unlike the categorical outline, it must grow from the bottom up; hence, additional levels cannot be inserted at will, and the roles of the headings cannot be interchanged at will. It should be self-evident that this constraint is salutary; it results in more "responsible" outlines in that they better reflect the true content of the material.

Misconception: "STOP may be appropriate for equipment descriptions, but is not suited to abstract or theoretical discussions.

A-0

Answer: Functional divisions in equipment are usually reflected in the outline of written descriptions of the equipment, so it seems logical to think of STOP as well suited to equipment subjects. The principle of Thematic Quantization, however, is independent of functional subject divisions. Thematic Quantization is just the grouping of ideas, of any intent, and is applicable to all types of material so long as it is thematic in nature, i.e., consists substantially of sentences and paragraphs, and is expository (committed to explaining things logically) — in other words, so long as it is not a mere list of equations, a list of short "definition" entries as in a specification, or a fictional narrative like a novel. Two years of experience on 120 STOP reports and proposals is substantial proof of this. Management plans, study proposals, theoretical analyses, math write-ups, have all been successfully and routinely modularized, as well as the system and equipment descriptions. In particular, there is a distinct advantage in modularizing the math type discussions (see Topic on Audio-Visual Technique for Math Write-Ups).

Misconception: "We have a page-limited book and can't afford the blank space."

Answer: On the contrary, the page-limited RFP can capitalize on STOP to impose early control over compliance to the request, relative emphasis, redundancies, and excesses of tangential detail. When River-Raft is elected for the dictatorial RFP, the last-hour chopping phase is agonizing because the good is thrown out with the bad. Besides, all formats have about 12% blank space, including STOP which recaptures lost space by starting on left-hand pages and backing-up foldouts.

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1. Section   II Design Concepts

2. Subsection   B. Height Data Processing.

3. Topic   1. PROPOSED METHOD FOR ALTITUDE COMPUTATION.

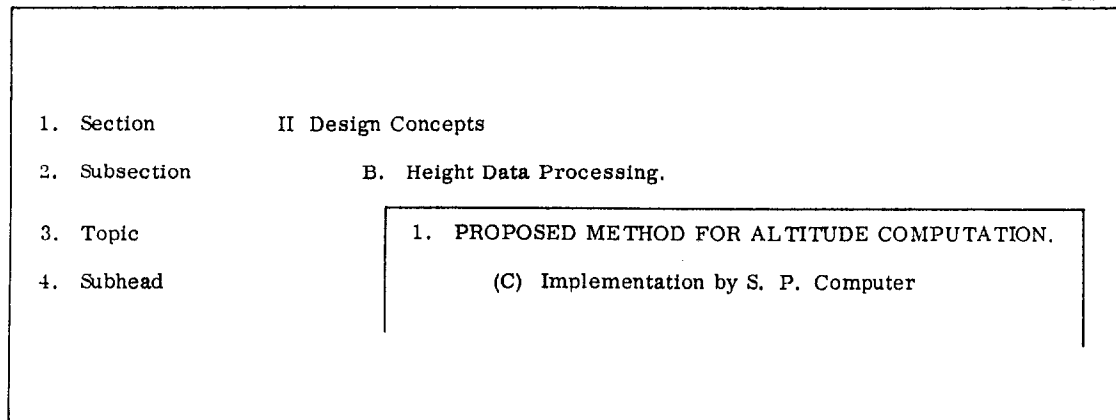4. Subhead   (C) Implementation by S. P. Computer

Figure A-1. Four levels of headings provide an adequate range and flexibility in outlining. Five or more levels risk exceeding the average reader's retention and span of comparison, hence blur perspective.

THE QUESTION OF CONTINUITY

STOP writing does not have to be choppy because it is modular. The distinction between continuity and transition, fostered by topical outlining, encourages the author to pay closer attention to the need for connective tissue within the topic where it matters most.

The sequence of themes creates an episodic effect similar to lessons in a textbook. Most expository writing has this episodic (or topical) quality, because it is intended to instruct by logical analysis. This will not create a choppy or disjointed effect, however, if the author is careful to provide the necessary continuity and transition.

The reader has a sense of continuity when he has visibility of and can follow a logical train of reasoning. Strong continuity is important to achieving coherence. Standard techniques are available to secure continuity in paragraph organizing and sentence linking within a given theme (e. g. , repetition of key words). They are effectively employed in STOP write-ups because they are guided by the rules of Thematic Unity, which is a procedural improvement over the River-Raft approach.

