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## COMPUTER-ASSISTED LAYOUT OF NEWSPAPERS

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## PREFACE

The material in this document is intended for members of the publishing business and their electronic-equipment suppliers. It describes a computerized system for structuring newspapers into sections and departments, positioning display ads on the pages and fitting news stories and pictures to the available news hole. The end product of the process is a page-by-page dummy that defines the boundary lines for all ads, stories and pictures on each of the pages. Although presented strictly in the context of newspaper layout, the approach we have taken to the layout problem has broader applicability. It should be generally useful in the publishing business as a whole.

Our approach to newspaper layout is best described as an interactive, computer-assisted approach in which the machine does most of the work but with the help of a layout supervisor who enters the layout process at crucial points for decision-making and possible override purposes. Based upon our extensive research in automated layout we have concluded that this division of responsibilities between the computer and layout supervisor is likely to be the most productive and cost-effective.

The document is divided into three segments. After discussing the layout problem in general terms and various possible approaches to automated layout in Chapter 1, we proceed, in Chapter 2, to a discussion of computer-assisted layout from the layout supervisor's viewpoint. Chapter 3 describes the newspaper-structuring process. At this point we are prepared to proceed with display-ads layout, Chapter 4, and then to news layout.

News layout is accomplished in two steps. News stories and pictures are first assigned by departments to various pages of the paper; then, the locations of the items on their assigned pages are established. This modular approach provides the flexibility that is needed in order to make changes in layout policies with a minimum amount of reprogramming. The method used to assign news stories and pictures to pages is presented in Chapter 5.

The story-positioning procedure is built upon the concept of layout templates and a symbolic language for describing the templates. A special symbolic template language is required in order to reduce the template library to a practicable size. Since the news-template concept and its associated symbolic language are rather unique, considerable space (Chapters 6, 7 and 8) is devoted to a discussion of these basic ideas and to their application.

In Chapter 9 we describe results of news-layout experiments that we performed. Data for these experiments were taken from pages of a local daily newspaper; experimental results are compared with the original newspaper. The document concludes with a chapter on the design of a template library.

The research which formed the basis for the document was made possible through a series of grants from the American Newspaper Publishers Association. We are most grateful, not only for the support extended to us by ANPA, but also for the enthusiastic cooperation we received over the years from many newspaper publishers and their staffs. We value highly the enduring relationships we were able to develop during the course of the project.

We acknowledge, also, the efforts of our support staff and our entire research staff including graduate and undergraduate students who participated in the project; they contributed constructively in many ways to the final outcome of the work.

The authors

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## CHAPTER 1

### THE NEWSPAPER LAYOUT PROBLEM

In general terms, the challenge in newspaper layout is to choose a page format for advertisements and news that satisfies the goals of both the advertisers and the publishers. The primary inputs to the layout process are the display ads, classified ads and the collection of stories and pictures that comprise the day's news. Since newspaper revenue depends heavily on advertising, the newspaper aims to accommodate all ads sold for each edition. On the other hand, there is always an excess supply of stories and pictures; hence, news layout is a selective process.

#### 1.1 Layout Goals

Layout styles for ads and news are designed to attract readership and to optimize the newspaper's effectiveness in presenting information. Rules and conventions have evolved over the years with the result that well-established layout principles are shared by virtually all American newspapers. Layout of display advertising, in particular, is quite similar among newspapers since all use some variation of a pyramid layout structure in which smaller ads are placed atop larger ones. News layouts tend to be more varied and often reflect the editorial "personality" of the individual newspaper. Although the information content of a paper changes completely from day-to-day, it is important to preserve layout style in order to maintain the newspaper's identity and to foster familiarity among its readers. At the same time a rigid, unvaried style may become monotonous and dull.

#### 1.2 Layout Functions

Functionally, the layout process consists of three tasks: structuring the newspaper; laying out the ads; and laying out the news around the ads.

In the structuring stage, the sequential order of the newspaper departments is established and specific pages are assigned to each department. The total number of pages is determined by the amount of available advertising and an editorial decision concerning the size of each department's news hole.

Once the page structure for an edition is established, the advertising can be laid out. Throughout this document we assume that classified advertising is assigned to separate pages and can be processed as a corpus. Display ads

are positioned on the pages of the remaining departments. In this process allowances are made for a variety of factors and constraints such as news-hole requirements, preferential locations, competing advertisers, ads with coupons, and so forth. The result is the display-ads dummy which specifies the page locations and boundaries on the page of all ads. The remaining space defines the news hole for each page.

Finally, the news is selected, edited and fitted into the available news hole. Ideally, it would be preferable to adjust the news hole to the totality of the day's news instead of vice versa; for practical reasons, however, the news is always tailored to fit available space. Newspapers simply cannot afford to print all the copy being generated by prolific wire-service reporters, feature writers and local news staffs. The news must be filtered to select stories that are judged to be of greatest interest to the individual newspaper's readership. These items are positioned on the pages to present an attractive layout with an esthetic balance of pictures, headlines, and text. In addition, the layout should maintain an orderly structure for easy reading. When the layout process is completed, each ad and news item will have a specific location in the paper and production can begin.

### 1.3 Layout in the Computerized Newspaper Environment

The ads- and news-layout processes are performed sequentially with deadlines for each well-spaced in time. Earlier deadlines are acceptable for ads because advertising has somewhat less immediacy than news. In today's newspapers page layouts are accomplished largely without benefit of computer assistance, although there is a trend toward computer-assisted layout. Some newspapers maintain computer-stored files of ads and news items, perhaps with some sorting capability, which can be utilized to generate lists for layout. Recently, computer terminals employing cathode-ray tubes have been made available to operators in order to permit layout through step-by-step interactions with the computer. In general, however, these systems substitute a cathode-ray-tube (CRT) display and graphics input devices for the traditional pencil and paper; they make little use of additional computer capabilities in the layout process. Since, with these systems, the human operator must still make all the detailed layout decisions, it is questionable whether or not any productivity gains thus achieved are cost-effective.

The results of our research support a more automated approach to computer-assisted layout. We believe that greater productivity can be achieved by more

extensive use of the computer's inherent capabilities in the layout process. In the design of a computerized-layout system, a broad spectrum of automaticity options is available. The "CRT scratch-pad" approach used by current commercial systems, as described above, represents one end of the spectrum, where a small part of the process is automated. At the other extreme, a fully automated layout system is conceivable where layouts would be created according to pre-conceived algorithms. Ideally, such a system would be the fastest and most efficient approach; however, we believe the layout process is too complex and day-to-day conditions are too varied to permit the design of an algorithm that can achieve acceptable layouts consistently and cost-effectively. When the layouts generated by a fully automated system are unsatisfactory, new layouts can be created only by revising the inputs and re-executing the entire set of layout algorithms. Many iterations may be necessary to produce satisfactory results; therefore, the over-all efficiency of the process may be much less than expected.

We advocate an approach between these two extremes in which the computer performs routine tasks and the layout editor interacts at key points to approve or override the process. In the layout systems we have investigated the computerized process is divided into subprocesses and the human is asked to evaluate the computer-generated results as each subprocess is completed. For each subprocess a computer-executed algorithm generates a "first pass" and the results are presented to the layout supervisor\* for review and evaluation. The supervisor can alter the results directly, as desired, or he can revise the program parameters and rerun the program to create desired changes. In any event, the layout supervisor must indicate his satisfaction before the next subprocess begins. Since each step in the sequential-layout process depends on the previous results, unnecessary processing is eliminated and the over-all efficiency of the layout process is improved.

#### 1.4 Software Design

The interactive approach described in the previous section facilitates a modular design of the system software. Modular-software design has several advantages. In program development it is simpler and more efficient to

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\* The term "layout supervisor" is used to designate the operator in the computer-assisted layout system. Present newspaper-personnel titles are not directly applicable because of the need to re-organize functions and responsibilities in a computerized system.

write and debug programs for relatively small modules rather than to implement a single, integrated system. The separate modules are easier to understand, inputs and outputs for each module are defined explicitly, and interactions between various parts of the layout process are clearly defined.

Since, in a typical newspaper organization separate layout functions may be assigned to different people, the modular approach facilitates this division of responsibilities. Each module, together with its own data base, can be regarded as a separate subsystem. With an integrated monolithic-system design, on the other hand, minor revisions may require extensive program modifications and re-assembly of the entire system program whereas in a modular system the revisions can be confined to a smaller segment of the system. Also, it is relatively simple to append new functions to a modular system by adding another module. For example, a display-ads billing module might be added to the layout system using much of the same ads data employed by the ads-layout module.

A key feature of our software design is the separation of layout policy from the actual layout algorithms. Policy data are the inputs which influence the layout style and format, the features that distinguish one newspaper from another. For example, department names and their preferred sequence of occurrence in the newspaper are part of the policy which determines the newspaper structure. Included in a display-ads policy might be the restrictions placed against the placing of display ads on certain pages and procedures that must be followed for laying out ads with coupons. News-layout policy may specify things such as a minimum and maximum number of stories to be started on page one and preferred pages for story continuations. The collection of policy data is stored in separate files which are called upon by the layout algorithms whenever appropriate. The policy files are semi-permanent in that their content does not change from day-to-day, but they may be revised when the newspaper management decides to implement a change in layout format or style.

The purpose of separating stylistic factors from the layout algorithms is to permit the design of universal layout algorithms which can be applied to all newspapers or to the same newspaper even though it undergoes periodic stylistic changes. Thus, computer-program-development costs can be shared, and system implementation can be made more efficient. Although this goal is not totally achievable, we believe that the layout algorithms developed during our research are applicable to a wide spectrum of American newspapers with only minor revisions in order to accommodate individual newspaper styles.

Another important advantage of this approach is that once a newspaper implements the system, changes in layout style or format can be effected simply by revising the policy data rather than reprogramming the layout algorithms.

### 1.5 Description of a Computerized Newspaper-Layout System

In the chapters that follow, a computerized newspaper-layout system is described in detail. This system represents a culmination of several years of research during which various techniques for both ads and news layout were proposed and evaluated. The system we shall describe represents an amalgamation of the best features of the various ideas that were tested. Chapter 2 contains an overview of the computer-assisted layout process from the layout supervisor's viewpoint. Chapters 3 through 10 describe in detail the layout algorithms for page structuring, display-ads layout, story and picture assignment, and news layout.

## CHAPTER 2

### COMPUTER-ASSISTED LAYOUT FROM THE USER'S VIEWPOINT

Laying out a newspaper with the assistance of a computer implies radical departures from manual procedures. A critical issue in the design of a computerized layout system is how to divide tasks between the computer and the layout supervisor. Tasks that are well-defined can be formulated in an algorithm and assigned to the computer. On the other hand, the layout supervisor can still perform valuable functions; he can act as an overseer of the computer process and be responsible for making stylistic and esthetic evaluations of the computer-generated results. By freeing the supervisor from routine time-consuming tasks, the computerized system offers potential for more effective utilization of human creativity and judgement in the layout process.

The functional block diagram shown in Fig. 2.1 is used to present an overview of a computer-assisted newspaper-layout system. In the diagram, the two large rectangular boxes drawn with dashed lines represent the two major layout tasks: over-all newspaper structuring and display-ads layout, and news layout. In the first task the newspaper is divided into sections and departments, each department is assigned a specific number of pages for a given edition, and the locations of display ads on each page are designated. The news-layout task includes page assignment of stories and pictures, and story and picture positioning on each page. Ads and news layout are performed sequentially in the layout process.

The cylindrical boxes in the diagram represent the major data files required in the layout process: ads data, ads-layout policy, ads-makeup dummy, ads dummy, news data, news-layout policy, news assignment, template-library and page-layout dummy. The content of all these files can be accessed by the layout supervisor for acceptance or modification.

One goal of our layout-system design is to separate factors which reflect the newspaper's style and format from the basic layout algorithms. Style and format information, along with other data relating to newspaper layout policies, is stored in the ads- and news-policy files rather than imbedded in the algorithms. This approach has two significant advantages: the basic algorithms can

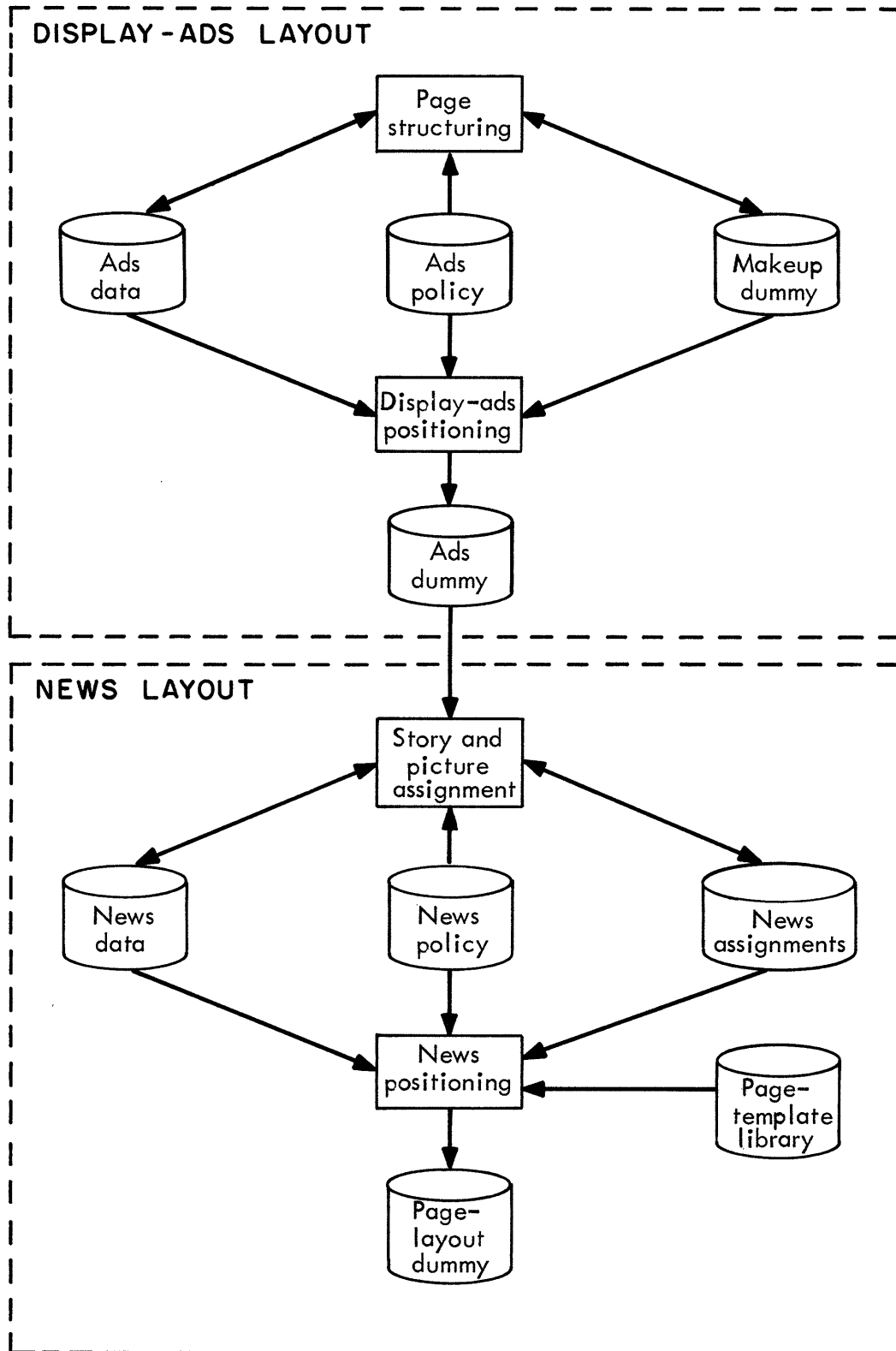


Fig. 2.1 Functional block diagram of a computer-assisted page-layout system.

be shared by newspapers with a wide variety of layout styles and formats, thereby reducing software development costs; and management decisions to revise styles or formats for a newspaper can be implemented simply by altering the policy data rather than through a rewrite of the layout programs. Thus, the policy files are semi-permanent files that do not change from day-to-day, but are revisable whenever a change in layout policy is decided upon.

### 2.1 Ads Layout

The layout process begins with the inputting of display-ads and classified-ads data. For layout purposes, the essential data are the display-ads dimensions and an estimate of total classified-ad lineage. From these data and policy guidelines concerning news-hole requirements, sectioning, and departmentalization, the page-structuring algorithm determines the number of pages required for the edition and assigns pages to each department. The results are stored in the makeup-dummy file and presented to the layout supervisor in tabular form for review. The tabular display shows the page assignments, ads, and news space for each department. At this point the layout supervisor can alter these assignments, if he so desires.

After the page structure is accepted by the layout supervisor, he activates the ads-positioning algorithm. Here the display ads are assigned to specific pages and located on the page in accordance with rules specified in the ad-policy file. The computer generates the ads dummy for the entire edition or for selected departments, as directed by the supervisor. The computerized-layout process easily accommodates a number of special requirements which complicate manual layout, such as avoiding back-to-back coupons, separating competitive ads, eliminating buried ads, restricting ads on certain pages, and so forth. Ads-layout results are stored in the ads-dummy file and presented in graphic form on a page-by-page basis to the layout supervisor for review. A variety of editing commands are available to the supervisor for relocating ads on a page, transferring ads to a different page, and inserting new ads. When the supervisor is satisfied with the ads dummy, news layout can proceed.

### 2.2 News Layout

In a computerized newspaper system, news stories are entered into the computer for online editing and computer-controlled typesetting. The essential input data needed for news layout are story lengths and picture dimensions.

Story lengths are calculated by the computer from their texts; picture dimensions are entered manually. In addition, the layout supervisor attaches a number signifying an importance rank to individual stories and pictures; these are used by the layout algorithms to place the most important items on the first few pages of the newspaper. Unranked stories and pictures are assigned a low importance ranking automatically by the computer. Also, the supervisor tags stories and pictures which belong together and those stories associated with each other.

The news-layout process occurs in two stages: Story and picture assignment and news positioning. The role of story and picture assignment is to select a subset of news items for each page whose area matches the available news-hole area on that page. This procedure not only simplifies the layout algorithm used later to position the items on the page, but it also provides the supervisor an option to alter the news budget page-by-page before the detailed layout is performed. Allowing changes at this point enables time to be saved in the over-all process.

The story- and picture-assignment algorithm utilizes the ads-dummy, news-data, and news-policy files in order to assign a set of stories and pictures to each page. The first step is to compare the total news-hole area for each department with the areas of stories and pictures available for the department. The department news budget is presented to the layout supervisor in a tabular display which indicates the stories and pictures that are likely to appear in each department. The acceptance list is based on importance ranking and a match of total story and picture area to the available news-hole area. Left-over stories and pictures are listed separately in the tabular display. At this point, the layout supervisor may either accept the department news budgets or make modifications. Stories and pictures can be deleted from the acceptance list or their dimensions reduced to make room for additional items. Alternatively, story and picture importance rankings can be revised to alter their order of acceptance. Thus, the complete news budget for each department is established and accepted by the layout supervisor before detailed layout begins.

The next step is to assign specific stories and pictures to each page such that their total space matches the page news-hole area defined by the ads dummy. The layout supervisor has the option of pre-assigning selected news items to specific pages before the page-assignment algorithm is activated. The algorithm assigns news items to pages on the basis of total area only;

no attempt is made at this stage to locate items within the news hole.

Rules governing layout style, such as maximum or minimum number of stories on the page and jumped stories, are retrieved from the news-policy file to guide the assignment process. Space is allowed for story headlines and picture captions, which are either pre-established by the supervisor or computed from the story and picture data under guidelines stored in the policy file. A leading tolerance can be included in the policy data to add flexibility in the matching of space requirements for the assigned news items to the available news hole.

The story- and picture-assignment results are stored in the news-assignment file, and presented in tabular format to the layout supervisor for evaluation. Stories and pictures assigned to each page are listed along with their space requirements. Again, the layout supervisor is free to modify the computer-generated results.

After the layout supervisor is satisfied with the story and picture assignment, he initiates the story-and-picture-positioning algorithm and specifies which pages or departments are to be laid out. The layout process proceeds a page at a time; for each page the assigned stories and pictures are positioned at a precise location within the news hole.

A key feature of the news-positioning algorithm is the use of page templates to guide the layout process. Each template represents a pre-determined, acceptable page layout for a specific combination of stories and pictures on the page. A collection of templates is stored as a permanent file called the template library. The library contains several hundred templates and may include several different templates for a given combination of stories and pictures. Therefore, the first step is to select an appropriate template before the page layout can begin. Template selection can be done either by the layout supervisor, who can review and select from templates stored in the template library, or by the computer according to guidelines stored in the news-policy file. Under certain conditions, the layout supervisor may wish to create a new template to be used in layout; if he does, the new template is added to the library.

Since templates specify only the relative positions and shapes of news items on the page, it is possible that the algorithm will fail to achieve a layout for a given template with the given story and picture sizes assigned to a page. In this case, another template must be selected, again either manually by the layout supervisor or automatically by the computer. This process is repeated for every page until a satisfactory layout is achieved. The successful layouts

are stored in the page-layout dummy file where they can be called up on a graphics display for review and modification by the layout supervisor.

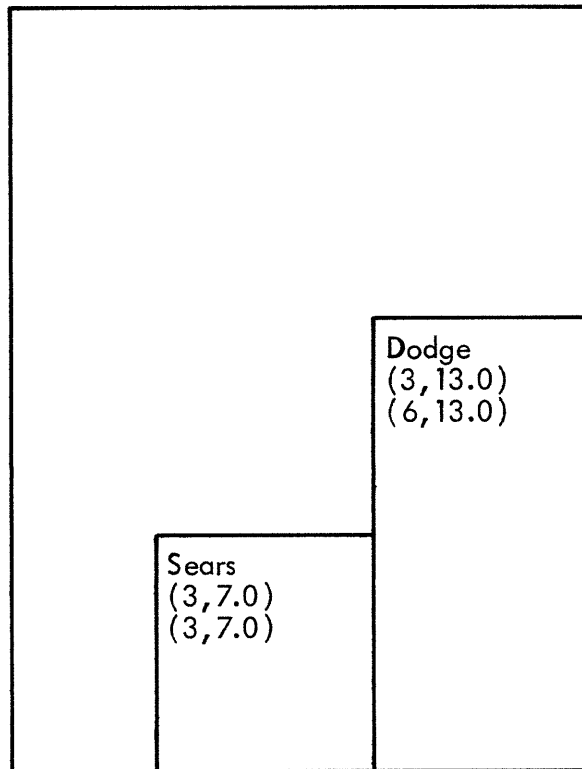
One might question whether or not a few hundred templates are adequate to accommodate the huge number of story and picture combinations that are possible and the enormous number of possibilities for story lengths and picture areas. A key feature of the news-layout program that has been developed is a means of representing templates symbolically. This approach permits a single template to accommodate a wide variety of story lengths and picture sizes, with the result that a practical template library can be reduced by at least two orders of magnitude. Our symbolic representation of templates is discussed in Chapter 6.

### 2.3 Equipment

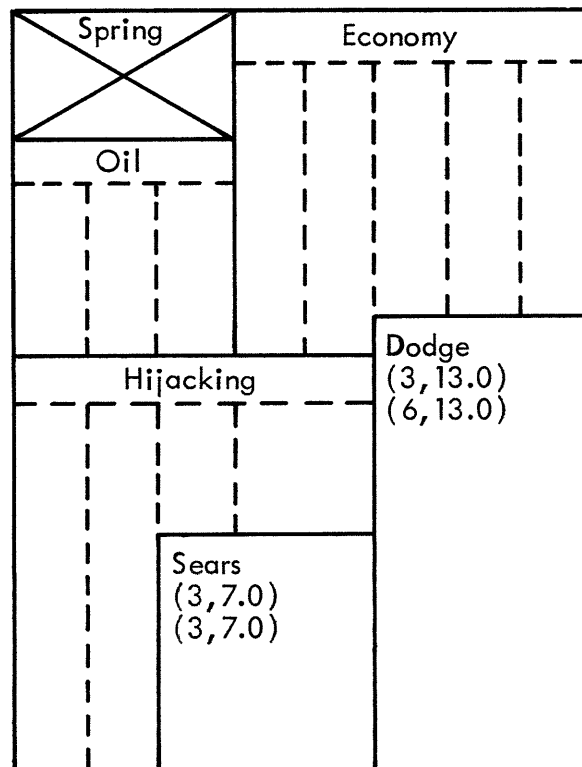
From the layout supervisor's viewpoint, the most important item of equipment in the layout system is the display terminal he uses to interact with the system. For inputting ads and news data, standard alphanumeric terminals suffice. However, for reviewing and modifying the ads and page-layout dummies, graphics cathode-ray-tube displays are required. Figure 2.2a shows a typical ads dummy for a page and Fig. 2.2b shows the dummy of the same page after news stories and pictures have been positioned around the ads. These layout dummies are presented on the layout supervisor's graphic display. Ads are identified by the advertiser's name, along with the ad size and position coordinates. News items are identified by their slugs, and pictures are signified by a box with lines connecting its diagonally opposite corners.

Editing commands can be input in various ways, depending on the capabilities of the graphics-terminal hardware; typical devices for editing are keyboards, light-pens, joy-sticks, or a combination of these devices.

Specifications for the computer facilities required for computerized layout depend on the newspaper size, number of layout terminals required, and so forth. However, some measure of the layout system software can be derived from the experimental system used for our research. The experimental layout software was developed on MULTICS, a general-purpose time-shared computer system based on a dual, Honeywell-6180 computer facility. The software was written in PL/1 computer language. The programs occupy approximately 60,000 computer words for page structuring and display-ads layout and 120,000 computer words for story assignment and news layout, where a computer word is 36 bits. Additional storage is needed for ads and news-data



(a) Display-ads dummy



(b) Complete layout dummy

files, policy files, and the page-template library. Although this represents a sizeable software system, it appears possible to implement an operational system on a mini- or medium-sized computer. Since the layout tasks are performed sequentially and the software is modular, only a fraction of the system software need be core-resident at any instant. Thus, a 16-bit mini-computer with 64 kilobits (or less) of core memory, backed up by a disc mass-storage unit, may well be adequate. However, definitive computer specifications for an operational system can be determined only through extensive analysis.

#### 2.4 Units of Measurement

Newspapers currently utilize many units of measurements such as points, picas, m-spaces, columns, lines, and so forth. For simplicity, we have adopted columns and inches as measurement units for width and height, respectively, throughout the layout processes. Of course, a column is not an absolute unit of distance since it depends on the page width and the format (e.g., six-, eight- or nine-column formats). However, its use simplifies layout because ads and news widths conform to integral numbers of columns. The layout algorithms can be tailored simply to accommodate different page widths and formats.

We measure page areas ordinarily in column-inches, except in the makeup process where column is used as a measure of area. In makeup, one column corresponds to an area one-column wide by a full page in height. This exception is allowed in order to reduce the magnitude of the numbers processed during makeup. For example, an eight-column by 22-inch page has an area of 176 column-inches, but its area can be specified simply as eight columns when column is used as an area measurement. It is easier to recognize a three-page department as one containing an area of 24 columns rather than 528 column-inches.

#### 2.5 Operational Consequences of Computer-Assisted Layout

The operational environment for newspaper layout is altered significantly by the computer-assisted layout system. Some of the most important factors are discussed below.

Layout speed. The computerized system reduces the time required for layout dramatically. In two experimental tests of the display-ads layout system with actual newspapers, the ads dummies for two complete newspapers, one 36 pages and the other 44 pages, were generated by one person plus the computer in less

than 20 minutes each, after the ads data were posted in the machine. In contrast, over three hours were required by several experienced newspaper people to do the same job manually. The actual computer-processing time required to complete each layout was less than 20 seconds; the remaining time was spent reviewing the computer-generated results and making some editorial changes to the layouts\*. Although not tested in an actual newspaper environment, similar time and labor savings can be expected in news layout. Thus, later deadlines for ads and news can be utilized.

Layout policy. The computer-assisted layout system demands a precise definition of layout policies, and these policies are rigidly adhered to unless specifically overridden by the layout supervisor. Changes in editorial policy or layout styles can be accommodated easily by revisions to the policy files.

Editorial control. The computerized system improves the layout supervisor's capability to examine the news budget before the detailed layout is initiated. Stories and pictures can be edited thoroughly before layout; it is the computer's job to generate a layout based upon final story lengths and picture sizes. This is an important advantage over current procedures in which layouts are created early because of time pressures and stories are edited later to fit the layouts. Clearly, it is a significant improvement to not have to compromise the news content of a story because of layout limitations.

Layout optimality. Computerized layout leads to more efficient utilization of space, thereby reducing the need for fillers and yielding savings in newsprint.

Thus, computer-assisted layout can be expected to offer productivity gains and improved editorial control of newspaper content. Computer programs for page structuring, display-ads layout, story and picture assignment, and news layout are described in the following chapters.

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\* Elkin, R.M., "An Evaluation of Computer-Assisted Display-Ads Layout in an Operating Newspaper Environment," M.I.T. Report ESL-R-553, July, 1974.

## CHAPTER 3

### THE PAGE-STRUCTURING PROCESS

The first step in the assembly of a newspaper edition is the establishment of its page structure. This process consists in making a determination of the number of pages, departments, and sections in the newspaper, and in making page assignments for each department. The number of pages depends on the total space needed for display advertising, classified ads, and news; sections and departmentalization are guided by editorial policy.

It is essential that each edition accommodate all ads received for that day. Since display-advertising deadlines normally precede the newspaper-layout process, display-ad space is known exactly during layout. Classified-advertising lineage can be estimated with reasonable accuracy from carry-over ads, new ads already in hand, and estimates of late-arriving ads. News content, however, must remain flexible until nearly press time in order to include late-breaking events. The total news space, called the news hole, is predetermined approximately by the editors and can be specified in one of several different ways, such as a minimum and maximum number of column-inches or as a ratio of advertising space to news space. In our layout system the algorithm which structures the newspaper from these data is part of the Makeup Module. Two data files are needed to carry out the makeup process; the Ads-Data File and the Makeup-Policy File. These are described below.

#### 3.1 Display-Ads Data File

Before the newspaper makeup and layout processes can begin, the ads data for the edition must be entered into the computer. This is accomplished through an interactive dialog between the user and the display-ads Input/Output (I/O) module. Ads-data files for future editions are created as ads are sold. The file-buildup process often extends over several days or even weeks in advance of the printing date or dates, with the result that many files are active simultaneously. Each file is given a unique name (Feb 19, for example) and is retrieved by its name.

The display-ads module also provides means for keeping each file up to date. New ads can be entered, ads can be deleted, dimensions changed and so forth, through use of the module. The module also can provide a complete listing of

all ads in each file, together with any information about an ad that is desired.

Several pieces of data about each ad are included in the ads-data file. Headings for these items can be described briefly as follows:

Advertiser's Name.

Dimensions. Height and width of ads are entered in the units defined in the makeup policy.

Departments. Entered here is the department to which the customer wants his ad assigned. If no specific department has been requested, nothing is entered, and the ad becomes a "run-of-paper" (ROP) ad. ROP ads are initially assigned to the news department although some may be moved to other departments during the makeup process. A second choice for department assignment can be entered for individual ROP ads to guide the reassignment of these ads to other departments.

Coupons. Ads containing coupons are identified to avoid their being laid out back-to-back.

Ad Type. The class of advertiser is included in order to avoid placement of similar type or competing ads on the same or facing pages. Advertiser types that can be specified (such as radio, auto, clothes, furniture and so forth) are defined in the makeup-policy file.

Preset Location. When an advertiser requests a specific page and location on the page for his ad, this information is entered here. The relative location within a department (for example, the last page of news department), and the assigned location on that page are entered under this heading.

Odd- or Even-Page Preference. An advertiser may request either an odd- or even-page location for an ad. The layout algorithm interprets this as a preferred location which can be overridden if necessary to place the ad.

The only essential data required for every ad are the name of the advertiser and the dimensions of the ad; the other data are entered only when applicable.

### 3.2 Makeup-Policy File

The separation of policy files from the operational algorithms is a major feature of our system. Parameters that vary from one edition to the next or among different newspapers are defined as policy variables and are separated from the layout algorithms themselves. In this way the same algorithms can accommodate a variety of layout styles and formats, and changes in policy within a newspaper can be implemented without reprogramming.

The section and department structure of the newspaper depends primarily upon managerial decisions at the individual newspaper; hence, the program parameters which control these factors are assigned to the makeup-policy file

rather than fixed in the algorithms. In general, a separate policy file is maintained for each day of the week so that day-to-day variations in newspaper structure will be possible. The Thursday edition of most newspapers, for example, usually contains many more pages than the Saturday edition because of a higher volume of food-market and other advertising. Also, space requirements for news depend upon the day of the week; Monday is usually a light news day, and certain days may have a heavy sports-news budget because of local-team schedules. All these factors can be accommodated by appropriate makeup policies for each edition. There is a distinct advantage to a system that treats special requirements of individual newspapers and differences among editions as policy variations because this approach obviates the need to tailor the algorithms to each unique set of requirements.

As described next, makeup policy concerns the sectional and departmental structure of the newspaper and the determination of department news holes.

3.2.1 Section policy. The section-policy rules specify the preferred number of sections for the edition and the number of pages per section. The number of sections can be specified as a function of the total number of pages in the edition. The number of pages per section is specified as a minimum-to-maximum range of pages. Sections must always contain an even number of pages, and the section policy can indicate a preference for sections containing a multiple of four pages.

3.2.2 Department policy. The number of departments and their names are specified as part of the department policy rules. The department sequence in the edition is influenced by several policy options. Selected departments can be linked so that two specified departments always occur in sequence. Also, departments can be assigned to positions within the newspaper; for example, the Sports department can be assigned to begin on the first page of the second section, or selected departments can be designated to begin on odd or even pages. In addition, a preferred sequence of departments or preferred section assignments for departments is included in the makeup policies. An odd or even option can be entered for each department to indicate a preference for starting the department on an odd or even page number. Thus, a two-page Editorial department consisting of an editorial page and an "op-ed" page can be designated to begin on an even-numbered page.

3.2.3 News-hole policy. Department sizes are determined by the sum of the areas required for advertising and news. The advertising space for each department is calculated directly from the ad dimensions stored in the display-ads data file. The department news-hole area is based on editorial policy.

Four different policy alternatives are provided to guide the determination of department size, as follows:

1. Fixed department size: Department size is fixed at a specified number of pages.
2. Fixed news-hole area: The size of the news area in the department is specified as a minimum-to-maximum number of news columns regardless of the space requirements for the ads.
3. Fixed news-to-ads ratio: Because advertising contributes such a significant part to a newspaper's budget, it is quite reasonable to establish some relationship between the areas occupied by the display ads and news. One way to do this is to set a fixed news-to-ads area ratio; that is, the news area in a department is proportional to the amount of ads space assigned to that department for the edition.
4. Fixed ratio with an upper or lower limit on news size: In addition to specifying the fixed news-to-ads ratio, the maximum or minimum amount of news area in the department is also specified. If the calculation of the news area, based on the ads area and news-to-ads ratio, falls within the specified bounds, it will be used as the news area for that department. Otherwise, either the upper or the lower bound will be used, depending on which is closer to the calculated value.

Areas for both news and advertising are measured in units of columns in the makeup process. A column is an area equivalent to a space one-column in width and a full-page in height. For a discussion of area units used in the makeup and layout processes, see Chapter 2, Section 2.4.

### 3.3 The Makeup Process

An overview of the makeup process is illustrated by the block diagram in Fig. 3.1. The five major steps that comprise the process are these: determination of the total number of pages in the edition; determination of the number of sections, the number of pages in each department, and the assignment of departments to sections; assignment of departments to specific pages; adjustment of the news-hole areas to target values specified by policy; and the acceptance or revision of the makeup results by the layout supervisor.

Each of these steps is described in detail in the following sections. The first four steps are accomplished through computer algorithms and the last involves interaction with the layout supervisor.

As a means of clarifying the algorithm descriptions, an illustrative example is introduced here and the algorithms will be applied to the same example through each step in the makeup process.

3.3.1 Policy and ads data for makeup example. The contents of the makeup policy file for a ten-department newspaper is shown in Table 3.1. The policy data are stored and retrieved under the name of the edition, Tuesday A.M.

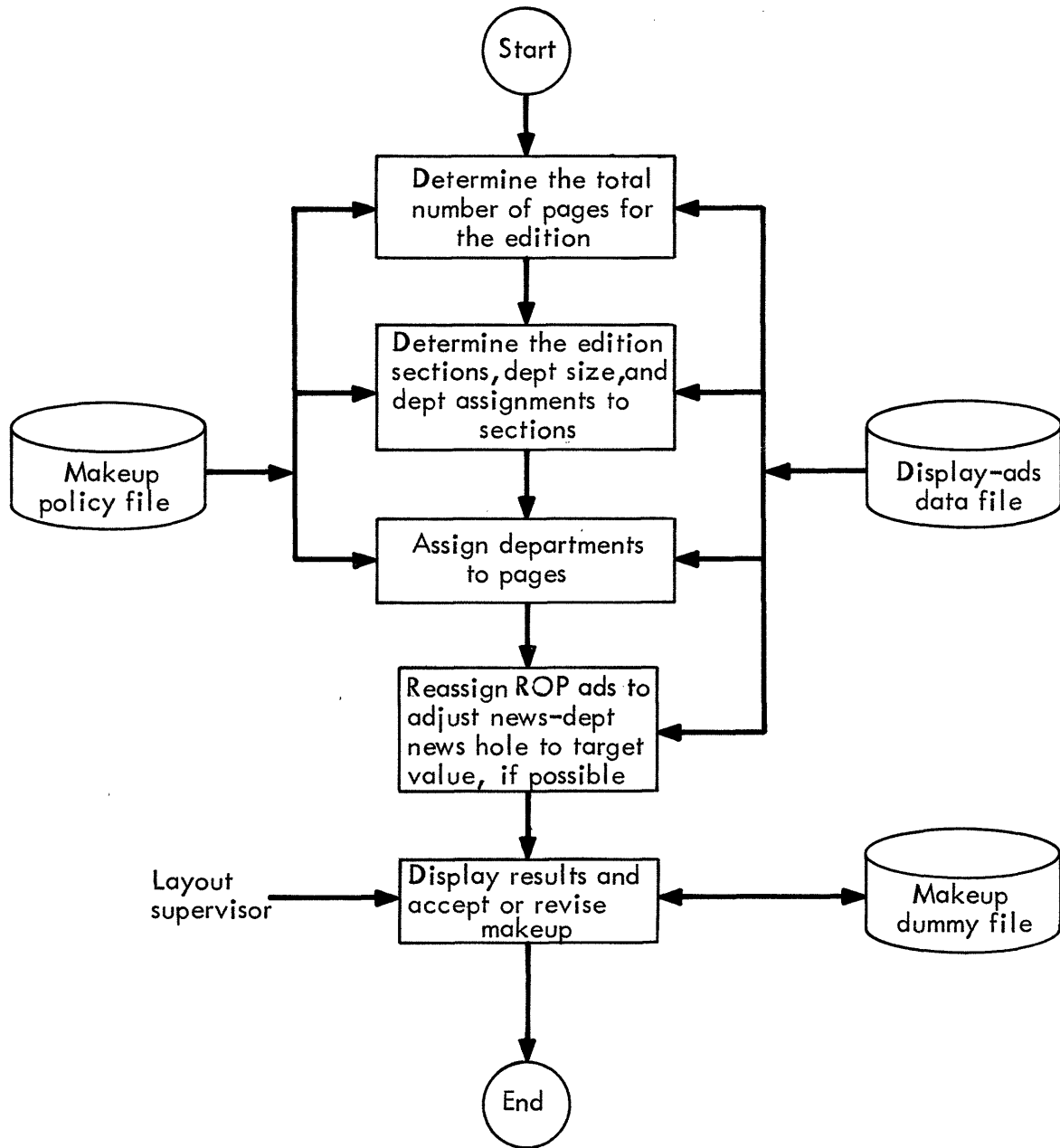


Fig. 3.1 Major steps in the makeup process

Table 3.1. Example of Makeup Policy.

EDITION: Tuesday A.M.

SECTIONS: 2 sections (A,B) when total pages  $\leq$  48  
 4 sections (A,B,C,D) when total pages  $>$  48.

No. of PAGES/SECTION: A 12-24  
 B 12-24  
 C 12-24  
 D 12-24

Multiple of 4 pages preferred

DEPARTMENT ASSIGNMENTS:

Department	Precedence	Section Assignments	Preassigned Locations	Linked To
News	1	A B C D	A - 0	
Editorial	2	A	A - 2	
Sports	5	B	B + 0	
Living	6	A B C D		
Arts	4	A B C D		
Finance	3	A B C D		
Obit	7	B C D		
Comics	8	B C D	Even	
Radio-TV	9	B C D		Comics
Classified	10	B C D		

DEPARTMENT SIZE SPECIFICATIONS:

Department	Specified Size (Pages)	News/Ads Ratio	News Hole (Min-Max Columns)
News		1.0	35 - 100
Editorial	2		16 - 16
Sports			20 - 34
Living			12 - 18
Arts			14 - 18
Finance		1.2	20 - 35
Obit	1		2 - 4
Comics	1		8 - 8
Radio-TV	1		4 - 6
Classified			0

The policy specifies that the number of sections is determined by the total number of pages in the edition, two sections for 48 pages or less, and four sections otherwise. Limits of 12 to 24 pages are specified for all sections with a preference for section sizes that are a multiple of four pages. Sections are designated as A, B, C, and D.

The department assignments include the preferred order for departments in the edition, as indicated by the precedence numbers; the lowest number departments come first. Acceptable section assignments are listed for the departments and consist of one or more sections for each department. The Editorial department, for example, is restricted to section A, whereas the Radio-TV department may appear in Sections B, C, or D. The preassigned-location entry may specify either a preferred position within a section or an odd or even starting page number for the department. Preferred department positions within a section are specified either by counting pages forward (+) from the beginning of the section or by counting backwards (-) from the rear of the section. For example, the Sports department is designated to begin on the first page (+0) of Section B, and the Editorial department is assigned to begin two pages back (-2) from the last page of section A. The Comics department is assigned to begin on an even-numbered page. The last column in the department-assignments table indicates that the Radio-TV department is linked to the Comics department. This specification, along with the even-page preference for the Comics department, assures that these two departments will be assigned to facing pages.

The department-size policy specifies for each department either a fixed number of pages or a means for determining the department news space. The department news space, in turn, can be specified as either a ratio of news-to-ads area or as a minimum-to-maximum range of columns. For example, a news-to-ads ratio of 1.0 is assigned to the News department, which means that its news-hole area will vary with the amount of advertising in each edition. A minimum of 35 columns and a maximum of 100 columns are also specified for this department, thereby imposing upper and lower bounds on the news-hole area. Columns are units of area based on an 8-column format, so that one column represents an area equal to one-eighth of a full page. Departments with constant news holes, such as the Editorial Department, have news-hole specifications in which the minimum and maximum number of columns are equal.

In addition to the makeup policy, ads data are required to calculate the advertising space in the edition. The areas for all ads assigned to a

department are summed to give a total ads space for each department. Run-of-paper ads are assigned initially to the News department, although some ROP ads may be reassigned to other departments during the makeup process. The ads data assumed for this example are shown in Table 3.2. Columns based on an eight-column format are used again as the units of area for convenience. The policy and ads data established in this example will now be used to illustrate the makeup process.

Table 3.2. Ads Data for Makeup Example

Department	Total Assigned Ads Area Columns
News	50.0
Editorial	0.0
Sports	26.0
Living	21.0
Arts	6.0
Finance	14.0
Obit	4.0
Comics	0.0
Radio-TV	3.0
Classified	48.0
	Total 172.0

3.3.2 Step 1 - Edition size. The algorithm for determining the total number of pages in the edition is shown in Fig. 3.2. Starting with the first department listed in the policy, we calculate the space requirements for each department. If the department size is specified by policy as a fixed number of pages, then that number is used and the algorithm proceeds to the next department. If the department size is not fixed, the department news-hole area must be calculated in order to determine the number of pages for the department.

The news-hole calculation branches, depending on whether or not a news-to-ads ratio is specified for the department. If a ratio is not specified, the target news-hole area is calculated by averaging the minimum and maximum number of columns specified in the policy. If the news-to-ads ratio is specified, the target news area is calculated by multiplying the ratio by the total ads space assigned to the department. This number is compared with the minimum and maximum specifications for the department news hole; if the result is

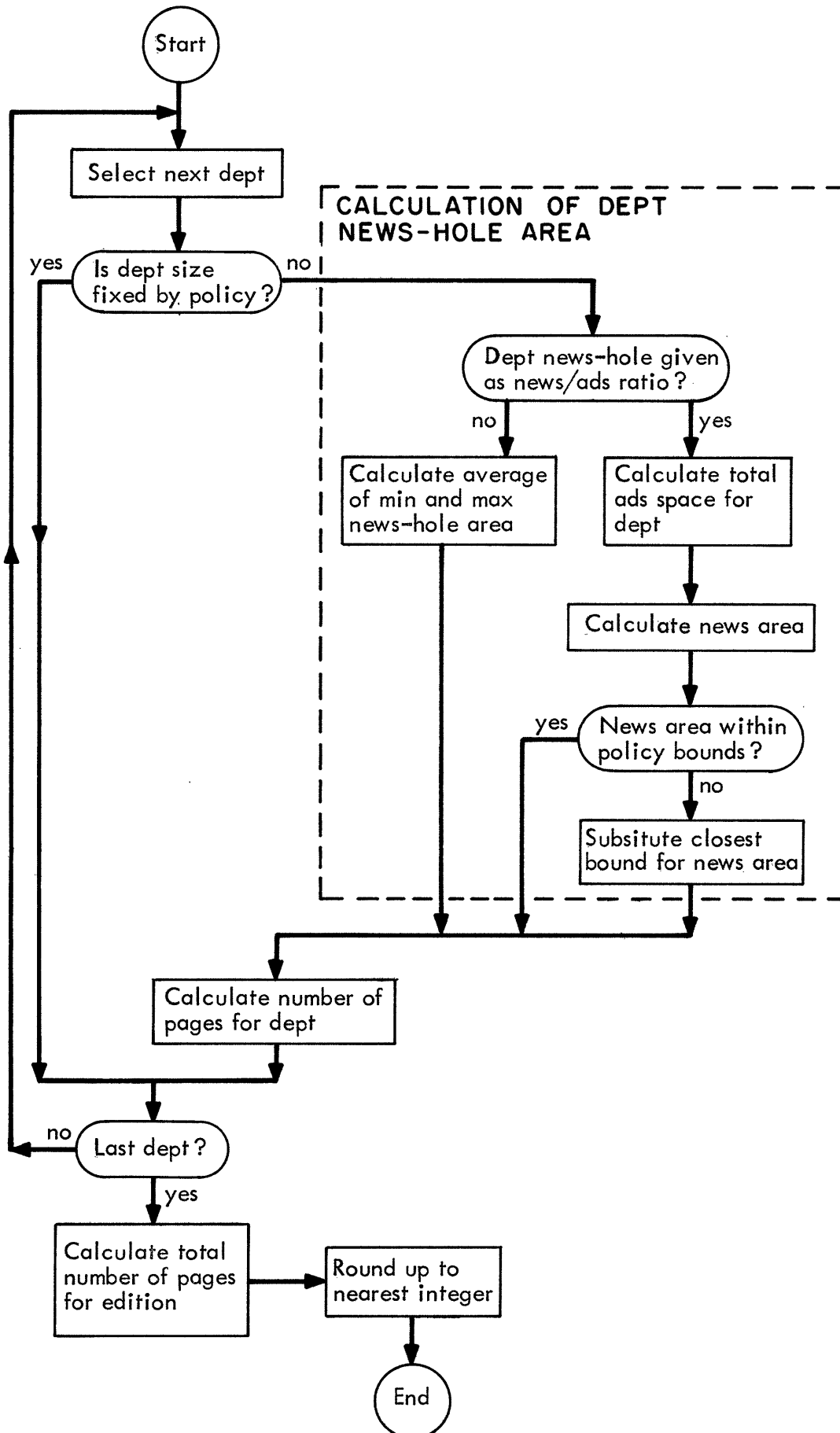


Fig. 3.2 Algorithm for determining edition size.

outside limits, the nearest bound is substituted for the calculated news area. After the target news area is determined, the number of pages for the department is calculated by totaling the ads and news areas measured in columns and dividing by eight. The result may include a fractional page, but it is not rounded off to an integral number of pages at this time.

After the number of pages is determined for a department, the department list is checked to see if all departments have been processed. After all department sizes have been determined, the total number of pages for the edition is calculated by adding the pages for all departments and rounding up the total to the nearest even integer.

The results of applying this algorithm to our illustrative example are shown in Table 3.3. Four departments are fixed in size by policy. The news areas for two departments, News and Finance, are calculated from the news-to-ads ratios specified by policy and the total area of ads assigned to those departments. Note that in the case of the Finance department, the news area calculated from the news-to-ads ratio is less than the minimum news area specified by policy; the minimum area is therefore used to determine the department size.

The third category of departments is departments that are not fixed in size nor assigned a news-to-ads ratio in the policy file; this category includes the Sports, Living, Arts, and Classified departments. For each of these, the news area is set at the average of the minimum and maximum values specified in the policy.

The pages for all departments are summed, and the result is rounded up to the nearest even integer; the result is 42 pages for our example.

3.3.3 Step 2 - Sections, department size, and department-to-section assignments, The next step in the makeup process is to divide the edition into sections, fix the department sizes, and to assign the departments to sections. The algorithm for this step is illustrated in Fig. 3.3.

The number of sections is specified by the makeup policy, usually in terms of the total number of pages calculated in the preceding step. In our example, the policy specified two sections for an edition of 48 pages or less. Since the edition size has been calculated as 42 pages, the algorithm establishes two sections, A and B. The number of pages per section is derived by dividing the total pages by the number of sections and rounding off to the nearest even integer. If the policy indicates that a multiple of four pages is preferred, the round-off is to the nearest multiple of four pages. The

Table 3.3. Results of Applying Edition-Size Algorithm

## Departments with fixed sizes

Department	Pages
Editorial	2.0
Obit.	1.0
Comics	1.0
Radio-TV	1.0

## Departments specified by news/ads ratio

Department	News/ads ratio	News hole min-max (Columns)	Total ads area (Columns)	Calculated news area (Columns)	Target news area (Columns)	Dept. size (pages)
News	1.0	35 - 100	50.0	50.0	50.0	12.5
Finance	1.2	20 - 35	14.0	16.8	20.0	4.25

## Departments specified by news-area bounds

Department	News-hole min-max (Columns)	Total ads area (Columns)	Calculated news area (Columns)	Dept. size (pages)
Sports	20 - 34	26.0	27.0	6.625
Living	12 - 18	21.0	15.0	4.5
Arts	16 - 16	6.0	16.0	2.75
Classified	0	48.0	0	6.0

Total pages = 41.625, Roundup to 42 pages

Edition size = 42 pages

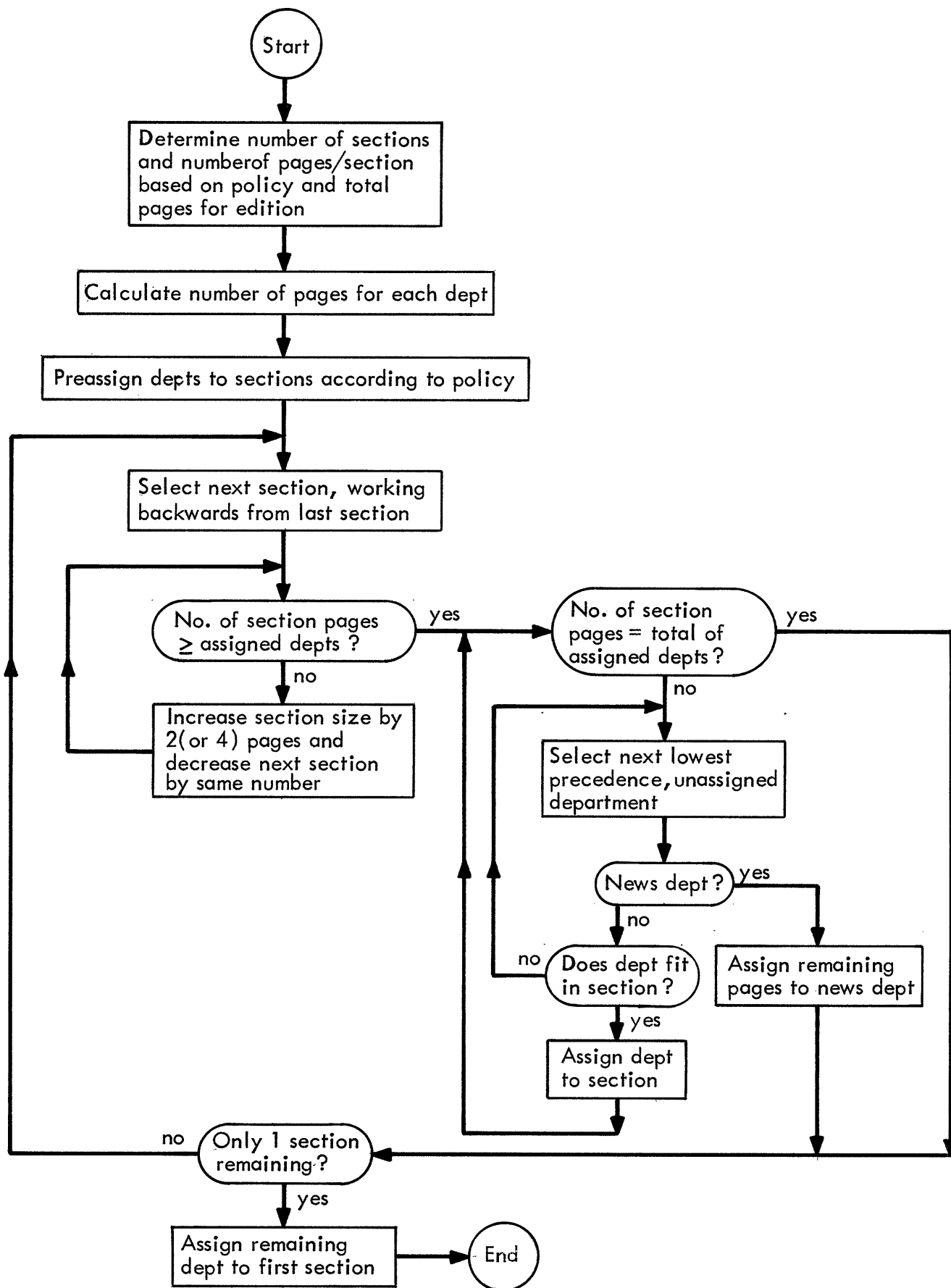


Fig. 3.3 Algorithm for determining sections, department size, and section assignments.

section pages are rounded off one at a time starting with the front section, and the last section is sized so that the total number of pages is correct; therefore, the last section is a multiple of four only if the total number of pages is divisible evenly by four. In the example, the number of pages is calculated as:

section A =  $42/2 = 21$ , rounded to 20 pages

section B =  $42 - 20 = 22$  pages

Note that even though the policy specifies a preference for a multiple of four pages, this policy is overridden in section B to satisfy the total number of pages.