Engineers often fail to achieve good continuity because they have to imply so much technically, but material treated modularly is more apt to be developed with continuity of theme, internal to the topics, because the given span of argument to be bridged is more obvious at any given moment.

On the other hand, moving from one topic to another is a matter of transition, not continuity (see Figure A-2), and the standard techniques are again applicable in STOP. It can be shown in River-Raft copy that the engineer leans on assumed technical reasoning to imply topical transitions, but with no more impunity than for implied continuity. Due warning when transition is to be made from one point to another is as crucial as smoothness of development within the point. Lack of such warning, or mistaking a transitional device for a continuity device, is a major cause of reader confusion in the River-Raft form — the "test for extraneity" can be made only by a second reading.

The traditional solution, a periodic infusion of purely editorial steering ("being told you're going to be told, " etc.) is subject to variations in skills of both the author and reader. As demonstrated by his conventional writing habits, the engineer-author prefers to achieve logical flow between topics by methodological implications (e. g. , beam steering is naturally discussed after beam formation, etc). STOP strikes a happy medium by not requiring trivial verbalizations of transition, accommodating it if desired, but clearly warning the reader in any case by the device of uniform boundaries. Also, ordering of topics for a good sense of technical inevitability is attended to with more diligence because theme sequencing is a distinct organizing decision.

It is interesting to observe that the relatively recent rise of internal text headings in modern technical literature has been an attempt to cope with the problems of continuity-versus-transition in the complex industrial document, though it seems that confusion over interminable subordination, or absence of absolute topic level, has largely defeated it.
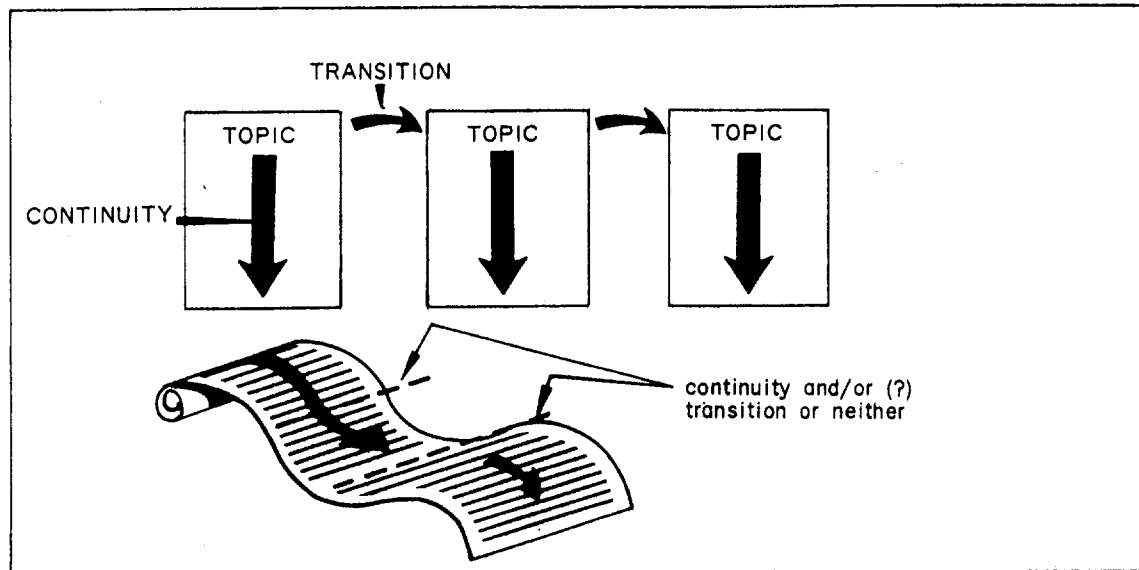
Figure A-2. Continuity and transition are functions which use similar editorial devices, but serve different purposes. A strong topical structure is needed to avoid confusing the two, a prime cause of incoherence because both are frequently implied.

THE QUESTION OF RELATIVE IMPORTANCE

STOP gives the first impression that all subjects are treated as equally important. In practice, the uniform topic boundary accomplishes just the opposite, by establishing a unit of measure for thematic emphasis.