Department sizes are fixed by rounding the number of pages for each department other than the News department to an integral number of pages. Fractional pages of  $1/4$  or larger are rounded up to a full page, and fractions less than  $1/4$  are dropped. The News department is sized by adding the pages for all other departments and subtracting the sum from the total number of pages in the edition. The result of applying this process to our continuing example is shown in Table 3.4.

Table 3.4. Department sizes for makeup example

Department	Calculated size pages	Final size pages
Editorial	2.0	2.0
Sports	6.25	7.0
Living	4.5	5.0
Arts	2.75	3.0
Finance	4.25	5.0
Obit.	1.0	1.0
Comics	1.0	1.0
Radio-TV	1.0	1.0
Classified	6.0	6.0
		Subtotal = 31.0
News	12.5	11.0

Note that the News department is reduced by 1.5 pages from its calculated value because of round-off increments in other departments. This implies a shrinkage in the News department news hole, but this is compensated for later in Step 4 by reassigning ROP ads to other departments.

The algorithm is designed for an integral number of pages for each

department primarily because it reduces complexity; however, the system could be modified to accommodate fractional pages for departments, if necessary. One relatively simple method of handling this problem would be to link two departments whose fractional-page components add to a full page, or nearly so. Then, the linked departments can be treated by the algorithm as a single pseudo-department with an integral number of pages. For example, the Financial and Arts departments in our case can be linked to form a single department of seven pages, and these departments would share a common page.

After department sizes are established, the next requirement is to assign the departments to specific sections. First, all departments that can have only one location among the available sections are assigned to that section. As may be seen in Table 3.1 for our example, the policy for the Editorial, Sports, Obit, Comics, Radio-TV, and Classified departments limits these departments to only one section. The policy for the latter four departments specified sections B, C, and D, but since the algorithm has established a two-section edition, only section B is available for these departments.

The assignment of the remaining departments begins by selecting the last section in the edition -- section B in our example. The number of pages in the section is compared to the total pages for all departments already assigned to the section. If the assigned departments over-fill the section, the section is enlarged by either two or four pages, depending upon whether the policy specifies a multiple of four pages or not. The next section is reduced by the number of pages added. This process repeats until the section equals or exceeds the total pages of the assigned departments. If the total pages of the assigned departments equals the number of section pages, the assignment process for that section is complete.

If the section is not filled, an unassigned department whose total pages is less than, or equal to, the remaining number of section pages is assigned to the section. For this step, the unassigned departments are selected in reverse order of precedence. Therefore, the News department, which always has top precedence, is the last department to be selected. If the section is not exactly filled through a combination of the other departments, leftover pages are assigned to the News department. Therefore, it is quite possible that the algorithm will split the News department between two or more sections, whereas all other departments are assigned to contiguous pages in one section. After the section is filled, the algorithm determines how many sections are still unprocessed. If two or more remain, the assignment is repeated for the next section; if only one section is left, all unassigned departments are assigned

to that section.

The assignment of departments to sections can be illustrated by continuing with our example. The algorithm begins with the last section, section B. Application of section-assignment policy results in five departments -- Sports, Obit, Comics, Radio-TV and Classified -- being preassigned to section B. These departments total 16 pages with six pages left in the section for other departments. The remaining unassigned departments eligible for section B are listed in Table 3.5. Starting in reverse order of precedence, the

Table 3.5. Unassigned Departments Eligible for Section B

Department	Precedence	Pages
News	1	11
Living	6	5
Arts	4	3
Finance	3	5

algorithm selects the Living department first and assigns this department to the section, since its five pages will fit. Now, only one page remains, and both the Arts and Finance departments are too large. Therefore, the algorithm assigns one page from the News department to complete the section, and assigns remaining departments to section A. These include the Arts and Finance departments and the remainder of the News department. The section-assignment results are shown in Table 3.6.

Table 3.6. Section Assignments of Departments

Section A		Section B	
Department	Pages	Department	Pages
News	10	News	1
Editorial	2	Sports	7
Arts	3	Living	5
Finance	5	Obit	1
		Comics	1
		Radio-TV	1
		Classified	6
TOTAL	20	TOTAL	22

In summary, in Step 2 the number of sections and the section sizes are determined first. Then department sizes are rounded to an integral number of pages, and the departments are assigned to specific sections. The assignment process adheres to section-assignment restrictions specified by policy and tends to follow the specified order of department precedence. Section sizes may be altered slightly from their original number of pages in order to accommodate the section-assignment restrictions. All departments are treated as single entities and assigned to a single section except the News department, which may be split among more than one section.

3.3.4 Step 3 - Assignment of departments to pages. In this step, departments are assigned to specific pages within their assigned sections. The algorithm is illustrated in Fig. 3.4. Sections are processed sequentially, starting with the first section.

First, the makeup policy for departments assigned to the section is examined from the viewpoint of preferred location, and departments with specified locations are preassigned to appropriate pages. In the makeup policy for our example in Table 3.1, the last page of section A is reserved for the News department, and the Editorial department is assigned to start two pages ahead of the last page in the section. The News department is the only department permitted to run on nonconsecutive pages. Therefore, whenever a preassigned location is specified for any department other than News, it is interpreted as the starting page for the department and a block of pages equal to the department size is assigned at this point. Thus, the algorithm assigns pages 18 and 19 to the Editorial department. Note that the preassignment policy assures that the two-page Editorial department will start on an even page, with the result that the editorial and "op-ed" pages will face each other. Since the number of pages in the section must be even, the last page minus two must be even also.

After the policy-designated locations are assigned, the algorithm selects the highest-precedence department assigned to the section. The policy file for that department is checked to determine if an odd or even starting page is specified for the department. If there is no specification, or if the next available page satisfies that preference, the department is assigned a block of pages starting at the next page to be assigned. Pages are assigned in ascending order starting with the first page in the section. If the odd or even preference is not met by the next page to be assigned, the algorithm selects the next highest preference department and repeats the process. If

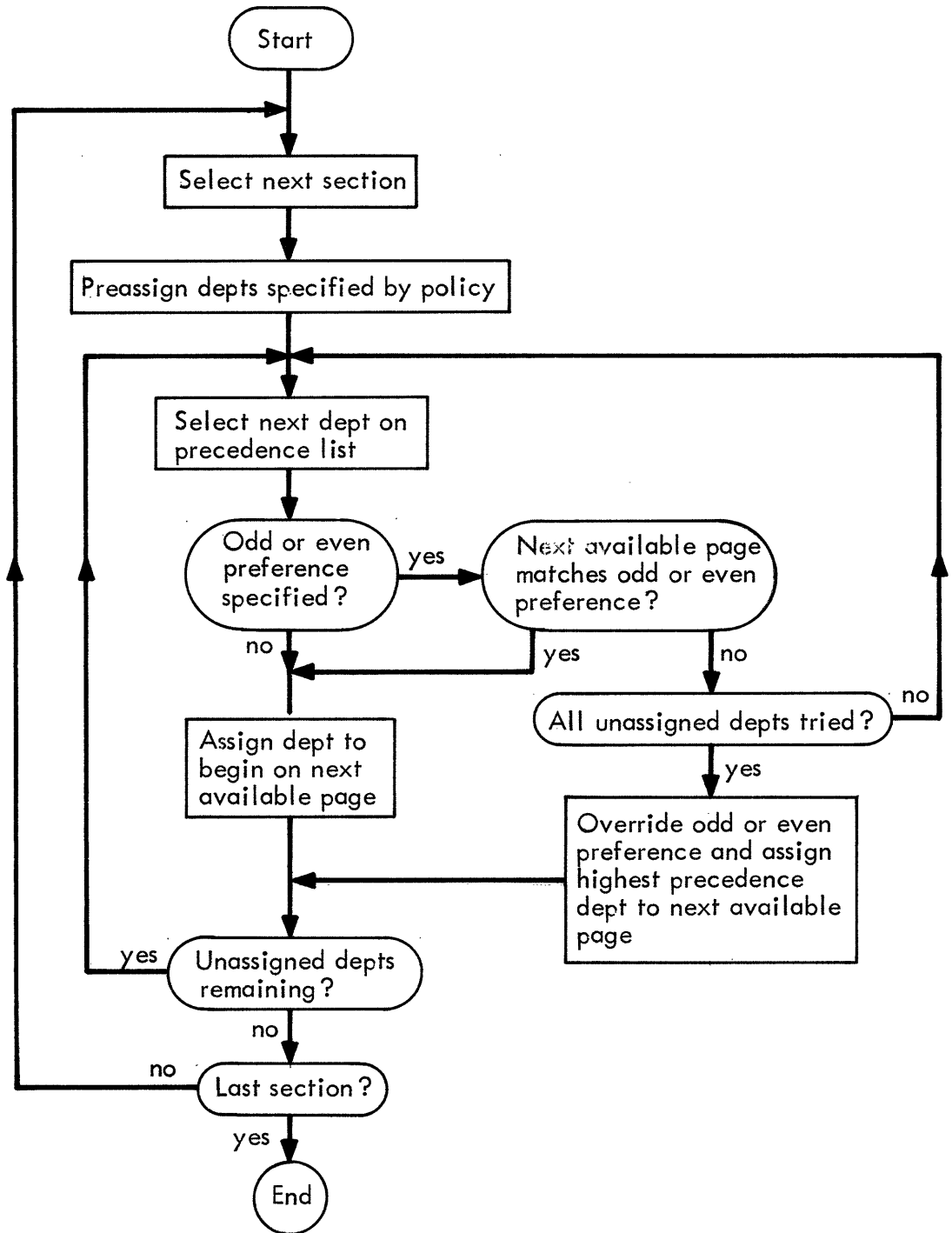


Fig. 3.4 Algorithm for assigning departments to pages.

all departments assigned to the section are tried and fail, the odd-even preference is overridden and the highest preference department is assigned. The process iterates until all departments in the section are assigned pages and then proceeds to the next section.

In our example, the last three pages of the section are assigned to the Editorial department and the News department in accordance with the preassignments specified by policy. The News department is selected as the highest precedence department, and the remainder of the News department is assigned to pages one through nine. Then, the Finance department is selected as the next highest precedence and assigned to pages 10 through 14. Finally, the Arts department is assigned to pages 15 through 17. The section-A page assignments are now complete.

In section B, the Sports department is preassigned to pages 21 through 27. Remaining parts of the News department which spill over from Section A are moved to the bottom of the precedence order. Therefore, the Living, Obit, Comics, Radio-TV, Classified and News departments are assigned in that order to pages 28 through 42. The even-page preference specified for the Comics department is satisfied without changing the order of preference. The final page assignments for both sections are listed in Table 3.7.

Table 3.7. Page-Assignment Results

Section A		Section B	
Department	Page Assignments	Department	Page Assignments
News	1-9, 20	Sports	21-27
Finance	10-14	Living	28-32
Arts	15-17	Obit	33
Editorial	18-19	Comics	34
		Radio-TV	35
		Classified	36-41
		News	42

At this point the page structuring of the edition by the computer is finished; all that remains for the makeup algorithm is some adjustment of department news area through re-assignment of ROP ads.

3.3.5 Step 4 - Reassignment of ROP ads. Because of the properties of the page-structuring algorithms, the size of the News department may be reduced below the number of pages calculated on the basis of ads space and the "target"

news area specified by policy. Since the area of the assigned ads is fixed, a shrinkage of the news hole is implied. As described in Step 2, the News-department size reduction occurs because the round-off of other department sizes favors an increase in the area allocated to those departments, while the total number of pages for the edition remains fixed. The purpose of Step 4 is to recognize when the News-department news area falls below policy specifications and to remedy the problem by reassigning run-of-paper (ROP) ads to other departments. The algorithm for this step is shown in Fig. 3.5.

The algorithm begins by comparing the actual news area for each department with the target news area as specified by policy. If the makeup policy specifies a news-to-ads ratio for the department, the target news area is calculated by multiplying that ratio by the total area of ads assigned to the department. If a ratio is not specified, the target news area is the average of the minimum and maximum allowable news hole specified in the department makeup policy. The actual news area is determined from the number of pages and the total area of ads assigned to the department. The difference between actual and target news areas is considered the excess news area of the department.

If the excess news area of the News department is zero or positive, the makeup is considered acceptable and no ROP ads are reassigned. However, it is more likely that the News-department excess area will be negative; in that case, ROP ads are sought for reassignment to other departments. All ROP ads are assigned initially to the News department, but a second choice for department assignment can be entered for individual ads. For example, a bank advertiser may prefer his ad to be located among the general news, but the Finance pages might be an acceptable alternative. The algorithm first selects ROP ads for reassignment which carry a second department choice. If no such ads exist, the algorithm only reassigns ads if the News-department news area is less than the minimum specified by policy. If the news area is below minimum, ROP ads are reassigned sequentially. For each reassignment the department with the largest excess news area is determined and the ROP ad with the smallest area is reassigned to that department. This process is repeated until the News-department news area equals or exceeds the policy minimum.

When ROP ads with a second department choice do exist, the reassignment of these ads follows a similar procedure. First, the department with the largest excess news area is determined and an ROP ad with that department listed as second choice is sought. If one is found, the ad is reassigned to the

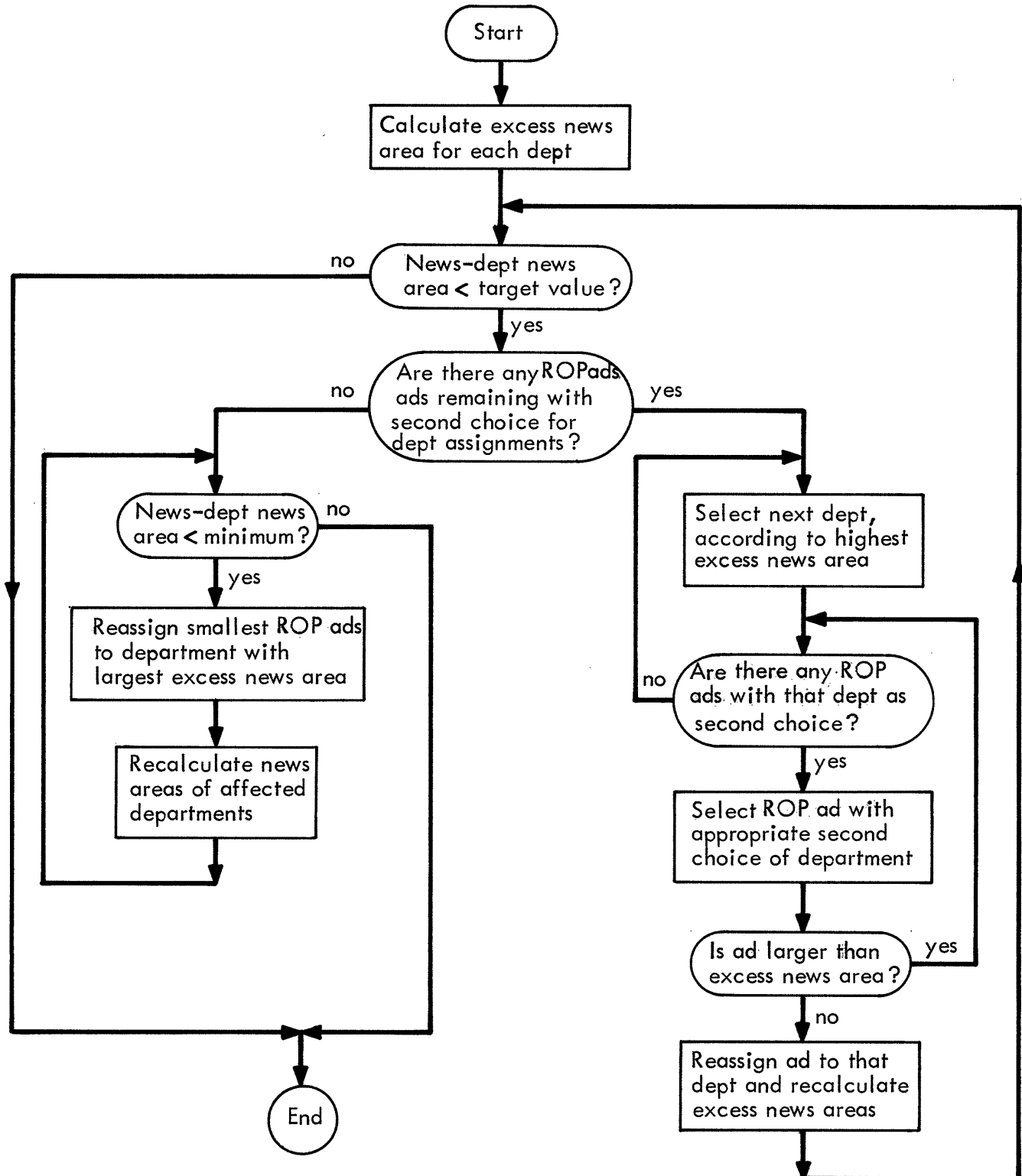


Fig. 3.5 Algorithm for reassignment of ROP ads.

department only if the department news area is not reduced below its target value. If an appropriate ad is not found for reassignment to that department, the department with the next highest excess news area is selected, and the process repeats. Ads are reassigned in this manner until either the News department news hole is at least its target value or all ROP ads with an indicated second choice for department assignment have been tried.

In our example, we assume that possible department reassignments have been entered for five ads with a total area of 10.0 columns. The News department has been assigned 11 pages and 50 columns of ads, resulting in a department news hole of only 38 columns. (11 pages corresponds to an area of 88 columns in our area units.) Since a 38-column news hole is below the target value of 50 columns, the ROP ads with indicated alternative department assignments are reassigned to those departments, thereby increasing the News-department news hole to 48 columns. The reassignment of ROP ads does not alter the department sizes or their page assignments; it merely attempts to align the department news areas more closely with the policy specifications.

Now the computer-generated makeup dummy is complete and the results are displayed to the layout supervisor for acceptance or revision.

3.3.6 Step 5 - Review of makeup dummy. The computer-generated makeup dummy is displayed to the layout supervisor in tabular form for his review; he may either accept the results or make revisions. The page assignments are listed, together with the news and ads areas for each department. Any policy guidelines that could not be met by the algorithms are also displayed. For example, if a department news hole is outside the minimum-or-maximum limits specified by policy or a department begins on a page contrary to an odd or even policy specification, the condition is displayed as a policy violation. Finally, the makeup-dummy display provides a list of ROP ads assigned to departments other than the News department.

For the illustrative example used throughout this chapter, the makeup-dummy display would appear as shown in Table 3.8. Departments are listed in sequence according to their page assignments with the News department split into three parts. For this example, no policy guidelines were overridden. The five ROP ads reassigned to other departments are listed.

If the makeup dummy is unsatisfactory to the layout supervisor, several alternative methods may be used to revise the results. Changes in department page assignments that do not affect department sizes may be entered directly. The display of the makeup dummy is then revised to reflect those changes.

Table 3.8. Display of Makeup Results

Makeup dummy: Mar 28 A.M.

Total pages: 42; Sections: 20/22

Section	Department	News Hole (Columns)			Ads Area (Columns)			Page Assignments
		Min-Max	Target	Dummy	Assigned	ROP	Dummy	
A	News	35-100	50	48.0	50.0	-10.0	40.0	1-9
	Finance	20-35	20	23.0	14.0	3.0	17.0	10-14
	Arts	14-18	16	17.0	6.0	1.0	7.0	15-17
	Editorial	16-16	16	16.0	0	0	0	18-19
	News							20
B	Sports	20-34	27	28.0	26.0	2.0	28.0	21-27
	Living	12-18	15	15.5	21.0	3.5	24.5	28-32
	Obit	2-4	3	3.5	4.0	0.5	4.5	33
	Comics	8-8	8	8.0	0	0	0	34
	Radio-TV	4-6	5	5.0	3.0	0	3.0	35
	Classified	0	0	0	48.0	0	48.0	36-41
	News							42

Policy violations: None

ROP ads reassigned:

<u>Advertiser</u>	<u>Ads Area</u>	<u>Assigned to Department</u>
Fed. Savings	3.0	Finance
Gloria Stevens	3.5	Living
Ford	2.0	Sports
Jimmys	1.0	Arts
Heart Assn.	0.5	Obit
Total	10.0	

If he wishes to enlarge or reduce a department, he specifies the new number of pages for the department. Then, the makeup algorithms are re-executed using that number as the fixed department size in place of the makeup-policy guidelines. Alternatively, he may specify a revised news hole for one or more departments; in this case, the makeup algorithms recompute the makeup dummy with the specified news holes instead of the policy specifications. Another option is to reassign selected ads to other departments. In this case the news hole and ads areas for the affected departments are calculated, and the new makeup-dummy results are displayed.

After the layout supervisor is satisfied with the makeup dummy, he indicates his acceptance; the results are then stored in the makeup-dummy file. Now the display ads can be assigned to specific pages and located on those pages, as described in the next chapter.

## CHAPTER 4

### DISPLAY-ADS LAYOUT

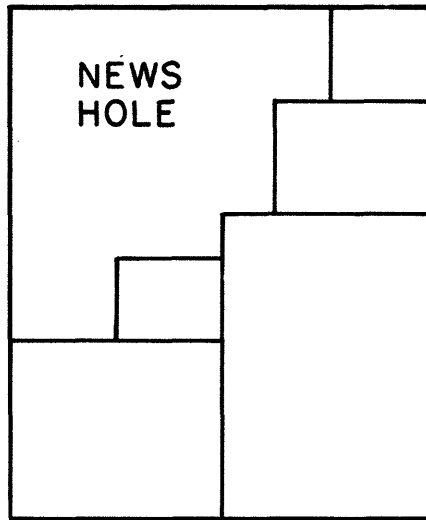
After the page structure of the newspaper has been determined through use of the makeup module, the next step is to generate the ads dummy by locating the display ads on the pages. The ads-layout module assigns each display ad to a specific page and positions it on the page. The layout supervisor has the option of limiting the layout to specific departments such as Sports, Financial, and so forth, or to a single page. Selected ads may be given preferential positions by assigning them to preset locations. After the computer-generated layout is completed, the layout supervisor can review the dummy at a graphics CRT-display terminal and alter the layouts as he pleases using the terminal keyboard. The editing commands allow a variety of layout revisions including relocating ads on a page, deleting an ad from a page, and inserting a new ad. In the latter two cases, a computer-generated layout with the new ad assortment can be requested for the page.

In addition to the ads-data file and the makeup results described in the preceding chapter, the ads-layout process requires one additional file, the layout policy file.

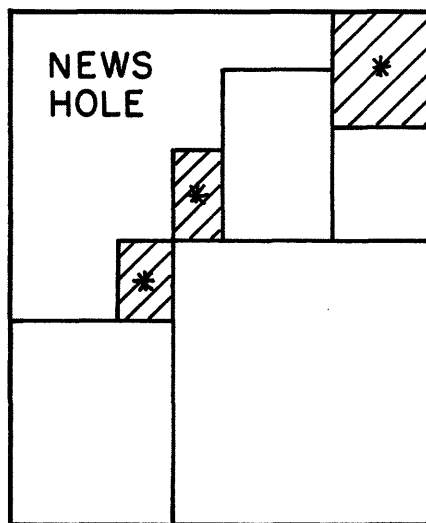
#### 4.1 Ads-Layout-Policy File

The ads-layout-policy file includes the policy rules that affect the page-layout style and ads distribution within a department. Policy rules are set generally by department, but in some cases, policy may vary from page-to-page within a department. The policy rules and layout options stored in the policy file are described below.

4.1.1 Strong and weak pyramid rules. The layout policy specifies either a strong or weak pyramid construction for ads layout. The strong-pyramid style requires that the sum of the widths of ads placed directly on top of another ad must be less than the width of the lower ad and the top of an ad placed inside another ad must be beneath the top of that ad. This produces a stair-case style layout, as shown in Fig. 4.1a. The weak pyramid rule is the same except that the sum of the widths and the height may equal those of the adjacent ads, as shown in Fig. 4.1b.



(a) Strong-pyramid layout



\* Shaded ads violate the strong-pyramid rule

(b) Weak-pyramid layout

Fig. 4.1 Single-pyramid layout

4.1.2 Page-layout styles. Either a right-sloped or left-sloped pyramid style can be specified by policy. The layout algorithm first attempts to lay out all pages in a single pyramid. If all ads cannot be placed in a single pyramid, the algorithm attempts to position the remaining ads in accordance with a double-pyramid construction which results in right and left pyramids on the same page. Single- and double-pyramid layouts are illustrated in Fig. 4.2.

4.1.3 Page sequence. The sequence in which department pages are laid out affects the distribution of ads within the department. Many newspapers encourage advertising by locating large ads in preferential positions. Since the layout algorithm first sorts ads by size, the larger ads are likely to be placed on the early pages in the sequence. Therefore, the distribution of ads, particularly the larger ones, can be controlled by specification of the layout-page sequence.

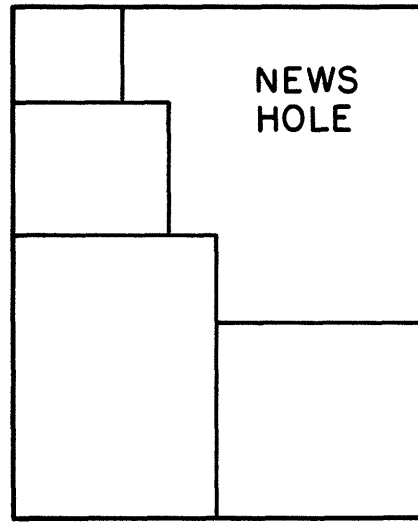
Two methods can be used to specify the layout-page sequence for a department.

1. Ascending page numbers in which the layout-page sequence is the same as the page-number sequence in the department.
2. Page-by-page, in which the page sequence is specified in detail; all pages are stipulated relative to the beginning or ending pages of the department. For example, the layout-page sequence for the News department could be specified as the first page, the last two pages, and the remaining pages in ascending order.

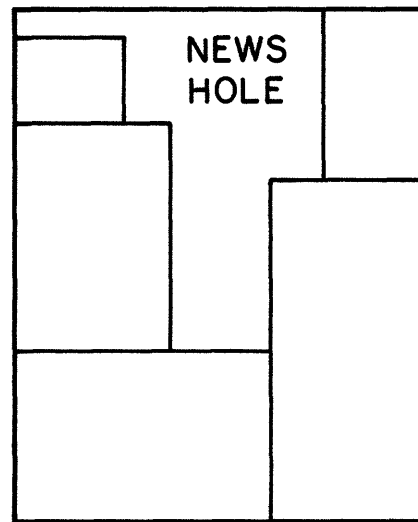
4.1.4 Buried ads. A buried ad is one which is positioned so that none of its edges touches the news hole. Ads 3 and 8 in Fig. 4.3 are examples of buried ads. Most newspapers avoid layouts with buried ads, but in some departments with a large number of small ads they may be acceptable. The layout policy permits buried ads to be specified for selected departments.

4.1.5 Maximum ad occupancy. The maximum ads area on specified pages can be limited by the layout policy. For example, a low maximum ads area may be specified for the first page of a department to ensure an adequate news hole for that page. Ads can be prohibited from selected pages by specifying a maximum ads area of zero percent for those pages. Ordinarily, the maximum-ads restriction can be overridden to place a full-page ad, but the ads limit can be specified as a rigorous constraint for pages if full-page ads are not wanted.

4.1.6 Minimum top margin. The minimum-top-margin policy can be used to avoid layouts that leave a narrow, horizontal strip between the top of the



(a) Single-pyramid style



(b) Double-pyramid style

Fig. 4.2 Page layout styles

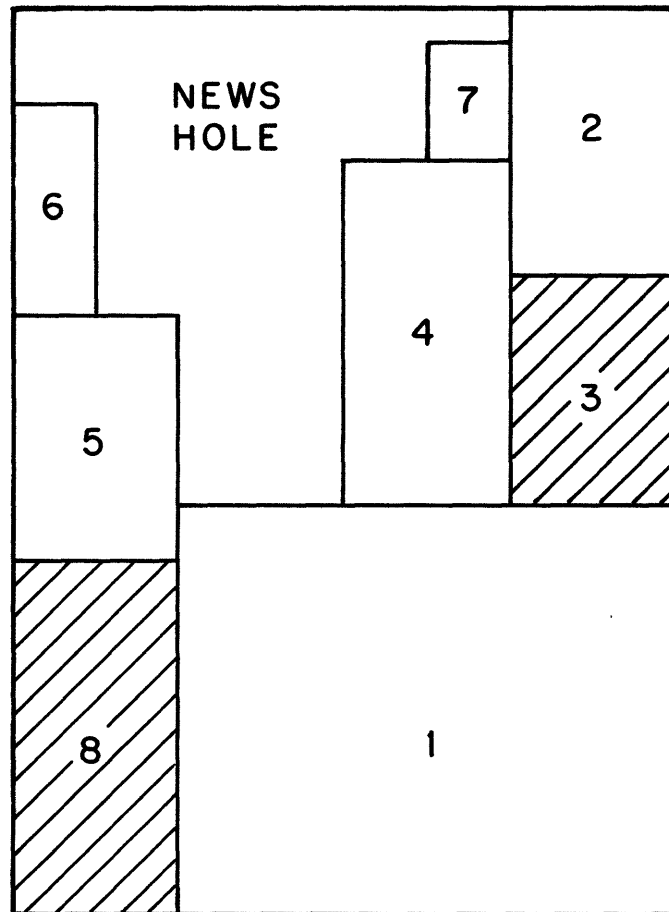


Fig. 4.3 Buried ads

ads and the upper page boundary. These bands, called ribbons, are undesirable because the space is too narrow for effective utilization as news space. By specifying a minimum top margin, ribbons can be avoided. The layout algorithm first attempts to construct the ads pyramid to top of the page. If the ads pyramid cannot be fitted exactly to the upper page boundary, the algorithm limits the pyramid height in order to maintain the specified minimum margin. For pages where a news space across the top of the page is desirable, the minimum margin can be specified as a rigorous constraint and the layout algorithm positions no ads within that space.

#### 4.2 Overview of the Ads-Layout Process

Display-ads layout is accomplished one department at a time. All display ads assigned to the department are positioned on the pages specified for the department in the makeup-dummy file. All necessary data are available in the files relating to display-ads data, the makeup dummy, and layout policy. The

ads layout must conform to a variety of constraints imposed by layout policy, such as prohibition of back-to-back coupons, separation of competing advertisers, minimum news holes for certain pages, and so forth. The major steps in the display-ads layout process are illustrated by the block diagram in Fig. 4.4.

To facilitate a pyramid-style layout, tall and large ads are placed first; then successively smaller ads are placed adjacent to or on top of these. The first step, therefore, is to sort all display ads assigned to the department by height and by area. Two categories of ads are thus established: "Tall" ads and "large" ads. The tall-ads category includes all ads at least five-sixths of the page in height; large ads are all remaining ads with an area at least one-quarter of the full-page area.

Next, ads that have a preassigned location are assigned to their designated pages. If a location on the page is also specified, the ad is placed in that position. If only the page is specified, a "preassigned-ad" flag is set and the ad is positioned later in the layout process according to its size.

After the preassigned ads are processed the tall ads are positioned on the department pages. Then, all large ads are placed, and finally all remaining ads are located. The same basic ad-placement algorithm is utilized for each ad category. Ads are positioned to form a left or right pyramid in accordance with either the strong or weak pyramid rule, as specified by policy. If an odd or even page is specified for an individual ad, the layout algorithm attempts to accommodate that preference. However, if the ad cannot be placed in that manner, the odd-even preference is overridden.

The layout algorithm first attempts to place ads in a single-pyramid style. If some ads cannot be placed, then a double-pyramid layout is attempted for the remaining ads. The page order in which double-pyramid layouts is attempted is determined by the page-sequence policy.

The computer-generated ads dummy is displayed a page at a time to the layout supervisor. At this point ads that failed to be placed by the layout algorithms are placed manually. The layout supervisor may shift ads to different locations on the same page or transfer them to other pages. In the latter case, new computer-generated layouts may be requested for the affected pages. After all ads are placed satisfactorily, the layout supervisor indicates his acceptance. The results are then stored in the ads-layout-dummy file.

In the next section, the basic ad-placement algorithm used to position all

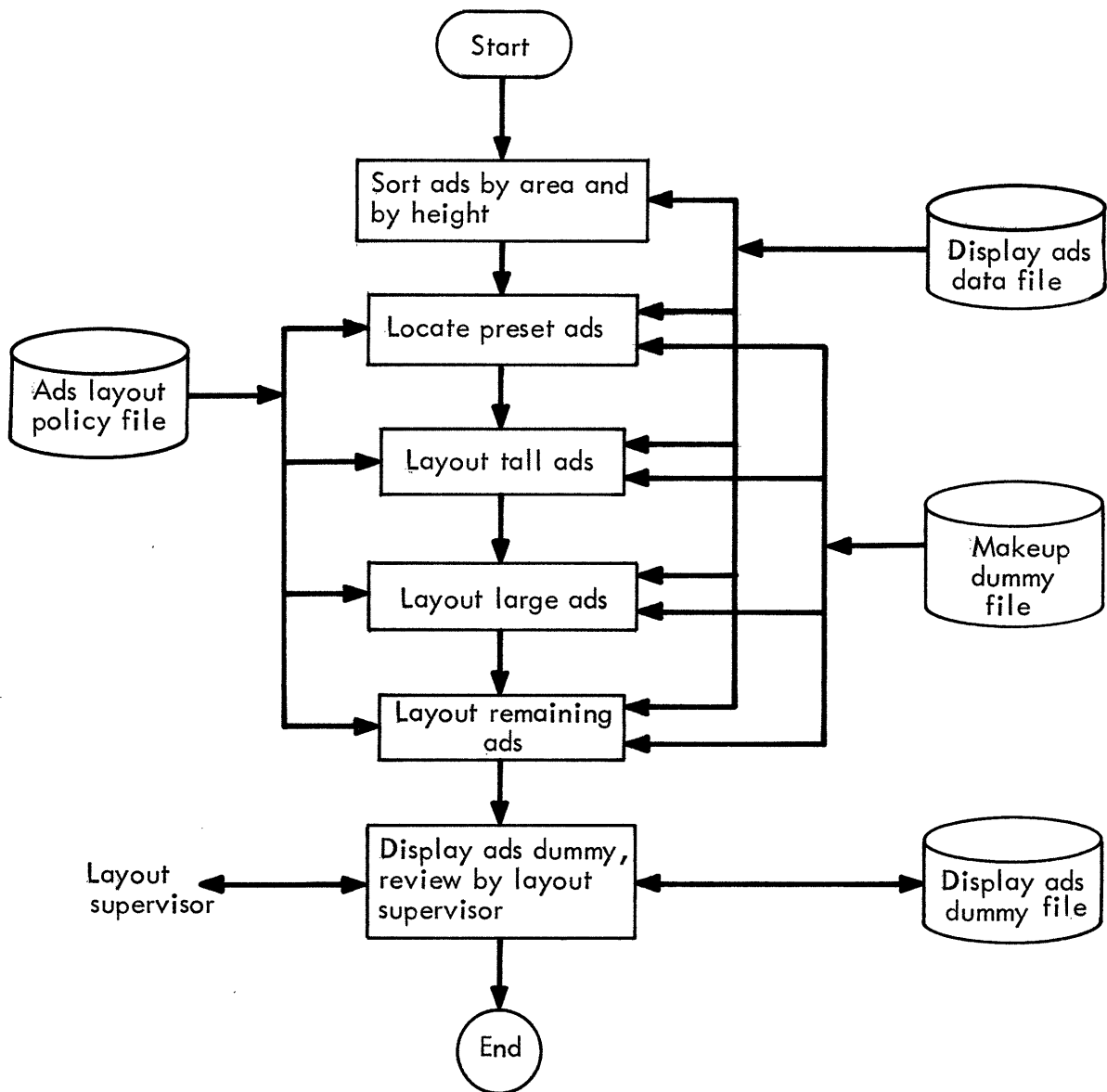


Fig. 4.4 Block diagram of display-ads layout process

ads is described. This is followed by detailed descriptions of the layout processes for the tall, large, and remaining ads.

### 4.3 The Ad-Placement Algorithm.

The objective of the ad-placement algorithm is to position a given ad on a given page in accordance with guidelines provided by the layout-policy file. If a suitable space is found on the page, the ad is assigned that spot; otherwise, control reverts to the layout process, in which case either another ad or another page is tried. The algorithm is illustrated in Fig. 4.5.

Before the placement process begins, the algorithm collects all necessary data concerning the given page and ad. The data include information about ads already placed on the given page, its facing page, and its reverse page, the maximum ads space allowed on the page, available area in each column, the preassigned-ad flag, dimensions and type of the ad to be placed, its odd-or-even-page preference, and so forth.

From these data, two initial tests are performed. In the first test, the area of the candidate ad is added to the total area of ads already on the page, and the sum is compared to the maximum ads area specified for the page by policy. If no maximum is specified, the full-page area is used as an upper bound. The second test checks the type of the candidate ad and compares it to the ad types of all ads already placed on the given page and its facing page. If an ad of the same type is found, the candidate ad is not placed on the page. This test is used to prevent ads from competing advertisers being placed on the same page or facing pages. If no ad type is specified for the candidate ad, the ad-type test is passed automatically. If the candidate ad fails to satisfy either the maximum-ads area or ads-type tests, the algorithm sets a "placement-failure" flag and exits. If both tests are passed, the algorithm attempts to position the ad on the page.

Ad positioning begins with the selection of a column for the initial trial position of the ad. The algorithm selects the far-right or far-left column as the starting column, depending upon whether a right or left pyramid is specified by policy. The ad is placed as far down in the starting column as possible, and a check is made for overlap with page boundaries or other ads. If the ad fits without overlap, the appropriate pyramid rules (strong or weak) are applied. If the pyramid rules are violated or if the ad overlaps either another ad or a page boundary, the trial position is moved over one column. For a right-pyramid construction, the trial-column number is decremented;

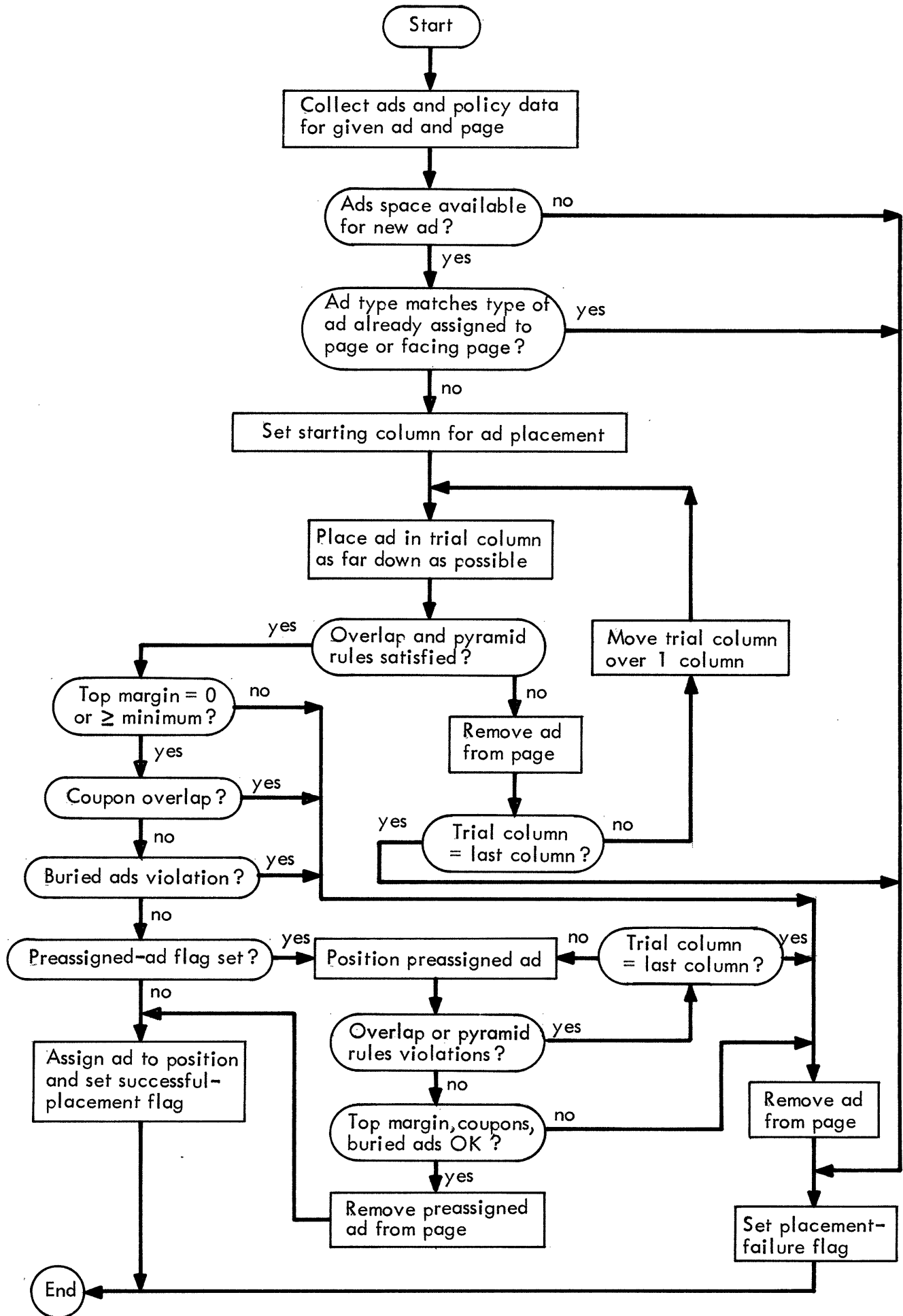


Fig. 4.5 Ad-placement algorithm

for a left-pyramid construction, the trial-column number is incremented. Then, the ad is positioned as far down as possible in the new trial column and the overlap and pyramid-rule checks are repeated. The process iterates until either a satisfactory position is found for the ad or all columns have been tried unsuccessfully. In the latter case, the algorithm sets the placement-failure flag and exits.

If an acceptable ad position is found, four additional tests must be passed before the ad position is finalized. The margin between the top of the ad and the top of the page is calculated and compared to the minimum margin specified by policy. To be acceptable, the margin must be either zero or greater than the specified minimum.

If the top margin is satisfactory, the next test is for back-to-back coupons. The ads data are examined to determine whether or not the new ad contains a coupon. If it does, ads already placed in the corresponding position on the reverse side of the page are checked for coupons. The new ad placement is not accepted if any ad occupying part of the same space on the reverse page also contains a coupon.

If the top margin and coupon tests are passed, the buried-ad test is applied next. This test is skipped if the policy specified that buried ads are allowed on the page. Placement of the candidate ad is disallowed if its placement prevents another ad on the page from making contact with the news hole.

Finally, the candidate-ad placement is tested for interference with the placement of ads preassigned to the page. If an ad has been preassigned to the page but not yet placed, an attempt is made to position that ad. The preassigned-ad placement process is similar to the ad-placement process just described. If the preassigned ad is placed satisfactorily, the position of the candidate ad is finalized. However, the preassigned ad is removed from the page; it is not assigned a final place until later. If the preassigned ad will not fit, the candidate ad must be rejected and a placement-failure flag set.

Preassigned ads are processed for final placement in the same order as all other ads; that is, in sequence according to size. The purpose of establishing an acceptable spot for the preassigned ad at this time is to ensure that the placement of the candidate ad does not prevent placement of the preassigned ad later. The process is designed to place as many other larger ads on the page as possible before the preassigned ad is assigned a final position.

If the new ad placement fails to satisfy any of these tests, the ad is removed from the page and the placement-failure signal is set. If all requirements are met, the ad is assigned the position and the successful-placement signal is set. In either case the subroutine exits and control reverts back to the layout process.

Examples of ad placements for four ads of different sizes on the same page are illustrated in Fig. 4.6. It is assumed that the layout process selects ads A, B, C, and D, in that order, for placement on a single page that is initially empty. It is also assumed that a right-pyramid layout is specified for the page and that the ads have no coupons nor an ad-type specified. The dimensional units for the ads are columns for width and inches for height. (See Fig. 4.6a.) It is assumed that the minimum top margin for the page is specified by policy as 2.0 inches, and the full page measures 8 columns by 22 inches.

In the first pass of the ad-placement algorithm, ad A is placed on the empty page. Since a right-pyramid layout is specified, the ad is initially placed with its lower-left corner at the bottom-left corner of column 8. However, the ad is two columns wide and overlaps the right page boundary in this position. Therefore, the trial column number is decremented, and the ad is repositioned with its lower-left corner at the bottom of column 7. There is no overlap and the pyramid rules are satisfied; therefore the ad is assigned to that position. Ad B is placed similarly in three trials, as shown in Fig. 4.6c.

In Fig. 4.6d, ad C is placed in three trials to satisfy the overlap and pyramid-rules restrictions, but the top of the ad extends into the minimum top margin specified for the page. Therefore, the ad is removed, and the placement-failure flag is set. The last execution of the ad-placement algorithm succeeds in placing ad D in three trials, as shown in Fig. 4.6e.

#### 4.4 Layout of Tall Ads

An ad is categorized as tall if its vertical dimension is at least five-sixths of the page height. Thus tall ads range in size from a full page to an area five-sixths column tall by one column wide. A tall-ads list is established for each department with the ads listed according to height; ads of equal height are sorted further by area. The tall-ads layout algorithm utilizes the ad-placement algorithm described in the preceding section to place the tall ads, one at a time, on the department pages. It attempts to

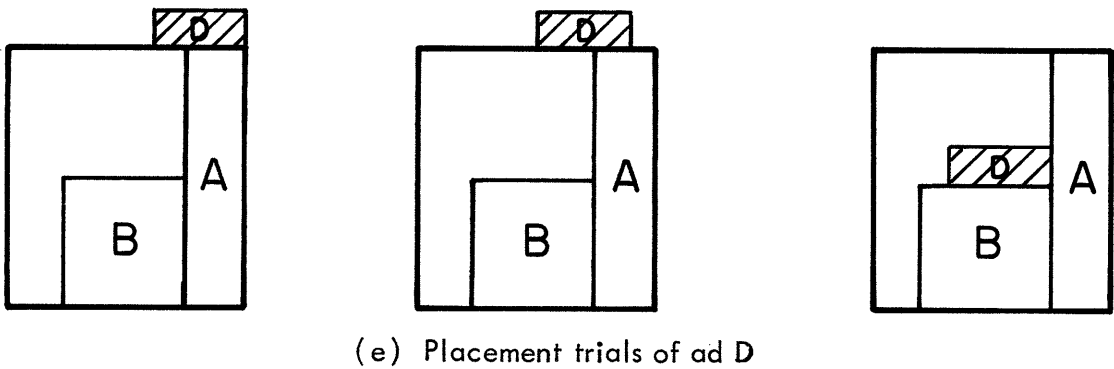
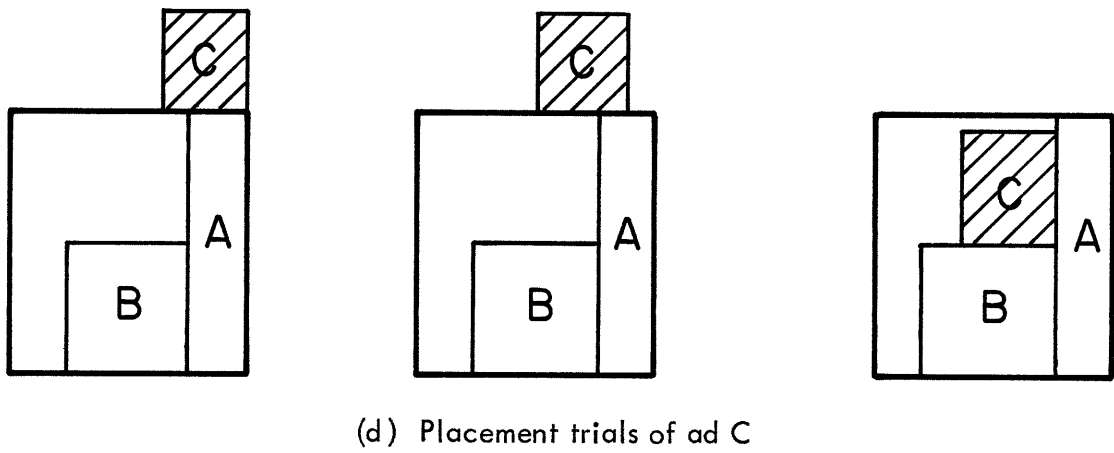
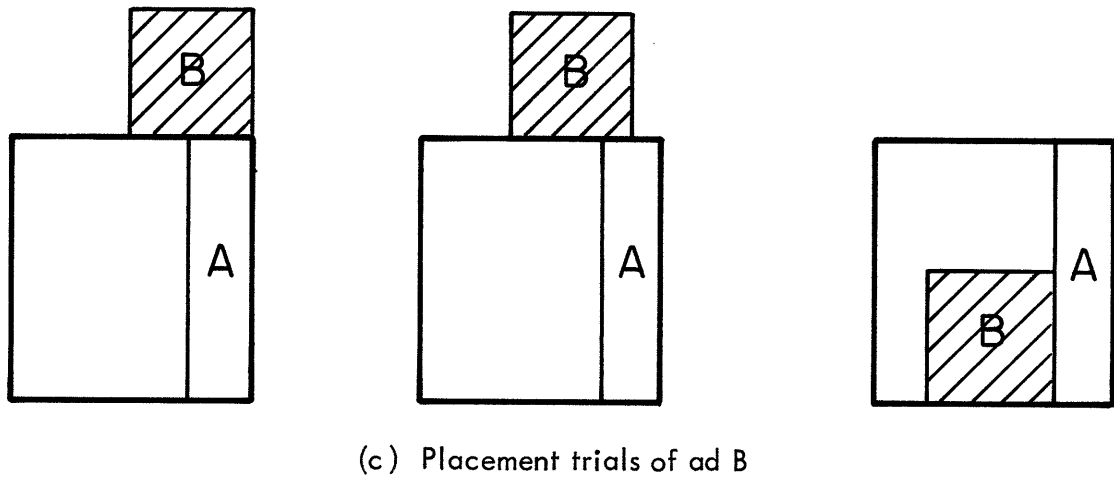
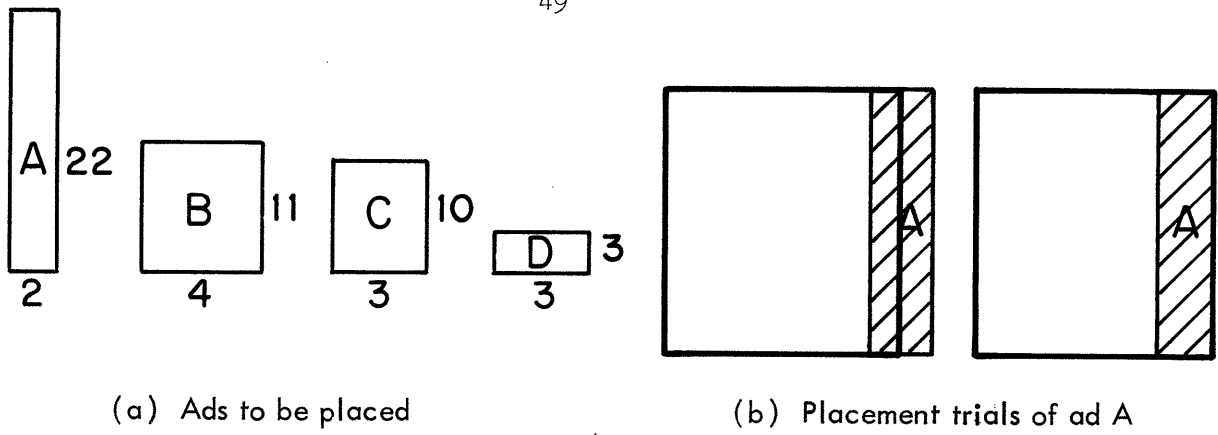


Fig. 4.6 Examples of ad placement

distribute the ads evenly throughout the department by placing each ad on a new page, if possible. The tall-ads layout algorithm is illustrated in Fig. 4.7.