Differences in thematic importance arise from various intrinsic reasons (e. g. , the inherent significance of system design as compared to circuit design), but also from extrinsic reasons such as the author's slant or set of values which characterize his approach. The reader must be able to see at once what relative importance the author attributes to different subject areas, and two principles can be observed to assist him in this. First, an unlimited range of shadings in emphasis is worse than a simpler system of contrasts, because subtleties become tiresome and confusing to the harried reader. Second, a standard, or scale of measurement, is useful, to indicate relative degrees of value.

The message module of uniform dimensions establishes something not available before: the concept of "unit emphasis. " This theme-structuring device offers a means of objectively clarifying the author's intended emphasis (importance attributing); thus, far from ignoring differential emphasizing, STOP offers a way to place emphasis unambiguously. The emphasizing options available to the STOP author are:

● Elect the discussion to topic status.
● Elect the discussion to multiple topic status.
● Subordinate it to within a topic.

These options are discernable to the reader almost immediately and are less dependent upon reading skill than interpretive comment by the author, rhetorical devices, or River-Raft structural devices.

The difficulty with River-Raft techniques of emphasizing structurally (such as length of passage, subordinating by heading indentation, positioning, underlining, etc.) is that they tend to be inconsistent and ambiguous, and they do not actually affect what is said in the write-ups. The length criteria is particularly meaningless because there is no standard "words/idea ratio". Further, emphasizing by increasing length of passage often falls prey to Parkinson's Law of the Trivial (general significance skimped, details lavished), hence is commonly self-defeating. In other words, the problem with present methods of outlining is that many subject areas are not receiving adequately equal "air time" (see Figure A-3).

A subject area is more important when it entails different aspects which warrant additional topics. Modularity recognizes such enumeration as a more valid criteria of importance than length of passage per se. Modularity also enforces a "functional subordination, " through the rules of Thematic Unity, in that relegating a paragraph to a subtopical level requires corresponding changes in the Thesis Sentence and continuity of the topic in question. This means that subordinating cannot be accomplished by laissez-faire techniques such as "playing with headings, " or by affixing an extra digit to a decimal notation.

The device of "unit emphasis" is most appreciated by the reader. An author does not have to read (learn from) his own material. Indeed, since he can read his own mind, he cannot "read" his material, so he can easily fail to appreciate the reader's quite crucial need for such objective criteria of theme structure.
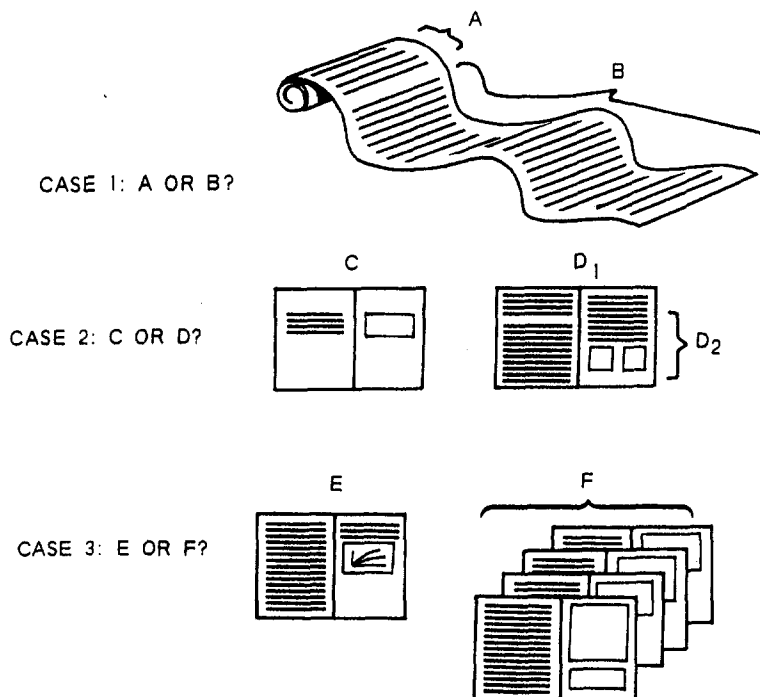
Figure A-3. Answers: Case 1 is indeterminant, but A is probably more important than B (Parkinson's Law of Triviata). In Case 2 both C and D are equally important despite differences in absolute length because author elected both to same presentational "status". D_2 is subordinate to D, hence is less important than C. In Case 3, the subject area treated as multiple topics under F is more important because its greater number of facets is recognized in the theme structure.

OBJECTIONS TO STOP

Some comment is offered for typical objections to the STOP technique.

"We would not have a figure for each topic." No figures are needed to make Thematic Quantization work, since it is not a "picture story" technique. Some STOP proposals have been all text and no art, because the concepts did not lend themselves to illustrating. It's still a good thing to be reminded by the format that an illustration ought to be considered for each message module.

"STOP would result in too many additional figures being created." The average report and proposal already contains 35 to 40 figures per 100 pages. The increase with STOP, if it does happen, is only about 10%, and it consists usually of simple figures that help greatly to get the message across most effectively.

"It would be a nuisance fitting the figures into the modules." Yes, but it's a nuisance to the reader if you don't. A basic reform in figure usage (integrating them into message purposes) is needed in reports and proposals; STOP affords the means of achieving it with the least difficulty.

"We would end up with short topics that wouldn't fill the spread." Statistics don't bear this out. Practically no topics are less than 250 words, or 1/2 page, which makes an effective message along with 1 figure, table or key-word list. One reason for this is you find ways to combine material for better coherence or more appropriate emphasis.

Or, you dig for more significance to justify the passage standing alone. In terms of a more readable end-product, it's beneficial to have to trade off these alternatives in your planning and writing. If the short topic is really that short and that important, it should stand alone; there's no better way to show your chosen emphasis.

"A lot of topics would be too long to fit." Statistics on your natural writing habits, and experience with STOP indicate that this is not a problem, believe it or not. When the material doesn't fit, chances are good that it's a compound topic which would be better treated as two separate modules for greater reading efficiency. The "truly verbose" topic (thematically unified but over 1,000 words) is very rare; it occurs about once in 50 topics, in the 2% bracket.

"It's too much of a constraint and requires painstaking bother; we can't afford to add more worries on top of our technical problems." As a writing guide, STOP requires discipline and extra thought, but not because it's unnatural to what you're attempting to do in the first place (be coherent). Rather, it establishes a minimum author accountability that can't be dodged for the wrong reasons (lack of skill, oversight, indifference, etc). Of course, one should not elect STOP if it is unimportant for the reader to receive your message in the first place. On the other hand, as a program-controlling tool, STOP repays your effort many times over, especially in storyboarding, by eliminating wasted effort and all-night panics.

"We're afraid to change over; our inexperience is too much of an obstacle." Each topicizing problem "programs" its own cure, i.e., the technique is self-correcting once you start. Furthermore, you always have the "bail out" option (simply closing up the modules), which can be elected at any phase prior to printing, thus it is a fail-safe proposition. The bail-out option has been resorted to once in two years

of doing major crash proposals by STOP.

"I wouldn't have a strong proposition to expound for every discussion." If true, this is too bad because you will lose reader interest. But you don't actually need a brilliant argument every time to achieve the basic goal of coherence. One can just write a brief summary sentence for use as the thesis.

"Printing requirements will increase book costs, cause delays." STOP books have been published with secretarial help only. STOP books can be done all-typewriter and with hand-drawn art if desired. Cost is about the same as for conventional books, as soon as some experience is gained. The only typography requirement is a page capacity of approximately 550 words. Conventional mulitilith methods are OK; bond keylines for ITEK masters are recommended (gives reductions and easy corrections). Provisions are needed to integrate art with text, and back-up foldouts. Art sizes should be a lot tighter to accommodate multiple figures per page.