The process begins with the selection of the first tall ad on the list and the first page in the department page sequence specified by the layout policy. The layout style for the page -- right or left pyramid -- is ascertained from the layout-policy file. Then, the ad-placement algorithm is called to position the ad on the page. If the ad is placed successfully, the next tall ad is selected and the process repeats, starting with the next page. If the ad cannot be placed, the algorithm proceeds to the next page in the department page sequence and attempts to place the ad on that page. The process repeats until the ad is placed or all pages in the department have been tried. It should be noted that when an ad is placed, the algorithm resumes with the next page in the sequence rather than reverting to the same page. Therefore, ads tend to be placed one to a page throughout the department.

If an ad is still not placed after all pages have been tried, a second pass through the page sequence begins. This time the ad can be placed on a page that already contains a tall ad. If the ad is still unplaced after the second pass, a third pass is tried using a double-pyramid layout style. The double-pyramid style is implemented by reversing the right- or left-pyramid policy utilized in the first two passes. Thus, an ad which cannot be placed under right-pyramid rules may be placed on the left side of the page when the policy is reversed to left-pyramid style. In effect, the algorithm overrides policy in order to maximize the probability of ad placement. Once an ad is placed successfully, the algorithm begins the first pass for the next ad under the left or right pyramid rules specified by policy.

An ad not placed after completing three passes through the page sequence is listed as an unplaced ad, and the algorithm begins the placement of the next ad. After all tall ads are processed, the algorithm exits.

#### 4.5 Layout of Large Ads

After the layout of tall ads is completed, the next step in the department layout process is the layout of large ads. A large ad is defined as one with an area at least  $1/4$  of the full-page area. An ad can qualify for both the tall and large ad categories; in this case the tall ad category is given priority and the ad is excluded from the large ads list. All large ads assigned to a department are listed according to area. The large-ad layout algorithm,

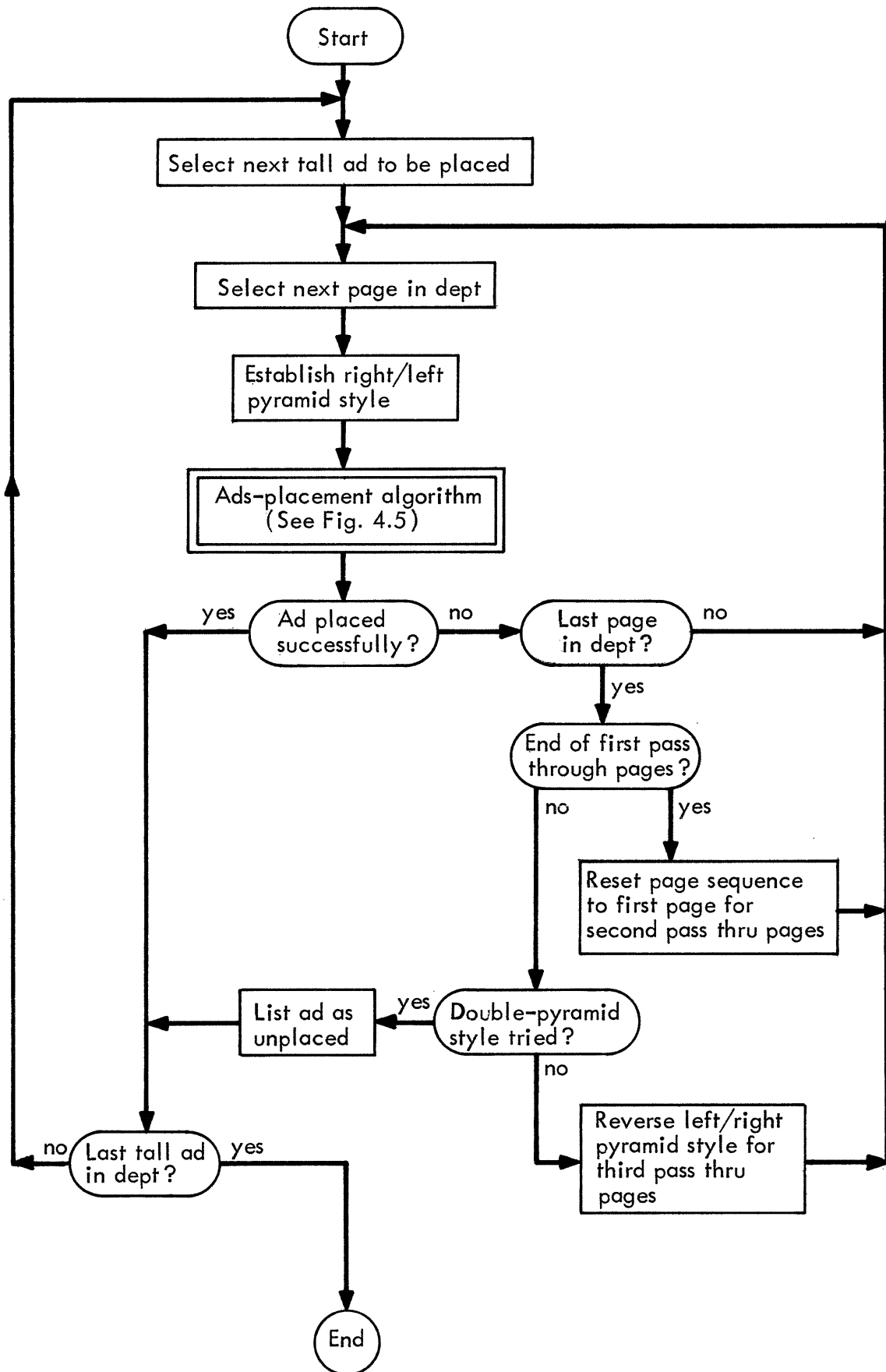


Fig. 4.7 Tall-ads layout algorithm

shown in Fig. 4.8, is similar to that for tall ads. Again, a maximum of three passes are made through the department pages in an attempt to position all ads from the large-ads list. During the first pass the algorithm attempts to place one large ad on each page. If ads remain unplaced after the first pass, a second pass is initiated in which a second large ad may be placed on a page. If all ads are still not placed, a third pass is initiated in which a double-pyramid-layout style is adopted. The algorithm exits when all ads are placed or after the third pass through the page sequence is completed.

The major difference between the tall-ads and large-ads algorithms lies in the order in which pages and ads are selected during the ad-placement process. For tall ads an ad is selected and tried on successive pages until it is placed successfully. For large ads, the page is selected first and successive ads are tried in order until one is found that fits on the page. The reason for this difference is that the large-ad algorithm is designed to maximize the probability of a large-ad placement on the early pages of the department page sequence. Thus, large ads are placed up front in the department, a policy which is considered desirable by advertisers. The tall-ads algorithm, on the other hand, is designed to maximize the placement of all tall ads without regard to the page distribution. Policy guidelines for the maximum allowable ads area on a page are used in both cases to assure minimum news-hole areas on selected pages.

#### 4.6 Layout of Left-Over Ads

After the tall and large ads are placed, the remaining ads are positioned. The layout algorithm for left-over ads consists of two parts. First, for pages on which the ads pyramid is less than full-page height, an attempt is made to position one or two ads that exactly fill the gap between the top of the highest ad and the upper page boundary. By filling these spaces first, the algorithm achieves effective utilization of space and improves its chances for placing all ads.

The second part of the algorithm attempts to position the remaining ads. It is designed to distribute ads evenly throughout the department pages within the constraints imposed by layout policy. The two steps in the layout algorithm for left-over ads are shown in Figs. 4.9 and 4.10 and are described in detail below.

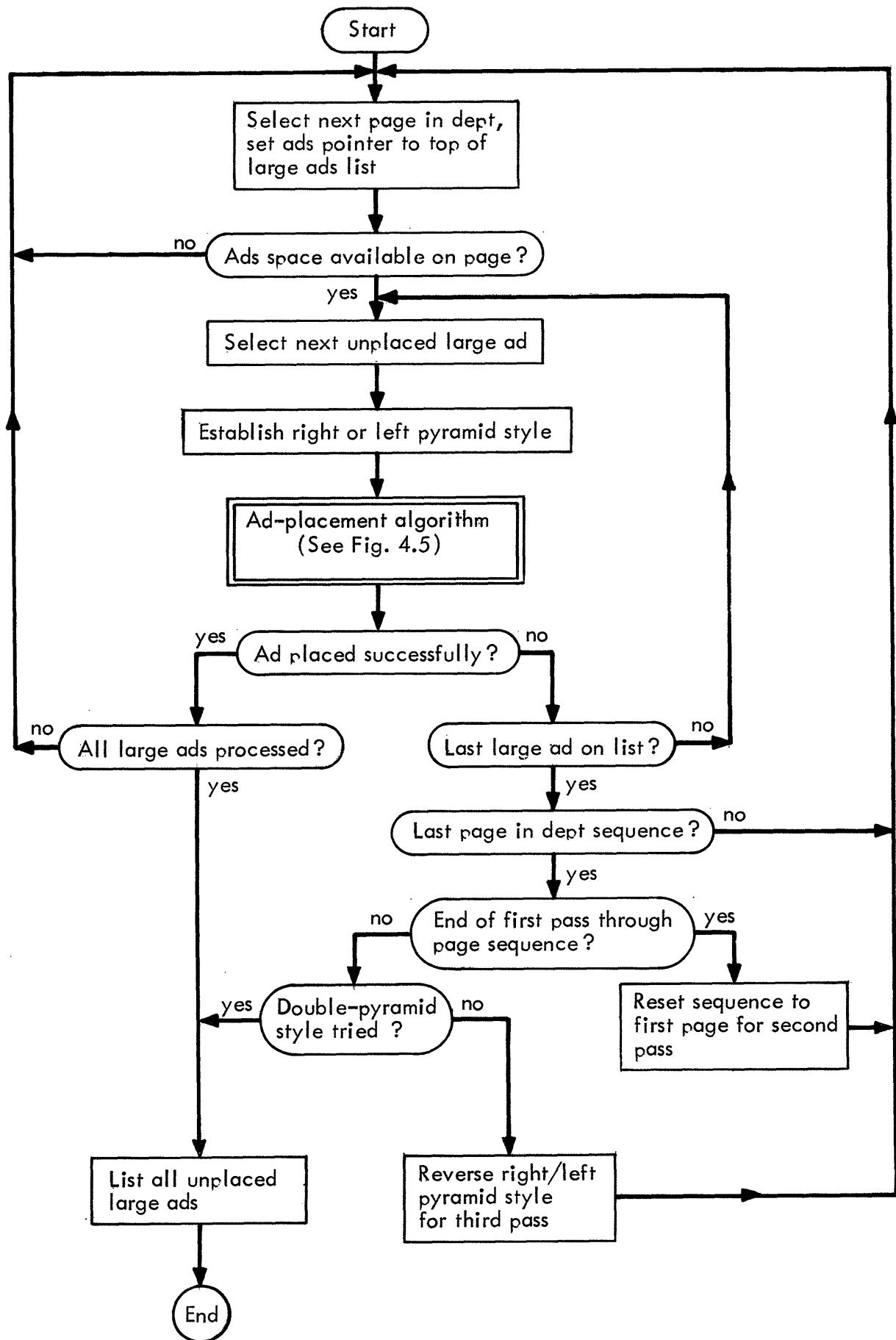


Fig. 4.8 Large-ad layout algorithm

In Step 1, Fig. 4.9, the department pages are examined one at a time to find pages with space between the top of the ads pyramid and the upper page boundary. If an absolute top margin is specified for the page, then the upper page boundary for ads is the top of the page minus the specified margin. The top of the ads pyramid is located in column one for a left-pyramid page and in the right-most column for a right-pyramid page. If this column is already filled with ads, the algorithm proceeds to the next page. If space remains in the column, the algorithm searches the unplaced ads for an ad with a vertical dimension equal to the remaining space in the column. A tolerance of minus  $1/4$  inch is allowed for matching the ad height to the available space. If a suitable ad is found, the ad-placement algorithm is called to make an attempt to position the ad on the page. If no ad can be placed satisfactorily to fill the column, a combination of two ads is sought to fill the gap. Again, a tolerance of minus  $1/4$  inch is allowed in a match of the total height of the ads column to the vertical page dimension. When a suitable combination is found, the ad-placement algorithm is called twice to place both ads on the page. If the ads cannot be placed, a new combination is sought and tried. The process repeats until the space is filled by two ads or all suitable combinations have been tried. Step 1 is complete when all department pages have been processed.

In Step 2, Fig. 4.10, the remaining ads are positioned by sequencing through the department pages and attempting to place one ad on each page in single-pyramid style. The page sequence is repeated until all ads are placed or until it is determined that the remaining ads cannot be placed within policy constraints. The latter condition is detected by the algorithm through the "successful-pass" flag. This indicator is reset at the beginning of each pass through the department page sequence and is set only when an ad is placed successfully. At the end of each page sequence, another pass through the pages is undertaken only if at least one ad has been placed successfully in the preceding pass. In this way the algorithm avoids continuous cycling through the pages when it is no longer possible to place the remaining ads.

After all ads that can be placed in single pyramid style have been positioned, the algorithm tries to place the remaining ads in a double pyramid format. Again, a null successful-pass flag at the end of a pass indicates that no more ads can be placed. The algorithm exits after all ads are placed or after the attempt at double-pyramid layout is completed.

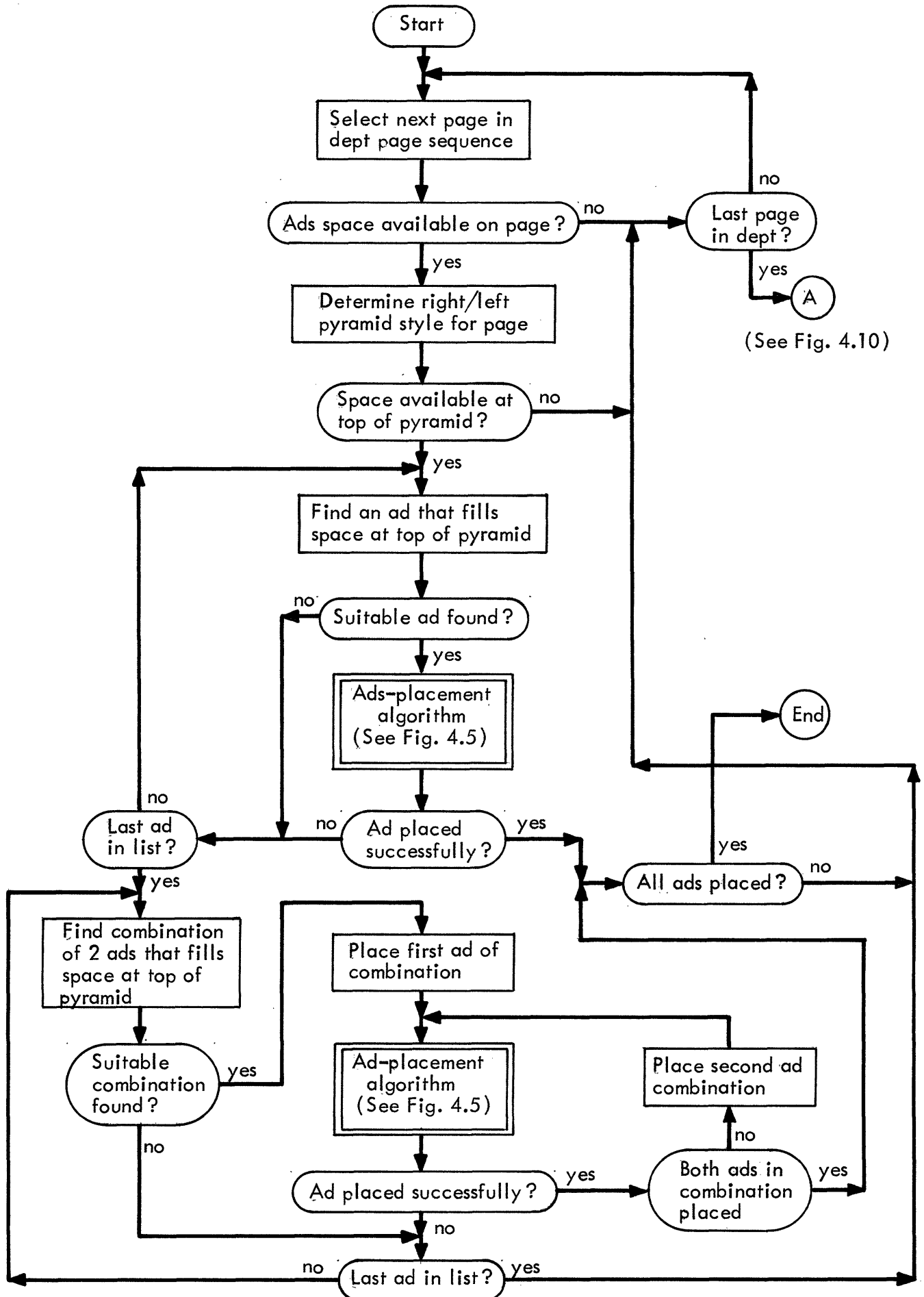


Fig. 4.9 Layout algorithm for left-over ads — step 1

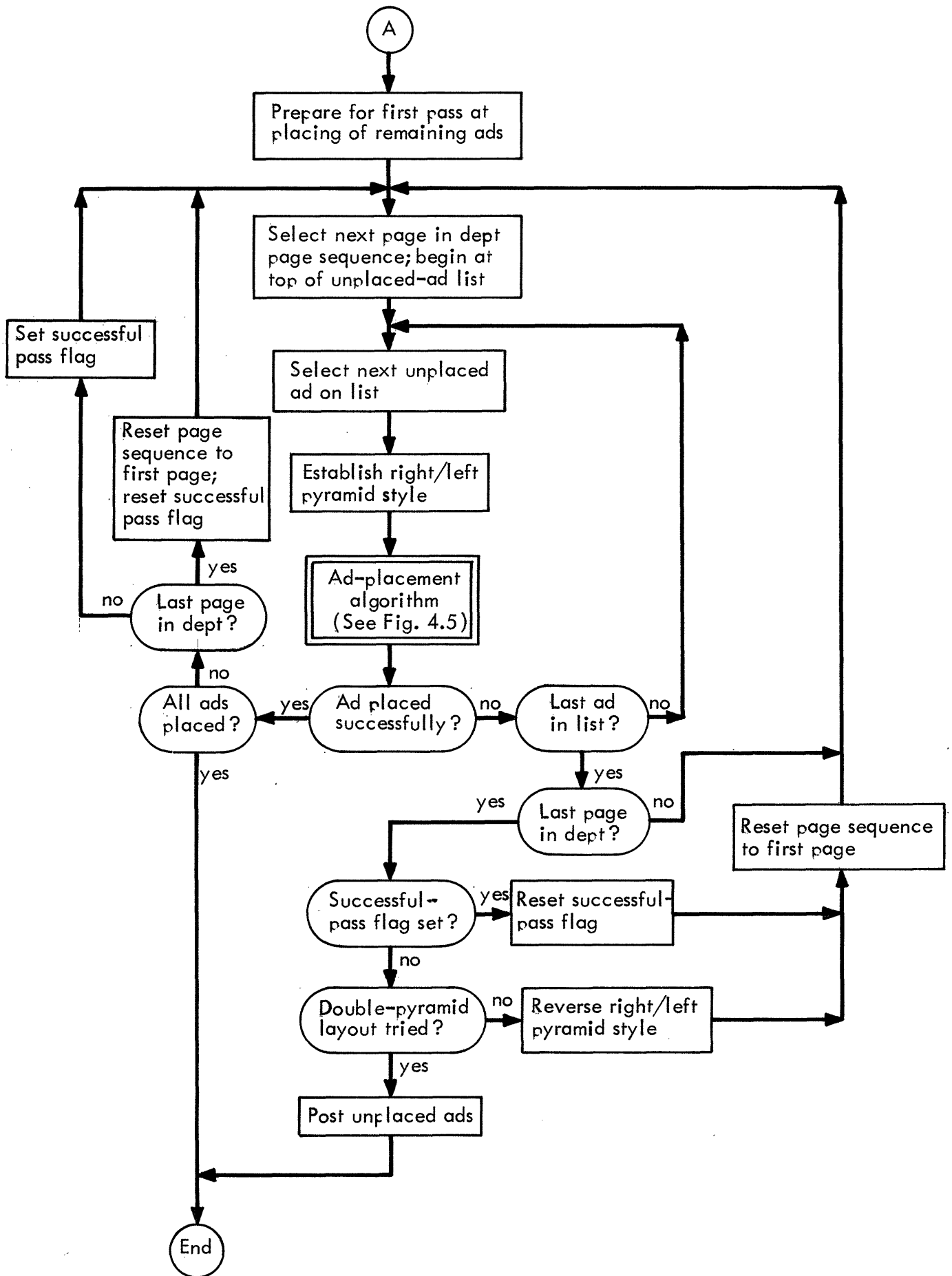


Fig. 4.10 Layout algorithm for left-over ads - Step 2

#### 4.7 Ads-Layout Examples

To illustrate the ad-layout algorithms described in the preceding section we shall lay out the ads listed in Table 4.1 using two different sets of policy inputs. It is assumed that the makeup module of Chapter 3 has established a nine-page department for these ads and the page format is eight columns by 22 inches. Ads F, N, and O are identified as competing bank ads, and there are no coupon ads. The ads are sorted by size with ads A and B categorized as tall ads and ads C through H categorized as large ads. For the first layout only, which corresponds to the first set of policy inputs, ad E is preassigned to page three. The total ads area represents 45.5 percent of the total space assigned to the department.

Table 4.1. Ads data for layout examples

Ad	Width (Columns)	Height (Inches)	Area (Col. in.)	Preassigned Page	Type
A	5	22	110		
B	1	22	22		
C	6	12	72		
D	5	14	70		
E	4	15	60	3(1st lay- out only)	
F	4	14	56		Bank
G	3	16	48		
H	3	15	45		
I	3	12	36		
J	4	8	32		
K	2	11	22		
L	2	10	20		
M	2	9	18		
N	3	5	15		Bank
O	3	5	15		Bank
P	2	6	12		
Q	3	4	12		
R	2	5	10		
S	2	5	10		
T	2	4	8		
U	2	4	8		
V	2	3	6		
W	2	3	6		
X	1	3	3		
Y	1	3	3		
Z	1	2	2		

The layout policies for the two layout examples are shown in Table 4.2.

Table 4.2. Policies for layout examples.

Policy	Pyramid rules	Maximum ads area		Minimum top margin		Page sequence
		Page	Area, Col -In.	Page	Margin	
Policy I	Strong, right pyramid	1	0	1-9	2.0	1-9
		2	44			
		3	88			
		4	132			
		5-9	176			
Policy II	Weak, right pyramid	1-3	0	1-8	3.0	1-3,9,4-8
		4-8	Full, 156	9	A10.0	
		9	96			

In Policy I, the first page is designated as a non-ads page and the ads area on pages two, three, and four are limited to 25, 50, and 75 percent, respectively, of the full-page area. The top margin is specified as 2.0 inches for all pages, and the layout page sequence corresponds to the numerical page order of the department. A strong right-pyramid construction is specified for layout.

In Policy II, ads are prohibited on the first three pages. For pages 4 through 8, the entry "Full, 156" means that full-page ads may be placed on these pages, but otherwise the ads area is limited to 156 column-inches. The minimum top margin is specified as 3.0 inches for pages 1 through 8. On page 9, an absolute minimum margin of 10.0 inches (A10.0) is specified. Because the margin designation is absolute, the policy directs the layout algorithm not to place ads in this area even though the ads pyramid can be matched to the upper page boundary. The page sequence is altered in Policy II from the ascending page-number sequence specified in Policy I by inserting the last page before pages 4 through 8. Policy II changes also the layout style from strong right-pyramid to weak right-pyramid rules.

The layouts generated by the algorithms for each of these policies are shown in Figs. 4.11 and 4.12. In both cases, there are four parts to the layout process:

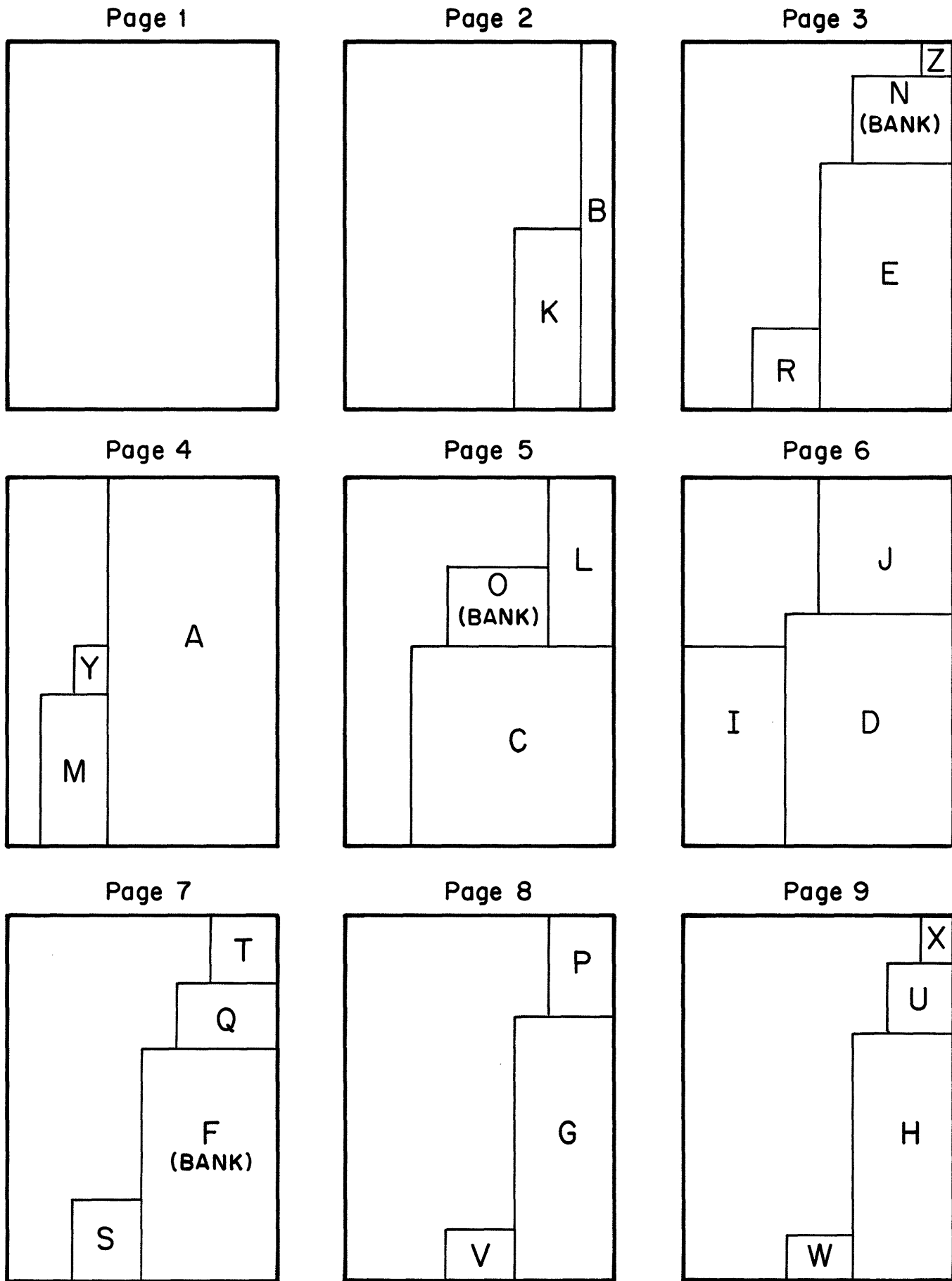
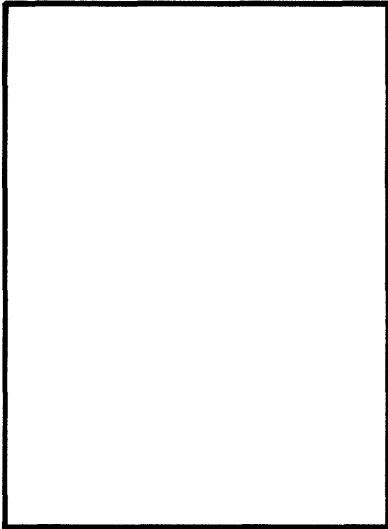
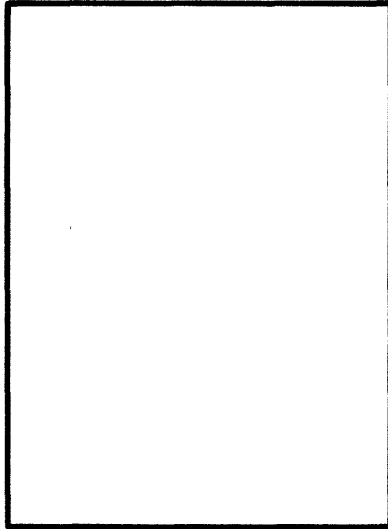


Fig. 4.11 Layout results - Policy I

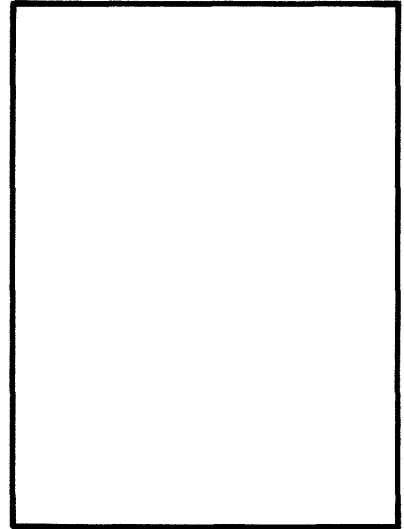
Page 1



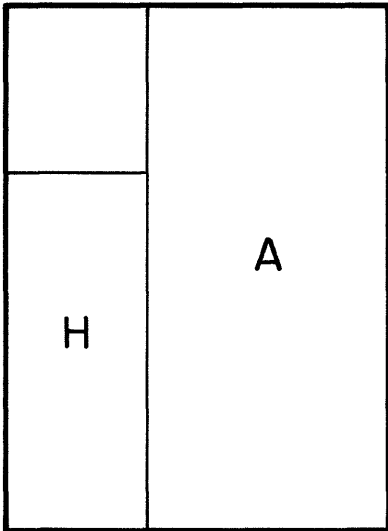
Page 2



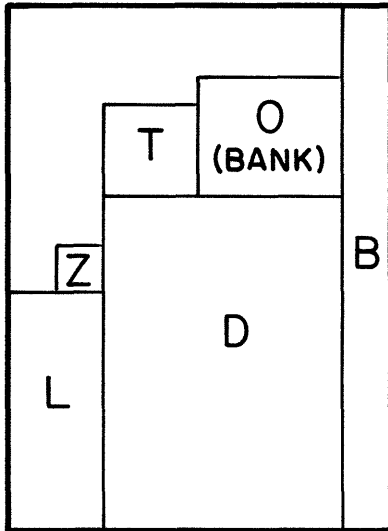
Page 3



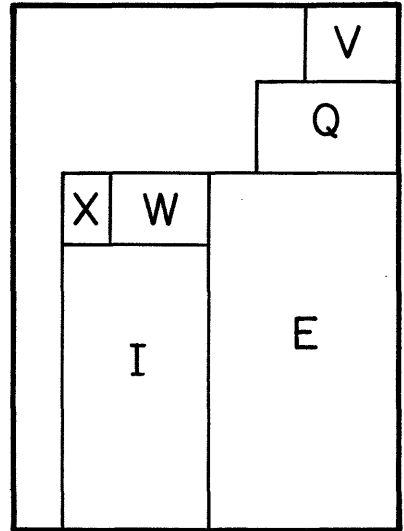
Page 4



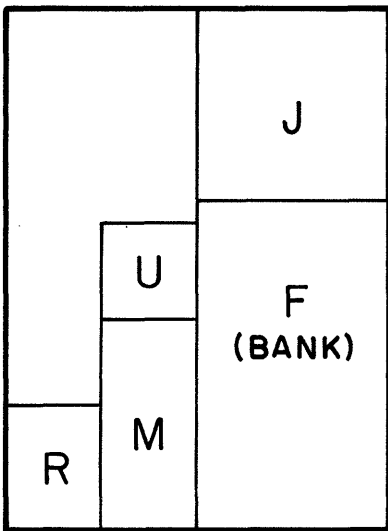
Page 5



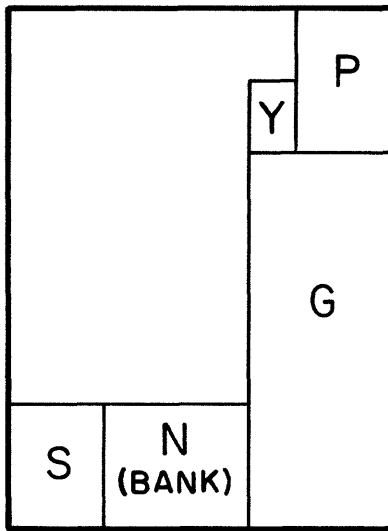
Page 6



Page 7



Page 8



Page 9

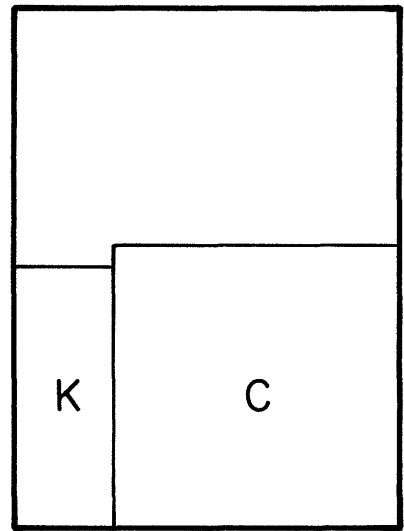


Fig. 4.12 Layout results - Policy II

layout of tall ads; layout of large ads; layout of left-over ads (step 1); and layout of left-over ads (step 2).

The sequences in which the ads are positioned are shown in Table 4.3.

Table 4.3. Layout sequence of ads for policies I and II

Policy	Tall ads	Large ads	Left-over ads	
			Step 1	Step 2
I	B,A,	E,C,D,F,G,H	N,Z,L,J,Q,T,P,U,X	K,R,M,O,I,S,V,W,Y
II	A,B,	C,D,E,F,G,H	Q,V,J,P	K,L,I,M,N,O,W,R,S, T,X,U,Y

Under Policy I, the tall-ads layout algorithm begins with page one, but ads are prohibited from that page by the maximum ads-area specification. On page 2, ad A exceeds the maximum ads area; therefore, ad B is placed on the page. Preassigned ad E prevents ad A from being placed on page 3, but it is placed on page 4. The large-ads algorithm positions the preassigned ad on page 3 and positions the remaining large ads in order on subsequent pages. Step 1 for the left-over ads succeeds in raising each of the ad pyramids to the upper page boundary. Finally, step 2 for the left-over ads distributes the remaining ads throughout the department pages following the strong-pyramid construction rules.

Policy II imposes a tighter packing of ads because of the ad prohibitions on pages 1 through 3 and the upper part of page 9. The layout solution is eased somewhat by the allowance of weak-pyramid construction. Under this policy, the ads occupy over 82 percent of the total area available for ads on pages 4 through 9. Under both policies I and II, all ads are placed without resorting to a double-pyramid style.

These examples illustrate the results that can be expected from the layout algorithms. Of course, the computer-generated ads dummy is not final. The page layouts are displayed to the layout supervisor who may either accept or revise the results, as he wishes. With careful attention to the formulation of makeup and layout policies, however, the computerized layout process should produce a reasonable ads layout dummy in a small fraction of the time required by current manual techniques.

## CHAPTER 5

### NEWS-STORY AND PICTURE ASSIGNMENT

After display ads have been positioned on the various pages of the newspaper, the next step in the total layout process is to position the news -- stories and pictures -- in the blank spaces that surround the ads. The news-layout procedure described here is a two-step process. In the first step stories and pictures are assigned to specific pages without regard for their location on the page. Actual positioning of the items takes place in the second step. From our examination of alternative approaches to news layout, we have concluded that a two-step process, which parallels the procedure used in display-ads layout, is highly desirable in a computerized-layout environment. A two-step process gives opportunities to the layout supervisor to check partial results as layout progresses, and to intervene and restructure the layout at crucial points should he so desire.

The online, interactive news-layout approach to be described requires departures from procedures that normally prevail in noncomputerized news rooms. In general terms, layout information that is commonly available to a layout man must be supplemented with additional data before the layout process can begin. Perhaps the most important data that must be on hand for posting in the machine is a ranking of all news stories assigned to a department by their order of importance.

In addition, a clear-cut set of statements that will govern news layout must also be formulated. In other words, a news-layout policy must be established. A further issue that must be resolved is the manner in which headlines will be handled, not only with respect to allocated space but the time in the layout cycle that headline space is frozen. Hence, a more formalized structure for the news-layout process is required in a mechanized environment than in a manual environment; the challenge is to design a structure which is sufficiently flexible to yield a variety of esthetically pleasing layouts, and which, at the same time, is cost-effective.

In this chapter we discuss the first step in news layout -- story and picture assignment.

### 5.1 Basic Goals

The story- and picture-assignment computer program has two functions:

1. It establishes a news budget for each department. This is accomplished by selecting, for each department, a subset of stories and pictures whose total area matches the area of the news hole assigned to the department.
2. It assigns stories, including parts of jumped stories, and pictures from the department news budget to specific pages in a way that their total area for each page matches the page news-hole area.

The goals are to assure that important news items are assigned to appropriate pages and that assignments conform to layout-policy guidelines for factors such as the number of stories starting on a page, distribution of pictures among the pages, distribution of jumped stories, colocation of associated news items, and so forth. By matching the total area of assigned items to the area of a page news hole before positioning takes place, we greatly simplify page layout.

The assignment process is performed by department, and page assignment of news items starts with the first page in the department. Stories and pictures with high importance rankings, as specified by the editor, are assigned to pages up front.\* The process culminates in a story and picture budget for each page of each department. The layout supervisor reviews these results and modifies the assignments, if he chooses, before actual layout begins.

The overall story- and picture-assignment process is illustrated by the flow diagram in Fig. 5.1. The process is initiated by the layout supervisor who specifies for which department the assignment process is to be executed. The process consists of two major parts: determination of the department news budget, and page assignment. These operations are performed sequentially, as described below.

### 5.2 Determination of the Department News Budget

The display-ads-layout process described in preceding chapters establishes the number of pages for each department and the space available for news items on each page. The first part of the news-assignment process is to establish the overall budget of news stories and pictures that will fill the department news hole irrespective of specific page assignments. The first step is to retrieve all pages for the specified department from the ads-dummy file, and to compute the department news-hole area. (See first rectangular block at top of

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\* In our system, stories are ranked on a scale of 1 through 10. The most important stories are rated 1; the least important, 10.

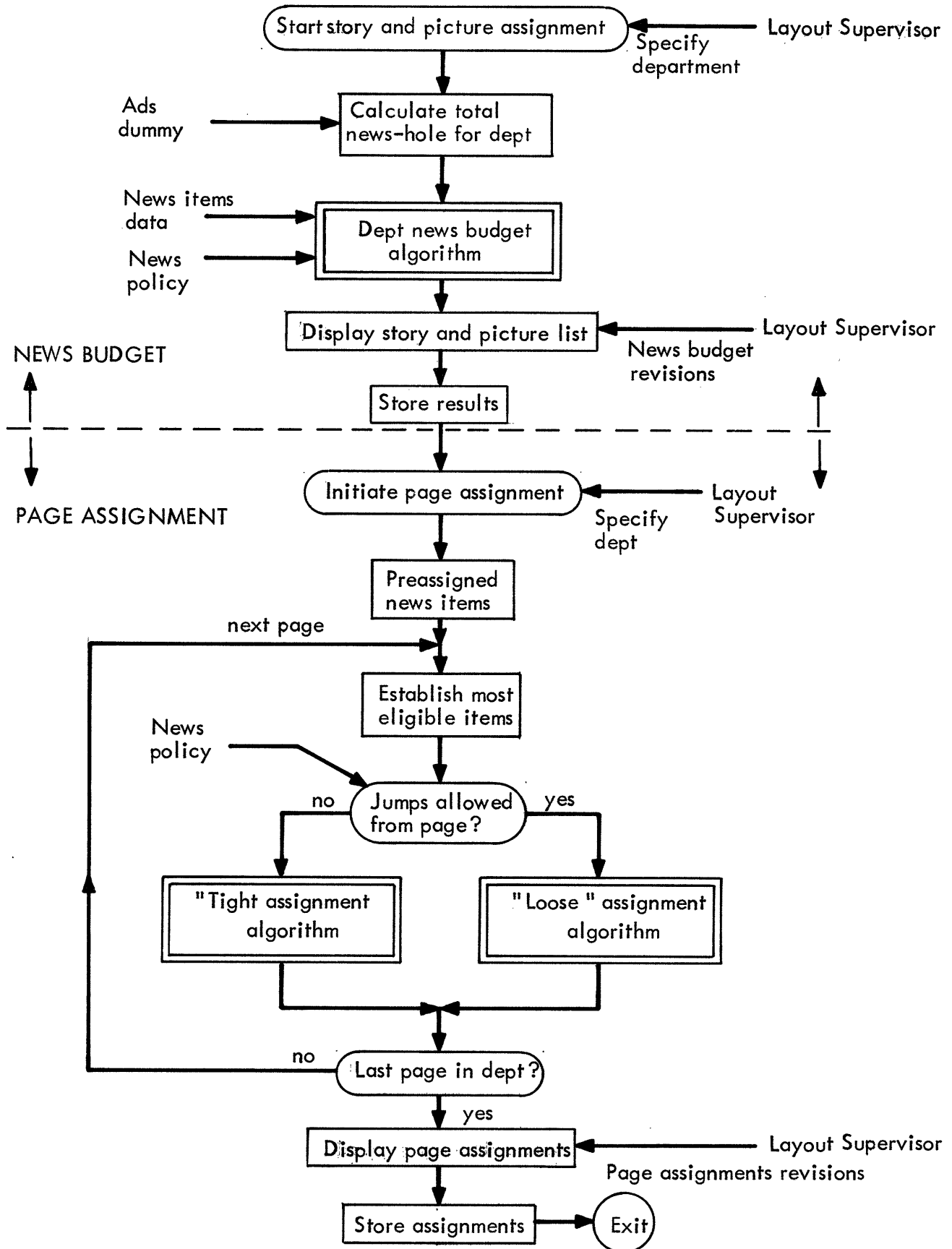


Fig. 5.1 The diagram of the story and picture assignment

Fig. 5.1.)

Next, the algorithm for determining the department news budget is executed. Figure 5.2 shows the flow diagram for this algorithm. The algorithm begins by retrieving all stories and pictures designated for the department and sorting them by their importance rankings. Stories and independent pictures are placed on a tentative "accepted" list one at a time, starting with the most important ranking. Pictures associated with accepted stories are also placed on the list. After each item is placed on the list, the total area for all items on the list is calculated and compared with the department news-hole area. If space is still available, another story or picture is accepted, and so forth, until the news-hole area is filled.

At this point, the items on the tentative acceptance list are examined for balance between stories and pictures. A desired range for the percentage of the total news area to be occupied by pictures is stored for each department as part of the news-policy file. The tentative picture-area percentage is calculated from the picture areas on the acceptance list and compared with the policy bounds. If the picture percentage is too low, an independent picture (one not associated with any story) is added to the acceptance list. To compensate for the added area, one or more stories without pictures, beginning with the story of lowest importance, are dropped from the list to make the total area of items on the list conform to the total available news-hole area. This process is repeated until the picture-area percentage is within the policy bounds or until all independent pictures have been accepted. If the picture-area percentage of the acceptance list is too high, a similar process takes place; in this case, the independent pictures with lowest importance ranking are removed from the accepted list and stories are added. The output of the process is a list, by department, of accepted stories and pictures whose total area closely matches the total news-hole area of the department and a balance between stories and pictures that falls within the policy guidelines.

The story and picture areas in the above calculations must include headline and picture-caption areas. In contrast to current manual procedures, where headline and caption space are usually left undesignated until layout, automated assignment requires an estimate of headline and caption areas during these preliminary calculations. Text areas for stories can be computed from a character count of story text, but headline content and fonts may be left unspecified until after the assignment process is completed. The layout

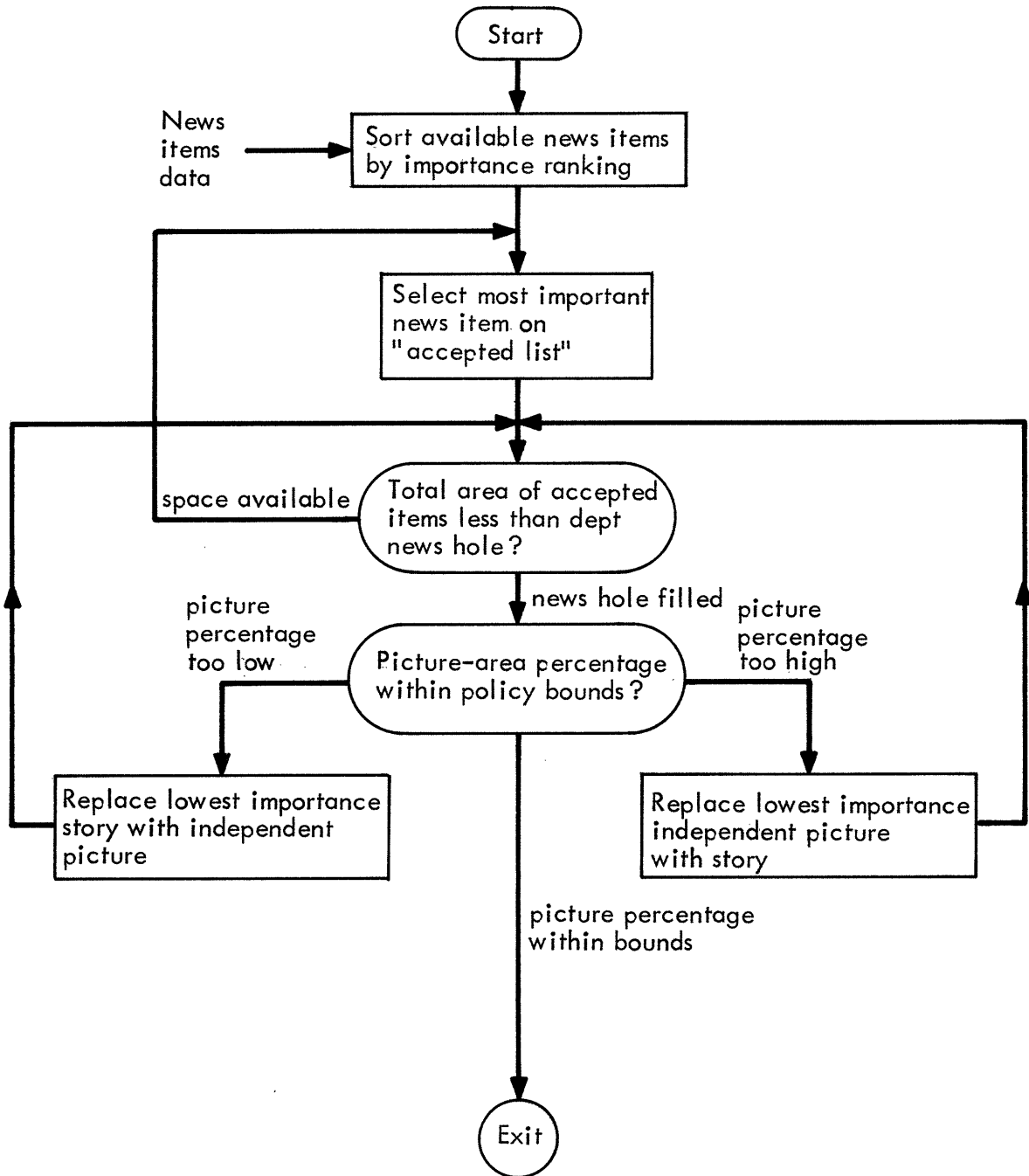


Fig. 5.2 Algorithm for determining the department news budget

program permits the supervisor to preassign headline and caption dimensions for selected stories and pictures; if he does, these data are used in the assignment calculations. If not specified, headline area is computed as a fixed percentage of story area. Although many factors such as story importance, position on the page, and story shape influence the final headline size, the simple percentage calculation used here is adequate for the preliminary calculations. This approach is supported by our analysis of several representative newspapers which revealed a reasonable correlation between story areas and their associated headline areas. Similarly, picture-caption areas are either prespecified by the editor or estimated from the picture dimensions.

The results of the news-budget determination are displayed to the editor as a tabular listing of stories and pictures divided into two groups: The accepted items which will fit into the available news hole and the left-over items. Stories and pictures are identified by their slugs, and the tabular display includes the importance ranking and size for each item. Also, associations between stories and pictures or between stories are indicated.

At this point, the layout supervisor has the opportunity to review the results and to revise them as desired. For example, individual stories or pictures in the accepted news budget can be deleted or their sizes reduced to make room for items from the left-over list. Alternatively, importance rankings may be changed and the budget assignment process reinitiated to create a new mix of accepted stories and pictures. After a satisfactory news budget is achieved, the supervisor indicates his acceptance and the results are stored in the department news file.

### 5.3 Page Assignment

After the news budget is established for a department, the layout supervisor initiates the page-assignment process for that department. Its purpose is to assign the stories and pictures from the news budget to specific pages in a way that the total area for the items assigned to each page matches the page news-hole area within a specified tolerance. Parameters stored in the news-policy file are used to guide the process on matters such as jumped stories, number of stories per page, story-picture balance, and so forth.

First, all stories and pictures that have been preassigned by the layout supervisor to specific pages are stored in the appropriate page-assignment files. Then, the assignment process begins with the first page of the department. At the start of each page, a list of eligible news items is formed

to serve as a collection of stories and pictures to be considered for assignment to the page. Stories for the list are selected in the following preference order:

1. Stories associated with stories preassigned to the page
2. Stories associated with other stories already on the list
3. Highest importance ranking

Twenty unassigned stories are selected from the department news budget according to the above priorities, and pictures associated with the selected stories are included. In addition, ten independent pictures are selected according to their importance ranking. The purpose of the eligible news-item list is to restrict the number of stories and pictures that must be processed for each page by the assignment algorithms. This restriction reduces processing requirements and assures that items of low-importance ranking are not assigned to important pages. For the last few pages in the department it may be necessary to use left-over stories and pictures which are not part of the department news budget in order to collect 20 stories and 10 independent pictures because most items in the news budget are likely to have been already assigned.\*

Next, the computer determines from the news-policy file if it is permissible to jump stories from the page it is working on. If jumps are allowed, the loose page-assignment algorithm is employed; if jumps are not allowed, the tight page-assignment algorithm is called.

5.3.1 Loose page-assignment algorithm. When it is permissible to jump stories from the page, it is relatively easy to match the assigned news-item area to the available news hole. However, two other policy inputs can be used to constrain the assignment process. One specifies a maximum and minimum number of stories to be started on the page; the other specifies a desired range of the picture-area percentage on the page.

The minimum-number-of-stories policy is useful for assuring that one or two long stories do not dominate an important page, such as the front page. The maximum number of stories prevents too many short stories being assigned to the same page, with the result that the layout takes on an excessively

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\* The 20-story and 10-picture policy is somewhat arbitrary. An ample excess of stories and pictures over the number of each assigned to a page is needed to ensure an area match. A huge excess will result in unnecessarily long processing times.

"busy" appearance. The purpose of the policy that controls picture-area percentage is to provide flexibility. A flexible policy makes it possible to achieve a balanced distribution of pictures throughout the department or to feature one or more pages as picture pages. These policy inputs can be specified for individual pages or for the department as a whole.

The loose page-assignment algorithm is illustrated in Fig. 5.3. The first step is to select news stories and pictures one at a time from the eligible news-items list until the minimum number of stories is reached and their total area equals or exceeds the available news hole. Stories and pictures are selected by giving preference first to items associated with items already assigned to the page and then to the highest importance ranking. When both the minimum number of stories and the news-hole area are equaled or exceeded by the corresponding figures for the assigned items, any remaining stories or picture associated with already assigned news items are also assigned. Then, the number of assigned stories is compared to the maximum number of stories specified by policy data. If the maximum is exceeded, the shortest two stories of the last five assigned are dropped and a single story is sought to fill or overflow the news hole. Stories unassociated with other stories or pictures are selected for this substitution process. The process is repeated until the number of stories is within bounds and the news-hole area is equaled or exceeded.

Then, the percentage of the page news-hole area occupied by the assigned pictures is compared with the policy guideline for picture-area percentage for that page. If the assigned items satisfy the policy, the algorithm proceeds to the determination of jumped stories. If the picture-area percentage is too high or too low, independent pictures are either deleted from or added to the assignments. If too low, the next independent picture on the eligible-news-item list is assigned to the page. If too high, the least important independent picture already assigned is dropped from the page and a story is added if needed to fill the news hole. After either of these steps, the comparison of area percentages is repeated and a further adjustment of assigned pictures is made, if necessary. The process iterates until the picture-area percentage is within policy bounds or until no more independent pictures are available for modifying the assigned items. In the latter case, the policy violation is flagged and displayed later to the layout supervisor.