"Reproduction typing will have trouble with copy-fit and art-fit problems; they'll be stuck with an unproducable book at the last minute." Not when they get going and get the hang of it. We worried about the same thing two years ago. Copy-fit problems are surprisingly infrequent, can be easily ironed out by a tech editor, the proposal manager, or the nearest commiserative author. Use of a dummy, and batching of text topics for typing greatly facilitates production workflow and make-up. Changes are easy to handle: no "domino" effect. Look out for page numbering (starts even, not odd).
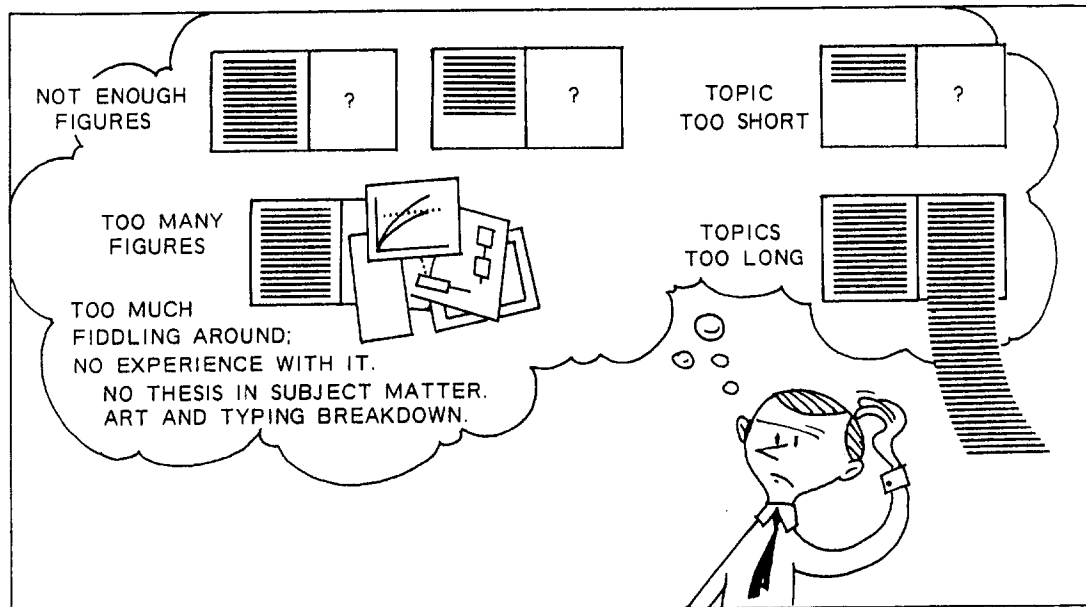
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Figure A-4. Obvious objections to STOP show why it can't possibly work, but innate topicality of expository writing dispells topic length problems, and reforms in figure usage provide self-induced layout solutions.

THE SWAPPED ROLES OF THE READER AND AUTHOR

The prevailing literary philosophy of narrative continuity has resulted in a doctrine of writing which assumes that the reader must <u>edit</u> the author as part of his duties of readership. STOP would shift the proof of coherence back to the author.

Since the origin of literature is story telling, it is not surprising that the ideal of literary form has been handed down as narrative continuity. This is seen when people complain that "it just doesn't flow," when they mean the writing lacks logical coherence. What may be forgotten is that the effect of narrative continuity is dependent upon the plot device, or some event-time assumption, to gain "coherence" through a resemblance to life itself, or some other process. A non-logical type of continuity is also obtained in fiction through the train of word-associations known as the "interior monologue," regarded as the ultimate extension of the narrative form of the novel. This is illustrated by Molly Bloom's 20-page stream-of-consciousness soliloquy in James Joyce's <u>Ulysses</u>. Devoid of any logical coherence, it is as smooth and continuous as the biological life force it extolls.

The appearance of text headings in the modern technical report indicates that the criteria of narrative flow has been a failure for expository literature in the circumstances of mass authorship and high-pressure, administrative readership. However, some authorities still apologize when recommending headings, even for the technical report, and others advise against it in general on grounds of propriety.[1]

Outlines are not in danger of being abandoned, but the predilections of generations of literature-minded English teachers (not to mention nine editions of <u>How to Read a Book</u>) has had its effect. It has created the lore of the Divine Right of Authors or Caveat Lector ("reader beware") which is the sustaining code for categorical outlining and the other privileged practices of River Rafting. In the officiations of this lore, definitions of the procedural rules of authorship are seldom attempted. The author for example is expected to <u>be</u> clear, and exhorted qualitatively to be so, but <u>how</u> to be so is part of a nebulous mystique of apprenticeship.[2] Curiously, the authorities are not so easy on the reader and, through the definitions of the reader's role, one can see and fully appreciate the license granted to the authors.

The reader's burden is codified by Dr. Mortimer Adler, of Great Books note, in the following "rules for reading" (see work cited):

1. Classify the book according to kind and subject matter.

2. State the unity of the whole book, what it's about, in a single sentence.

3. Set forth the major parts and show how these are related and organized into a whole.

4. Define the problems the author is trying to solve.

5. Come to terms with the author by interpreting his basic words.

6. Grasp the author's leading propositions by finding his important sentences.

7. Know the author's arguments by finding them in, or constructing them out of, sequences of sentences.

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[1] "I was so obsessed with the importance of structure that I outlined the structure of the book and published it. Naturally it was repulsive to most self-respecting readers, who thought they could do their job if I did mine." Mortimer J. Adler, <u>How to Read a Book</u>, Simon & Schuster, 1940 (ninth edition, 1963) p. 181.

[2] "Finding the unity belongs to the reader as much as <u>having</u> one belongs to the writer." Mortimer Adler, op. cit.

8. Determine which problems were solved, which not, and whether the author knew he failed to solve them.

There is a remarkable similarity between these rules for reading and the editor's rules for "topicizing" (converting a River Raft book to modular form):

1. Discover the true topic boundaries, or independent units of the discourse.

2. Mock-up each topical passage within the standard modular frame.

3. Identify the propositions specifically according to the rules of phrasing topical titles.

4. Locate or reconstruct the theses and write the thesis sentences.

5. Insure that the key words of the themes are included in the thesis sentences.

6. Examine the theme bodies for adherence to the rules of Thematic Unity.

7. Fill holes, combine fragments, and reorganize as necessary, both topically and categorically, to achieve optimum logic of continuity and transition, and compliance with purpose of document.

8. Check for pertinence of topical arguments to the whole proposition of the book; sharpen or revise accordingly.

The STOP Storyboard procedure also prescribes these operations, but for the author, during initial planning and writing, and systematically at the theme level. In other words, How to Read a Book asks the reader to accomplish what STOP expects of the author (or tech editor) in the first place. It is no surprise when Dr. Adler reaches this conclusion:

"In general, these rules of reading look as if they were rules of writing also. Though they are reciprocal, they are not followed in the same way. The reader tries to uncover the skeleton the book conceals. The author starts with it and tries to cover it up. His aim to conceal the skeleton artistically or, in other words, to put flesh on the bare bones. If he is a good writer, he does not bury a puny skeleton under a mass of fat."

It is even less of a surprise to come across this admonishment:

"You may ask: How will I know whether I am really following the rules when I read? The most direct sign that you have done the work of reading is fatigue."

Against the suggestion that reading comprehension must be based on a fatiguing, error-inducing struggle to insure effective communication ("... the lift which comes from managing to understand something which at first seemed unintelligible to you." — Adler), STOP rests its case on Skinner's examined principles of programmed instruction:

"We might say that the human organism is reinforced by any simple gain in competence. When we guarantee a consistent gain by breaking the material to be learned into small steps, we raise the frequency of reinforcement to a maximum and reduce aversive consequences to a minimum. It is true that those who learn in spite of a confusing presentation of a subject are better students, but are they better because they have surmounted the difficulties or do they surmount them because they are better? There is no evidence that what is easily learned is easily forgotten."[3]

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[3] B. F. Skinner (Professor of Psychology, Harvard) Teaching Machines, Scientific American, Nov. 1961.

BACKGROUND AND ACKNOWLEDGEMENTS

The STOP technique was not born by invention, but through the unfolding of numerous insights and accidental discoveries by a group of people over a 2-year period.

The idea of a modular treatment for organizing the full text of a technical document, and the decision to try it on a typical proposal, was reached by Jim Tracey and Dave Rugh at the close of a proposal crash in October 1962. It was their conclusion that the brochure-like, text-and-picture organizing method that presented story elements in a spread-by-spread sequence could offer the same reader advantage in the case of the fully detailed technical exposition as it did in the case of the slide and flip-chart presentational booklet. The assumption was that difficulties in writing and editing would necessarily have to be overcome to fit the detailed technical narrative into such a pattern. The plan was that the extra work of revising and rewriting would be shouldered by the technical editor.

The significant point is that this assumption was soon proved incorrect, but at that moment it was felt (in a mood of desperation) that the existing problems of achieving comprehensibility in the conventional production were already so difficult, and being so poorly resolved, that any change could only work for the better, expecially if it entailed a modular end result of proven reader benefit. For implanting this attitude of letting the devil take the author for a change, credit must be given to Mike Rapport, who had propelled the authors into the recognition that traditional editorial elegance was incontestably beside the point when having to spoon feed hard arguments to soft customers.