After the news items are assigned to the page, the algorithm determines

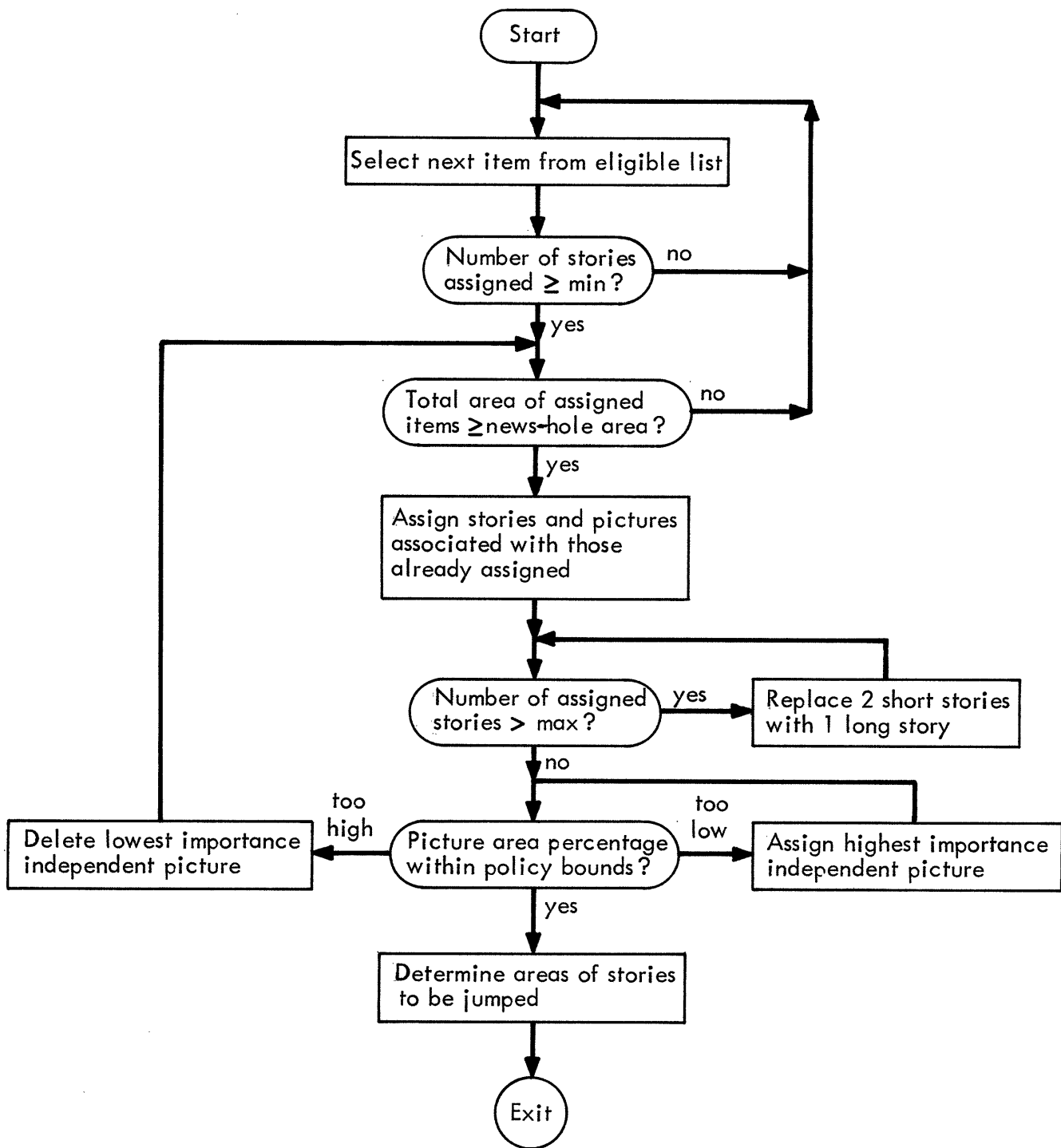


Fig. 5.3 Loose page-assignment algorithm

which stories are to be jumped and how much of their area must be jumped in order to match the total area of the assigned items to the page news hole. First, the algorithm jumps part of the longest story assigned to the page, up to a maximum jump percentage stored in the news-policy file. If this jump is insufficient to reduce the total area of the assigned items to the news-hole area, the process is repeated on the next longest story, and so forth, until an area match is achieved. When two or more stories are jumped, the jumped area is distributed equally among the jumped stories. If the maximum jump percentage, even when applied to all assigned stories, fails to reduce the area sufficiently, the least important story is deleted entirely from the page. The process iterates until the news-hole area is matched. After the jumping process is completed, the number of stories and picture-area percentage are compared with the policy bounds; if violations remain, they are flagged for later display with the page assignment results.

Jumped portions of stories are considered thereafter as separate stories with the same importance ranking as the original story. Hence, the process tends to assign the second part of jumped stories to the very next page. This tendency can be overridden, however, by specifying a "jump-to" page in the policy data. For example, editorial policy may dictate that all stories jumped from the front page be assigned to the last two or three pages in the department. In this case, the algorithm preassigns the jumped parts of the stories to one of the specified pages.

5.3.2 The tight page-assignment algorithm. Assignment of news items to pages where policy prohibits stories being jumped is more difficult because there is less flexibility in matching the total area of the assigned items to the available news-hole area. However, the tight-assignment algorithm must be employed for at least one page of each department, since jumps cannot be initiated on the last page. Editorial policy may restrict jumps on other pages, also. The tight page-assignment algorithm is illustrated in Fig. 5.4.

As in the loose-assignment algorithm, the tight-assignment process attempts to satisfy constraints specified by the policy inputs of picture-area percentage and number of stories for the page. The tight-assignment algorithm begins by assigning independent pictures or stories associated with pictures, one at a time, until the total picture area is within the policy bounds set for picture-area percentage. Items are selected from the eligible-items list for the page in order of their importance ranking. After the picture-area-

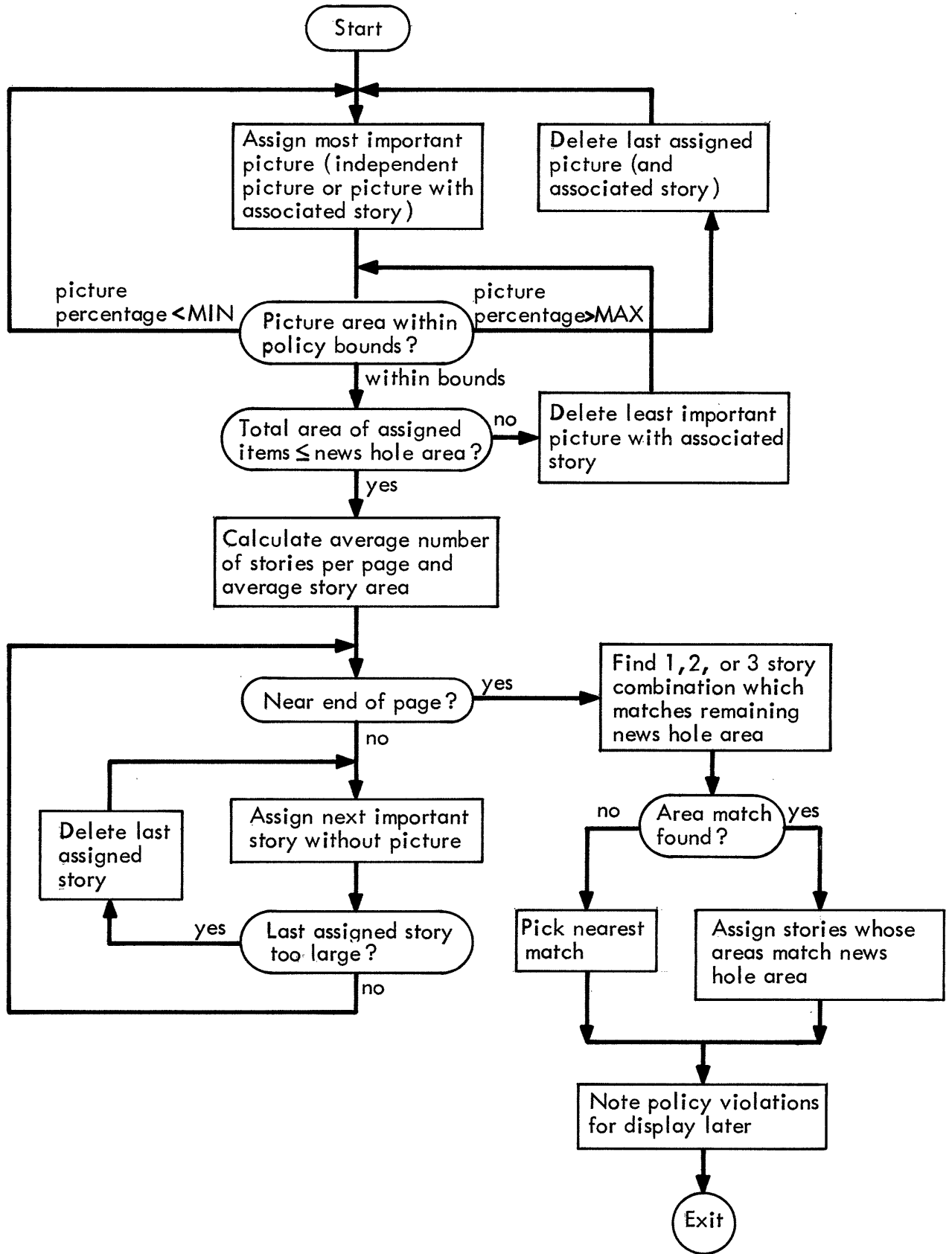


Fig. 5.4 Tight page-assignment algorithm

percentage bounds are satisfied, the total area of assigned items is checked to assure that the page news hole has not been overfilled. If it has, an attempt is made to substitute independent pictures for stories with pictures on the assigned-item list in order to satisfy both the picture-area-percentage bounds and to keep within the available news-hole area. If the process exhausts all items on the eligible-item list and still cannot satisfy the policy bounds, the violation is noted and the process continues to the next step.

At this point, the algorithm has assigned, if possible, sufficient pictures to satisfy the policy guidelines. The remaining news hole must now be filled with stories. While there is still plenty of space, stories can be assigned one at a time in their order of importance. However, as the news hole becomes nearly filled, care must be taken in selecting the last few stories so that the total news-item area matches the available news-hole area.

In order to assist in detecting when the end of the page is near, two parameters are calculated from the policy inputs and the available news hole:

1. The desired average number of stories for the page  $N_D$ ; and
2. the desired average story area for the page  $A_D$ .

These are calculated as follows:

$$N_D = \frac{(\text{max no. of stories}) + (\text{min no. of stories})}{2} \quad (5.1)$$

$$A_D = \frac{\text{news-hole area}}{N_D} \left[ 1 - \frac{(\text{max picture-area percentage} + \text{min picture-area percentage})}{2 \times 100} \right] \quad (5.2)$$

The maximum and minimum number of stories and the maximum and minimum picture-area percentages are part of the news-policy data. The quantities  $N_D$  and  $A_D$  are used in the end-of-page test as follows: If the number of assigned stories is within 2 of  $N_D$  or if the remaining news hole is less than  $2A_D$ , then the assignment algorithm proceeds to the end-of-page subroutine. Both parts of the test indicate whether the assignment process is within 2 nominal stories of satisfying either the number-of-stories policy or of filling the news-hole area.

If the test shows that the end-of-page is not near, the algorithm selects

another story from the eligible items list and assigns it to the page. Story selection is based on stories associated with previously assigned stories and their importance ranking, in that order. After each new story is assigned, the remaining news-hole area is checked, and if less than  $A_D$ , the story is deleted and the next most eligible story is tried. If all stories on the eligible list have been tried unsuccessfully, the process proceeds to the end-of-page part of the algorithm. After each successful story assignment, the end-of-page test is repeated. Thus, eventually page assignment is completed to within 2 nominal stories of the policy goals, and the end-of-page part of the algorithm is initiated. The process assures that the remaining news hole has an area of at least  $A_D$  when the end-of-page subroutine begins.

The purpose of the end-of-page part of the algorithm is to relax the dependence of the story-selection process upon story association and importance ranking in order to find a combination of stories whose total area best matches the remaining news hole. First, a single story is sought from the eligible news-items list with an area that matches the remaining news-hole area. If none exists, a combination of two stories is sought. If that also fails to produce an area match, a combination of three stories is tried. If a match is not found from any of these, the most nearly matching combination is assigned to the page, and the problem is indicated later during the display of the story-assignment results.

It should be emphasized that the leading tolerance specified in the news policy file provides flexibility in matching the area of assigned news stories to the available news hole. In all cases described above where an area match is sought, a match is considered to exist whenever the total area of the assigned items is within the specified leading tolerance of the available news-hole area. Allowing a liberal leading tolerance greatly improves the chances of the tight page-assignment algorithm in finding an acceptable solution.

Before the tight page-assignment subroutine is left, final assignment results are checked against the policy guidelines; all deviations are flagged for display with the page-assignment results.

5.3.3 Display of page-assignment results. The page-assignment results are presented to the layout supervisor as a tabular display which lists all stories and pictures assigned to each page in the department. Data displayed for each news item include the story or picture name, area, importance ranking, associated items, and whether or not a story is jumped. Also displayed are any violations of assignment policy that were necessary to achieve the assignment

results.

Examples of the assignment results for two pages are shown in Tables 5.1 and 5.2. Observe that six stories and one independent picture (Deep Freeze) have been assigned to page 1. Pictures are associated with two stories, and the first two stories listed are associated with each other. Since jumps were allowed from the first page, the loose page-assignment algorithm was utilized, and four stories were jumped. "Egypt", for example, is a 28 column-inch story, and 12.5 column-inches, signified by J12.5, have been jumped to page 8.

Table 5.1. An Example of News-Assignment Results (Page 1)

News Department: Page 1

Story	Picture	Associated Item	Importance	Area Col-in.	Jump to Page
British		Callaghan Visit	1	22.0	
Callaghan Visit		British	2	32.0(J12.5)	8
	Callaghan	Callaghan Visit	2	3 x 3.6	
Egypt			2	28.0(J12.5)	8
Refunds			3	26.0	
Vance Trip			3	41.0(J12.5)	9
White House			4	28.0(J12.5)	9
	Carter	White House	4	3 x 3.2	
	Deep Freeze		3	3 x 4.2	
				Total: 160	

Available News Hole: 160 Col-in.  
 Picture-Area Percentage: 21%  
 No. of Stories: 6

News Policies  
 Picture-Area Percentages:  
 15%, min; 35%, max  
 No. of Stories: 5, min; 9, max  
 Leading Tolerance: + 10%

In the second example, the policy for page 2 prohibited jumps from that page; the tight page-assignment algorithm was therefore used. The total area of the assigned items is less than the news-hole area, but the difference is within the leading tolerance set by the policy. Note that the number of stories on the page does not meet the minimum specified by policy, but this guideline has been ignored to match the assigned items to the available news hole.

Table 5.2. An Example of News-Assignment Results (Page 2)

News Department: Page 2

Story	Picture	Associated Item	Importance	Area Col-in.	Jump to Page
Names & Faces (feature)			Preassigned	40.0	
Heroin Ring		Meyer	4	19.0	
Meyer		Heroin Ring	4	21.0	
Speech			5	20.4	
	Dukakis	Speech	5	4x4.5	
Busing			6	15.7	
	White	Busing	6	4x5.5	
				Total: 156.1	

Available News Hole: 160 Col-in.

Picture-Area Percentage: 25%

\*\* No. of Stories: 5

\*\* Signifies a Policy Violation

News Policies

Picture-Area Percentages:

15%, min; 37%, max

No. of Stories: 6, min; 9, max

Leading Tolerance: + 10%

After reviewing the computer-generated assignments, the layout supervisor can revise the page assignments as he wishes. It should be emphasized that the goal of the computerized page-assignment process is to provide tentative page assignments which can either be accepted by the layout supervisor or altered by him. The layout supervisor can delete items from the page or add new items. After assignment revisions, it may be necessary to adjust dimensions of individual items on the page so that the total area of the assigned items matches the news-hole area. Alternatively, the layout supervisor can preassign selected items to specific pages and reinitiate the page-assignment algorithm to generate a new assignment list for the remaining items.

For those pages where the computer has been unable to find a combination of stories and pictures which match the available news hole within the specified tolerances, the results are displayed to the layout supervisor for his corrective action. The news items comprising the best match found by the assignment algorithm are displayed in the format of Tables 5.1 and 5.2. The layout supervisor can adjust the size of the assigned items to fit the news hole or make other assignments to correct the problem. The department news budget, listing all stories and pictures available for the department, can be called for display to assist in this task.

After satisfactory page assignments are achieved, the layout supervisor indicates his acceptance, and the results are stored in the page-assignment dummy file. A subset of stories and pictures with appropriate areas has thus been determined for each page in the department and page layout can begin.

## CHAPTER 6

### A SYMBOLIC GRAPHICS LANGUAGE FOR NEWS LAYOUT

After stories and pictures are assigned to specific pages, as described in Chapter 5, the next task is to position them on the pages. An automated news-layout system for accomplishing this task is described in the remaining chapters. The system is based upon computer-stored layout templates and employs a symbolic graphics language for describing the templates. In this chapter, an overview of the automated news-layout system is presented, together with a detailed discussion of the graphics language that is used to describe news-layout templates.

#### 6.1 Overview of the Automated News-Layout System

The primary input data to the news-layout process are the display-ads dummy, which defines the space available for news, and the story-assignment results which specify stories and pictures for each page.

Our research has demonstrated that layout algorithms based on brute-force, sequential, one-at-a-time positioning of news items (analogous to techniques used for display-ads layout) are not effective. The wide variety of news-story shapes and layout styles complicate the news-layout process and introduce a multiplicity of choices not present in display-ads layout. Experimental results indicate that sequential news-layout algorithms oftentimes fail to achieve satisfactory layouts, particularly for pages that contain more than three news items. The fundamental problem is that items positioned early in the process tend to distort the remaining news space to the extent that acceptable layout patterns are impossible for the last one or two items to be positioned on the page. Attempts at deriving rules and "look-ahead" techniques to constrain the layout algorithm and to avoid this problem proved futile because of the complexity of the layout options.

We turned, therefore, to the development of the template-driven approach in which predetermined page layouts are stored in the computer and used by the layout algorithms to achieve acceptable layouts.

Page-layout templates provide structural guidelines for positioning individual stories and pictures according to approved layout styles. However, a template library containing at least one layout for each combination of stories and pictures of various sizes that might be assigned to a page is estimated to require

of the order of  $10^5$  to  $10^6$  templates. Clearly, such a library imposes a costly computer-storage burden; moreover, the creation and inputting of that many templates is too time consuming and costly to implement.

In order to make template-driven layout practical, a symbolic graphics language has been developed to describe the templates in a way that reduces the required number of templates by approximately three orders of magnitude. Symbolic operators are used to define templates by the relative positions of news items on the page, independently of news-item size. Utilization of this language limits the library to an estimated 500 to 1000 templates and establishes the practicality of the template-driven news-layout approach.

The layout process consists of three major steps: Selecting a template for the page; associating the stories and pictures assigned to the page with specific template elements; assembling the page layout in accordance with the given story and picture areas and in conformity with the layout structure specified by the template. It is not always possible to fit the assigned stories and pictures into the layout structure of a particular template. In that case, another template must be selected and the process repeated.

Template selection may be either manual or automatic. In the manual mode, the layout supervisor selects the template from the library or creates a new one. In the automatic mode, the computer selects a template from a group of templates having the appropriate numbers of stories, stories associated with pictures, and independent pictures. Selection rules involve the shape of the news hole, the relative importance of template components, and so forth.

The assigned stories and pictures are associated with corresponding elements on the template in accordance with the relative importance rankings of the individual news items and template elements. Then, the layout is constructed by calculating the dimensions of template components which conform to the given sizes of the news items. When the layout process succeeds, the results are presented to the layout supervisor for acceptance or modification. Should the layout algorithm fail, the layout supervisor must resolve the problem by either offering a new layout structure, revising the news items assigned to the page, or reshaping the news hole by altering the display-ads dummy. Layout proceeds page-by-page until the process is complete.

## 6.2 Symbolic Graphics Language for News Layout

Described in this section is a news graphics language which is utilized to define page templates in a template-driven news-layout system. This language

permits templates to be specified by the relative positions of news items on the page. Initially, the discussion is restricted to pages with full-page news holes; later, the concepts are extended to pages with display ads.

The major advantage of using a symbolic language to represent layout templates is that many different layouts with the same layout structure can be described by a simple, unique symbolic expression having a small set of well-defined relational operators. The symbolic approach not only greatly reduces the total number of templates required in a news-layout system but also gives a formal mechanism to describe all the structural information contained in a two-dimensional page template. Thus, the symbolic representation of templates can be used to guide the actual layout process without need for a close match between a precast template and the sizes of news items assigned to the page. Whenever a story or picture is to be placed, the selected symbolic template describes how the item should be shaped and where it should be placed in relation to previously placed items on the page. As a result, the layout process provides a page layout whose structure conforms to acceptable layout practices. If a given set of stories and pictures cannot be laid out in accordance with a particular template, another template may be selected and the layout can be tried again.

6.2.1 Motivation for symbolic representation of layout templates. Figure 6.1 illustrates three of many possible templates with the same basic structure and the same number of stories and pictures but with different combinations of story and picture sizes. Note that by merely changing two story sizes (increasing  $S_1$  and decreasing  $S_2$ ) in Fig. 6.1a we create the new template shown in Fig. 6.1b even though everything else remains the same. Similarly, a third template is required to define the layout in Fig. 6.1c, since alterations in the sizes of stories and a picture have been made. However, the relative positions of the stories and pictures in all three templates are identical. Obviously, the template library can be simplified if all the layouts in Fig. 6.1 plus others with the same basic layout structure can be represented by a single layout template. Therefore, the goal is to define templates by the structural relationships from their components only while retaining effective control of the layout of individual news items on the page. This type of template is not constrained by the areas of items on the template. To accomplish this goal, a formal mechanism is needed to describe the relative geometric information of a template without specifying the position coordinates or sizes of its components. Toward this end, a set of basic opera-

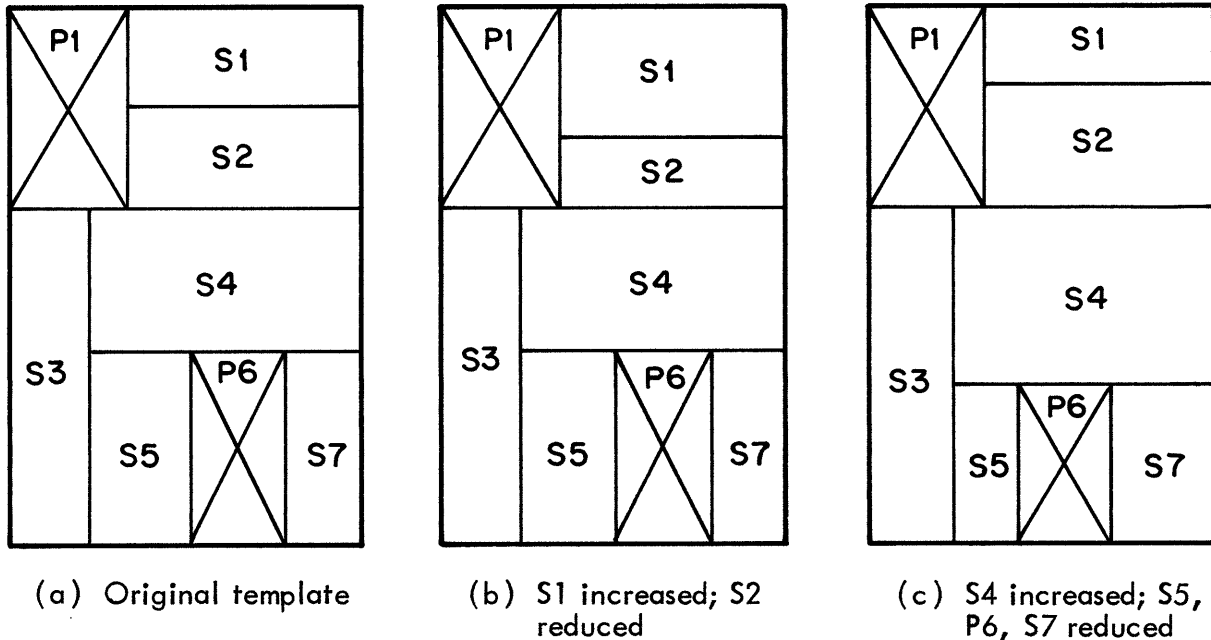


Fig. 6.1 Templates with the same basic layout structure

tors expressing the geometric relationship among items on a template has been defined.

6.2.2 Relational operators and their usage. A set of binary symbolic operators has been developed for use in describing the relative positions of two adjacent news items (stories or pictures) on layout templates. Through utilization of relational operators, a wide range of commonly encountered newspaper layouts can be represented symbolically. This section defines each relational operator and illustrates their usage in the composition of a symbolic description for templates with two or more news items. The news items connected by a relational operator are called operands, and an infix notation is adopted in which the operator appears between its two operands. In accordance with their usage, binary relational operators are classified into three groups: basic, embedded, and extended.

Basic operators. Operators used to indicate adjacency, either vertical or horizontal, of two news items with the same dimension at their common edge

are designated basic operators. We define two basic operators, denoted by the symbols = and ||. The interpretation of these operators is as follows:

= This is a vertical-construction operator; it indicates that one operand is positioned above the other. Thus,  $A = B$  means that news item A is on top of news item B, and A and B have the same width at their common edge. Examples are illustrated in Fig. 6.2a.

|| This is a horizontal-construction operator; it indicates that its operands are beside each other.  $A || B$  means that news items A and B are next to each other, and A and B have the same height at their common boundary. Examples are shown in Fig. 6.2b.

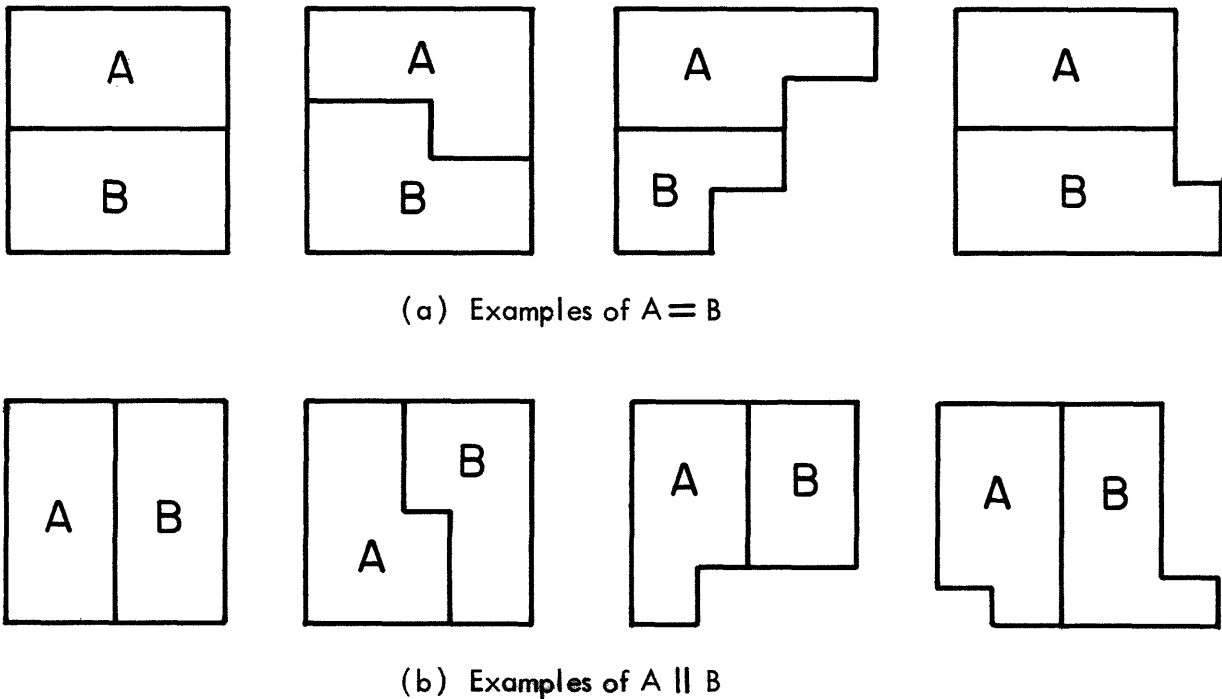


Fig. 6.2 Configurations of basic-operator constructions

Embedded operators. Operators used to indicate that one news item is nested at the corner of another item are classified as embedded operators. Figure 6.3 depicts such a construction where one operand, item B, is embedded within another operand, item A. Three forms of operators of this type are defined in Fig. 6.3. A fourth possibility, with B in the upper left corner, represents a generally unacceptable layout for story A, since the headline cannot cover the left portion of the story area. The symbols used to represent the three acceptable templates are drawn above each example.

The five operators comprising the basic and embedded classifications can

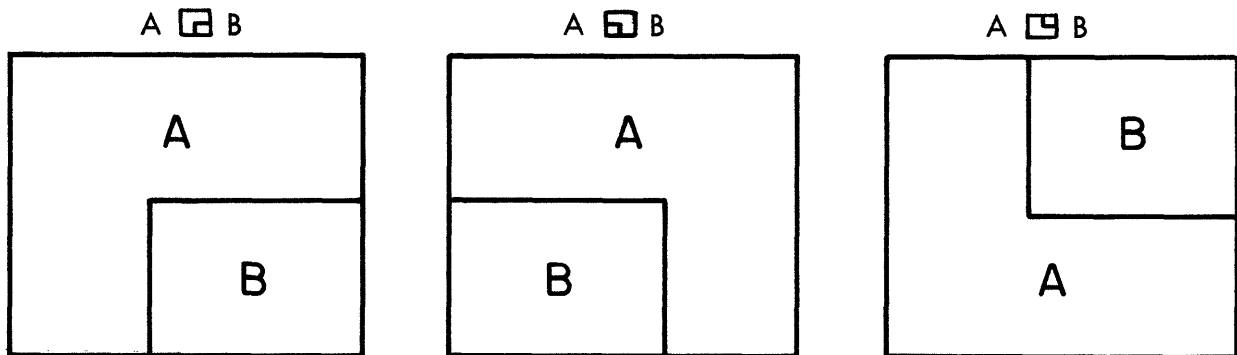
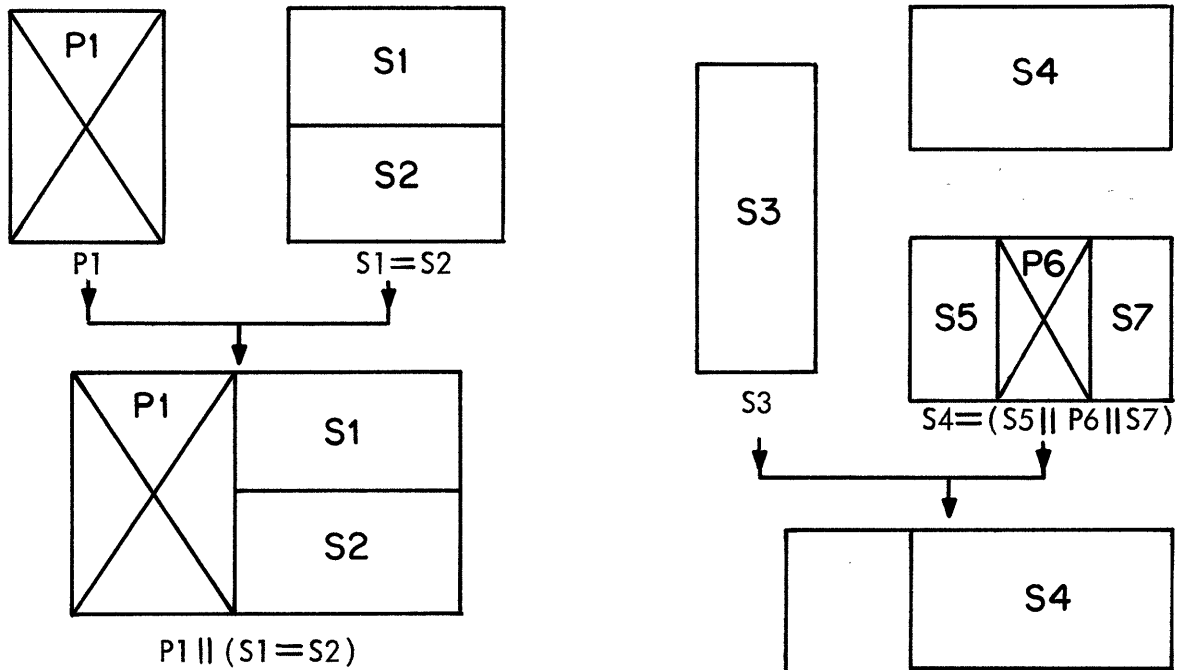


Fig. 6.3 Embedded operators

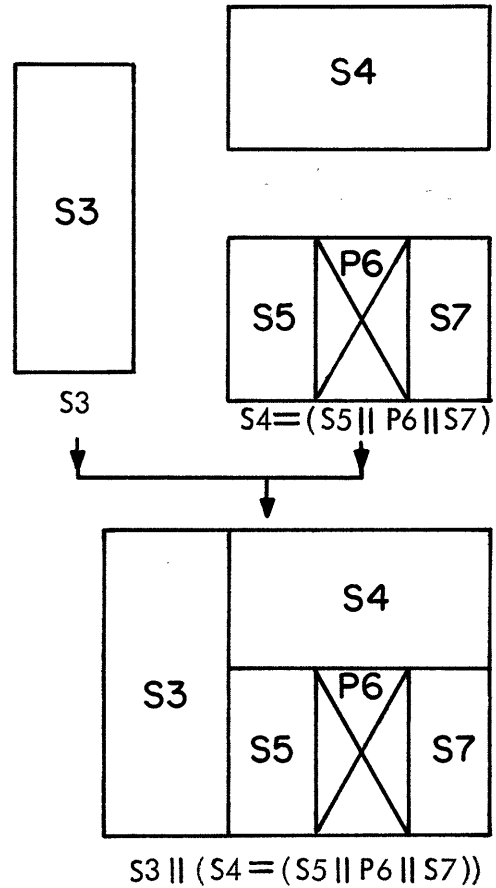
be combined to describe templates with more than two news and picture items with the help of parentheses to indicate the precedence of the operators. Thus,  $P1 \parallel (S1 = S2)$  means that story  $S1$  is directly above story  $S2$  and the combination is adjacent to picture  $P1$ . Figure 6.4 illustrates how a complete page template such as that in Fig. 6.1 can be defined by combining expressions representing page sectors. Figure 6.4c is the full page structure. The upper part of the page template is shown in Fig. 6.4a and is defined by the expression  $P1 \parallel (S1 = S2)$ . The lower portion is shown in Fig. 6.4b and is defined by  $S3 \parallel (S4 = (S5 \parallel P6 \parallel S7))$ . Through combination of these expressions, the symbolic representation of the complete page structure is:

$$(P1 \parallel (S1 = S2)) = (S3 \parallel (S4 = (S5 \parallel P6 \parallel S7)))$$

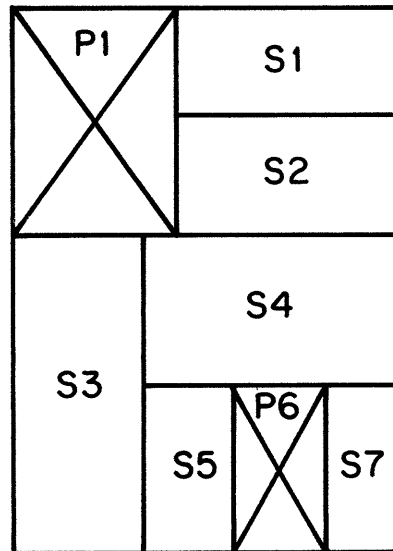
The kinds of templates that can be described with the five basic and embedded relational operators are limited because, in order to be able to apply these operators, adjacent news items must have the same dimension along their line of contiguity. Hence, it is not possible to represent some commonly



(a) Symbolic expression  
for  $P1, S1, S2$



(b) Symbolic expression for  
 $S3, S4, S5, P6, S7$



$$(P1 \parallel (S1 = S2)) = (S3 \parallel (S4 = (S5 \parallel P6 \parallel S7)))$$

(c) Full-page structure

Fig. 6.4 Formation of a template description

encountered news structures such as the one depicted in Fig. 6.5 where two news items A and B are of different heights. Therefore, the family of operators must be expanded to accommodate this case. This leads us to the concept of extended operators.

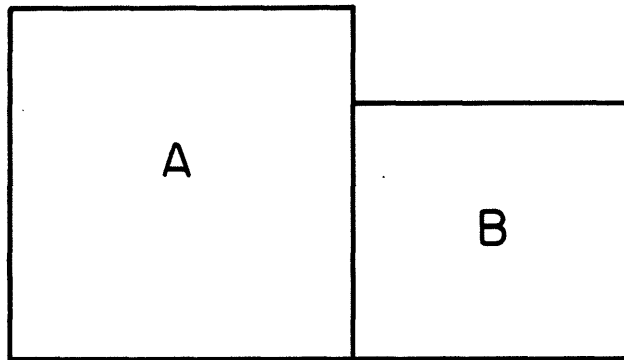


Fig. 6.5 News items with different heights

Extended operators. A set of extended operators is used to describe the layout structure of two news items with different dimensions along their line of contiguity. We define eight possible extended operators as follows:

- |  |   |
|--|---|
| $\uparrow $ and $\downarrow $                | These have the same meaning as the basic horizontal-construction operator $  $ except that the left item is longer than the right item at their common edge. The arrow indicates the direction in which the left item is elongated. See Fig. 6.6a.                  |
| $  \uparrow$ and $  \downarrow$              | These have the same meaning as the two operators above except that the right item is longer than the left item, as shown in Fig. 6.6b.  |
| $\overrightarrow{=}$ and $\overleftarrow{=}$ | These operators have the same meaning as the basic vertical-construction operator $=$ except that the top item is wider than the bottom item at their common edge. The arrow indicates the direction in which the top item is widened, as illustrated in Fig. 6.6c. |
| $\overrightarrow{=}$ and $\overleftarrow{=}$ | These have the same meaning as the preceding two operators except that the bottom item is wider than the top item, as shown in Fig. 6.6d.   |

With the availability of these eight extended operators, we can now describe symbolically a wide range of commonly used layouts. For example, the

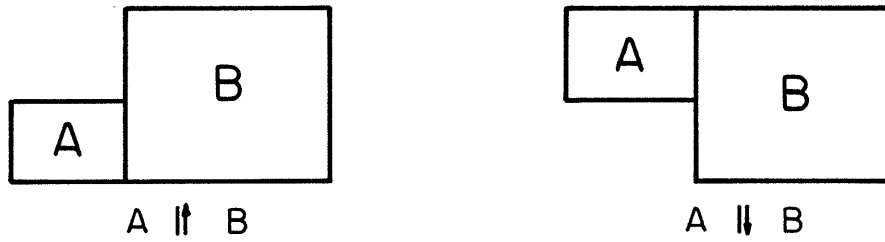
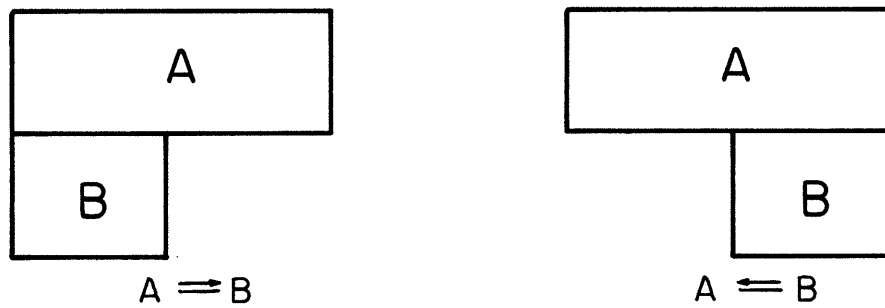
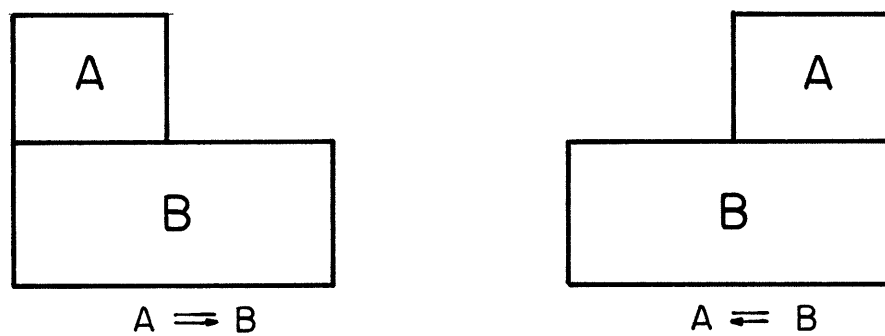
(a) Illustrations of  $\parallel$  and  $\Downarrow$ (b) Illustrations of  $\Uparrow$  and  $\Downarrow$ (c) Illustrations of  $\Rightarrow$  and  $\Leftarrow$ (d) Illustrations of  $\Rightarrow$  and  $\Leftarrow$ 

Fig. 6.6 The extended set of operators

templates in Figs. 6.7a and 6.7b can be expressed as  $A = (B \uparrow C)$  and  $(A \overleftarrow{B}) \parallel C$ .

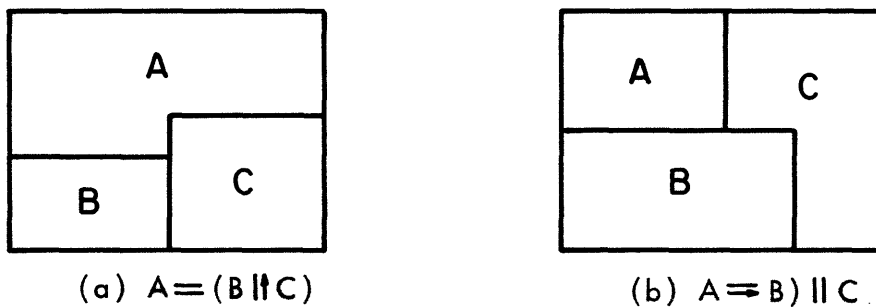


Fig. 6.7 Applications of the extended set of operators

Figure 6.8 shows the step-by-step derivation of the expression for the full-page template in the example. Figure 6.9 shows four additional examples of layout templates together with their corresponding symbolic representations. These examples indicate that the set of thirteen relational operators are capable of describing a wide spectrum of complicated layout template structures, and are relatively simple to use.

Relational-operator types. The thirteen relational operators may also be classified by the types of constructions the operators represent. The three types of construction are: vertical construction where one news item is on top of another, horizontal construction where one item is next to another, and embedded construction where one item is embedded into the other.

According to these classifications, operators  $\overline{=}$ ,  $\overline{=}$ ,  $\overleftarrow{=}$ ,  $\overline{=}$ ,  $\overleftarrow{=}$ , are classified as vertical-construction operators. Operators  $\parallel$ ,  $\uparrow$ ,  $\downarrow$ ,  $\uparrow$ ,  $\downarrow$ , are classified as horizontal operators, and

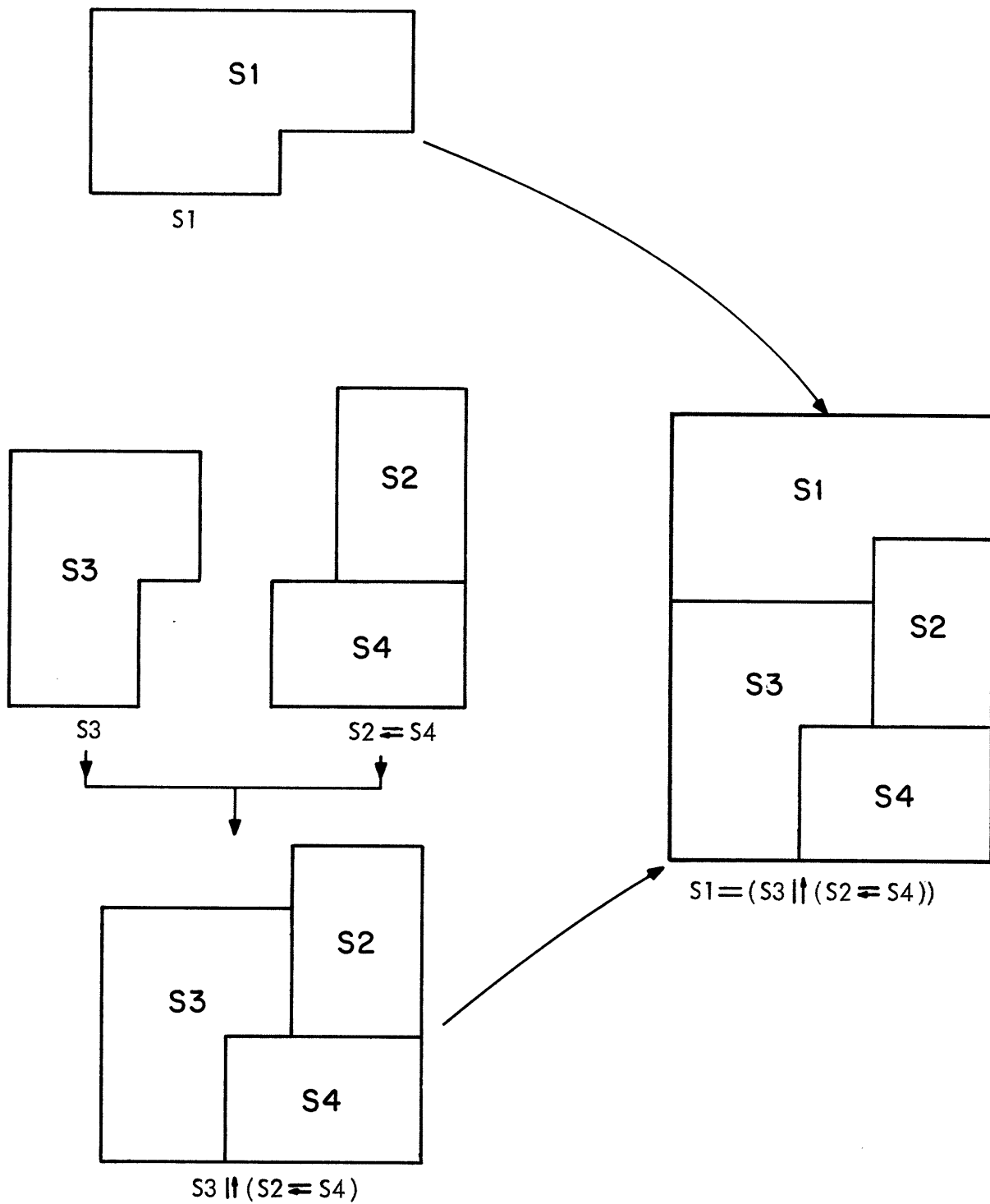
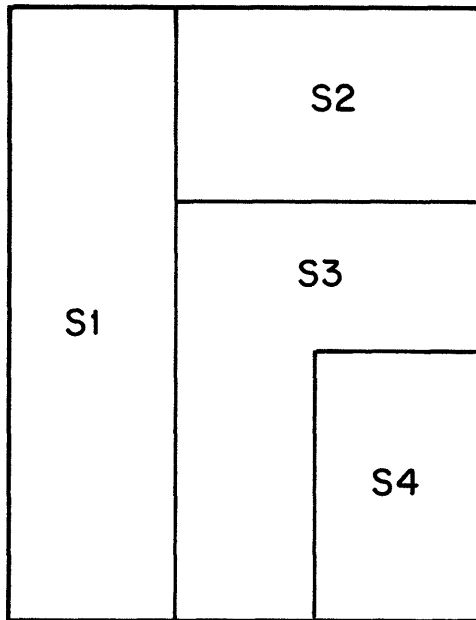
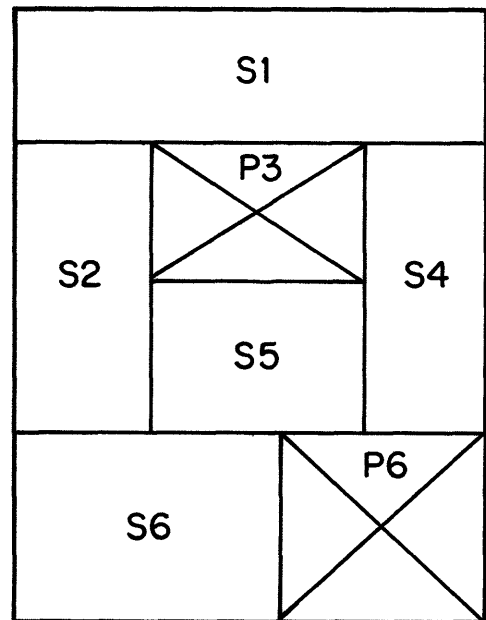


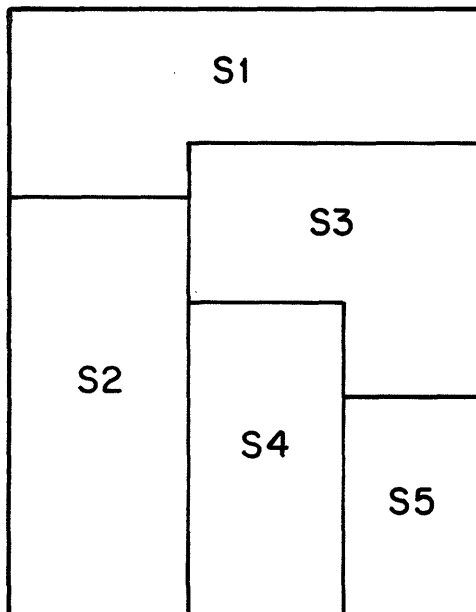
Fig. 6.8 Formation of a full-page template description using extended operators



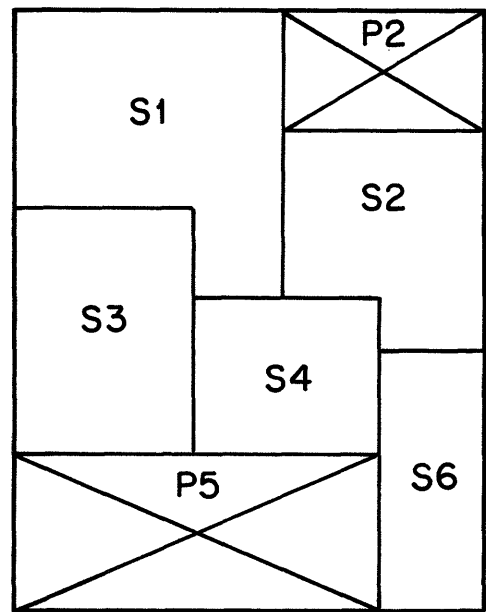
$$S1 \parallel (S2 = (S3 \sqcap S4))$$



$$S1 = (S2 \parallel (P3 = S5)) \parallel S4 = (S6 \parallel P6)$$




$$S1 = (S2 \uparrow (S3 = (S4 \uparrow S5)))$$



$$(S1 \parallel (P2 = S2)) = (((S3 \uparrow S4) = P5) \parallel S6)$$

Fig. 6.9 Examples of templates and their symbolic descriptions

 , are embedded-construction operators.\*

In a template expression containing the same type of operators, it is not necessary to use parentheses to indicate the precedence of constructions. That is, template expression  $A \text{---} (B \text{---} C)$  and  $(A \text{---} B) \text{---} C$  have the same interpretation and can be expressed without the parentheses.

However, for template expressions with operators of different types, parentheses are required to indicate the desired precedence. For example, template expression  $A || B = C$  is ambiguous, and has to be expressed explicitly as either  $(A || B) = C$  or  $A || (B = C)$ .

6.2.3 Syntax of news graphic language. In this section we discuss the formal syntax of the news graphic language.

In general, an artificial language\*\* is a subset of the set of all possible strings that may be constructed by concatenating symbols from the specified language alphabet. Hence, a language does not necessarily include all possible strings formed from its alphabet. Elements belonging to the subset of strings are called "sentences" or "legal strings" of the language.

In the case of the news graphic language, all the symbolic template descriptions presented in the previous section are presented as "legal" templates, although we have not rigorously defined the language syntax. We have illustrated the generation of the template descriptions primarily through examples and informal explanations of the language syntax. This informal approach is adequate if we are concerned only with the generative aspect of the symbolic representation for a desired layout template. However, the purpose of developing the news language is not only to express the layout structure of news items symbolically but also to use the symbolic template expression as a structural guide in the placement of stories and pictures on pages. Therefore, a formal syntax specification of the news-graphic-language syntax is necessary in order to enable the layout process to recognize the validity of a given symbolic-template representation and then to interpret it properly. With a

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\* It may help the reader to recall these definitions by remembering that the two horizontal bars are stacked vertically. Hence, horizontal bars represent vertical construction. Similarly, the two vertical bars are horizontally displaced from one another. Hence, the vertical bars represent horizontal construction.

\*\* An artificial language is a language which is designed according to certain user-specified rules for communicating ideas or expressing notions.

formal syntax specification established, one can then parse the template description into a proper syntactical equivalent form suitable for interpretation later in the layout process. In the paragraphs that follow the Backus Normal Form (BNF) is employed as a grammatical tool to specify the language syntax; an introduction to such notation is included in Appendix A.

Relational operators. We begin the discussion of our language syntax with the simplest language construct, the relational operators. In our case, there are thirteen relational operators; their syntax, as well as semantics, has been defined previously in section 6.2.2.

In terms of BNF, the grammar for the language construct "relational operator" can be expressed by the following production rule:

$$\langle \text{Relational operator} \rangle ::= = | \Rightarrow | \Leftarrow | \Rightarrow | \Leftarrow | || | \uparrow\uparrow | \downarrow\downarrow | \uparrow | \downarrow$$

$$| \boxed{\square} | \boxed{\square} | \boxed{\square} \quad (\text{Rule 1})$$

News items. Thus far, news items (stories or pictures) have been represented by user-designated, arbitrarily distinctive symbols. In order to allow the symbolic-template description to convey more information about the layout templates, restrictions on the symbols representing news items have to be imposed. Besides representing the desired layout structure, a symbolic description must be able to distinguish stories from pictures, and furthermore, to identify story-picture associations. The template description should also indicate the relative importance ranking of various news items on the template. Therefore, news items are constrained to two-part symbols. The first part of the news-item symbol is either S, denoting a story item, or P, denoting a picture item. The second part is a positive integer denoting the relative importance ranking of the news item. The importance of items is assigned when creating the template and the smaller the number, the more important the news item. Furthermore, a story and its associated picture are coupled by assigning the same number to a story and its associated picture.

As an example, the symbolic representation of the template shown in Fig. 6.4c.  $(P1 || (S1 = S2) ) = (S3 || (S4 = (S5 || P6 || S7) ) )$  not only describes the layout structure but also indicates that:

- a. News items S1, S2, S3, S4, S5, and S7 are story items, and S1 is the most important story item, S2 next important, and so forth.
- b. News items P1 and P6 are picture items, P1 is associated with story item S1, and P6 is a stand-alone picture less important than P1.

In BNF notation, the syntax of the language construct "news item" can be expressed by the following production rules:

$\langle \text{news item} \rangle ::= S \langle \text{number} \rangle \mid P \langle \text{number} \rangle$  (Rule 2)

$\langle \text{number} \rangle ::= \langle \text{digit} \rangle \mid \langle \text{digit} \rangle \langle \text{number} \rangle$  (Rule 3)

$\langle \text{digit} \rangle ::= 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9$  (Rule 4)

Note that Rule 3 can be recursive thus enabling users to generate numbers consisting of more than one digit. For example, news item S16 can be generated by the application of Rule 2 first, then the recursive option of Rule 3, followed by the nonrecursive option of Rule 3, and finally Rule 4. The syntax tree\* for the language construct S16 is shown in Fig. 6.10. The Rule at the upper-right corner of each node indicates the production rule being applied.

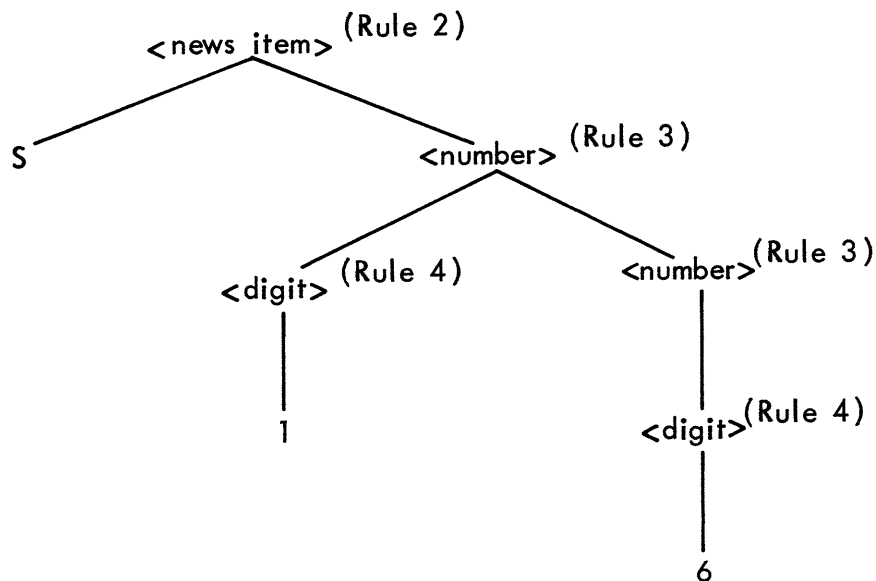


Fig. 6.10 Syntax tree for news-item construct S16

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\* Syntax tree is a tree diagram that describes the structure of a language construct. The tree shows how the construct can be generated from the production rules. At each application of production rules, the left-hand side of the rule is designated as a root node in a subtree (or tree) and the different elements in the right-hand side are designated as its subnodes. If a string can be derived by constructing a syntax tree according to the specified language grammar, the string is considered to be a legal string of the language.

The definition of news items can be extended further to include symbolic-template expressions enclosed by a pair of parentheses. For example, the partial page template shown in Fig. 6.4a is expressed by  $P1 \parallel (S1 = S2)$  which means that picture item  $P1$  is along side another news element, namely  $(S1 = S2)$ . Here, news elements  $S1$  and  $S2$  are treated as a single, combined news item which serves as the second operand of the horizontal operator. The symbolic expression within the parentheses, which describes a subtemplate structure, is called a news expression. Therefore, production Rule 2 for the news-item construct is extended as follows:

$$\langle \text{news item} \rangle ::= S \langle \text{number} \rangle \mid P \langle \text{number} \rangle \mid \langle \text{news expression} \rangle$$

The news-expression construct is formally defined in the following subsection.

News expressions. A news expression is a sequence of news items and relational operators in the following form:

$$\left( \begin{array}{c} \text{news} \\ \text{item} \end{array} \right) \left( \begin{array}{c} \text{relational} \\ \text{operator} \end{array} \right) \left( \begin{array}{c} \text{news} \\ \text{item} \end{array} \right) \left( \begin{array}{c} \text{relational} \\ \text{operator} \end{array} \right) \left( \begin{array}{c} \text{news} \\ \text{item} \end{array} \right) \dots \left( \begin{array}{c} \text{news} \\ \text{item} \end{array} \right)$$

where all the relational operators are required to be the same type (as defined in the preceding section) and all news items in the expression must be distinctive. In accordance with the above definition,  $S1 \parallel S2$ ,  $S1 = P1 = S2$  and  $S1 \parallel S2 \uparrow S3$  are examples of news expressions; while  $S1 \parallel S1$  and  $S1 \parallel S2 = S3$  are not because the former has two identical news items and the latter contains operators of different types.

Again, the syntax for news expressions can be defined in BNF notation as follows:

$$\left\langle \begin{array}{c} \text{news} \\ \text{expression} \end{array} \right\rangle ::= \left\langle \begin{array}{c} \text{news} \\ \text{item} \end{array} \right\rangle \left\langle \begin{array}{c} \text{relational} \\ \text{operator} \end{array} \right\rangle \left\langle \begin{array}{c} \text{news} \\ \text{item} \end{array} \right\rangle \mid \left\langle \begin{array}{c} \text{news} \\ \text{item} \end{array} \right\rangle \left\langle \begin{array}{c} \text{relational} \\ \text{operator} \end{array} \right\rangle \left\langle \begin{array}{c} \text{news} \\ \text{expression} \end{array} \right\rangle \quad (\text{Rule 5})$$

As an example of news-expression generation using Rules 1 through 5, consider Fig. 6.11. It depicts a complete syntax tree for the news expression  $S1 = S2$  with the relevant production rule shown in parentheses at each node. Note that production rules 2 and 5 for the news-item and news-expression constructs are recursive. A news expression enclosed by a pair of parentheses can also be regarded as a compound news item by production Rule 2 and used to construct another, more complex, news expression. For example,  $S1 = S2$  is a news expression by definition; the addition of parenthesis

on both sides of it forms a compound news item ( $S1 = S2$ ), which can be used as the second operand of another operator to form the news expression  $P1 || (S1 = S2)$ .

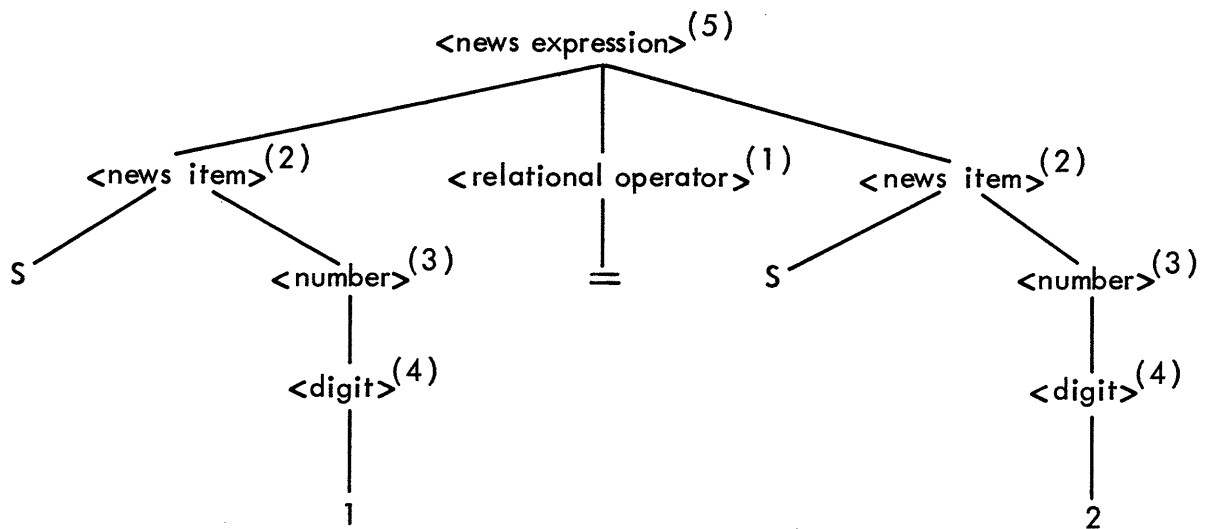


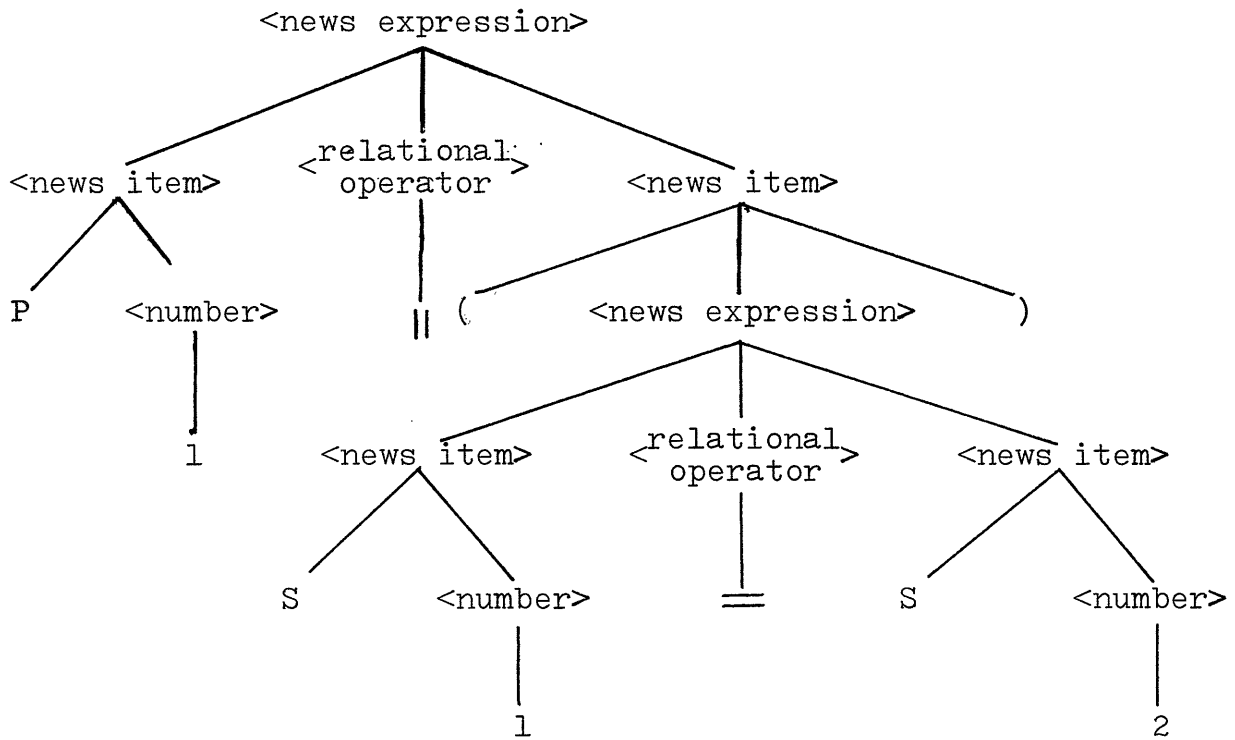
Fig. 6.11 Syntax tree for news expression  $S1 = S2$

Figure 6.12a depicts a complete syntax tree for the above expression which proves that  $P1 || (S1 = S2)$  is indeed a legal news expression. An equivalent compact version of the syntax tree is shown in Fig. 6.12b; here, all the intermediate-language constructs (enclosed by brackets) have been eliminated. Since the compact syntax tree is much simpler in form but still preserves the syntax structure, only the compact tree is used to illustrate language-construct generation in later discussions.

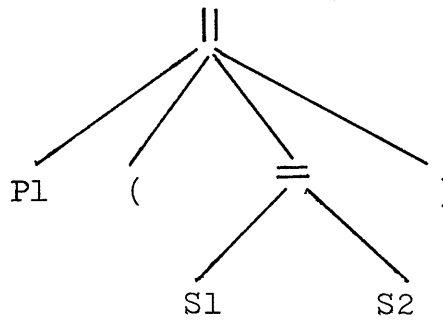
As an example of more complicated news-expression generation, consider Fig. 6.13a which depicts the compact syntax tree for the layout-template expression for Fig. 6.4b. Through construction of syntax trees for basic expressions, it is obvious that the precedence of different type operators in an expression is implied in the tree structure; a higher tree level implies a lower precedence.\* Therefore, the parentheses indicating the desired operator

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\* The tree level is defined by stipulating that the root has level 1 and other subnodes have a level that is one higher than that of their ancestors.

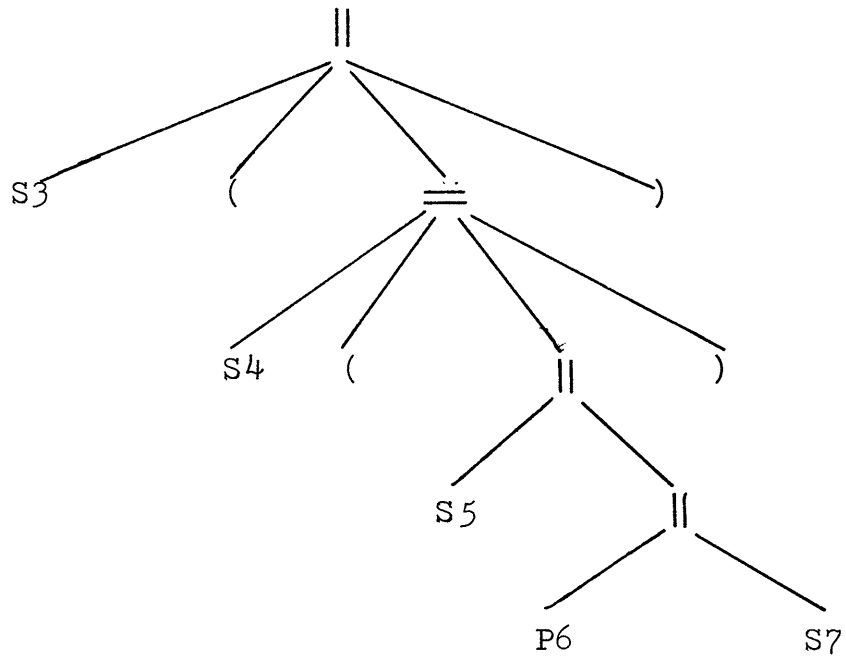


(a) Complete syntax tree

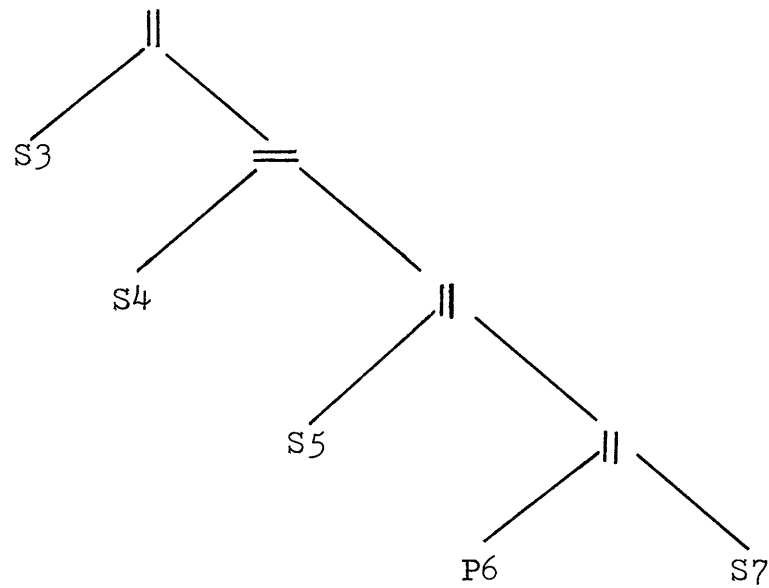


(b) Compact syntax tree

Fig. 6.12 Syntax tree for news expression  $P1 \parallel (S1 = S2)$



(a) Compact syntax tree



(b) Equivalent syntax tree

Fig. 6.13 Syntax tree for news expression  $S3 \parallel (S4 = (S5 \parallel P6 \parallel S7))$

precedence can be eliminated from the syntax trees without losing any syntax information. Figure 6.13b shows an equivalent syntax tree without the parentheses. The simplified syntax tree in Fig. 6.13b contains essentially all the syntax (structure) information included in the operational expression.

Layout templates and complete language specification. We can now formally define the syntax of symbolic layout representations and establish the legitimacy of news layout templates. By the syntax definition, a layout template is a news expression as defined in the preceding section. Thus, layout templates can be defined by the following BNF production rule:

<layout template> : : = <news expression> (Rule 6)

Therefore, the expressions  $P1 \parallel (S1 = S2)$  and  $S3 \parallel (S4 = (S5 \parallel P6 \parallel S7))$  in the preceding section can also be considered as templates by themselves.

The combined expression

$$(P1 \parallel (S1 = S2) ) = (S3 \parallel (S4 = (S5 \parallel P6 \parallel S7) ) )$$

which describes the layout structure depicted in Fig. 6.4c, is also a news expression by the syntax definitions and thus is regarded as a layout template.

A complete simplified syntax tree for the above expression is drawn in Fig. 6.14. Success achieved in constructing such a syntax tree according to the specified production rules further proves that the expression is indeed a legitimate layout-template representation. Additional examples are given in Fig. 6.15, which shows the corresponding syntax trees for each of the four layout templates of Fig. 6.9. The constructed syntax trees not only prove the validity of template descriptions but also are used later in the layout process as structural guides for the actual placement of stories and pictures assigned to the pages.

Table 6.1 summarizes the formal syntactical specifications of the news graphic language, including a collection of all the BNF production rules introduced in this section.

6.2.4 Application to pages with display ads. So far we have restricted the application of layout templates to pages that contain only news stories and pictures. Since the proposed symbolic description of a page template serves only as guidance for story and picture placement in the layout process, it is conceivable that the same templates can be used for positioning stories on pages containing display ads. Of course, the layout process must be modified slightly for this application in order to avoid overlaps between stories and ads.

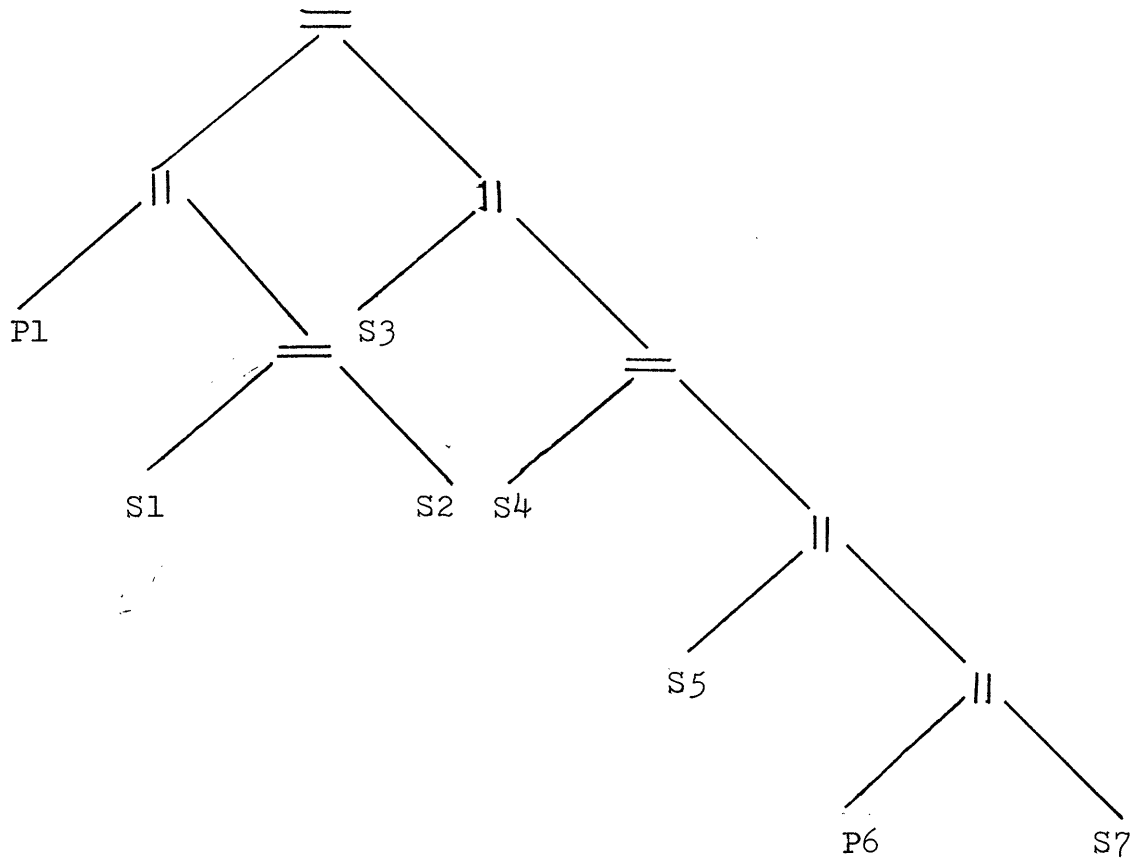
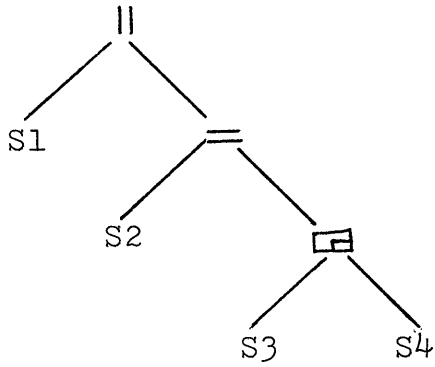
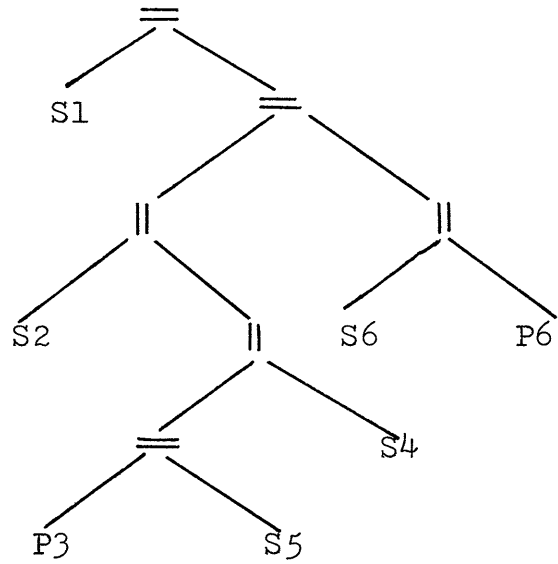


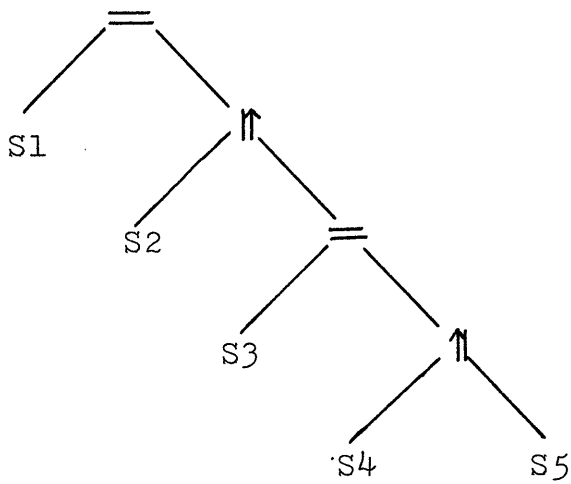
Fig. 6.14 Syntax tree for layout template in Fig. 6.4c



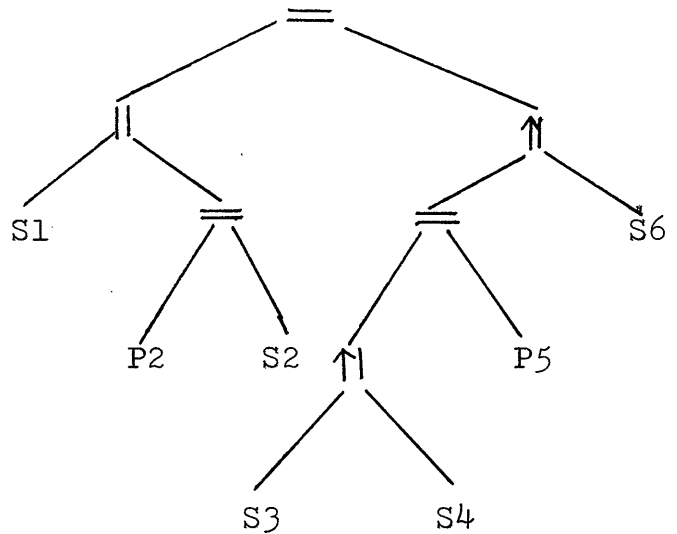
(a)  $S1 || (S2 = (S3 \square S4))$



(b)  $S1 = (S2 || (P3 = S5)) || S4 = (S6 || P6)$



(c)  $S1 = (S2 \uparrow\uparrow (S3 = (S4 \uparrow S5)))$



(d)  $(S1 || (P2 = S2)) = (((S3 || S4) = P5) \uparrow\uparrow S6)$

Fig. 6.15 Syntax trees for layout templates in Fig. 6.9

Table 6.1. Formal Syntax Specifications of News Graphic Language

## Language Alphabet

S, P, (, ), 0, 1, 2, 3, 4, 5, 6, 7, 8, 9,

=, ⇒, ⇐, ⇨, ⇩, ⇪, ||, ↑↑, ↓↓, ||, ||, □, □, □

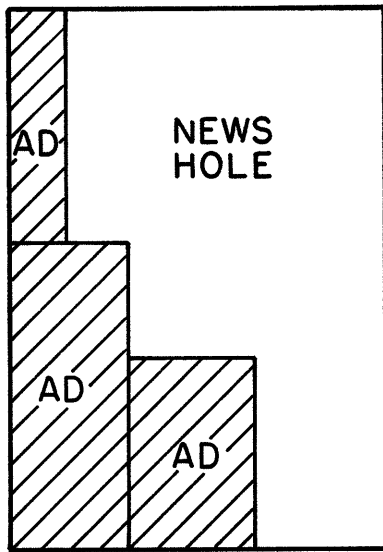
## Production Rules

< Layout Template >	::=	< News Expression >
< News Expression >	::=	$\left( \begin{array}{c} \text{News} \\ \text{Item} \end{array} \right) \left( \begin{array}{c} \text{Relational} \\ \text{Operator} \end{array} \right) \left( \begin{array}{c} \text{News} \\ \text{Item} \end{array} \right) \mid$ $\left( \begin{array}{c} \text{News} \\ \text{Item} \end{array} \right) \left( \begin{array}{c} \text{Relational} \\ \text{Operator} \end{array} \right) \left( \begin{array}{c} \text{News} \\ \text{Expression} \end{array} \right)$
< News Item >	::=	$S \langle \text{Number} \rangle \mid P \langle \text{Number} \rangle \mid \left( \begin{array}{c} \text{News} \\ \text{Expression} \end{array} \right)$
< Number >	::=	$\langle \text{Digit} \rangle \mid \langle \text{Digit} \rangle \langle \text{Number} \rangle$
< Digit >	::=	0   1   2   3   4   5   6   7   8   9
< Relational Operator >	::=	$= \mid \Rightarrow \mid \Leftarrow \mid \Rightarrow \mid \Leftarrow \mid    \mid \uparrow\uparrow \mid \downarrow\downarrow \mid \uparrow\downarrow \mid \downarrow\uparrow \mid$ $\square \mid \square \mid \square$

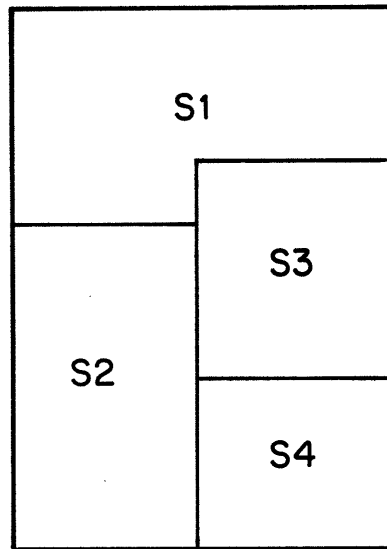
As an illustration, an ads dummy and a four-story page template are drawn in Fig. 6.16a and b, respectively, and a possible layout result following the template pattern is shown in Fig. 6.16c. The layout results are duplicated in Fig. 6.16d where the heavy-lined boxes show that the layout dummy indeed conforms to the template, assuming the story areas are extended into the ads areas. Note that a symbolic layout template specifies the desired structure of the news items on the page and the relative positions of the items to be placed rather than their precise shapes or areas. Therefore, the news layout in Fig. 6.16c can still be represented by the template in Fig. 6.16b, although stories S1, S2, and S4 no longer occupy rectangular areas.

Figure 6.17 shows two additional examples of how the news layout of pages with various news-hole shapes can be described by means of a single full-page template. Figure 6.17a illustrates two page layouts (of different ads dummies) with news-layout structures that are represented by the same expression, and Fig. 6.17b shows the same two pages, the news layouts of which are described by means of a different template.

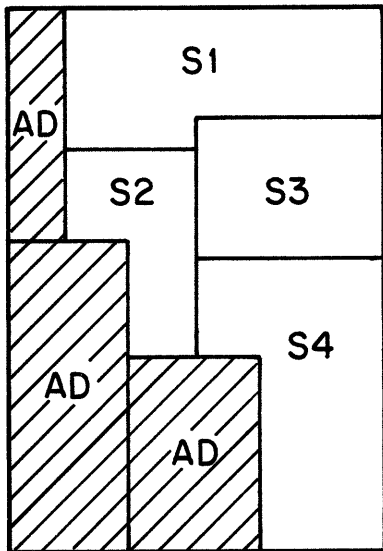
Although it is possible to use templates in laying out pages with display



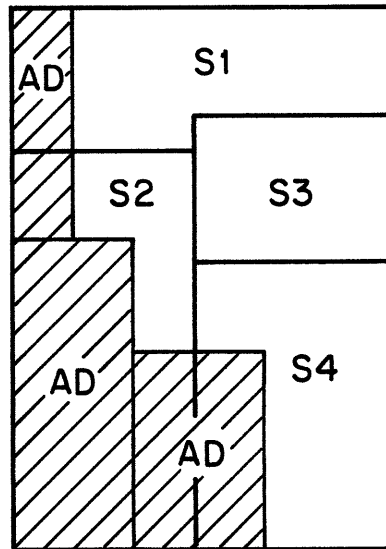
(a) Ads dummy



(b) Four-story template  
 $S1 = (S2 \parallel (S3 = S4))$



(c) A possible layout



(d) Result of using b directly

Fig. 6.16 News layout with display ads

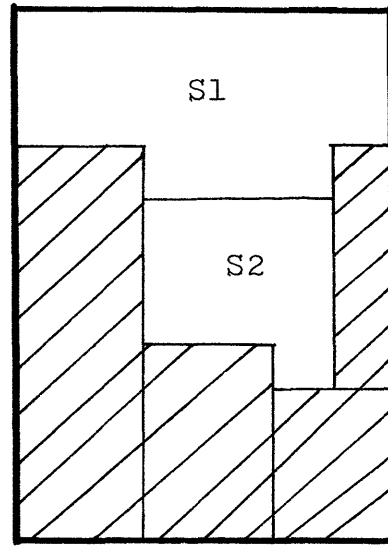
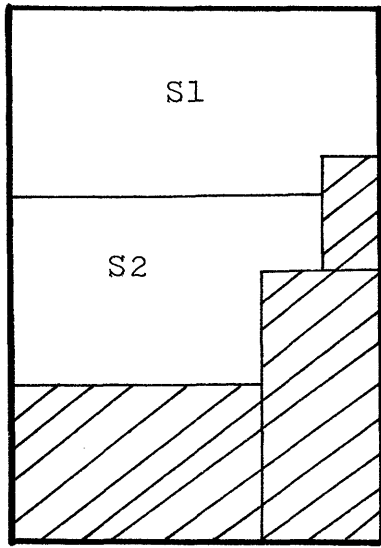
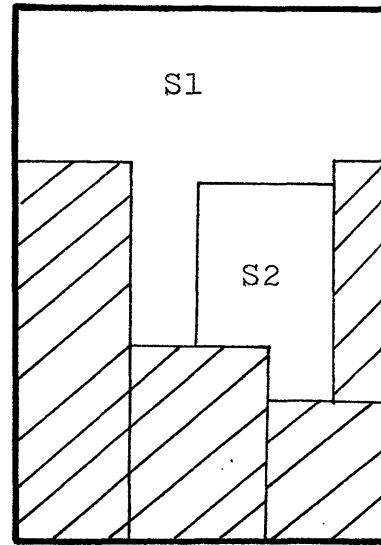
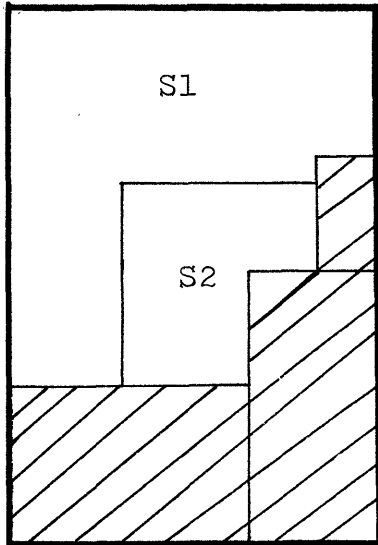
(a) News layout structure  $S1 = S2$ (b) News layout structure  $S1 < S2$ 

Fig. 6.17 Examples of page layouts with display ads

ads, special care has to be taken in the design of templates for this application. For example, a template intended for pages with ads laid out in left-pyramid style should concentrate news items on the right side. Layout-template design and organization are discussed further in Chapter 10.

## CHAPTER 7

### TEMPLATE-DRIVEN PAGE-LAYOUT TECHNIQUES

Presented in this chapter are the basic techniques needed to place assigned stories and pictures on pages through use of a layout template as a structural guide. The techniques include parsing, development of a page-layout algorithm, and a virtual-page concept. Before stories and pictures can be placed on a page, the symbolic template must be parsed into a syntax-tree representation; an algorithm for doing this is required. Our page-layout algorithm is based on the concept of traversing the layout syntax tree in a prescribed order. A virtual-page concept of layout which treats part of a page as a full news page is employed to allow the algorithm to work recursively.

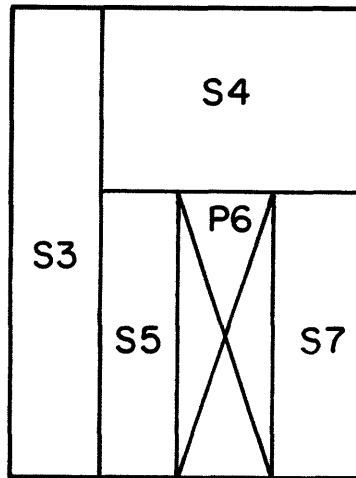
Initially we describe an algorithm for laying out full news pages with only basic and embedded operators in the symbolic template. Later, in Chapter 8, we refine the algorithm to permit inclusion of the extended set of operators and its application to pages containing display ads.

#### 7.1 Parsing

Parsing of our artificial language serves two purposes: First, it determines the validity of the symbolic-template expression; and second, it produces a syntax tree which can be used visually to understand the syntactical-structure relationships among the language constructs of the template expression.

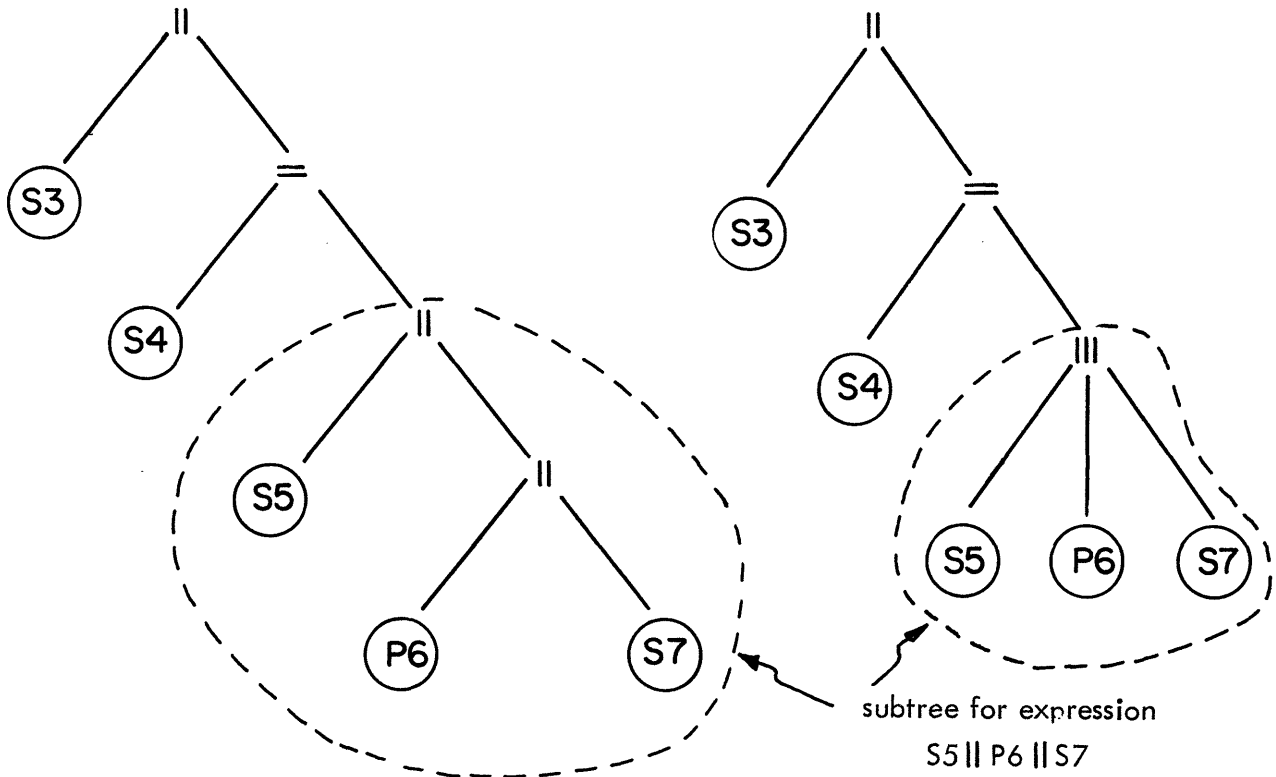
The parsing process involves construction of an equivalent syntax tree for a layout template in accordance with a prescribed parsing algorithm. If a syntax tree cannot be constructed within the rules, the template is considered to be an illegal expression. Otherwise, a syntax tree is generated and used as the basis for layout interpretation.

7.1.1 Concise syntax trees. For simplicity and compactness it is desirable to design syntax-tree structures that portray templates as concisely as possible. Figures 7.1a and b show an example of a layout-template structure and its corresponding syntax tree. The top-most node of the syntax tree is called the root node of the tree. All the leaf nodes such as S3, S4, S5, P6, and S7, are called terminal nodes and the intermediate nodes are



$$S3 \parallel (S4 = (S5 \parallel P6 \parallel S7))$$

(a) Layout template



(b) Syntax tree

(c) Simplified syntax tree

Fig. 7.1 Example of syntax-tree representations

designated nonterminal nodes. Since nonterminal nodes in the syntax tree of layout templates are always relational operators, they are also called operator nodes.

Subnodes of a nonterminal node are nodes on the ends of branches which extend from the nonterminal node. Subtrees, as well as terminal nodes, can be subnodes. As an example, terminal node S<sub>4</sub> in Fig. 7.1b is the first (leftmost) subnode of the vertical operator node at level 2, and the subtree circled by the dashed lines is its second subnode. A nonterminal node is called a parent node with respect to its subnodes. Subnodes connected to a nonterminal node through one or more branches are called descendants of the node. Therefore, the parent node of S<sub>5</sub> in Fig. 7.1b is the horizontal operator node at level 3, and nodes S<sub>5</sub>, P<sub>6</sub>, and S<sub>7</sub> are the terminal descendants of the parent node.

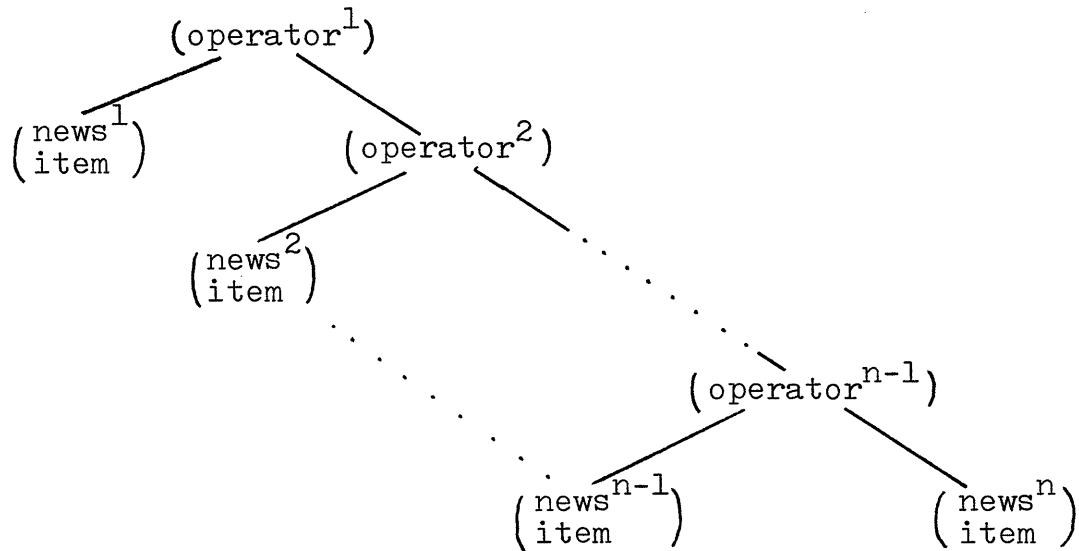
A news expression with a single operator of the form shown in Fig. 7.2a can be represented by the syntax tree shown in Fig. 7.2b, where the root node is the operator in the expression and the subnodes are the news item operands. Similarly, a multiple-operator news expression, such as that illustrated in Fig. 7.3a, can be represented by the syntax tree shown in Fig. 7.3b. However, since all the operators in a multiple-operator news



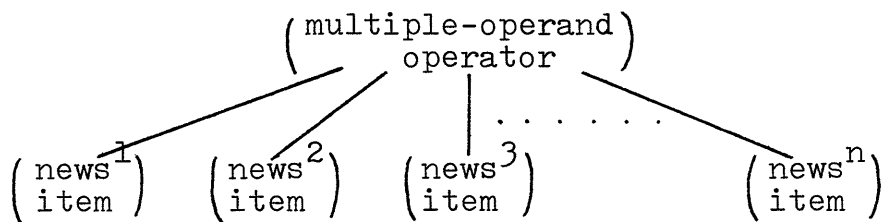
Fig. 7.2. Single-operator news expression and its syntax-tree representation

$$\left(\begin{array}{c} \text{news}^1 \\ \text{item} \end{array}\right) \left(\text{operator}^1\right) \left(\begin{array}{c} \text{news}^2 \\ \text{item} \end{array}\right) \left(\text{operator}^2\right) \dots \dots \left(\begin{array}{c} \text{news}^n \\ \text{item} \end{array}\right)$$

(a) News expression



(b) Syntax-tree representation



(c) Simplified syntax-tree representation

Fig. 7.3 Multiple-operator news expression and its syntax-tree representations

expression are required to be of the same type, the syntax-tree representation can be simplified further. Figure 7.3c depicts the simplified syntax tree in which the only operator, denoted as a multiple-operand operator, represents all the operators appearing in the original expression.

The simplified syntax-tree representation requires the introduction of additional operator symbols when there are more than two operands. For horizontal-construction-type operators, multiple vertical lines (see Fig. 7.4a) are used as a multiple-operand operator symbol. The number of lines indicates the number of operands in the news expression. Similarly, multiple horizontal lines, Fig. 7.4b, are used to represent vertical-construction-type operators in the simplified syntax tree. For the extended horizontal or vertical operators, lines with arrows are used in the same way as in the notation for two-operand operators.

As examples, the syntax trees of news expressions  $S1 \parallel S2 \parallel S3$ , and  $S1 = S2 \Rightarrow S3 \Rightarrow S4$  are depicted in Fig. 7.4. In Fig. 7.4b, the arrow on the third horizontal line means that story  $S3$ , the third operand, is

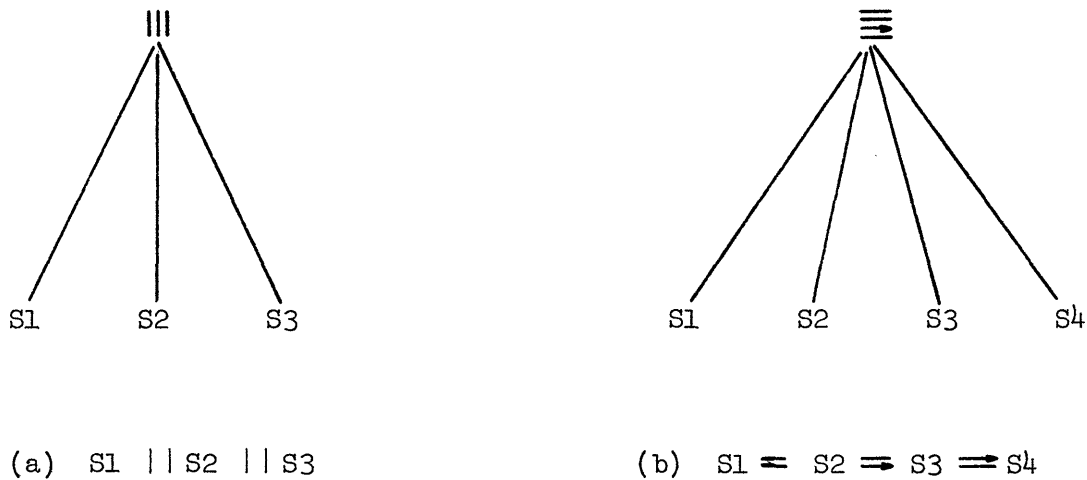


Fig. 7.4. Examples of simplified syntax trees

extended outward at the right-hand side with respect to its two adjacent neighbors S2 and S4. Through use of the above notation for multiple-operand operators, the syntax tree in Fig. 7.1 can be simplified; the result is shown in Fig. 7.1c.

It is important to note that an operator node and its operator subnode(s) must be of different types when the syntax tree is in its most reduced form; otherwise the syntax tree can be simplified further, as was done in Fig. 7.3. Figure 7.1c is an example of a syntax tree in its most simplified form. It is this two-dimensional representation that is used later in the layout interpretation stage.

7.1.2 Basic news expression. Basic news expressions are those news expressions whose operands are all simple news items. In other words, the operands in a basic news expression do not include parenthesized news expressions. Thus, expression  $S5 || P6 || S7$  is an example of a basic news expression, whereas expression  $S4 = (S5 || P6 || S7)$  is not because one of its operands is a parenthesized news expression.

The syntax tree of a basic news expression is a tree whose root node is the multiple-operand operator and the subnodes are the operands. In the next subsection a layout-template parsing algorithm is presented in which an attempt is made first to find a leftmost basic news expression in the template expression and then to construct a corresponding syntax tree for it. The constructed syntax tree becomes a building block for the complete syntax-tree construction.

7.1.3 Parsing algorithm. Before a symbolic-layout-template expression is parsed, two symbols  $\dashv$  and  $\vdash$ , indicating the beginning and end of the template, respectively, are used to surround the expression. To parse a layout template, the algorithm first searches the template expression for the leftmost basic news expression whose operands are all simple news items. This is achieved by starting at the beginning symbol and reading the template expression from left to right until a right parenthesis or an end symbol is encountered. Then, starting from that point we read the template expression backward until a left parenthesis or a begin symbol is encountered. The expression within the pair of parentheses, or within the begin and end symbols, is the desired leftmost basic news expression.

A syntax tree representing the encountered basic news expression can be constructed with the multiple-operand operator in the basic news expression as the root node and the operands as the subnodes. If the syntax tree of

the basic news expression cannot be constructed either because the operators in the basic expression are of different types or because a mistaken syntax for news-item symbols is found, the parsing process stops and it is concluded that the given template is an illegal syntax expression.

After the syntax tree for the basic news expression is constructed successfully, the tree is designated by its first subnode and the template expression is reduced by substituting this designation for the basic news expression and its enclosing parentheses. After the replacement of a complicated news expression by a simple news-item symbol, a new basic news expression may exist in the reduced template expression. Therefore, the process of searching for a basic news expression is repeated -- a corresponding syntax tree for the new basic expression is constructed, and the process continues iteratively. The construction of a syntax tree for a layout template is completed when the template expression is reduced to a single news item. In the second iteration and thereafter, some of the subnodes in the syntax tree might be news items whose syntax trees have already been constructed previously. These subnodes are replaced by the corresponding existing syntax trees to form the complete syntax tree.

As an example, Fig. 7.5 shows step-by-step how a complete syntax tree can be constructed from a layout-template expression through use of the parsing algorithm just presented. Step 1 is the complete symbolic expression of the template structure shown in Fig. 7.1, and the corresponding syntax tree to be generated from the parsing process is shown in Fig. 7.1c. In Step 1 begin and end symbols are added to the template expression and an arrow is used to indicate the starting point of the expression being read. By reading the template expression from left to right, we encounter the first right-closure parenthesis to the right of S7, as indicated by an arrow in Step 2. Reading backward (right to left) from the arrow locates the corresponding left parenthesis. Hence, the expression enclosed by this pair of parentheses is the leftmost basic news expression bounded by the two arrows in Step 3.