The modular technique was therefore adopted on two proposals in November and December of 1962: the Small Ships Data Processor, and the Space-Ground Link Subsystem. Both of these proposals lost. Important discoveries were made, however, which justified the editorial efforts. First, it was seen that the topicizing operation inexorable shook out editorial defects (most material was being converted from River Raft) as though by formula. Second, it was observed that the text body was already naturally structured by topical segments, accomodating modular uniformity without extra work, but that the possibility was being concealed by the categorical headings. This was in January of 1963.

By February, the Storyboard concept of outlining was accepted as an essential step in planning the modular publication, and its superior role in managing proposal content was seen. A Storyboard form was printed up (on B-size vellum), though it did not include a Thesis Sentence. Instead, space was provided at the bottom of the sheet to answer this question: "What conclusions do you want the reader to draw from this write-up?"

As the number of modular proposals grew through March and April of 1963, a realization dawned concerning thematic unity which, looking back, seems as though it should have been self evident. This odd discovery was voiced by Walt Starkey, who held up a topic in genuine surprise and said "Look, each of these is a self-contained theme." Previously, module content was more-or-less being "packaged" by dividing the material uniformly along the clearest line of change in subject category (in itself a remarkable advantage). The new viewpoint made it clearer that thematic unity (i.e., coherence of the theme body) was a property of self-containment, and that "circles of coherence" could exist repeatedly within a larger narrative, Self-sufficiency of topics as complete messages became a leading goal. This occured during the edit of the first AADS-70 proposal, the eleventh modular document produced by the then Systems Publications Sections.

By the end of 1963, 44 modular publications had been produced. It was felt that a decided measure of control had been gained over the basic parameters of coherence, and enough customer favor was filtering back to verify that the improvement existed for the reader. But one dissatisfaction persisted, namely a sense of low pertinence or missing significance throughout the technical "descriptions" which make up the bulk of the average proposal. Must proposals be dull? This question led to a search for ways to insure that the author would elect and declare a propositional intent, rather than just describe. It was then found that the traditional Thesis Sentence could be applied repeatedly to the topic elements for this purpose. This sentence would prompt conclusions and also double check theme contents, thus would enhance coherence as well as pertinence. It was seen that the product, so to speak, of pertinence (having a propositional thesis) and coherence (sticking to one thesis at a time) could be considered an operational definition of expository clarity. This was in November 1963, one year after the basic modular technique was adopted.

The first modular document employing the printed out Thesis Sentence was prepared as an experiment in December 1963[1]. In July 1964 three modular proposals were also so prepared (an inexplicable delay, though there was as understandable reluctance to become committed to the "exposure and labor" of the technique). Since then, the Thesis Sentence has lost its threat, becoming a highly useful standard device and the identifying symbol of both the Storyboard and the topic.

Thus the various modular ideas had matured into the full STOP technique by the Summer of 1964. By the end of 1964 about 120 documents of major proportions had been produced by the method. Several technicalities were also clarified that year, such as the identification of the operational parameters of organizing[2], the essential procedural defects of the categorical outline[3], and some of the secrets of Storyboard reviewing[4].

The Audio-Visual technique of handling math writeups (a Tracey-Rugh production) was developed in detail in November 1964 with the encouragement and examples of Ron Long.

As can be seen, the development of the STOP technique was a gradual process of worry, speculation, brainstorming and fumbling experience. Members of the Writing Services Section contributed valuable assistance, particularly Dick McCormack, who provided a much needed layman's description of STOP, and Dave Gater, who assisted Rugh in proselyting a generation of skeptical authors. Walt Starkey proved the efficacy of Storyboarding once and for all on the 6,000-page cross-cultural NADGE program. Jack Hunt and Dorothy Morico led the revolution in graphics that was prerequisite to smooth production of STOP books. Bob Perry furnished the Storyboard clue, discovered Parkinson's Law of the Trivial, and endorsed all with an enthusiatic managerial indulgence.

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1) Multilaminates for Nanosecond Circuitry, W.T. Rhoades, ID-64-33, a technical paper dated for presentation in March 1964.
2) Assuming the existence of the topic structure, they are: Categorizing, Sequencing and Subordinating.
3) Showing both categorization and subordination by the device of indenting; failure to exclude categorical headings from the thematic outline(text plan).
4) Seriously pretend it's the finished copy; look for the real thesis in the 4th paragraph (Dave Rugh).