Next, a syntax tree is constructed for this basic news expression, and the tree is named after its first subnode S5. After the basic news expression and its parentheses are replaced in the template by S5, we obtain the intermediate parsing results shown in Step 4. The arrow in Step 4 indicates where the reading process should resume. Now, the process of searching for a basic news expression is repeated. Step 5 shows that another pair of parentheses is found which enclose a new basic news expression, and Step 6

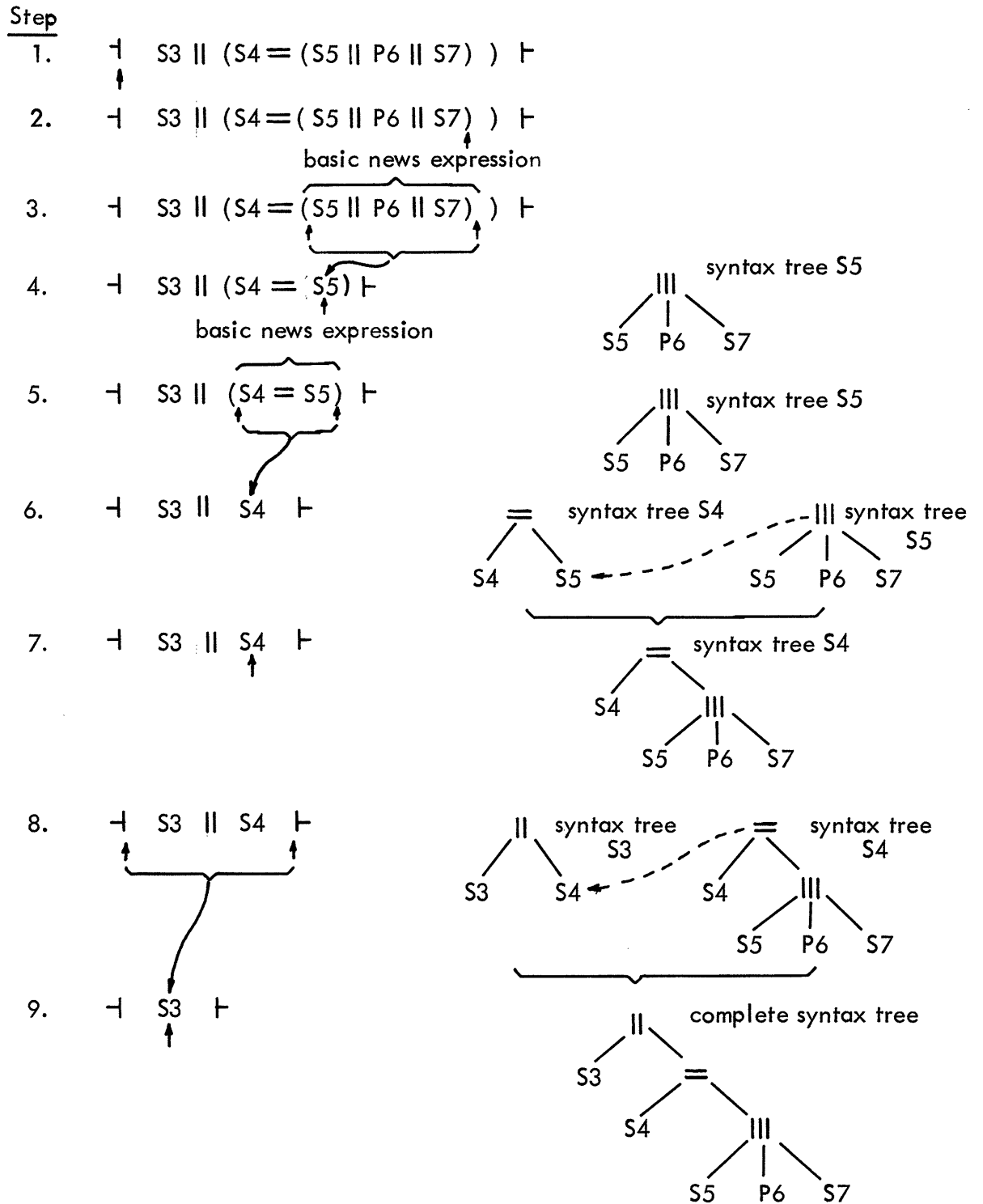


Fig. 7.5 Parsing of a layout-template expression

illustrates the reduced template expression after  $S^4$  is substituted for the second basic news expression. The constructed syntax trees  $S^4$  and  $S^5$  are also drawn. These two syntax trees are combined by substituting the syntax tree  $S^5$  for the subnode  $S^5$  in syntax tree  $S^4$ . That is, the syntax tree  $S^5$  becomes a subtree of the syntax tree  $S^4$ . The combined syntax tree  $S^4$ , together with the new reduced template expression, is shown in Step 7.

In the next iteration, the reduced template expression in Step 6 is first read forward and then backward, and a new basic news expression enclosed by the begin and end symbols is detected. Following the same procedure, we construct a syntax tree  $S^3$ , as shown in Step 8, and then merge it with the previously constructed syntax tree  $S^4$ . Step 9 depicts the resulting tree and the reduced template expression. The syntax-tree construction is now complete because the reduced template expression contains only one news item. The success of the syntax-tree construction verifies the validity of the original template expression.

We now turn to the basic techniques which underlie use of the layout syntax tree as a structural guide for the placement of stories and pictures on a page.

## 7.2 Basic Techniques of Page-Layout

This section presents the basic page-layout techniques that have been developed to position the stories and pictures assigned to a page through use of the syntax tree representation as a layout structure guide. The layout process, if successful, produces a page dummy showing the outlines of every story and picture location on the page. Moreover, the structure of the news-item locations conforms to that described by the layout template.

In order to simplify the presentation, we first restrict our attention to the layout of pages with no display-ads and to templates with no extended operators.

7.2.1 Traversing the layout syntax tree. The page-layout algorithm developed for actual story and picture placement is based on the principle of traversing or "walking through" the layout syntax tree. In this procedure, the nodes of the syntax tree are examined systematically, starting with the root node, so that each node is visited exactly once. During the visit to each node, certain layout actions are taken; the visit is complete when all required layout actions for that node have been performed. Hence, the visit to a tree node is also referred to as the layout of that node.

During the visit to an operator node, all subnodes of that node are visited in a prescribed order. Thus, the layout-traversing algorithm is recursive, and the visiting process can be described by indicating the sequence in which the subnodes of a particular operator node are traversed.

Unlike most tree-traversing schemes in which the order of subnodes to be visited is determined by their relative positions in the tree (such as left-precedence or right-precedence methods), our layout-traversing sequence of subnodes in the layout-syntax tree depends on the types of the parent operator node and its subnodes.

For a vertical-construction-type operator node, an operator-type subnode has higher precedence than a terminal-type subnode. On the other hand, operator subnodes of a horizontal-construction-type operator node have lower precedence than the terminal subnodes. Among subnodes of the same type, the left subnode takes precedence over the right subnode. The primary concern here is to assign higher traversing precedence to subnodes which involve more difficulty in achieving a satisfactory layout. A more detailed reasoning of the traversing sequence is discussed later.

As an example of how a syntax tree is traversed, consider Fig. 7.6, which illustrates the syntax tree of the layout template  $((P1 = S2) || S1) = S3$

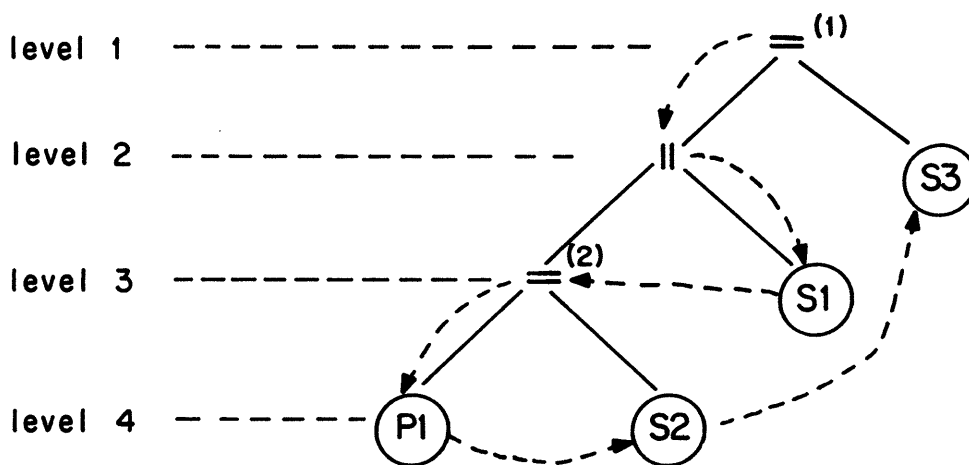


Fig. 7.6 Traversing a layout-syntax tree

In the figure, terminal nodes are circled in order to distinguish them from the operator nodes, and the occurrences of the vertical-construction operator node at two different levels are denoted by the number at the upper-right corner of the operator symbol. As stated previously, the traversing process begins at the root node (1) and proceeds downward. For the two subnodes of the root node, the horizontal-construction-operator node has a higher priority than does the terminal node S3, on the basis of the policy cited above. Therefore, the horizontal-construction-operator node is the second node to be visited. Because of the recursive property of the traversing algorithm, the subnodes at level 3 are traversed next. In accordance with the traversing rule for a horizontal-construction-type operator node, terminal node S1 has precedence over the operator node (2). Therefore, S1 and (2) are the third and fourth nodes to be visited, respectively. During the visit to (2), terminal subnode P1 is traversed before terminal subnode S2 because P1 is a left-terminal node and hence has precedence over right-terminal node S2. Upon completion of traversing all the subnodes of the horizontal operator, only terminal node S3 remains to be visited. The dashed lines in Fig. 7.6 indicate the complete layout-traversing sequence.

Besides a determination of the traversing sequences for the subnodes, additional layout actions are performed during the visit to each operator node. Two items of information are passed to the node from its parent node. They serve as inputs for the layout actions taken during the visit. The information items are:

1. a set of stories and pictures that matches the number as well as the type of the terminal descendents attached to the node, and
2. the width and height of a rectangular news area that matches the total area of the story and picture set specified in 1.

From this node information, similar information is derived for the subnodes and passed to the subnodes when they are visited. Recursively, the information generated for the subnode serves as inputs for its layout actions.

For a root node, results from the story- and picture-assignment process (a news budget for the page) and the dimensions of the full news page being laid out are used as inputs for the layout actions performed at the root node. The basic concepts used in selecting a set of stories and pictures and constructing a news block for each subnode are presented below.

7.2.2 Story and picture selection for subnodes. During the visit to an operator node, the story- and picture-selection process chooses, for each

subnode, a subset of stories and pictures from the given set of operator-node news items. The number and type of stories and pictures selected for a subnode match the number and type of the terminal descendents of the subnode. There are four types of news items, and hence, four terminal-node types, as listed below:

- S type: a story (or a story terminal node) not associated with any picture (or picture node)
- SP type: a story (or a story terminal node) associated with a picture (or picture node)
- P type: an independent picture (or picture terminal node)
- PS type: a picture (or a picture terminal node) associated with a story (or a story node).

Therefore, the stories or pictures selected for a subnode from all news items assigned to the parent node should match the terminal descendents of that subnode. That is, all the news items passed to the parent node are distributed to its subnodes in accordance with the number and type of each subnode's terminal descendents. Often, more than one possible distribution satisfies the number and type requirements. In that case, priority among the different possibilities is determined from a comparison of the relative importance rankings of the terminal descendents with the importance rankings of the selected news items. The distribution possibility that is assigned first is the one that yields the closest match among the importance rankings of news items and terminal descendents.

As an example, consider the syntax tree previously presented in Fig. 7.6. Assume that three stories A, B, and C, and one picture P associated with story A are assigned to a full news page as the result of the story- and picture-assignment process carried out prior to the page-layout operation. This information is passed to the root node (level 1) of the syntax tree and represents the input to the story- and picture-selection process during the visit to the root node. Thus, the root node has two news items of the S type (stories B and C), one SP type (story A tied to picture P), one PS type (picture P tied to story A), and no P type. This story- and-picture combination matches the number of terminal descendents in each type category (S<sub>2</sub>, S<sub>3</sub> of S type, S<sub>1</sub> of SP type, and P<sub>1</sub> of PS type).

During the visit to the root node, the news items selected for the node are distributed to its two subnodes, namely, the horizontal-operator node and terminal node S<sub>3</sub> at level 2. The horizontal-operator subnode has terminal descendents of 1 S type (S<sub>2</sub>), 1 SP type (S<sub>1</sub>), and 1 PS type (P<sub>1</sub>);

while the terminal subnode S3 is an S type. Because the parent node has two S-type news items (B and C) and since either can be selected for the subnode S3, there are two possible distributions:

Selection 1: at horizontal-operator subnode distribute stories A and B, and picture P; at terminal subnode S3 distribute story C.

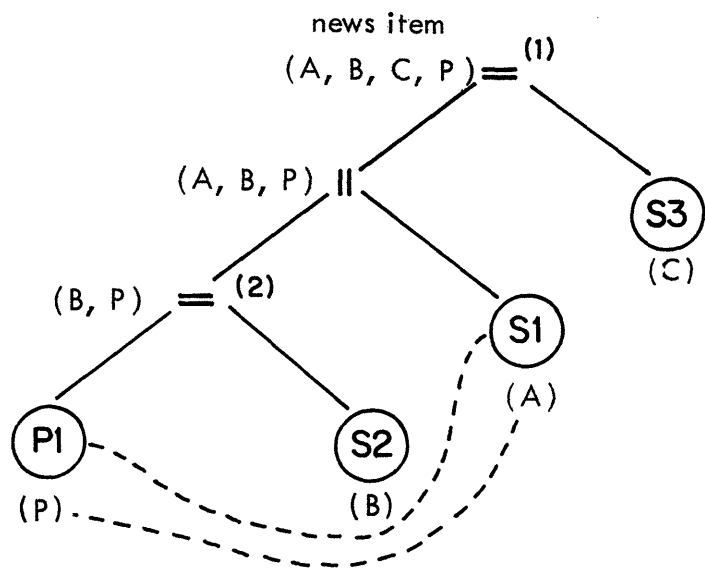
Selection 2: at horizontal-operator subnode distribute stories A and C, and picture P; at terminal subnode S3 distribute story B.

The newsgraphic language defined in Chapter 6 specifies that story nodes be assigned numbers in accordance with their importance. Therefore, should story C carry a lower importance ranking than story B, Selection 1 is assigned a higher priority than Selection 2 because terminal node S3 is less important than S2. If story C has a higher importance ranking than B, Selection 2 is assigned the higher priority.

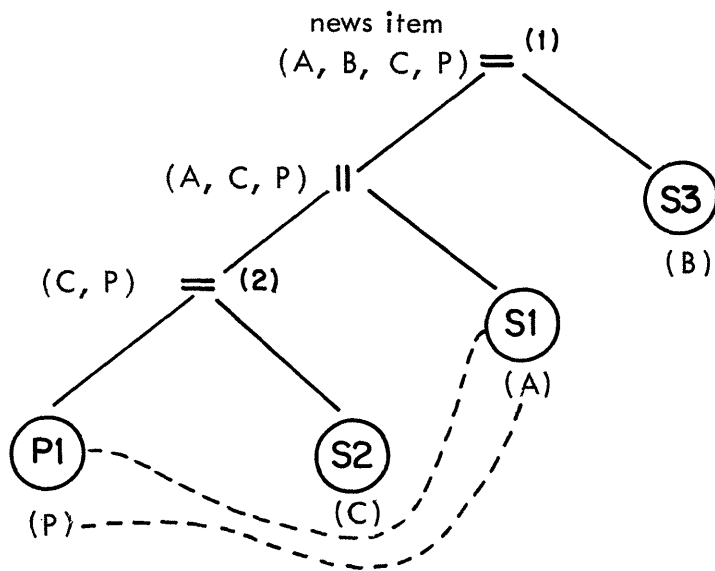
Similarly, at the level 2 horizontal-operator node, the selected news items (A, B, and P) of Selection 1 are distributed to its two subnodes. Story B (S type) and picture P (PS type) go to the level 3 for operator subnode (1 S type, and 1 PS type terminals), and story A (SP type) goes to terminal subnode S1 (1 SP type terminal). Working downward, the distribution algorithm selects story B and picture P for story node S2 and picture node P1, respectively. Note that this selection process ensures that the associated story and picture terminal nodes S1 and P1 are assigned a pair of associated news items, story A and picture P. Figure 7.7 shows the two possible story and picture selections for the syntax tree, where the news items selected for each node are denoted in parentheses, and the association of story and picture is indicated by dashed lines.

7.2.3 Virtual-page construction. Besides story and picture selection, another major layout function performed during the visit to each node is the construction of a rectangular page area for each subnode. The constructed news-block area for each subnode matches the total area of the selected stories and pictures for the subnode. Furthermore, the width and height of the news block are determined by both the news-block dimensions and the operator type of the parent node, as described below.

Since the set of stories and pictures selected for a subnode is a subset of available news items for the parent node, the subnode news-block area is always smaller or equal to the news-block area of the parent node. Therefore, by traversing the syntax tree downward from the root node, the size of the



(a) Selection 1



(b) Selection 2

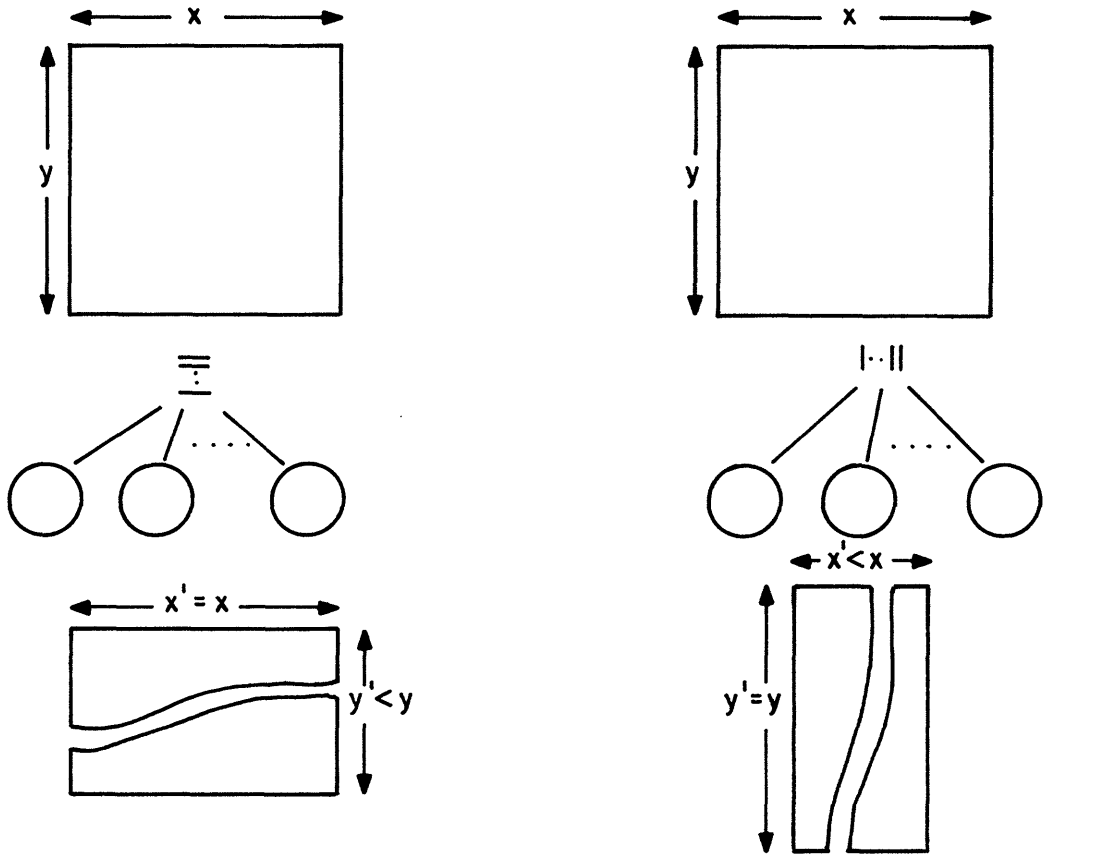
Fig. 7.7 Story and picture selections

news block is reduced from its original full-page size at the root node to successively smaller areas. Conceptually, during the visit to each node other than the root, the reduced news block and the selected news-item set for that node can be thought of as a smaller news page to be laid out; the only differences between conditions at the nodes are the page sizes and the news-item sets. Hereafter, this is called the virtual-page concept of layout, and the reduced news block at each node is referred to as the virtual page of the node.

During the formation of virtual pages at subnodes, the height of a virtual page for a basic vertical-construction-operator is shortened and the width is retained. Similarly, only the width of a virtual page for a basic horizontal-construction-operator node is reduced to form its subnode virtual page. Figures 7.8a and b illustrate these two construction methods where the news blocks at the top represent the parent virtual page, and the blocks at the bottom are the subnode virtual pages. The actual values of the height of subnode virtual page Y' in Fig. 7.8a, and the width of subnode virtual page X' in Fig. 7.8b, are determined by the virtual-page area, which is equal to the total area of the selected news items for the particular subnode. For an embedded-type operator node, the virtual page remains unchanged, as shown in Fig. 7.8c, for the left subnode, and shrinks proportionally in both vertical and horizontal dimensions for the right subnode.

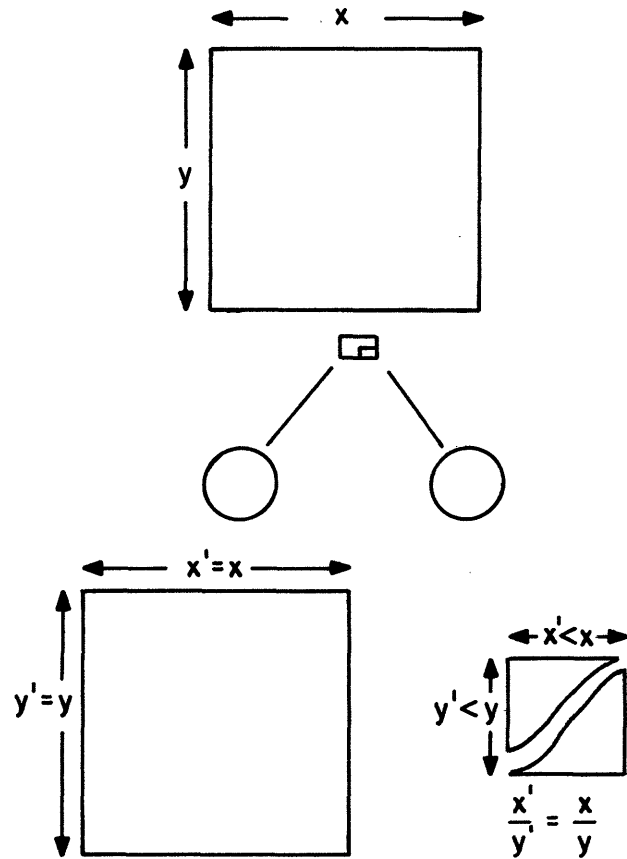
Since all news items selected for a basic operator node are distributed among its subnodes in a prescribed fashion and the virtual-page area of each subnode is determined by the total area of the news items distributed to the subnode, the summation of all the subnode virtual pages should be equal to the virtual-page area of the basic-operator node. Therefore, the construction of subnode virtual pages for a basic-operator node can be interpreted in the following alternate way: By traversing the syntax tree downward from the root node, the given full news page is "cut" into subpages horizontally or vertically. Each subpage is then assigned to a corresponding subnode as its virtual page. As a result, the information distributed from the parent node to its subnodes includes the virtual page as well as the set of news items. Figure 7.9 shows the virtual pages of vertical- and horizontal-operator nodes with three subnodes. The cutting and distribution effects are illustrated by the dashed and solid lines, respectively.

As an illustration of virtual-page layout, consider the story- and picture-assignment results contained in the example used in the preceding



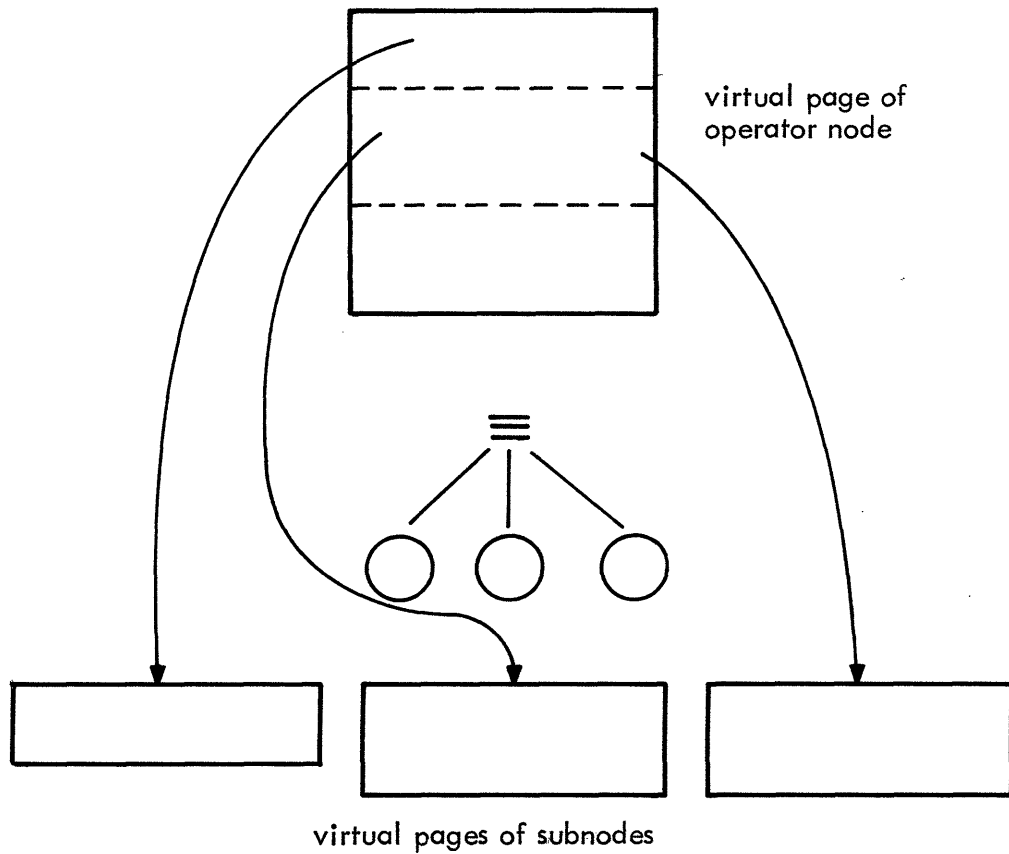
(a) Vertical-construction operator

(b) Horizontal-construction operator

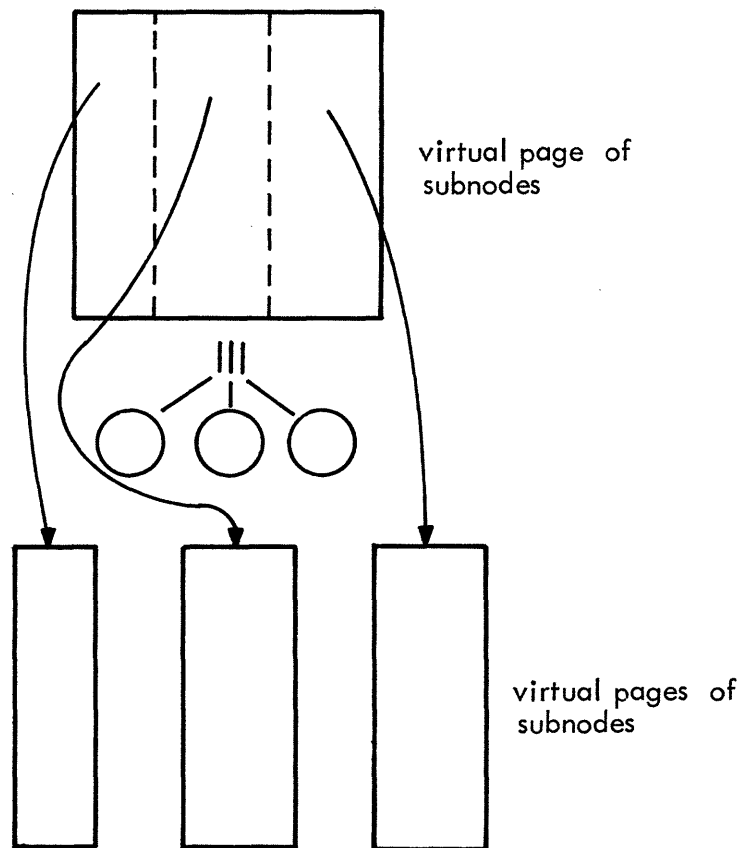


(c) Imbedded operator

Fig. 7.8 Virtual pages of subnodes



(a) Vertical construction



(b) Horizontal construction

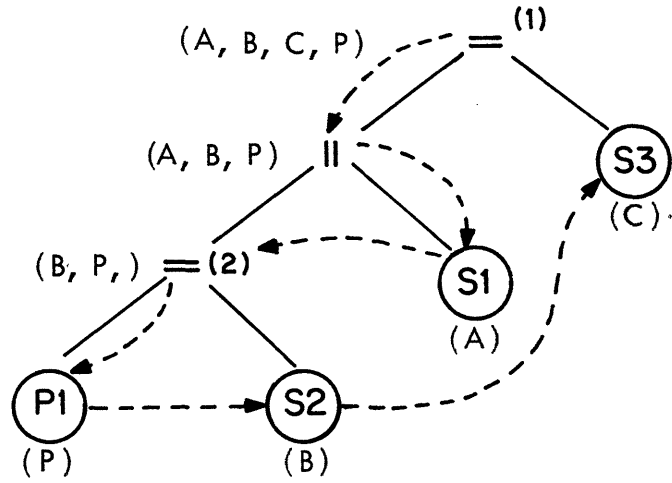
Fig. 7.9 Cutting and distribution of virtual page for basic-operator node

section. Figure 7.10a duplicates Fig. 7.7a, and Fig. 7.10b shows all the virtual pages constructed during the node visits. At the root node the virtual page represents a full news page whose area is the total area of the assigned news and picture items. The page is cut horizontally into two virtual subpages; one is assigned to the horizontal-operator node; the other to terminal node S3. The size of the constructed virtual pages matches that of the news items selected for the subnode. Following the traversing sequence, the virtual page of the horizontal operator node is further cut vertically into two subpages, which are assigned to its two subnodes. No cutting is made during the visit to the next node S1 because it is a terminal node and cannot be reduced further. Finally, at the vertical-operator node on level 3, its virtual page is cut horizontally into two subpages and distributed to its corresponding terminal subnodes P1 and S2. Since the remaining nodes to be traversed, P1, S2, and S3 are all terminal nodes, the construction of virtual pages for the syntax tree is complete.

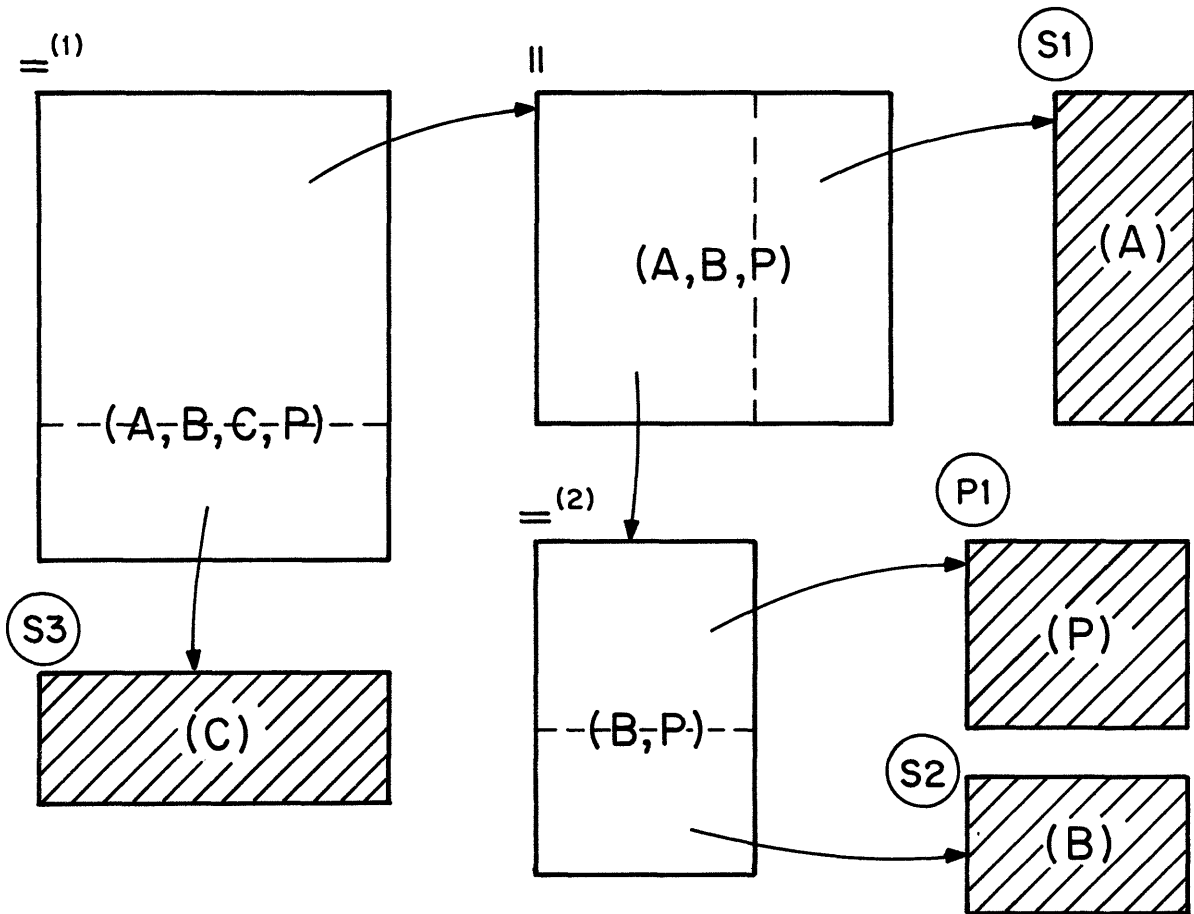
Upon completion of the virtual-page construction, each news item assigned to the news page has a fixed-dimension news block (shown as shaded areas of Fig. 7.10b) representing the virtual page for that terminal node, and the news-block area matches the area of the assigned news item. A page-layout dummy can now be produced by assembling these virtual-page blocks together, as described in the next section.

Thus far, the columnar structure of the newspaper has been ignored. In a real case, the news page is measured in terms of vertical and horizontal units; the places where a virtual page can be cut are therefore restricted. A virtual page must be cut in a way that all its subpages have an integral number of columns in width and tenths of inches in height. For example, if the virtual page of the operator node in Fig. 7.9 is 6 columns wide and 10 inches high, there are only five and 99 possible vertical and horizontal cutting lines, respectively. In other words, an exact match between the area of the virtual subpage and that of the news items assigned to the subnode is very unlikely. However, if the area difference is small, it is assumed that leading can be used to make up the difference.

7.2.4 Virtual-page assembly. In the construction of a virtual page, the news block of a parent node is divided into subblocks in a prescribed way. Each subblock is the virtual page of its corresponding subnode. The assembly process of the virtual pages is just the reverse process. That is, given a set of constructed virtual pages of the subnodes, the virtual page of the



(a) Syntax tree and news item assignment



(b) Virtual pages of nodes

Fig. 7.10 Example of virtual-page construction

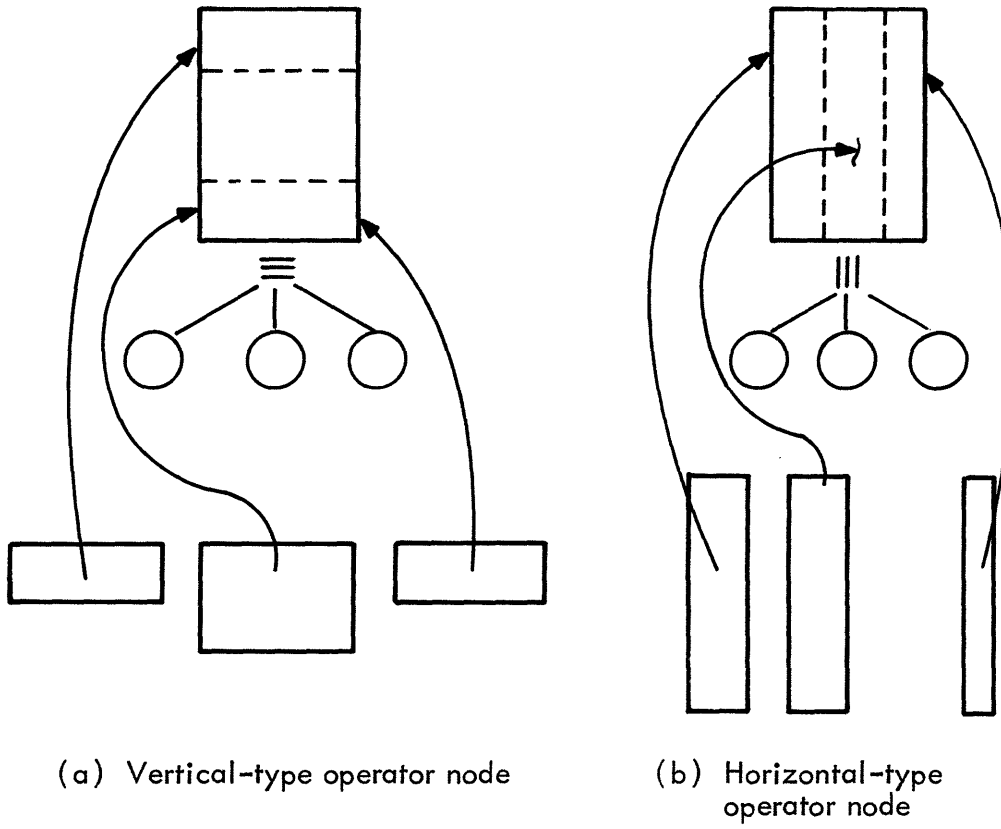
parent node is constructed by assembling the subnode virtual pages.

For a vertical-type operator node, the subnode virtual pages are stacked atop one another to form the assembled virtual page of the node. Similarly, for a horizontal-type operator node, the virtual pages are sided next to each other horizontally. For an embedded-type operator node, the virtual page of the second subnode is embedded into one of the three allowable corners of the virtual page of the first subnode. Figures 7.11a and 7.11b illustrate the assembly process at three subnodes for a vertical and a horizontal operator node, respectively. Figure 7.11c illustrates the assembly of a lower-right-corner embedded-operator node. Note that Figs. 7.11a and 7.11b are essentially the same as Fig. 7.9 except that the arrows which indicate the flow of the virtual-page construction process are reversed.

The assembly process for an operator node starts after all the virtual pages of its terminal descendents are constructed. That is, virtual pages of terminal nodes are used as building blocks in the assembly process. The virtual page constructed for a terminal node is also regarded as the assembled virtual page even though no actual assembly process occurs because of the lack of subnodes for a terminal node. For operator nodes, the assembly process is performed when all its subnodes have an assembled virtual page. In contrast to the top-down virtual-page construction process, the assembly of virtual pages starts at the terminal-node level of the syntax tree and works upward until the root node is reached.

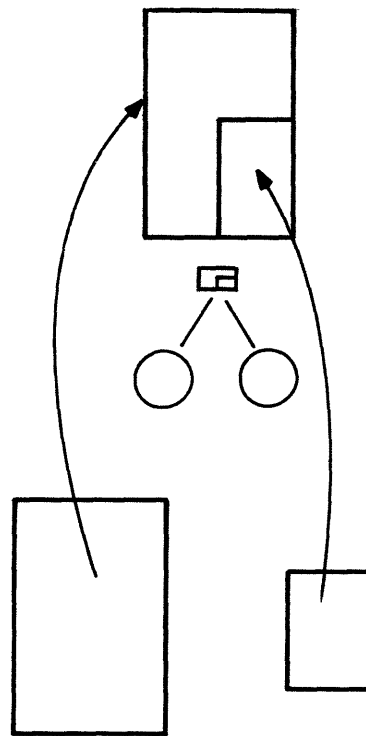
After the virtual page of a node is assembled, the layout actions (or the visit) of the node are completed. When the layout of the root node is completed, the page-layout process for that news page is terminated. Since the assembly as well as the construction of virtual pages is performed according to the type of operator nodes in the syntax tree, the final news structure of the assembled news page at the root node conforms to the structure requirement specified in the layout syntax tree.

As an example, let us consider again the virtual-page construction of Fig. 7.10. The syntax tree is redrawn in Fig. 7.12a and the virtual-page construction of all terminal nodes is shown in Fig. 7.12b. After the virtual pages of terminal nodes S1, P1, and S2 are constructed, the assembly process begins at operator node (2). This is the first operator node encountered in the traversing sequence which has all its subnode virtual pages assembled. Recall that for a terminal node, a constructed



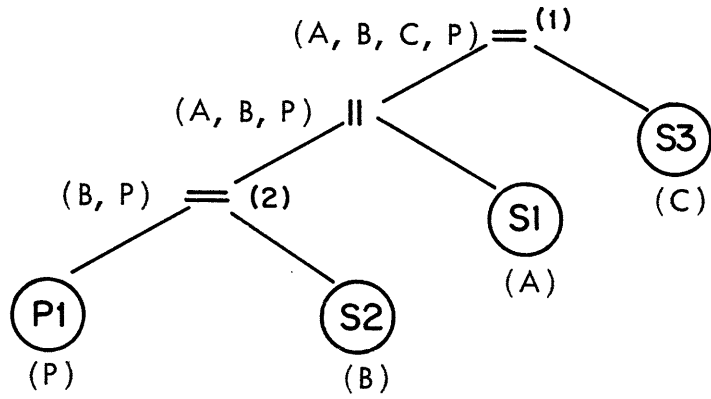
(a) Vertical-type operator node

(b) Horizontal-type operator node

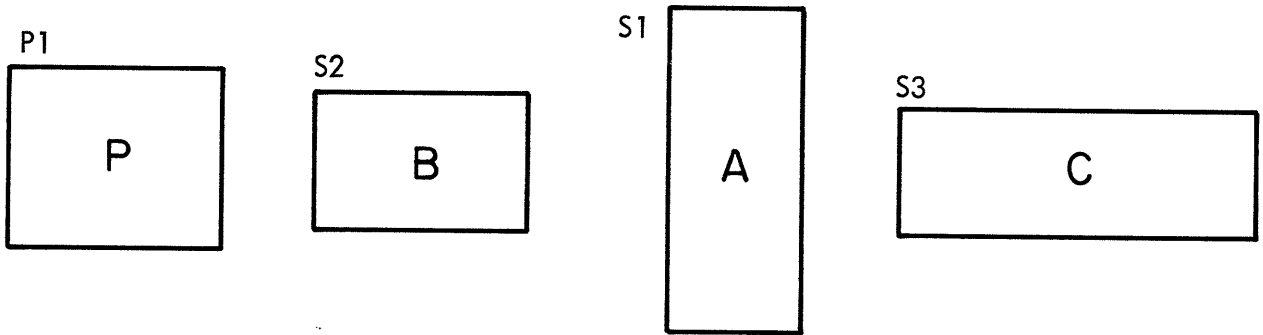


(c) Imbedded operator node

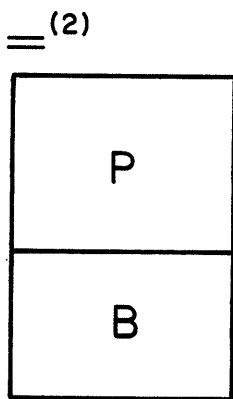
Fig. 7.11 Examples of assembled virtual pages of operator nodes



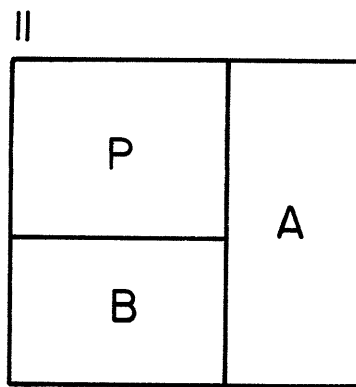
(a) Syntax tree



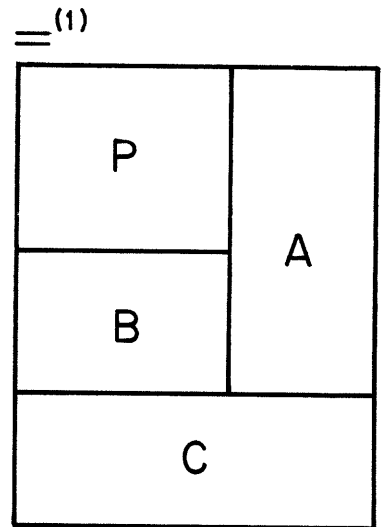
(b) Virtual-page construction for terminal nodes



(c) Assembled virtual page of = (2)



(d) Assembled virtual page of ||



(e) The complete layout

Fig. 7.12 Example of virtual-page assembly

virtual page is also the assembled virtual page. Therefore, as shown in Fig. 7.12c, the virtual page of terminal node P1 (the news block for picture P) is placed on top of the virtual page of S2 (the news block for story B) to form an assembled virtual page for the vertical operator node. Note that as the result of virtual-page construction, the news blocks of picture P and story B must have the same width and thus the assembled virtual page in Fig. 7.12c must also form a rectangular news block.

Then, as shown in Fig. 7.12d, the assembled virtual page of the vertical-operator node is placed next to the assembled virtual page of terminal node S1 (news block A) to form an assembled virtual page for the horizontal operator node. This completes the layout of the horizontal operator node; next, terminal node S3 is visited. Its virtual page is constructed and placed beneath the assembled virtual page of Fig. 7.12d to form an assembled virtual page for the root node. The result is the final page-layout dummy, Fig. 7.12e; this layout structure conforms to that specified by the syntax tree.

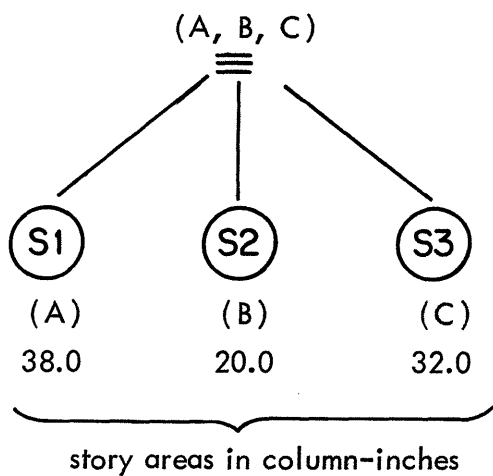
7.2.5 Layout failures. Thus far, we have ignored the possibility of layout failures. In actual situations the layout of a node can fail during any of the following three operations: the construction of virtual pages; the assembly of virtual pages; the layout of its subnodes. Each of these possible layout failures is discussed below.

In the construction of virtual pages for the subnodes, an exact match between the total area of the selected news items and that of the virtual page is unlikely. The reason is that one dimension of the constructed virtual page is required to remain the same as that of its parent virtual page and the other dimension must be an integral number of measurement units (columns or tenths of inches). However, for story terminal nodes, if the area difference is small, the difference can be accommodated through leading. Assume, for example, a horizontal-operator node has a virtual page of 3 columns wide by 10.0 inches high. Now assume a story with an area of 11.0 column-inches is assigned to one of its story-type terminal nodes. Since the terminal node is a subnode of a horizontal operator, the height of the subnode virtual page remains the same as its parent node (10.0 inches). Hence, the subnode virtual page can be constructed only as one column by 10.0 inches (10.0 column-inches) or two columns by 10.0 inches (20.0 column-inches). That is, the story has an area mismatch of one column-inch in the former case, and nine column-inches in the latter. However, if a 10-percent area tolerance is

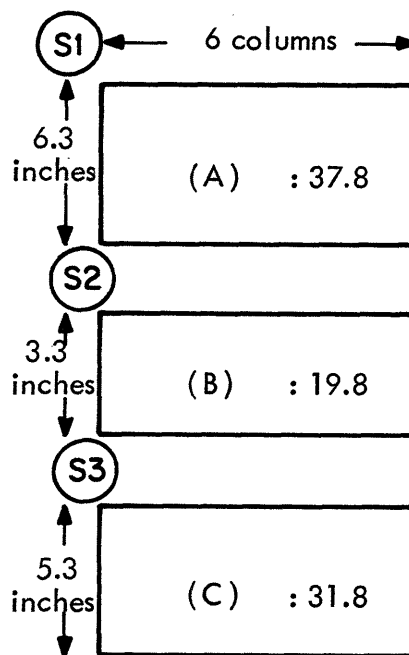
allowed through the use of leading, the virtual page of one column by 10.0 inches is within tolerance, and the virtual page can be constructed successfully.

In the case where the subnode has an immediate picture descendent, the construction of the virtual page is further constrained. In addition to the requirement that one dimension of the virtual page must equal the corresponding dimension of its parent virtual page, the other dimension is also bound since it must be the same as the corresponding dimension of the assigned picture. The horizontal operator node in Fig. 7.10a illustrates this case since one of its subnodes has an immediate picture descendent P1. Therefore, in addition to the equal-height requirement set by the parent operator, the width of the virtual page constructed for this vertical operator subnode must equal the width of the picture P assigned to the node P1. Should the resultant virtual page area not match the total area of picture P and story B after taking the leading tolerance for story B into account, the virtual-page construction for that subnode is considered a failure.

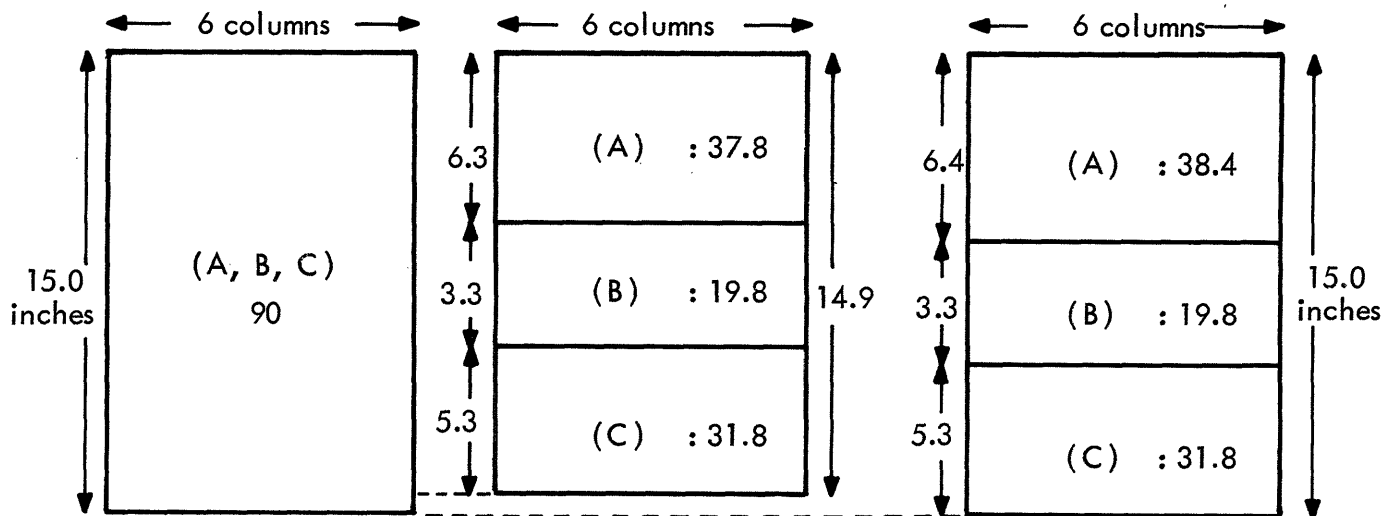
Since the sizes of subnode virtual pages must be adjusted slightly to meet the integer-dimension requirement, page assembly does not always yield an exact match between the assembled page and the previously constructed virtual page of the node. If this happens, an attempt is made to adjust some of the constructed virtual pages to compensate for the difference. For example, Fig. 7.13a depicts a vertical-operator node with three story-type terminal subnodes. Assume that the areas of the three assigned stories A, B, and C are 38, 20, and 32 column-inches, respectively, and policy dictates a 6-column page. Therefore, a virtual page measuring six columns by 15.0 inches or 90.0 column-inches, Fig. 7.13c, is constructed for the operator node in order to match the total area of the three assigned stories. In the layout of the operator node, further assume that stories A, B, and C are assigned to subnodes S1, S2, and S3, respectively. A virtual page for each subnode is constructed according to the size of the assigned story with the height rounded off to the nearest tenth of an inch. As shown in Fig. 7.13b, the dimensions of the virtual page are six columns by 6.3 inches for S1, six columns by 3.3 inches for S2, and six columns by 5.3 inches for S3. The assembly of these three virtual pages results in a news block of six columns by 14.9 inches -- one-tenth inch shorter than the originally constructed virtual page. See Fig. 7.13d. The difference can be eliminated, however, by lengthening the virtual page of subnode S1 one-tenth inch. A new



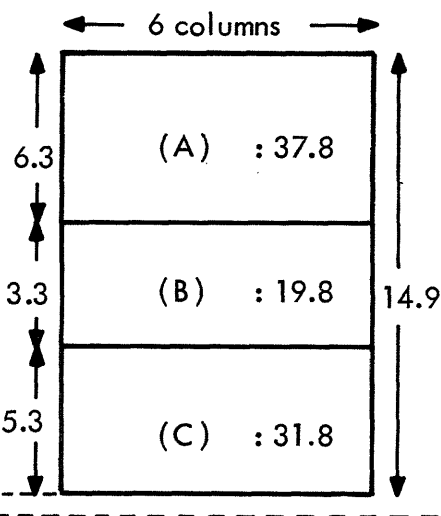
(a) Vertical-operator node



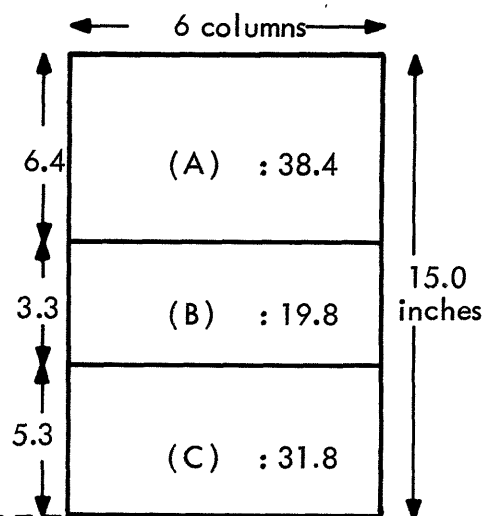
(b) Subnode virtual pages



(c) Constructed virtual page



(d) Assembled virtual page



(e) Final reassembled virtual page

Fig. 7.13 Readjustment of assembled virtual pages

virtual page of six columns wide and 6.4 inches high is thus constructed for S1 which still retains its area within the tenth of an inch leading tolerance of the original area of story A. The new assembled virtual page is drawn in Fig. 7.13e. An exact match between the constructed and new assembled virtual page is thus achieved, and the assembly process for the operator node is accomplished successfully. Should the readjustment of an assembled virtual page create an area difference outside the leading tolerance, the assembly process fails.

The last type of layout failure concerns the layouts of the subnodes. Layout at a node fails if all possible story-and-picture selection combinations for a subnode are tried and fail. However, in order to keep the layout algorithm deterministic, no special rescue attempt is made to retry a failed subnode by reselecting the news items for the subnodes which have been previously laid out successfully.

As an example, in Fig. 7.14, assume that an operator node with three assigned items A, B, and C, has three subnodes S1, S2 and S3. Further assume that the subnodes are traversed from left to right, and subnode S1 is laid out successfully with one of the options, namely, news item A. If subnode S2 fails to be laid out with either of the remaining two possible options (news item B or C), then the layout of the subnode S2 is considered a failure, and so is the layout of its parent operator node. No attempt is made to return to subnode S1 to try other possible assignments, such as news item B or C, because in doing so the layout algorithm may iterate endlessly. In order to reduce the probability of a failure of this kind, subnodes which are supposedly more difficult to be laid out receive a higher traversing order. Generally, a news page contains a smaller number of discrete horizontal units (such as six or eight columns) than vertical units (such as 220 tenths of inches for a full 22-inch page). As a result, the success of virtual-page construction for subnodes of a horizontal-type operator depends more on the leading tolerance than does that for the subnodes of a vertical-type operator. That is, the subnode virtual pages of a horizontal-type operator are more difficult to construct successfully than are those of a vertical-type operator. Therefore, for a vertical-operator node, a horizontal-type subnode is assigned a higher traversing precedence than a terminal subnode. The opposite is true for a horizontal-operator node. Furthermore, because of the fixed dimensions of a picture terminal node, an operator subnode with a picture descendent has precedence over an operator subnode

without a picture descendent.

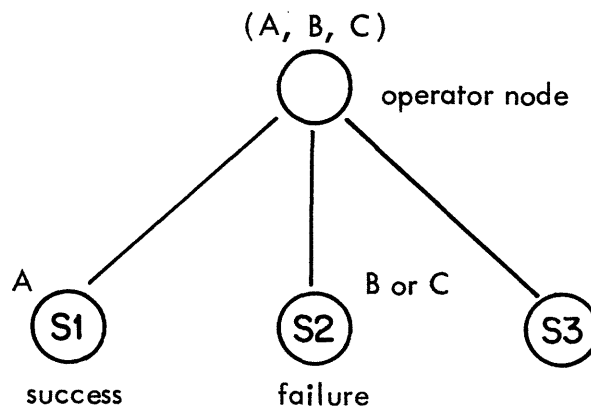


Fig. 7.14 Layout failure of a subnode

7.2.6 Summary of layout algorithm. We summarize here the important elements of the layout algorithm. The algorithm consists of two traversing sequences (visits) of the syntax-tree nodes which describe the layout template. The first sequence begins with the root node and proceeds downward to the subnodes; the second sequence begins at the bottom, starting with a terminal node and proceeds upward to the root node. The traversing sequence of the subnodes is determined by the type of the parent node as well as the subnodes. During the downward visit to each node, two items of information are assigned to the node by its parent node: first, a set of stories and pictures which matches the number and type of terminal descendents of the node; and second, a virtual page whose area equals the total area of the assigned stories and pictures. The main purpose of the downward traversal of the nodes is to produce these two items of information for each subnode.

Upon completion of the downward-traversing sequence, the subnodes are revisited one by one in a prescribed order, starting at the bottom and working up towards the root node. In the upward process, subnode virtual pages are assembled to form assembled virtual pages for parent operator nodes in a

prescribed order. The page layout is complete when the virtual page of the root node is assembled.

## CHAPTER 8

### NEWS-LAYOUT TECHNIQUES APPLICABLE TO EXTENDED OPERATORS AND PAGES WITH DISPLAY ADS

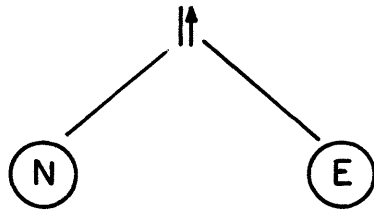
In this chapter the basic layout techniques presented in the preceding chapter are modified to include the extended set of operators and to accommodate pages with display ads. An extended operator, unlike a basic operator, does not require its operands to have the same dimension at their line of commonality. Therefore, layout with an extended operator differs from that with a basic operator in that the virtual pages of its subnodes are no longer required to have either the same height, for an extended horizontal operator, or the same width, for an extended vertical operator. In the determination of the traversing sequence and selection of news items for its subnodes, the extended set of operators is treated exactly the same as are the basic or embedded set; only in the construction and assembly of virtual pages is a modification of layout techniques necessary.

On pages containing display ads, the news area may be shaped irregularly, but again the same layout concepts can be applied.

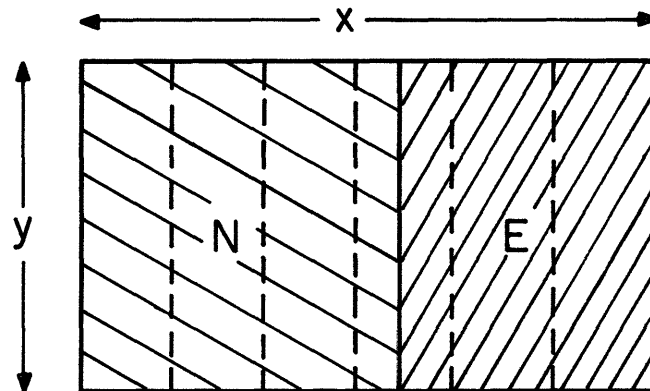
#### 8.1 Virtual-Page Construction and Assembly for Extended Operators

Consider the extended horizontal-operator node shown in Fig. 8.1a. As before, a rectangular news block (virtual page) is associated with the operator node; its dimensions are such that the news-block area matches the total area of the news items distributed between the two subnodes, in this case E and N. Now we wish to establish virtual pages for each of the subnodes from the parent virtual page. Since the virtual page  $VP(E)$  of the right subnode must be taller than that of the left subnode  $VP(N)$ , the parent virtual page cannot simply be cut into two proportional parts as was done for nonextended operators. The reason is that for an extended-operator node, the virtual page of one subnode extends beyond the parent virtual page. In Fig. 8.1, E is the extended subnode and N is the nonextended subnode.

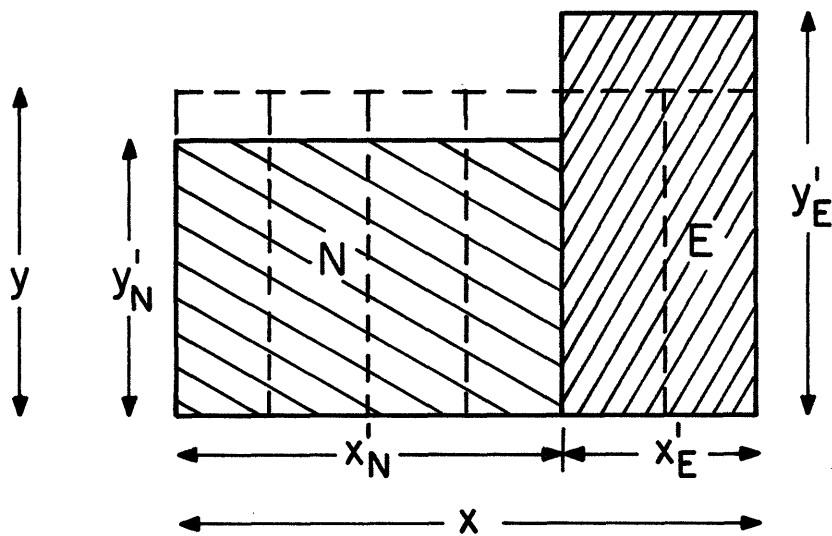
To divide the subnode virtual page into two subareas of different height but of approximately the same total area, we proceed as follows. Assume that we are given the dimensions X and Y of the extended-operator virtual page in Fig. 8.1, and we wish to determine the virtual pages  $VP(N)$  and  $VP(E)$  of the



(a) An extended-operator node



(b) Subnode virtual pages before roundoff



(c) Subnode virtual pages after roundoff

Fig. 8.1 Virtual-page construction for subnodes for an extended operator

subnodes. We denote the subnode virtual page dimensions by  $X'_N$ ,  $Y'_N$ ,  $X'_E$ , and  $Y'_E$ . The width in columns of the subnode virtual pages are determined from:

$$X'_N = \left[ \frac{\text{Total area of news items selected for subnode N}}{Y} \right] \quad (8.1)$$

$$X'_E = \left[ \frac{\text{Total area of news items selected for subnode E}}{Y} \right] \quad (8.2)$$

The brackets  $[ ]$  denote that the enclosed number is rounded up to the nearest integer, and the brackets  $\lfloor \rfloor$  denote that the enclosed number is rounded down to the nearest integer.

Next, the heights of the subnode virtual pages are calculated as follows:

$$Y'_N = \left[ \frac{\text{Total area of news items selected for subnode N}}{X'_N} \right] \quad (8.3)$$

$$Y'_E = \left[ \frac{\text{Total area of news items selected for subnode E}}{X'_E} \right] \quad (8.4)$$

In this case,, the numbers inside the brackets  $[ ]$  are rounded to the nearest tenth-inch.

By rounding up the virtual page width of the nonextended subnode to the next column, its virtual-page height tends to be shortened, whereas the virtual-page width of the extended subnode is rounded down, and its height is increased. Therefore, two virtual pages are constructed for the subnodes with different heights, but whose total width matches that of the parent virtual page.

Figures 8.1b and c illustrate the construction process for the subnodes N and E. A six-column parent virtual page is illustrated by dashed lines, and the resultant subnode virtual pages are denoted by shaded areas.

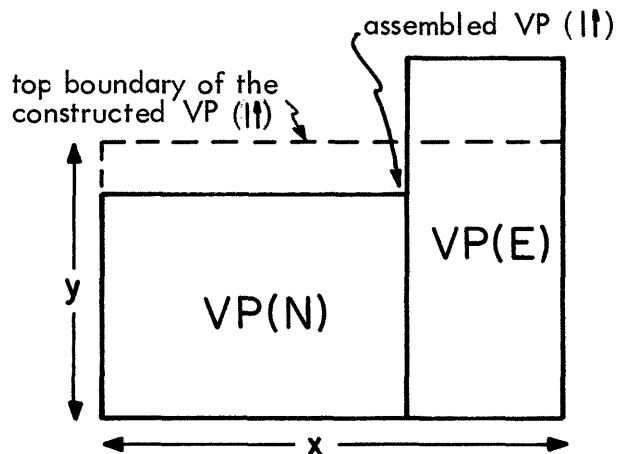
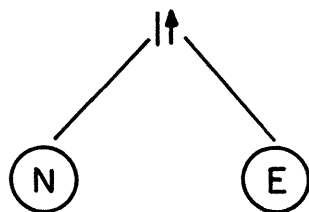
Virtual-page assembly for extended horizontal operators. The assembly process for virtual pages with different heights is carried out the same way as before except the resultant assembled virtual page for the extended operator is no longer a rectangular news block. The subnode virtual pages are placed next to each other in such a way that either a flat top (for operators  $\downarrow|$  and  $| \downarrow$ ) or a flat base (for operators  $\uparrow|$  and  $| \uparrow$ ) is maintained. Since the assembly process requires that the assembled virtual pages have a straight line at their common boundary, the assembled non-

rectangular virtual page for an extended operator uses an additional auxiliary line on the nonflat side for assembly with other nodes. The auxiliary line is the boundary line of a previously constructed rectangular virtual page for the extended operator.

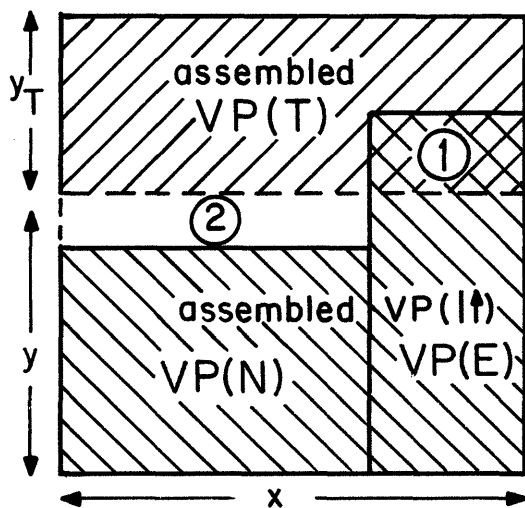
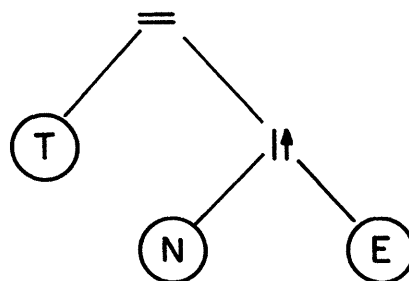
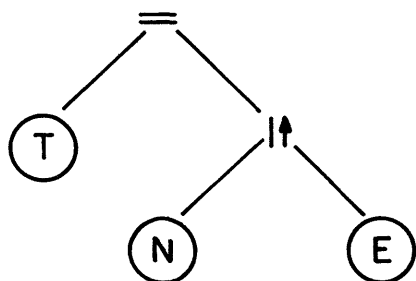
As an illustration, Fig. 8.2a shows the syntax tree for a news expression with an extended operator. The resultant virtual page, drawn beneath its tree has a flat base and a nonflat top boundary line. It was constructed step-by-step in the preceding section. However, since it must now be merged with other virtual pages (see Figs. 8.2a and 8.2b) the original top boundary of VP(N), shown as a dashed auxiliary line, is retained. In the assembly of this nonrectangular virtual page with other virtual pages, the horizontal auxiliary boundary line is attached beneath another assembled virtual page. See Fig. 8.2b. Here the virtual page of the extended-operator node is placed beneath the virtual page of terminal node T. The assembled virtual pages of the extended-operator node and the terminal node T are denoted by shaded areas. Because of the different heights of VP(N) and VP(E) at the boundary of the two assembled virtual pages, the virtual page of the terminal node VP(T) is reshaped accordingly to create a rectangular assembled virtual page for the vertical operator node, as shown in Fig. 8.2c. Note that the area of the terminal virtual page VP(T) is preserved during the reshaping process. That is, the virtual page of the terminal node VP(T) has lost area 1 but has gained an equivalent area 2.

Should a virtual page consisting of two or more assembled virtual subpages be placed on top of the virtual page for the extended operator node  $\uparrow$ , some size adjustment may have to be made to the virtual subpages. If the adjustment cannot be made satisfactorily, meaning that each virtual subpage cannot be adjusted to a size close enough to the specified size of the original news item, the assembly process of the extended operator is considered a failure.

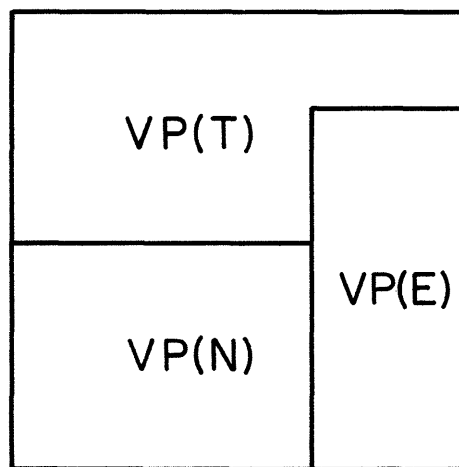
As an illustration, consider this example. Assume the terminal node in the preceding example is replaced by a horizontal operator with two story terminal nodes  $T_1$  and  $T_2$ . The corresponding syntax tree is drawn in Fig. 8.3a, and the assembled virtual pages for the horizontal and extended-operator nodes are given in Figs. 8.3b and 8.3c. The assembled virtual page placed on top of the extended-operator virtual page now consists of two subpages. Figure 8.3d shows how these two virtual pages are assembled. The resultant virtual page for the vertical operator node is drawn in



(a) Step 1

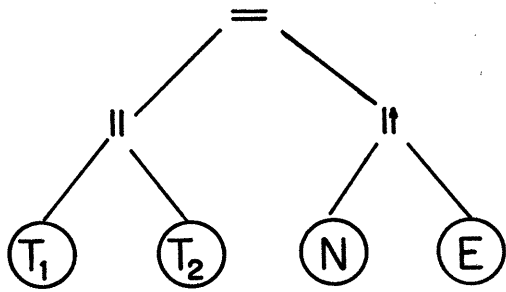


(b) Step 2

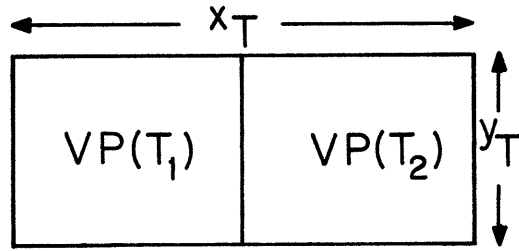


(c) Final assembly

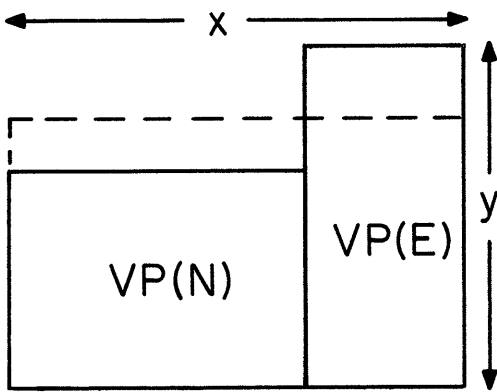
Fig. 8.2 Virtual-page assembly of an extended operator



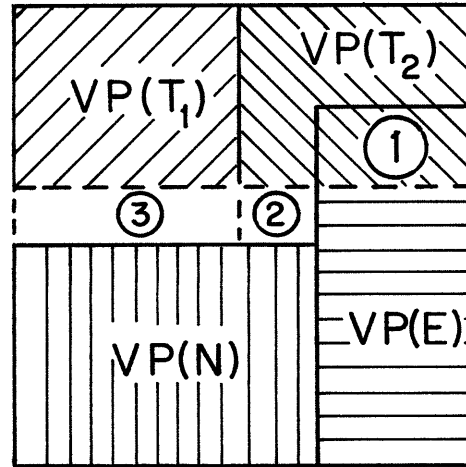
(a) Syntax tree



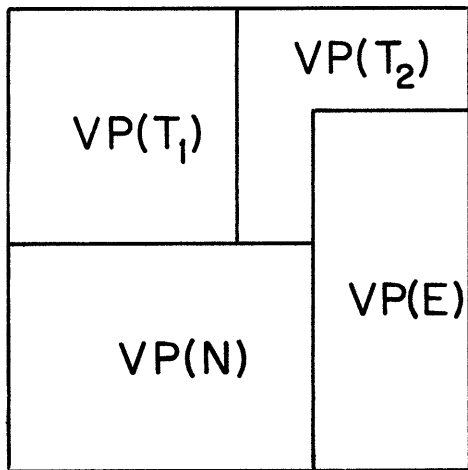
(b) Assembled virtual page of horizontal operator



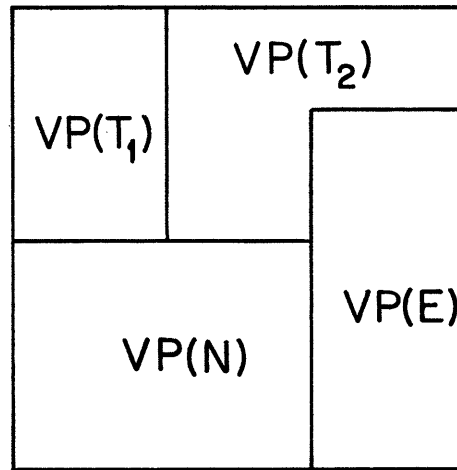
(c) Assembled virtual page of extended operator



(d) Combined virtual page



(e) Assembled virtual page of vertical operator



(f) Adjusted virtual page of vertical operator

Fig. 8.3 Size modification and check of neighboring virtual pages

Fig. 8.3e. Comparison of Figs. 8.3d and 8.3e shows that the virtual-page area of terminal node  $T_2$  is reduced; it gives away area 1 and gains a smaller area 2. On the other hand, the virtual-page area of terminal node  $T_1$  is expanded; it gains area 3. If the area change exceeds the leading allowance, an attempt is made to shift the vertical common boundary line of  $VP(T_1)$  and  $VP(T_2)$  to the left by one column. The area of the new  $VP(T_1)$  and  $VP(T_2)$ , as shown in Fig. 8.3f, is then rechecked. Should the area difference still be outside the leading tolerance, the assembling process for the extended operator has failed.

In our discussion of assembling virtual pages for the extended set of horizontal operators, we have used a particular operator exclusively for illustration. However, the same techniques can also be applied to the other extended horizontal operators. Figure 8.4 shows the assembled virtual page for each extended horizontal operator. The auxiliary straight boundary line for the assembled virtual page is denoted in each case by a dashed line.

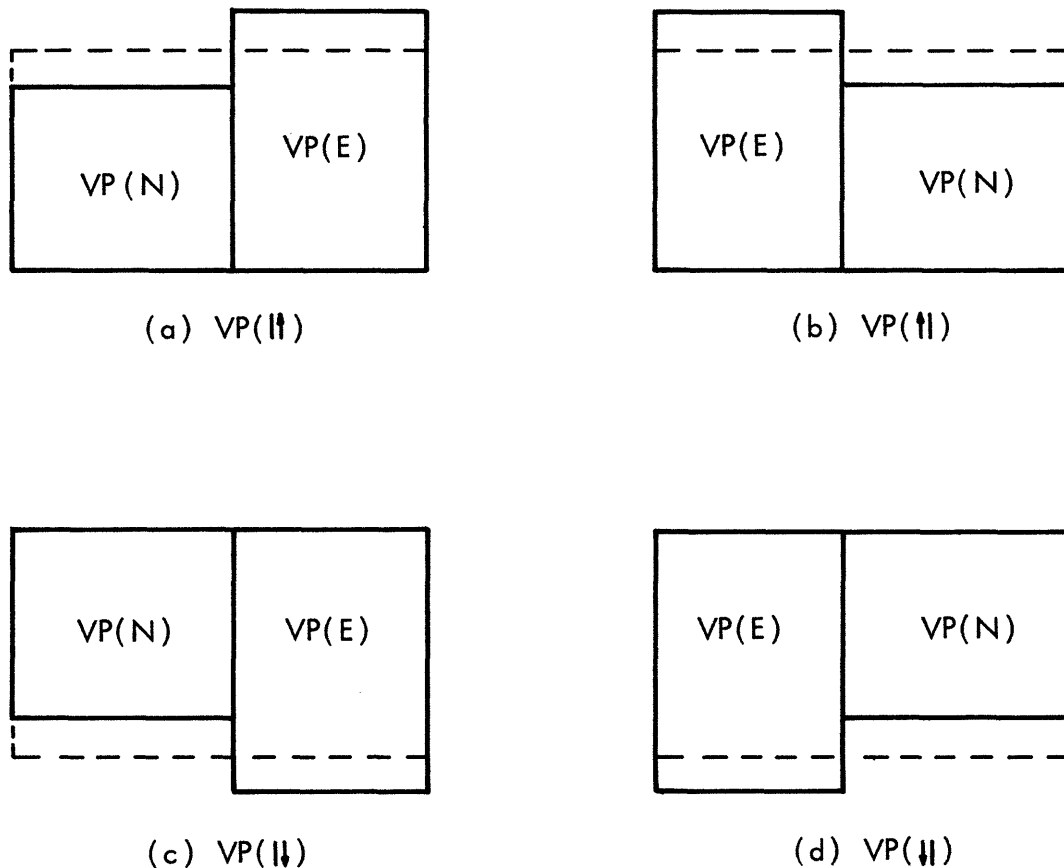


Fig. 8.4 Assembled virtual pages for the complete set of extended horizontal operators.

Virtual-page construction and assembly for extended vertical

operators. In the construction of virtual pages for subnodes of extended vertical operators, the virtual page of a nonextended subnode is set to be one column less than its parent virtual page. In other words, if  $X$  and  $Y$  are the dimensions of the given parent virtual page for the extended vertical operator, the dimensions  $(X'_N, Y'_N)$  of the nonextended subnode virtual page,  $VP(N)$ , is determined as follows:

$$X'_N = X - 1 \quad (8.5)$$

$$Y'_N = \frac{\text{total area of news items selected for the nonextended subnode } N}{X'_N} \quad (8.6)$$

where  $Y'_N$  is rounded to the nearest tenth inch. Then, the dimensions  $(X'_E, Y'_E)$  of the extended subnode virtual page  $VP(E)$ , are calculated from the following relationships:

$$Y'_E = Y - Y'_N \quad (8.7)$$

$$X'_E = \frac{\text{total area of news items selected for the extended subnode } E}{Y'_E} \quad (8.8)$$

where  $X'_E$  is rounded off to the nearest integer.

As a result, there are constructed two subnode virtual pages of different widths having a total height equal to the height of their parent virtual page. The width of virtual page  $VP(E)$  is either greater than or equal to the width of the parent virtual page, depending on the relative size and shape of the two subnode virtual pages. If the virtual page of subnode  $N$  is large enough and wide enough to allow the one-column area reduction to be absorbed by the leading tolerance, then the extended-subnode virtual page need not be widened. Otherwise, the virtual page  $VP(E)$  has to be extended by one column to keep the total area of the two-subnode virtual page close to that of the given parent virtual page. Figure 8.5 illustrates the two possibilities for an extended vertical operator with a six-column wide virtual page. The dashed lines indicate the given virtual page for the extended operator.

The techniques used for extended-horizontal operators can be applied to the assembly of subnode virtual pages for extended vertical operators. Subnode virtual pages are placed on top of each other to create a nonrectangular assembled virtual page with either a flat left-hand or right-hand side, depending on the particular operator. In the assembly process of the extended-

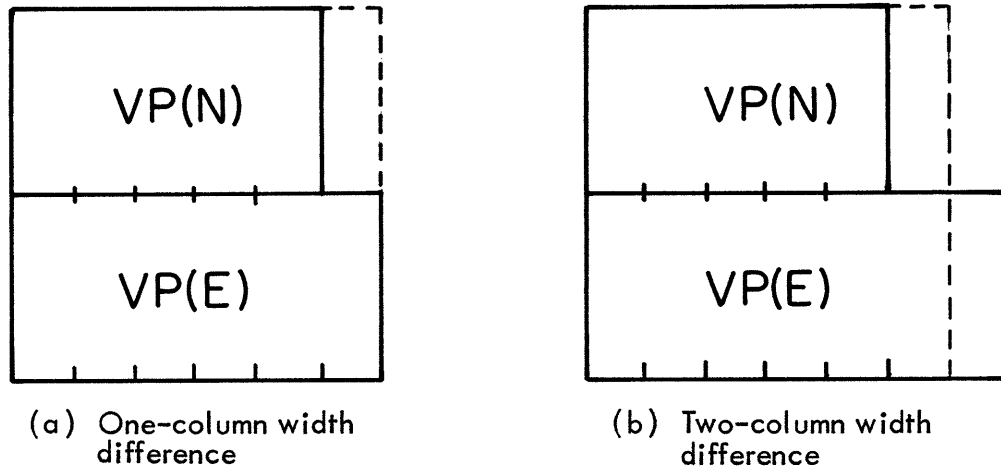


Fig. 8.5 Virtual-page construction for extended-vertical operator

operator virtual page with other virtual pages, the previously constructed parent virtual page is used to determine the auxiliary boundaries for the irregular side. Furthermore, virtual-page size modification and an area check are also performed for a virtual page attached to the irregular side of the assembled virtual page. The assembled virtual page for each extended vertical operator is presented in Fig. 8.6. In the sketches the auxiliary boundaries are denoted by dashed lines.

## 8.2 Extension of Layout Techniques to Pages With Display Ads.

Thus far, we have restricted application of our layout techniques to pages with no display ads. In this section we extend the non-ads page-layout techniques to accommodate pages with ads, using a full-page non-ads layout template as a layout guide.

The layout of pages with ads differs from procedures previously described primarily in that the virtual pages (or news blocks) in the layout generally have nonrectangular shapes. Although the virtual-page concept of layout can still be applied, a virtual page can no longer be described by only two

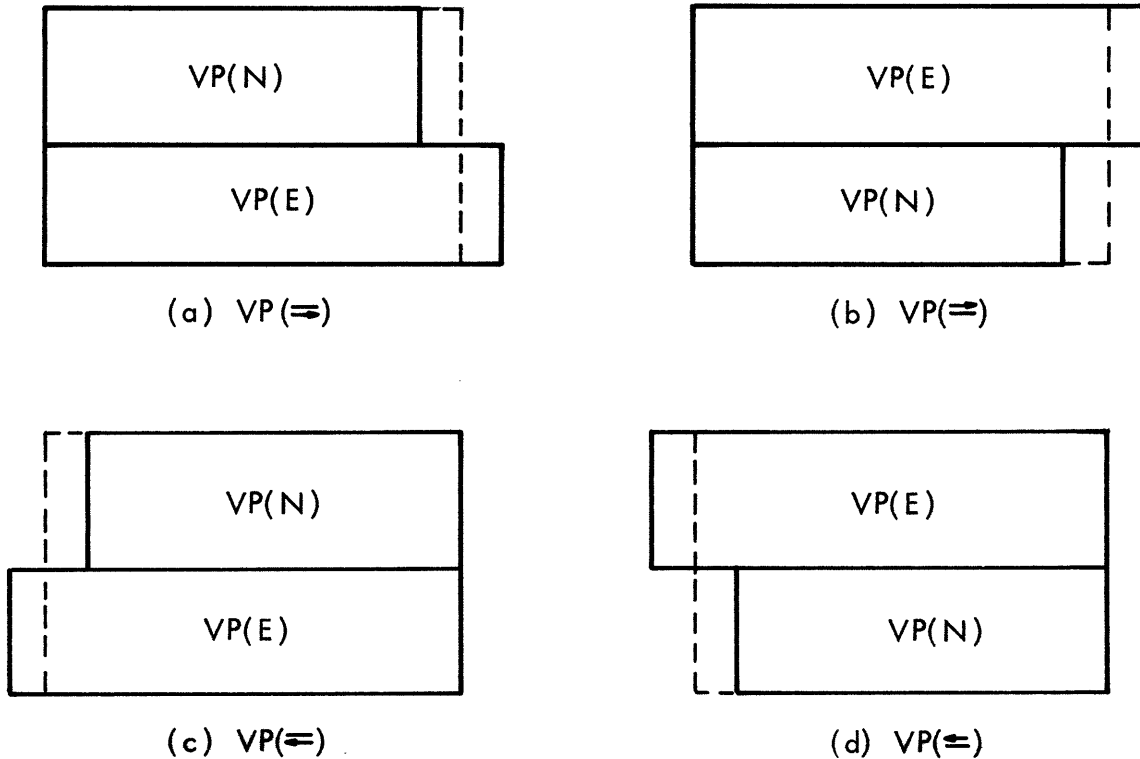
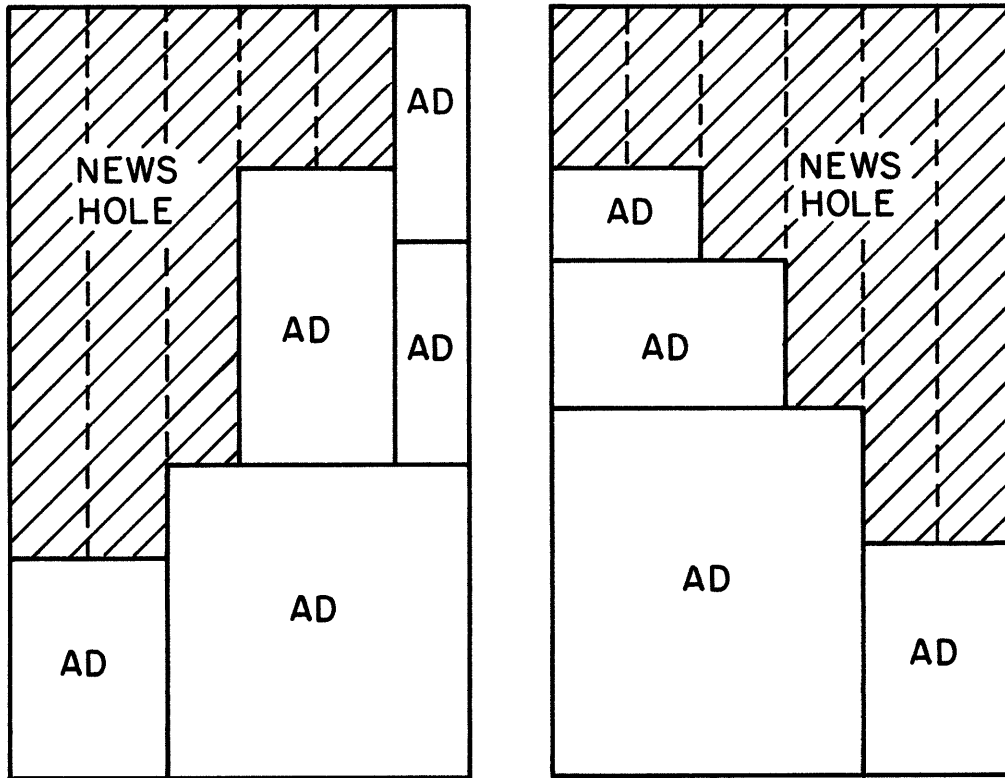


Fig. 8.6 Assembled virtual pages for extended vertical operators

numbers which represent the width and height of a rectangular news block.

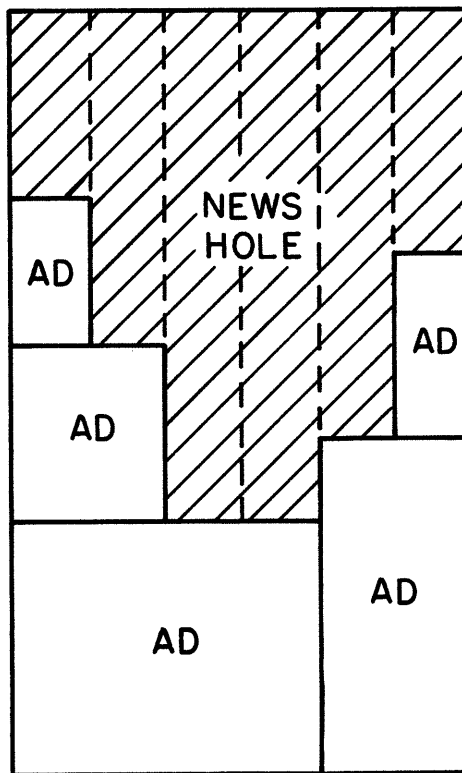
8.2.1 Nonrectangular virtual-page description. Three possible ads-layout styles are shown in Fig. 8.7 where the shaded areas denote the resultant news hole. All ads-layout styles follow the so-called "pyramid rule" defined in Chapter 4 which requires that the width of an ad placed on top of another ad be less than, or equal to, the width of the bottom ad, and the height of an ad that borders the news hole must be less than, or equal to, the height of an adjacent ad. As the result, the remaining news hole is usually nonrectangular in the form of an inverted pyramid with a flat top boundary. Such a non-rectangular virtual page can be described uniquely and unambiguously by an array of numbers indicating the length of the news space in each column.

Consider the typical eight-column upside-down pyramid virtual-page area of Fig. 8.8 and its numerical representation. An array of numbers above the virtual page indicates the length component (in terms of vertical measuring units such as inches) of the news area in each column.



(a) Right-pyramid

(b) Left-pyramid



(c) Double-pyramid

Fig. 8.7 Ads layout styles and the remaining news hole

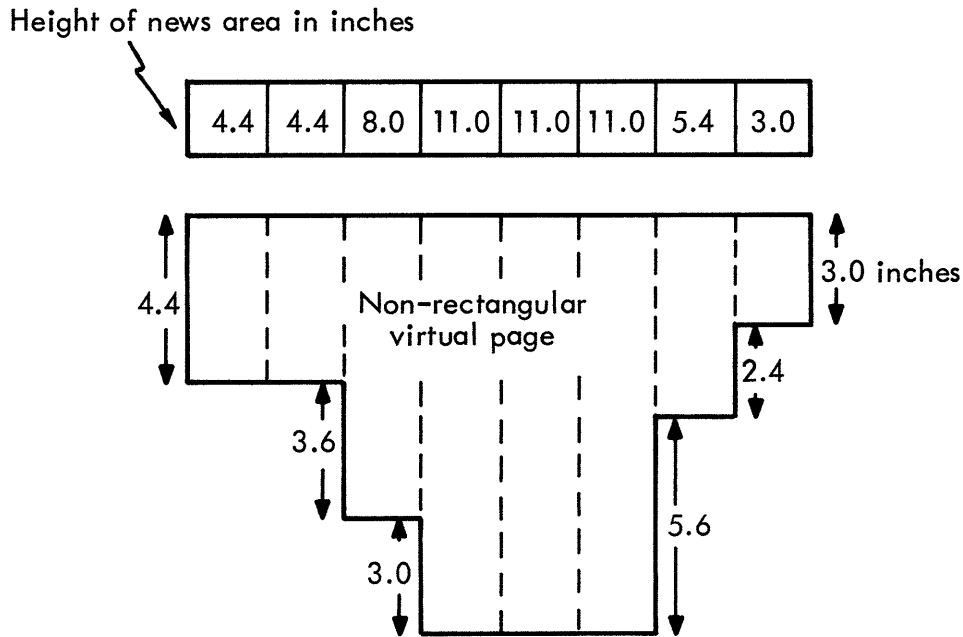


Fig. 8.8 Nonrectangular virtual page and its numerical description

8.2.2 Subnode traversing sequence. With an appropriate description of a nonrectangular virtual page in hand, one can easily apply the basic layout technique of traversing the layout syntax tree and the notion of virtual-page layout to pages with ads. As before, the layout of a news page is accomplished by traversing the nodes of the syntax tree in a prescribed order. Furthermore, during the visit to each node, certain layout actions are performed, such as determining the subnode traversing sequence, and the construction and assembling of the virtual subpages for subnodes.

In the determination of subnode traversing sequence, subnodes are first grouped into pairs according to their positions in the subtree. Figure 8.9 illustrates how the subnodes are grouped into pairs. For an operator node with an odd number of subnodes, the last "pair" contains only one subnode. The outermost pair of subnodes is assigned the highest priority, and the inward pairs of subnodes are assigned progressively lower priority. In other words, subnodes in the first pair PR1 are traversed before subnodes in PR2, PR2 is before PR3, and so forth. Within each pair, the traversing precedence

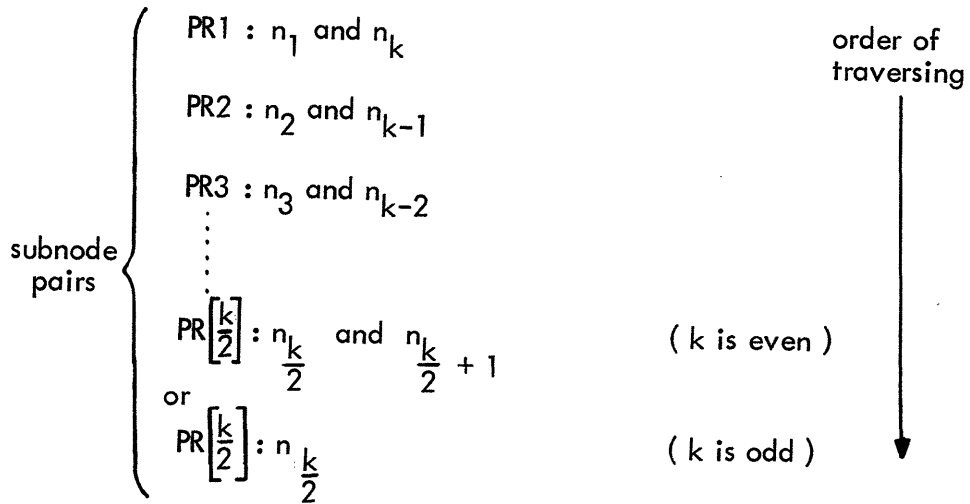
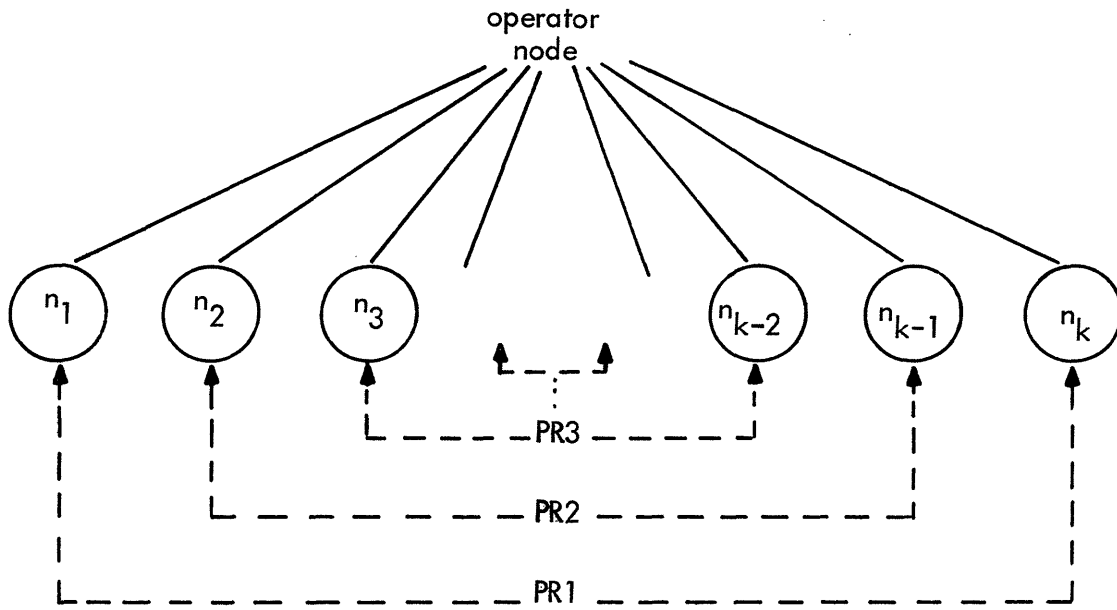


Fig. 8.9 Formation of subnode pairs

of the two subnodes is determined in the same way as discussed in section 7.2.1: For a vertical-construction operator node, an operator subnode has precedence over a terminal subnode; for a horizontal-construction operator node the terminal subnode has priority.

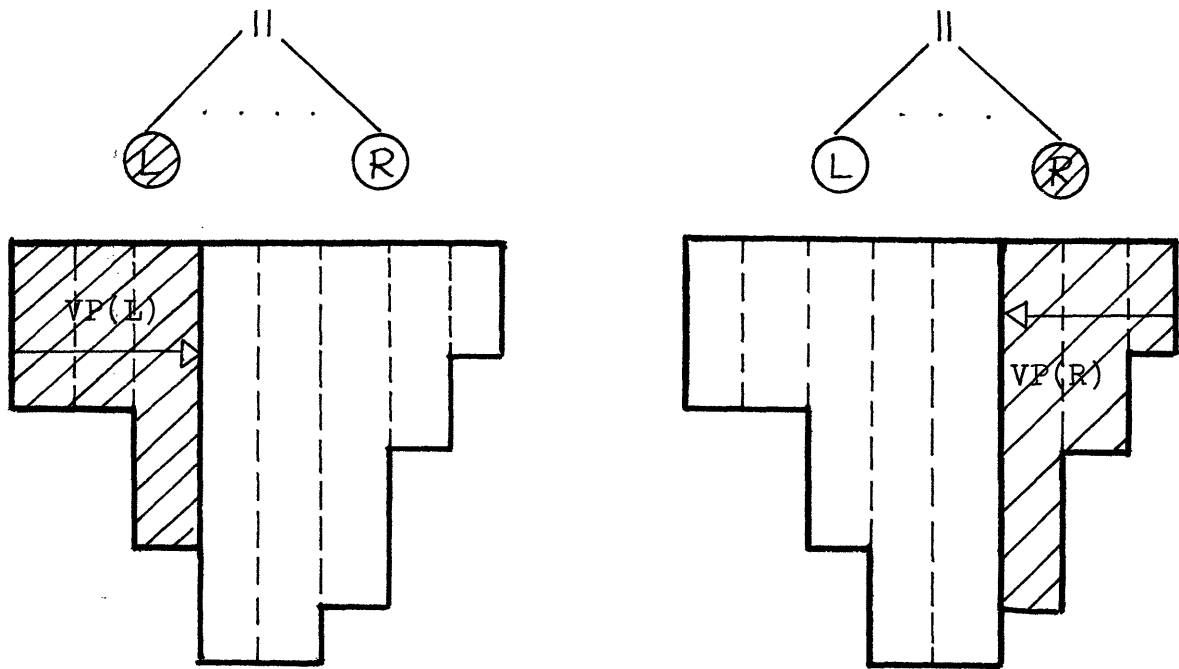
By traversing the subnodes from outer to inner pairs, the nonrectangular virtual page can be cut into subpages accordingly, as described in the next section.

8.2.3 Construction and assembly of nonrectangular virtual pages. During the layout of an operator node, news items assigned to the node are distributed to its subnodes according to the number and type of its terminal descendents. The virtual page is then constructed for each subnode. The virtual-page area matches the total area of the news items distributed to the subnode. For layout of pages with ads, the given news hole is nonrectangular and so are the news blocks constructed for the subnodes.

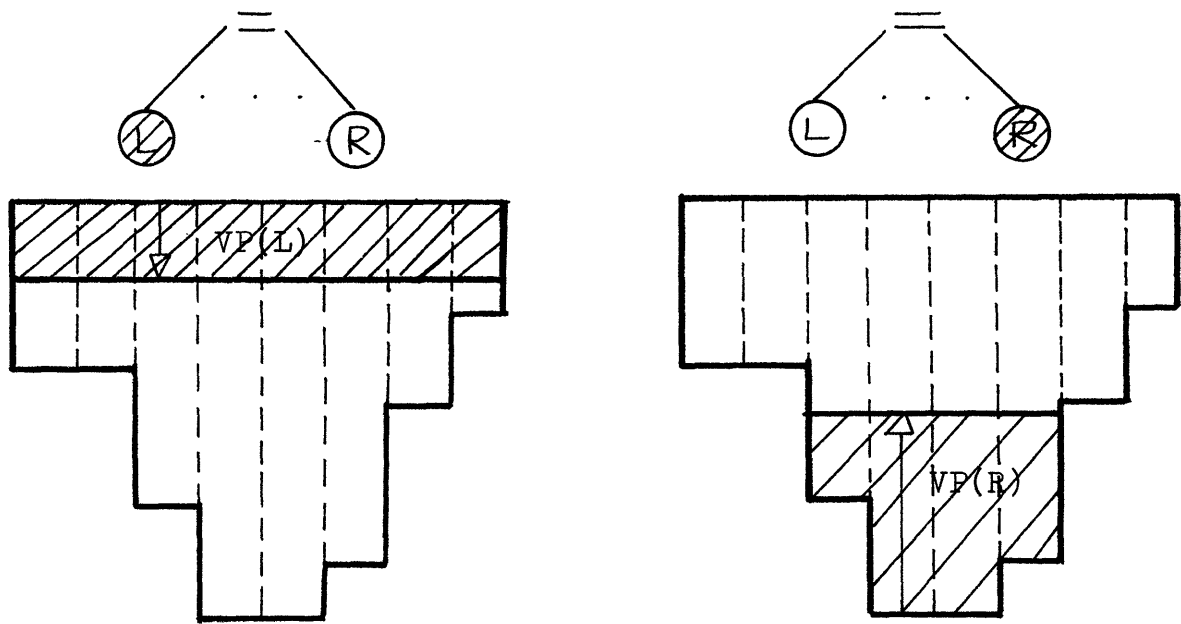
The nonrectangular virtual pages for subnodes are constructed while following the same order as the subnode traversing sequence. In other words, virtual pages of outer subnodes are constructed before the inner subnodes. For each subnode, the virtual page is constructed by deleting from the parent nonrectangular virtual page an area which, within the leading tolerance, matches the total area of the news items selected for the subnode. For vertical- or horizontal-construction-type operator nodes, the cutting of the parent virtual page is made either vertically or horizontally and the subnode virtual page area is cut from one of the four sides of the parent page, depending on the type of the parent operator node and whether the subnode is a left or right subnode in the traversing precedence pair to which it belongs. For an embedded-type operator node, the virtual page of the left subnode is the same as its parent virtual page, and the virtual page of the right subnode is cut from one of the three allowable corners of the parent virtual page.

Figure 8.10 illustrates the cutting procedure of the virtual subpage for the pair of leftmost and rightmost subnodes L and R, respectively. For both horizontal and vertical operator nodes, the constructed virtual subpages (the areas being cut off) are the shaded areas. Note that the shaded area should match the total area of news items selected for the subnode. The arrows in the figures indicate the directions that the cutting lines are moved to attain an appropriate area.

After the virtual page for a subnode has been formed from its parent virtual page, the reduced parent virtual page is used as the current parent

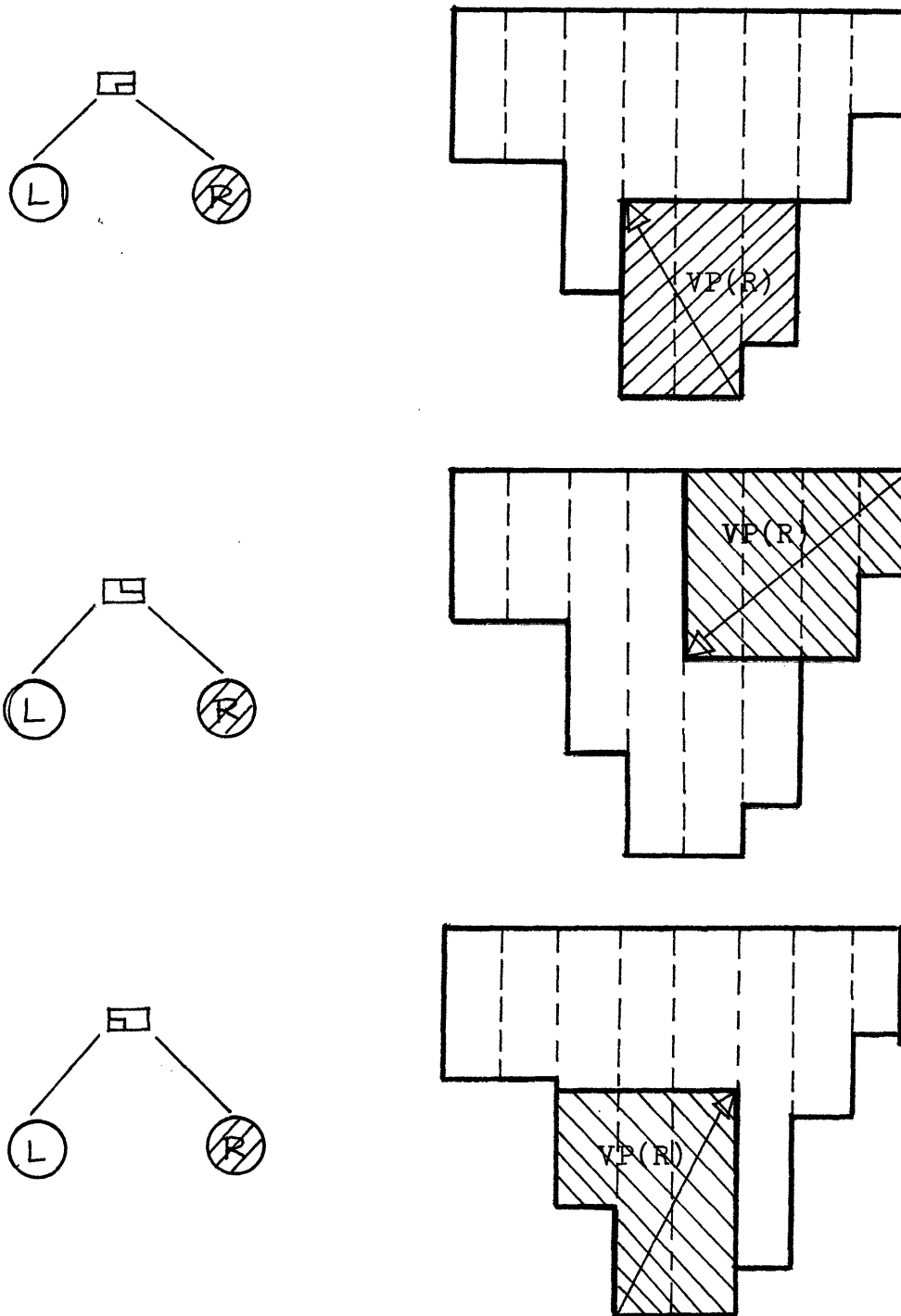


(a) Horizontal-Construction-Operator Node



(b) Vertical-Construction-Operator Node

Fig. 8.10 Cutting of virtual subpages



(c) Embedded Operator Node

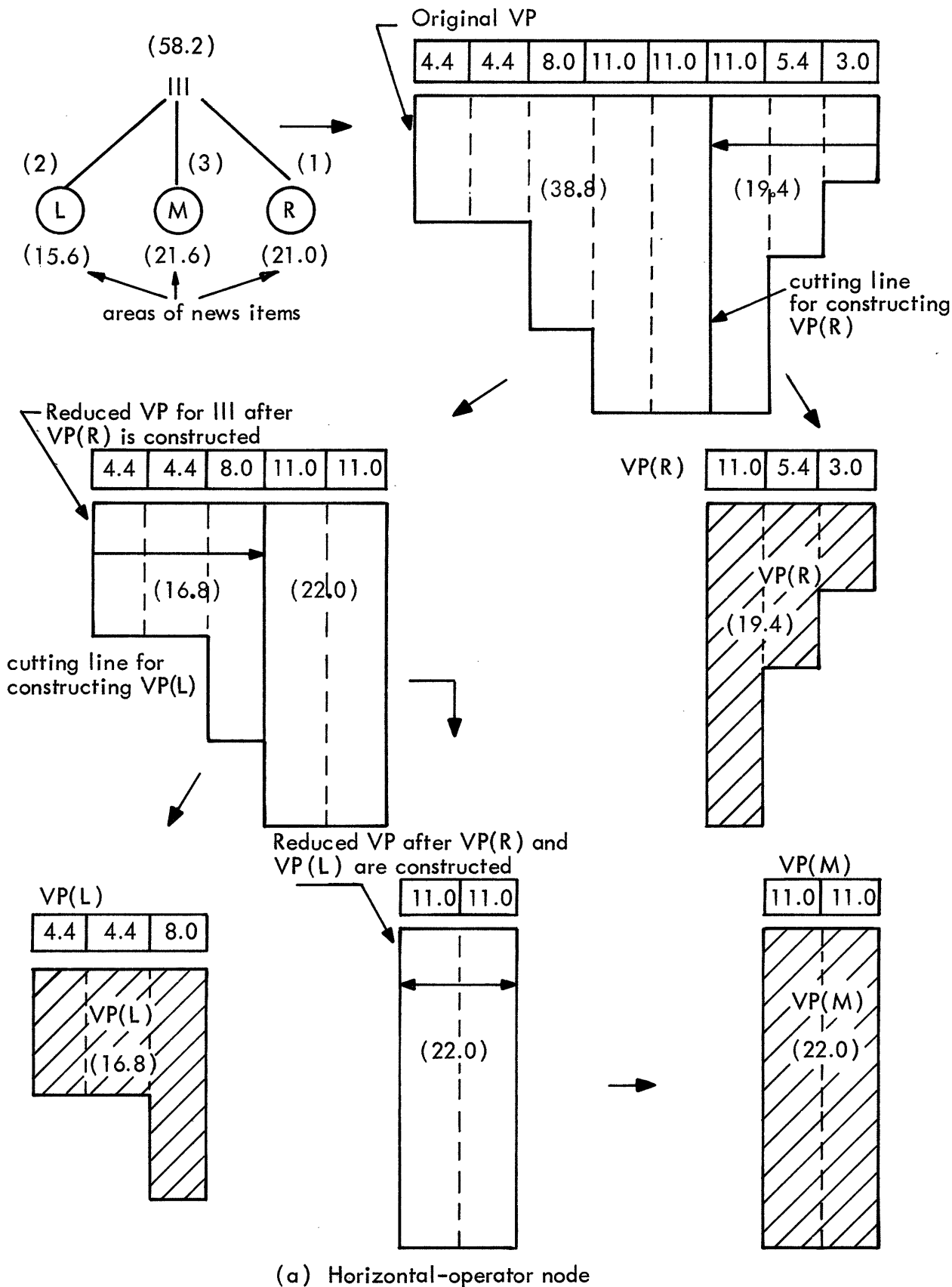
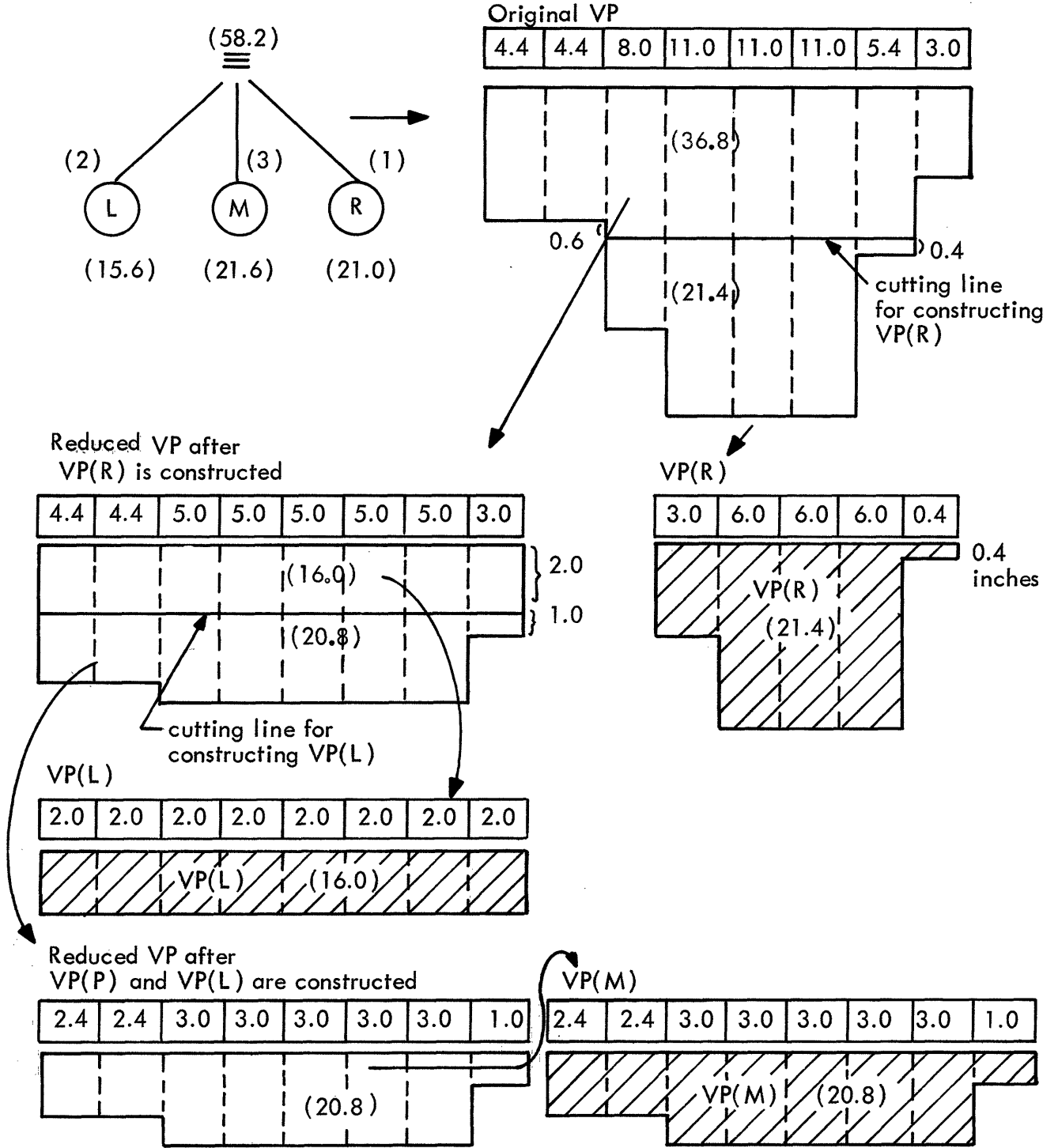


Fig. 8.11 Construction of a nonrectangular virtual page



(b) Vertical operator node

Fig. 8.11 Continued

virtual page for construction of the next subnode virtual page. As a result, the virtual page of the last subnode to be traversed is the finally reduced parent virtual page.

Figure 8.11 illustrates the virtual-page cutting process and the reduced parent virtual page at each stage for an operator with three subnodes, L, M, and R. The 58.2 column-inch nonrectangular news block in Fig. 8.8 is used as the parent virtual page, and the news-item areas assigned to the subnodes L, M, and R are 15.6, 21.6 and 21.0 column-inches, respectively. Assume that subnode R is traversed first, then subnode L and finally subnode M. The construction process for a horizontal-operator node is shown in Fig. 8.11a. The constructed subnode virtual pages are the shaded areas; the numbers within the parentheses are the areas of the virtual page constructed at each stage. The area is calculated by summing the numbers in the array above the news block. The corresponding construction process for a vertical-construction operator node is given in Fig. 8.11b.

Observe that the virtual page constructed for subnode R in Fig. 8.11b has a very small area -- only 0.4 inch high by one column wide in its rightmost column. Hence, this layout is inadequate for accommodating the headline of the story placed in VP(R). In order to solve this problem, two numbers associated with each horizontal cutting line are defined, as illustrated in Fig. 8.12. They are:

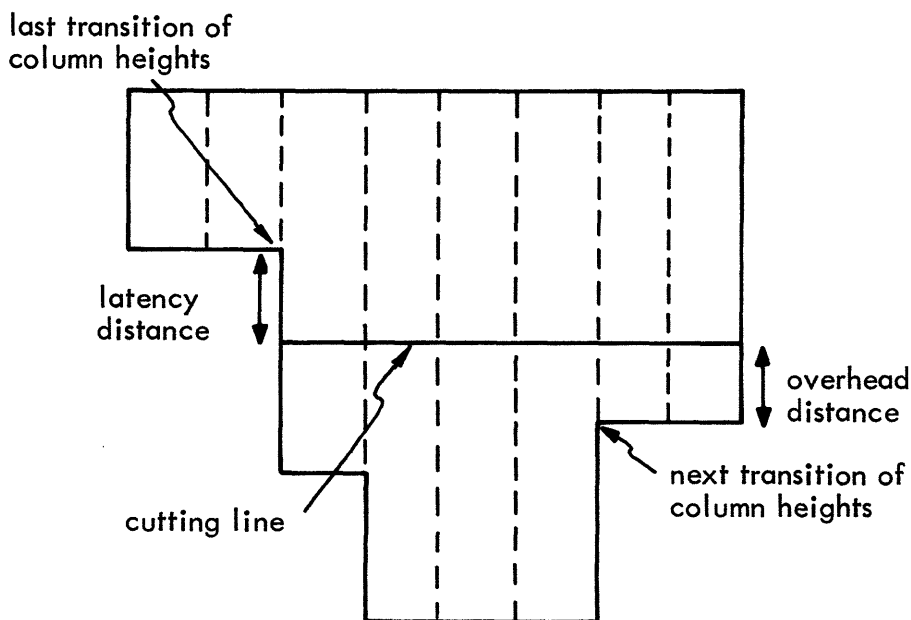


Fig. 8.12 Overhead and latency distance.

Overhead distance --- the distance between the horizontal cutting line and the next transition of column heights below the cutting line.

Latency distance --- the distance between the horizontal cutting line and the next transition of column heights above the cutting line.

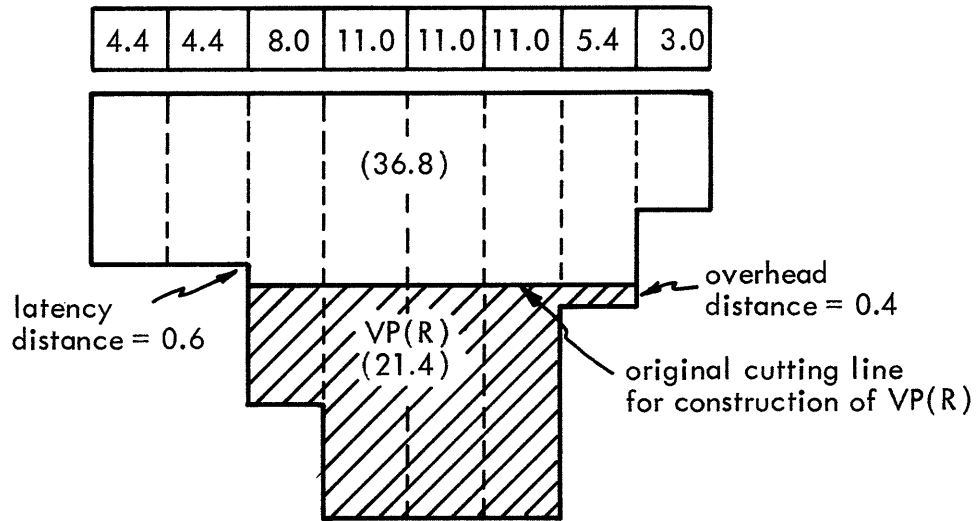
Note that the next lower or higher column-height transition points can be either on the left-hand or right-hand side of the virtual page.

For layout of pages with ads, the minimum allowable overhead and latency distances are stored in the news-layout-policy file. During the construction of subnode virtual pages for a vertical-operator node, the resultant overhead and latency distances for each cutting line are compared to the policy-specified minimum distances. If either distance is less than the minimum requirement, an attempt is made to move the line either up or down in order to reach the specified minimum-distance requirement. Should such a move be unacceptable because of the area constraint of the news items, the construction of the subnode virtual page is considered to have failed.

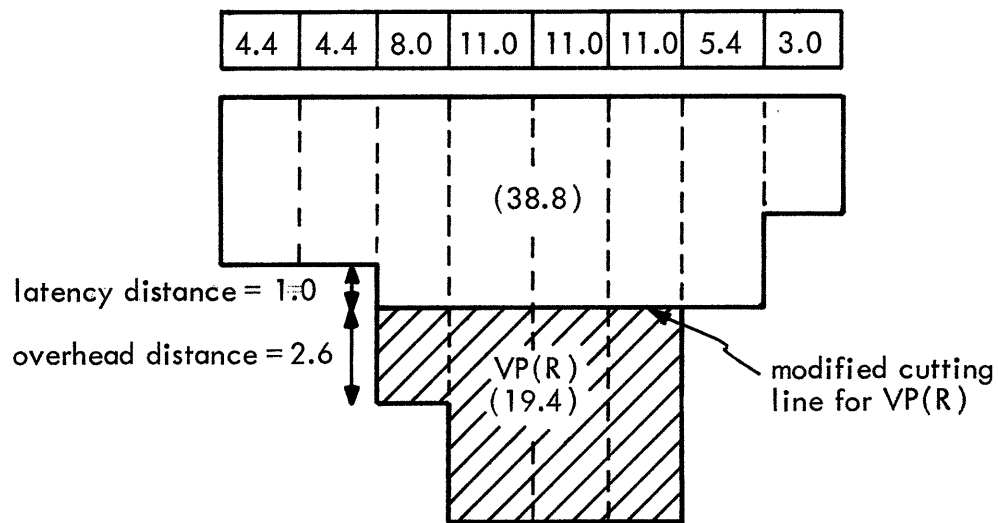
The process of adjusting cutting lines is demonstrated in the following example. Assume the minimum overhead and latency distances for the layout of Fig. 8.11b are specified as 1.0 and 0.6 inches, respectively. The cutting of VP(R) from the original virtual page results in an 0.4-inch overhead distance and a 0.6-inch latency distance; the overhead distance is unacceptable. The cutting line is therefore moved downward 0.4 inch to eliminate the top small area in the rightmost column of VP(R). The original and the modified cutting lines are shown in Fig. 8.13. The modified line now has a 2.6-inch overhead and 1.0-inch latency distance, and creates a VP(R) of 19.4 column inches. Since the difference between a 19.4-column-inch VP(R) and the specified 21.0 column-inches for subnode R is within the  $\pm 10$  percent leading tolerance, the virtual subpage is thus constructed successfully.

Although the constructed virtual subpages are nonrectangular, use of a straight cutting line gives them a straight line at their common boundary. Therefore, the techniques of assembling the subpages presented in Section 7.2.4 can be applied to the assembly of nonrectangular virtual pages without modification.

8.2.4 An illustrated example. Consider the layout of the 86.4-column-inch nonrectangular news-hole area of Fig. 8.14a. Three stories A, B, and C, and one stand-alone picture P are assigned to the area. They have the dimensions indicated in the figure. Observe that the total area of the four news items matches the area of the given news block. This result emerged

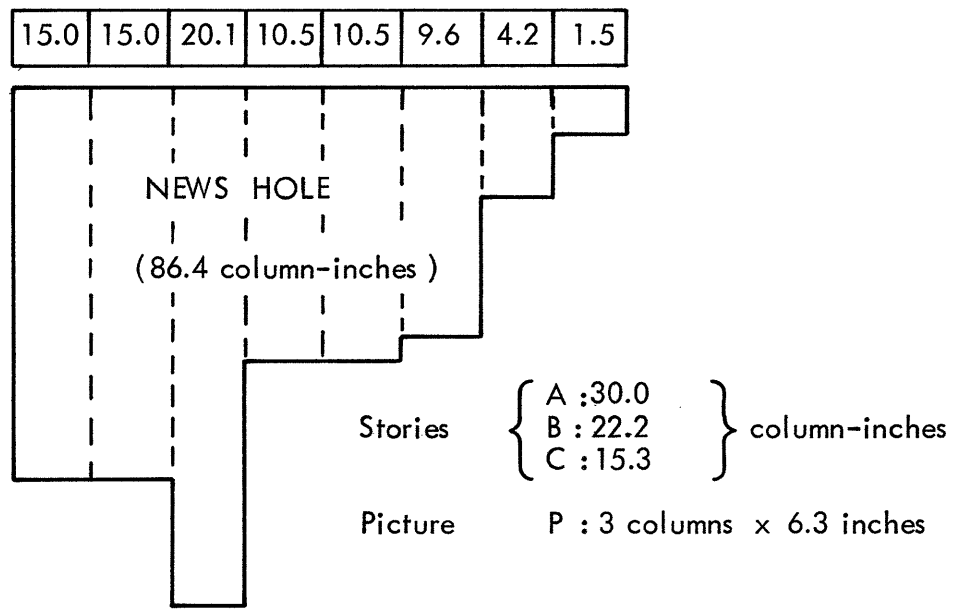


(a) Unacceptable location for cutting line

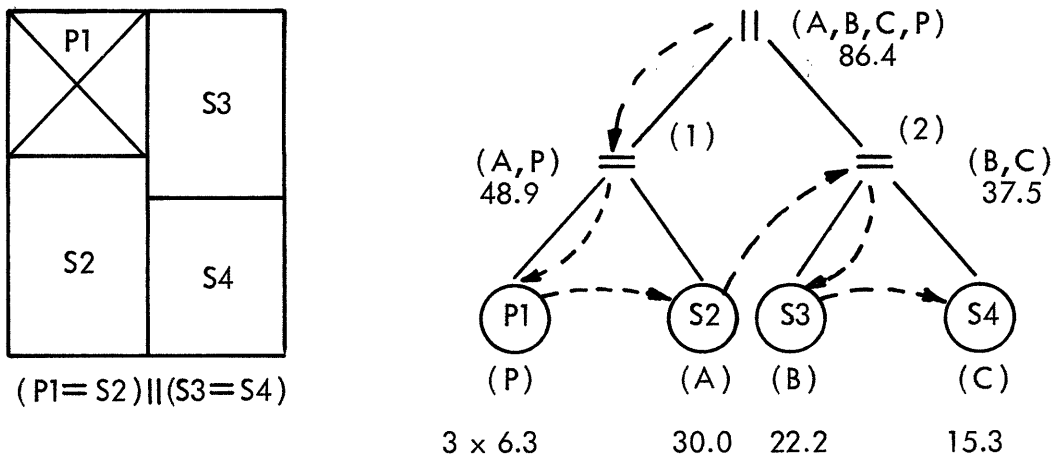


(b) Acceptable location for cutting line

Fig. 8.13 Modification of virtual-page cutting line



(a) The news-hole and story-assignment data.



(b) Layout template and its syntax tree

Fig. 8.14 Example of page layout

from the story- and picture-assignment process.

The non-ads layout template shown in Fig. 8.14b is used as the structural guide for news-item placement. Its syntax-tree representation is also drawn in the figure. If we assume story A has the highest importance rating and story C has the lowest, the news items selected for each node are those listed within the parentheses alongside each node in the figure. The numbers beneath the news items are the total area of the news items selected for the nodes.

The various stages of the virtual-page construction process for each node are shown in Fig. 8.15. At the root node the virtual page of the left vertical-operator node is constructed by cutting off a three-column area (50.1 column-inches) from the left-hand side of the given nonrectangular news block. The remaining area (36.3 column-inches) becomes the virtual page for the other vertical operator node. If a  $\pm 10$  percent leading tolerance is assumed, the areas of these two virtual pages (50.1 and 36.3 column-inches) are within the allowable tolerance of their original total-area specifications (48.9 and 37.5 column-inches, respectively). Each constructed virtual page is further cut horizontally to create two terminal virtual subpages. If the minimum overhead and latency distances are specified as 1.5 and 0.9 inches respectively, all four terminal virtual pages satisfy these requirements and are constructed successfully. The resultant terminal virtual pages, VP(P1), VP(S2), VP(S3), and VP(S4), are shown as shaded areas in the figure, where the number within the shaded area denotes the area of the page.

Since a virtual page whose area is within the specified leading tolerance of the selected news item can be obtained for each terminal node, the assembly process can now proceed starting from the left vertical-operator node; the result is shown in Fig. 8.16. The final assembled virtual page at the root node represents the news-layout dummy and is drawn at the bottom of the figure. Observe that the structure of the news items placed on the page conforms to that specified by the layout template.

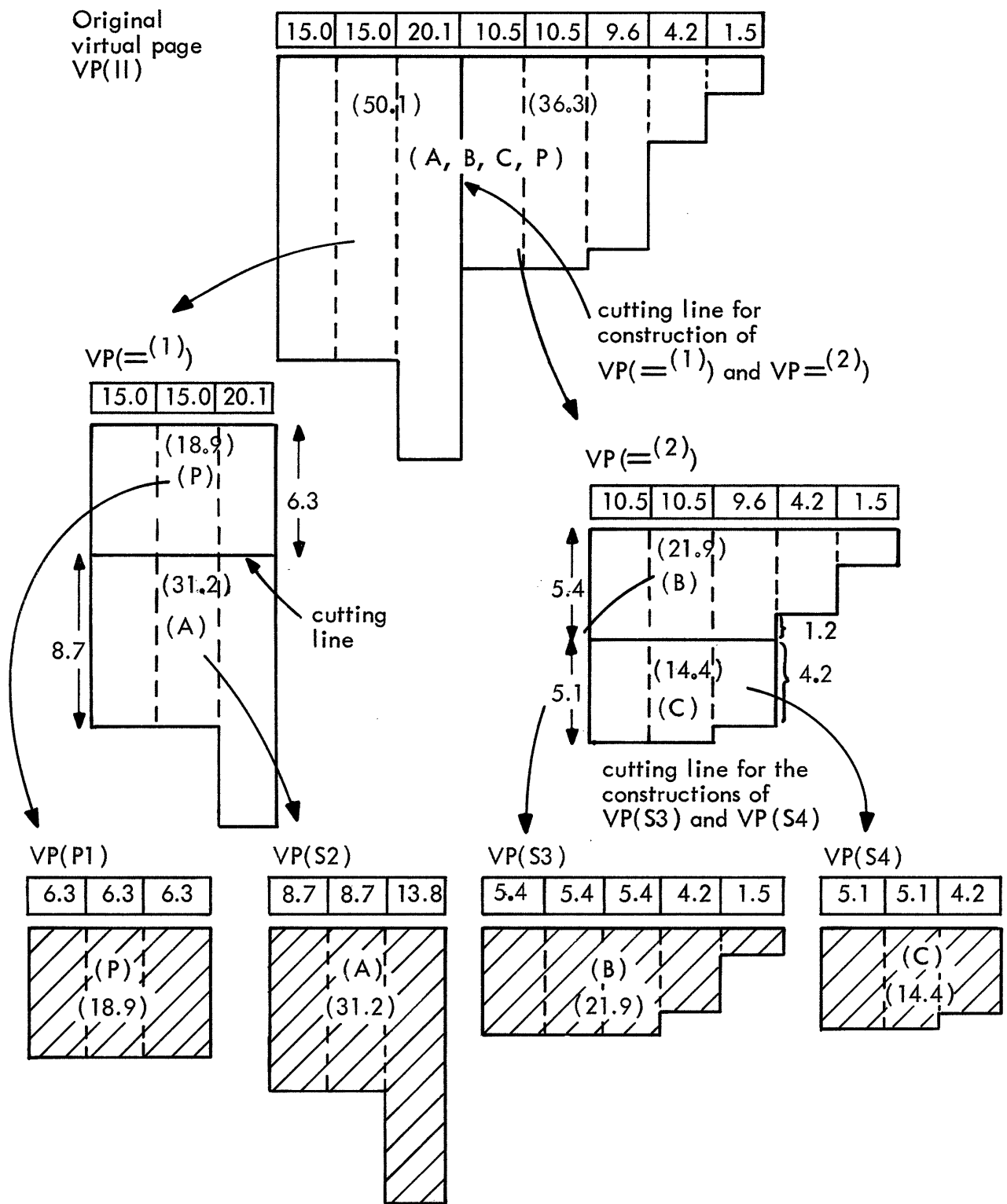


Fig. 8.15 Construction of virtual pages for layout example

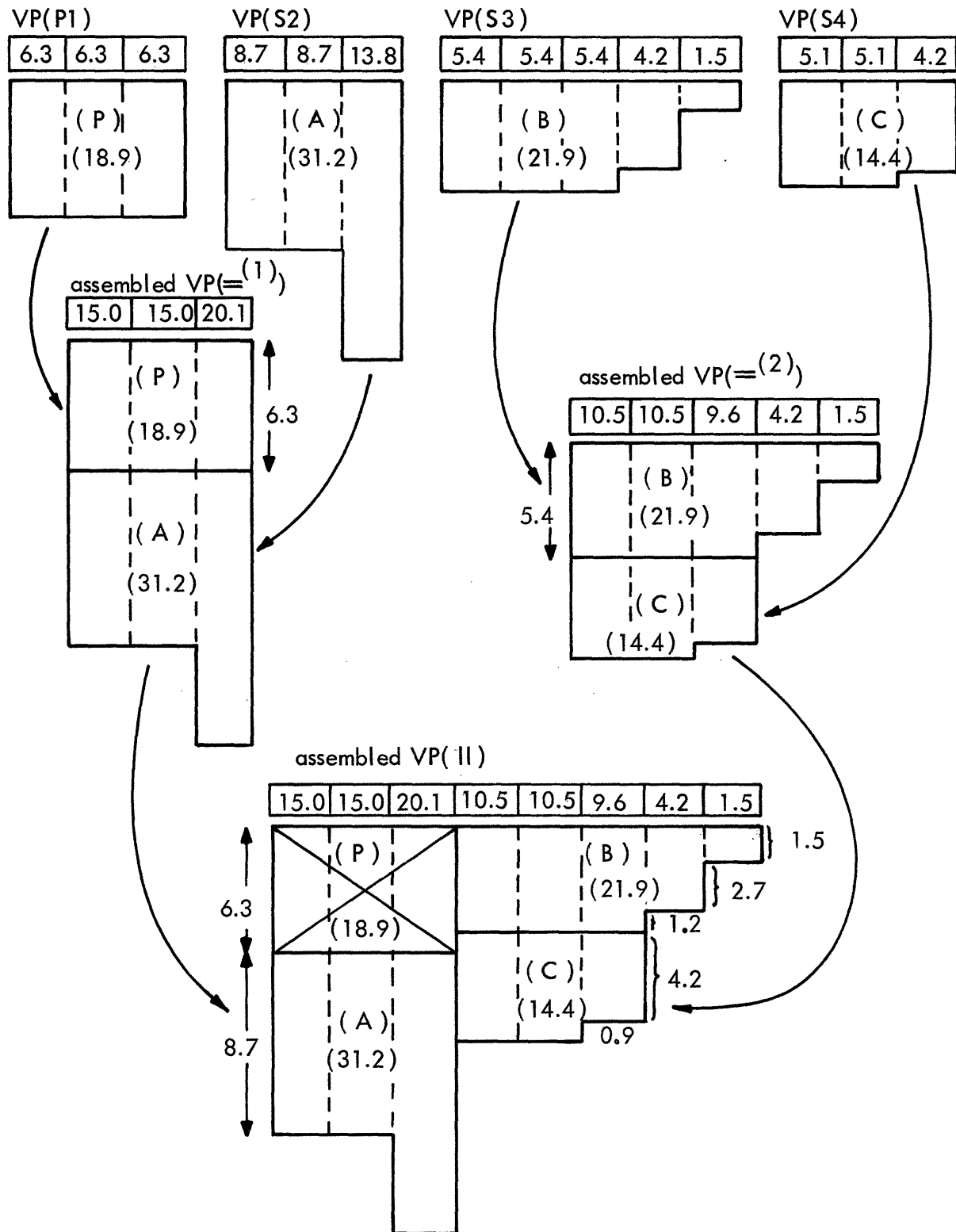


Fig. 8.16 Assembly of virtual pages of layout example

## CHAPTER 9

### NEWS-LAYOUT EXPERIMENTS

Experimental results generated by applying our template-driven layout techniques to actual newspaper pages are presented in this chapter. Data were taken from a local newspaper (The Boston Globe) and include two news pages without display ads and one page with ads. The full news pages have a six-column format, and the page with ads has an eight-column format. In our experiments, all pages are divided into 21.2 inches, vertically, and the areas of stories, pictures, and ads on the pages are measured in units of columns-inches. Headline and caption areas are included in the story and picture areas.

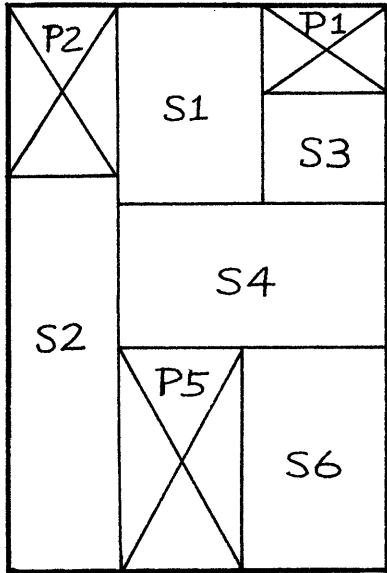
In the test cases, the set of input data for each news item on the page includes the measured story area or picture dimensions and an importance ranking of the story or picture. The importance rankings were assigned according to the location and appearance of the news item on the page. Several layout templates whose structures differ from the page as laid out by the Globe are selected and used as the structural guide for placing the news items according to the layout algorithm described in the preceding Chapters 7 and 8. The results are presented for the successful layouts, and explanations of layout failures are given. In all experimental cases, a +10 percent leading of story area was allowed.

#### 9.1 Layout-Experiment 1

Page three of the July 22, 1976 issue of the Globe is used as the first test case of a page without ads. As laid out by the Globe, there are five stories and one stand-alone picture on this page. Two of the five stories have pictures associated with them. The measured areas or dimensions of the news items, together with their assigned importance rankings, are listed in Table 9.1.

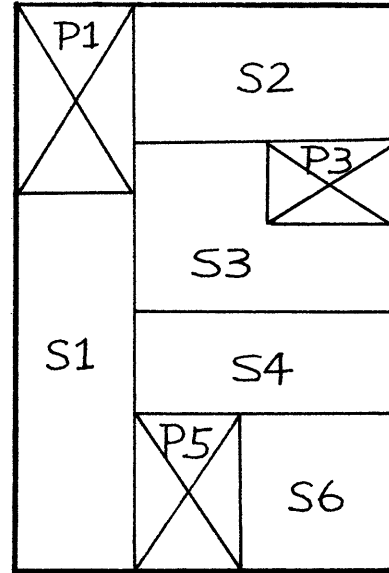
Figure 9.1 shows four layout templates, T1 through T4, used in the layout experiment. The number associated with a story S or picture P represents the relative importance ranking of the news item, and a story and picture having the same integer are associated with each other; thus, P1 is associated with S1, P2 with S2, and P1 and S1 are more important than P2 and S2. Note that each template has exactly the same number of news items in each type category

$$(P2=S2) \parallel ((S1 \parallel (P1=S3))=S4=(P5 \parallel S6))$$



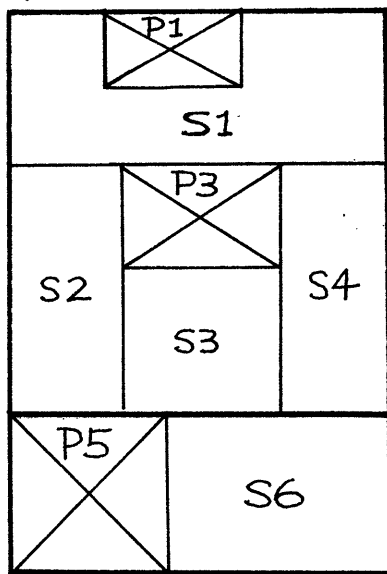
(a) T1

$$(P1=S1) \parallel (S2=(S3 \boxminus P3))=S4=(P5 \parallel S6)$$



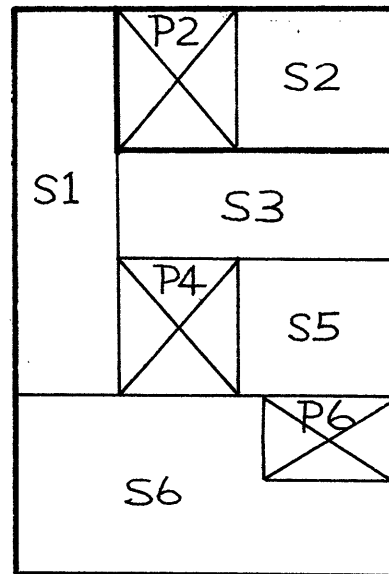
(b) T2

$$(S1 \boxminus P1)=(S2 \parallel (P3=S3)) \parallel S4=(P5 \parallel S6)$$



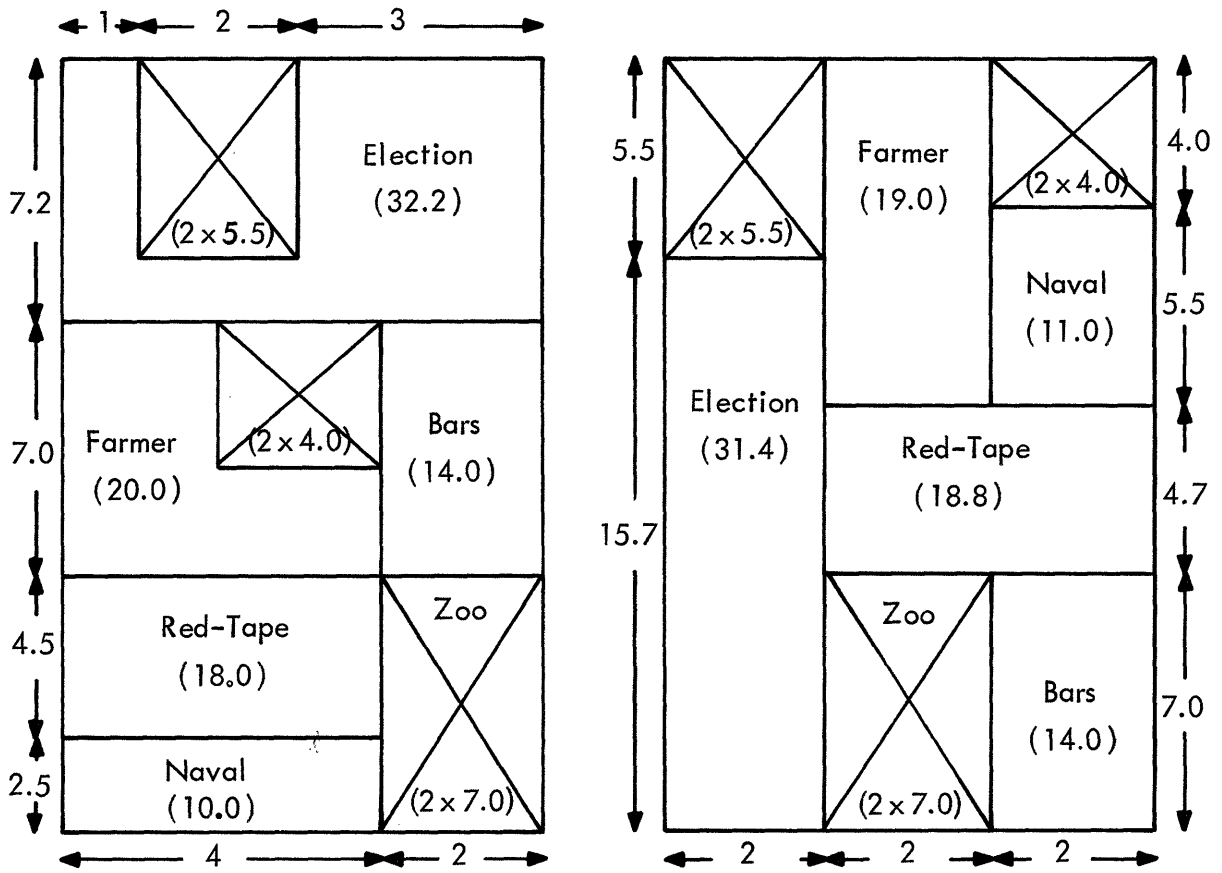
(c) T3

$$(S1 \parallel ((P2 \parallel S2)=S3=(P4 \parallel S5))=(S6 \boxminus P6)$$



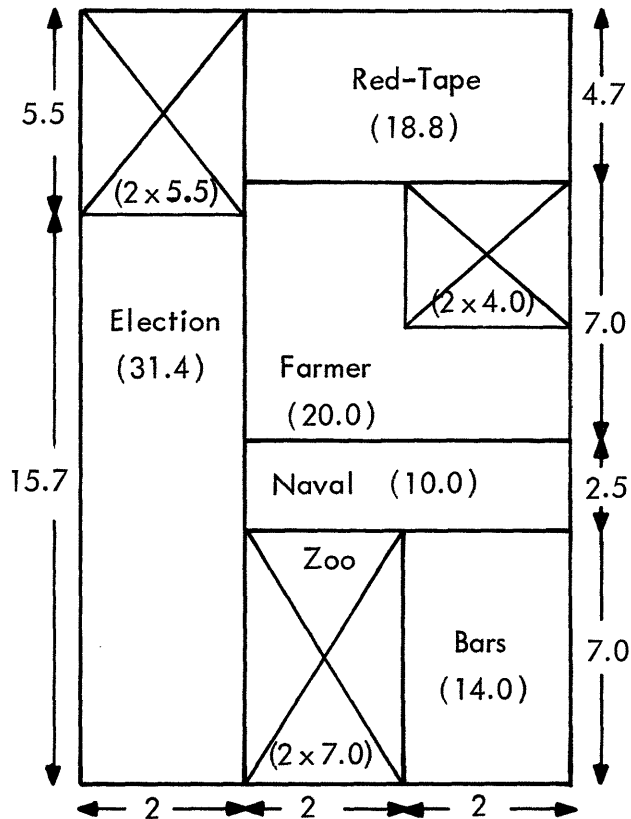
(d) T4

Fig. 9.1 Layout templates used in Experiment 1



(a) Page as laid out by the Globe

(b) Template-generated page using T1 as a guide



(c) Template-generated page using T2 as a guide

Fig. 9.2 Layout dummies of Experiment 1

Table 9.1. Input Data for Experiment 1

News Item	Classification	Area, Column-inches	Importance Ranking
Election	Story	32.2	1
	Associated Picture	2 X 5.5	
Farmer	Story	20.0	2
	Associated Picture	2 X 4.0	
Bars	Story	14.0	3
Red-Tape	Story	18.0	4
Naval	Story	10.0	5
Zoo	Stand-Alone Picture	2 X 7.0	6

as the input data: 3 S type, 2 SP type, 2 PS type, and 1 P type. The page dummy used by the Globe is drawn in Fig. 9.2a; the area of each news block is the parenthesized number within the block, and pictures are indicated by diagonal lines.

The template-driven algorithm successfully produced layouts from both templates T1 and T2. The resulting layout dummies are shown in Fig. 9.2a and 9.2b. To portray the effect of a completed newspaper, we have reproduced the original news page, as it appeared in the Globe, in Fig. 9.3. We also pasted up the two computer-generated dummies manually; the results are shown in Figs. 9.4 and 9.5. For simplicity, the small block "Correction" is considered to be part of the story "Naval". Note that in the layout results of Figs. 9.4 and 9.5 the structures of the news items placed on the page do conform to the layout templates T1 and T2.

On the other hand, templates T3 and T4 in Fig. 9.1 fail to generate acceptable layouts. In Fig. 9.1c template T3 calls for a stand-alone picture and an unassociated story of the same height. Since the dimensions of the only available stand-alone picture are two columns by 7.0 inches, the story located beside the picture must fit into an area of four columns by 7.0 inches or 28.0 column-inches. None of the areas of the three unassociated stories are within the leading tolerance of the required area. As a result, the layout attempt using template T3 as a structural guide fails.

Template T4 requires a story along with its associated picture to be placed in the upper-right corner of the page. See Fig. 9.1d. Since the story item S1 next to it must occupy at least one column, the maximum width of the

# Times have changed, and Burke has election opponents

By Maria Karagannis  
Globe Staff

For nearly two decades, US Rep. James Aloysius Burke, the 65-year-old, cigar-smoking Democrat of Milton, has represented the 11th Congressional District.

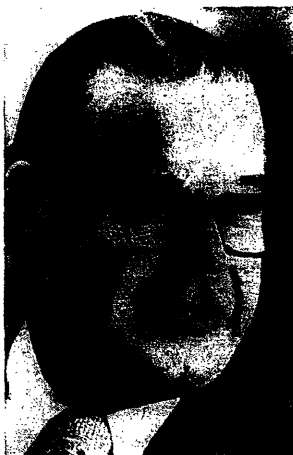
Virtually unchallenged, except for the doomed candidacies of three Republicans running against him in a heavily Democratic district and a token fight in the last primary, Rep. Burke has sailed into office every 24 months for the past 18 years as surely as the swallows return to Capistrano.

But times have changed—Nixon, Watergate, Congressional scandals—all have taken their toll on the good ole boys in Congress, many of whom have been picked off in recent years by younger, more aggressive candidates.

In the generally conservative 11th District, the question now is whether or not a politically astute warhorse like Jim Burke can best the challenge at not one, but two new faces.

Running against him in the Democratic primary Sept. 14 is Patrick Henry McCarthy, a 29-year-old Harvard Law School graduate and Vietnam veteran. Schooled in politics as former chief aide to US Rep. Joe Moakley, McCarthy is bright, ambitious and articulate.

Also on the ballot, as an independent in the general election, is Dante di Benedetto, 30-year-old attorney from Milton. Bright, energetic and determined, he is a former assistant attorney general, a founder of the First Women's Bank and former counsel to the state Public Utilities Commission.



REP. JAMES A. BURKE... "there's no race"

Over the years, much of Rep. Burke's success—besides the obvious fact that 11th district voters have had few other choices on the ballot—has come from his carefully cultivated

reputation as a man who takes care of his constituents. On Capitol Hill, where he is second ranking Democrat on the powerful House Ways and Means Committee,

Jim Burke is known for quiet diligence and a near-perfect attendance record.

At home, in a district stretching south from Dorchester and Hyde Park to Quincy, the shoe-manufacturing city of Brockton and such working-class suburbs as Holbrook, Stoughton and Whitman, he's Rep. Jimmy Burke, an old-style political veteran groomed in the hurly-burly of Boston politics. Always willing to do a favor or shake a hand, he's the kind of congressman who remembers to send congratulations when his constituents have a baby, graduate from college or turn 100.

He is also known as a congressman who takes full advantage of his franking privileges, sending constituents reams of newsletters at the public expense.

Although Burke is rumored to have a solid grip on the district, some observers are speculating privately that the solid organization he is purported to have has withered and died.

Like many of his colleagues, Rep. Burke has not been without his problems recently.

Some of his stances have been controversial and his critics have accused him of having a pro-business voting record.

Also, not long ago, he was forced to deny allegations made by a former Gulf Oil employee, who said he had turned over to a Burke aide an envelope filled with an unspecified amount of cash from an illegal slush fund in 1962.

Burke also has been forced to deny recent reports that he dyes his hair,

that his health is failing and that he's too old for another term.

Vowing to defeat Burke on the issues, McCarthy has been in the district 14 hours a day, seven days a week since December. At scores of coffee parties, on street corners and outside factory gates, he's telling voters what he calls "the other side of the story about Cong. Burke."

Using the \$31,000 he has raised so far (he plans to raise and spend about \$84,000) and relying on advice from political advertising wizard John Mastella, McCarthy is running an aggressive, grassroots campaign based on bread-and-butter issues. At the same time, McCarthy has launched a direct frontal attack on Burke's voting record in Congress, which the Congressmen, so far, has chosen to ignore.

"There's no race as far as I'm concerned," said Burke last week, reiterating his pledge not to spend a dime and not to begin campaigning until Labor Day, which is less than 10 days before the primary election.

Ignoring the opposition, of course, is an old political tactic. Relying on the power of his incumbency not wanting to promote the name of Pat McCarthy, Burke is refusing publicly to comment on the primary race or to defend his record. Some observers believe it is a wise move. However, organizers in the McCarthy camp say Burke will eventually be forced to defend himself before the end of the campaign.

Although Burke says he has not been campaigning, he has recently been frequenting the district, holding regular post office hours, marching in parades and otherwise greeting his constituents.

Among the messages McCarthy is bringing to the voters is that Rep. Burke voted recently to raise the price of gas, milk and bread, that he votes more like a big business Republican than a northern Democrat and that he has brought less Federal revenue into the district than many of his junior-colleagues.

"Burke is saying that he has muscle and Massachusetts needs muscle," says McCarthy. "I say we need muscle, no flab."

Neither Burke nor his aides would respond to these charges.

Saying she is campaigning on the issues, particularly the economy, di Benedetto said last week she is not conducting a media-oriented, old-style political campaign.

"To me, McCarthy is a younger version of Burke," she said, claiming McCarthy has repeatedly asked her to drop out of the race. "I'm advocating a system of two, four-year terms for Congressmen."

"What we should stop breeding another generation of professional politicians," she added, saying, "I'd like to do away with the buddy system altogether."

The 11th District, which voted overwhelmingly for Gov. George Wallace in the last presidential primary, is a largely working-class area inhabited by second and third generation Jews, Italians and Irish. Many of them are working-class people, refugees from such city neighborhoods as Dorchester, and Hyde Park.

## Farmer can't buy water to save Hingham corn

By William B. Hamilton  
Globe Staff

Bill Costa waved his hand disgustfully at the rows of waist-high corn stalks that stood motionless in the Hingham field yesterday in the muggy afternoon air.

"There's nothing here," he said. "There's not even 10 percent. You can see that. If I'd had water last Friday morning when I asked for it, I could have saved this field."

Costa didn't get that water, not because there was none available, but because the Hingham Water Co. wouldn't sell it to him. As a result, he says he stands to lose some \$25,000 on the 20 acres of corn he has planted in Hingham.

"The issue to him is clear: His fields are dusty for lack of moisture. There are three fire hydrants within 100 feet of his fields. Why shouldn't the Hingham Water Co. provide the water that supplies the town with water, allow him, for a price, to use the hydrants and save his crop?"

"To James Cypher, manager of the water company, the issue is just as clear: 'The point is,' he said yesterday, 'the inconvenience to our customers day in and day out wouldn't be right.'"

The inconvenience, he said, would come in two ways. First, taking any substantial amount of water from the hydrants would stir up sediment and

result in dirty water for consumers within a half-mile radius of Costa's fields.

Second, the amount of water that Costa would need for his 20 acres—Cypher says it would be a million gallons—would reduce pressure in the area and would deplete reserves that might be needed later this summer.

"Could you guarantee me that we're going to get 4 inches of rain next week? It's a long-range thing. You don't know what's going to happen in September," he said.

Lined up in support of Cypher's position is Fletcher K. Patch, Hingham's acting fire chief, who said: "Mr. Cypher feels that it would impair that area with low water pressure and I have to agree with him. I feel sorry for him (Costa); I feel sorry for everybody who has burned lawns. But I have no control over it."

In Costa's corner, however, is the Massachusetts Department of Agriculture.

"A guy in a situation like that, he's dead. He's got no other choice — he loses it," said Guy Paris, the department's assistant director for marketing, who spent a lot of time this week trying to help Costa out.

But, he said yesterday: "I don't know what the heck you can do."

Even if Costa does lose most of his crop, Hingham, he still has about 180 additional acres of corn planted in irri-



Farmer William Costa of Hingham holds stunted corn. (Globe photo by Ted Dully)

gated fields in Halifax, Plymouth, Scituate, Norwell, Marshfield and Weymouth. He sells some of the corn wholesale and the rest at Fenimore Hill Farm, a stand on Route 53 in Hingham.

Ironically, in Hingham, much of the land farmed by Costa, who also works in the Boston Globe composing room, is owned by the Hingham Water Co.

According to Paris, the Agriculture Department official, there are a few vegetable farmers such as Costa whose fields are not irrigated, but most truck farmers are coping successfully.

Paris emphasizes that, although it

is a serious situation, the lack of rain is not yet critical throughout the state.

Last night's downpour, which followed a day of intermittent showers, did not have any significant effect on the lower-than-average rainfall total the Boston area has received, according to the National Weather Service.

Those most affected right now, he said, are dairy farmers, particularly those in Worcester County and in the southeastern part of the state. There has been less rain in those areas, Paris explained, and the expense makes it impossible for those farmers to irrigate their pastures.

## Two Bay Village bars ordered by court to stay closed 60 days

The doors of two controversial bars in the Bay Village section were bolted shut last night in apparent compliance with a Federal bankruptcy court ruling ordering them closed for 60 days.

US District Court Judge Walter Jay Skinner ruled yesterday that the state Alcoholic Beverages Control Commission may enforce 60-day suspensions of the liquor licenses of the two bars.

Boston police vice squad detectives were not immediately available last night to confirm whether the licenses had been surrendered.

Attorneys for Jacques and The Other Side, located opposite each other in Bay Village, had petitioned a Federal bankruptcy court to block the closings ordered by the ABC for violation of a midnight closing order issued by the Boston Licensing Board.

Residents have complained repeatedly that the two bars, which are frequented by homosexuals, attract an undesirable element that leads to noise and rowdiness in the neighborhood.

Both bars, owned by the Vava liquor interests, claim that they are insolvent and are seeking to reorganize

under Chapter 11 of the bankruptcy statutes.

Attorneys for the bars claimed that Federal bankruptcy laws prohibit the state from closing them, but Skinner said the "Bankruptcy Act was never intended by Congress to subvert the valid police power of the states in this manner."

Skinner said that if the arguments of the bars' attorneys were adopted, "Chapter 11 would provide an instantly available, cheap and easy sanctuaries from all state regulatory enforcement proceedings."

A temporary restraining order barring the ABCC from closing the bars was issued in May by Bankruptcy Court Judge Paul W. Glennon. He later rescinded the order, but kept it in effect pending the outcome on an appeal to Skinner.

"I'm delighted with it (the ruling) because it shows that the Vavas aren't going to be able to use a phony bankruptcy to frustrate the laws of Massachusetts," Rep. Barney Frank, D-Back Bay, said last night.

Neither Francis Kirby, attorney in the bankruptcy, nor Frank Cashman, manager of the bars, could be reached for comment last night.

## Red tape helps broken sewer to pollute home

By Walter V. Robinson  
Globe Staff

John McLean, his wife, June, and their seven children would like the Boston city bureaucracy to know that they will not have to commandeer a City Hall bathroom after all.

Yesterday, five days after "it" happened, their sewer line was fixed, and their toilets were restored to order—despite the best efforts of a city sewer inspector.

"It" is the raw sewage (John McLean didn't call it that) that kept backing into their home in Centerville Park, Dorchester, after a city contractor apparently broke the sewer pipe while laying electrical line outside.

"I swept it out. I hoveled it out. I broomed it out. It was 3 inches deep on the cellar floor," McLean said of his five-day ordeal.

Between showells, McLean tried to get help from the city, the contractor, Legal Aid. Meanwhile, his 12-year-

old sons, Danny and Shawn, carried buckets and the whole family used buckets instead of their useless toilets.

It was Tuesday when McLean, a skilled craftsman who is unemployed, decided that raising a stink about the stink was not going to solve his problem.

So, shovel in hand, he began to dig out front of his white garish colonial on the tree-lined street in an attempt to find and repair the sewer pipe himself.

After nine hours of digging, he was about to uncover the broken pipe yesterday morning when the bureaucracy intervened.

"Bill Hannigan from the Sewer Department came by and said it was against the law for me to dig here," McLean said.

"He said I needed a building permit but that I can't get one anyway,"

June McLean said. "We're here

with no plumbing for five days, and he tells us we need a building permit."

Hannigan could not be reached for comment at City Hall yesterday afternoon. Someone at the Sewer Department said he had gone home.

McLean said Hannigan then ordered the contractor's backhoe operator to fill in the hole McLean had dug. "So I jumped in," McLean said.

Hannigan called police, who arrived and persuaded McLean to get out, and the hole was filled again.

The McLeans' German shepherd, Trip, was the only family member untroubled by the ordeal.

"He owned every tree and hydrant," a chortling Mrs. McLean remarked.

After yesterday morning's confrontation with the city, McLean found a city employee willing to fight for him — Mary Aeron, assistant manager of the Public Works Little City Hall — and yesterday afternoon the original

contractor, Strytek Inc., arrived to fix the pipe.

The sewer pipe was not the only problem, of course. Because it was broken, the McLeans could not use the water in their house, since draining water only caused more sewage to back up.

On Tuesday night, June McLean said, she called the Sheraton Tara Motel in Braintree and made a reservation for a room for yesterday so her children could shower, "but when they got there this morning they were told we didn't have a reservation" until tomorrow.

Then daughter Kathleen came home from work with a severe toothache and was sent to a dentist. Mrs. McLean shook her head, sighed, and said: "The kids say to me, 'Do what you tell us to do. Count your blessings.'"

John McLean shrugged as he watched the men work and said: "The contractor told me he was going to send me a bill for this work."



Tudi, a female black rhinoceros born yesterday at Boston's Franklin Park Zoo, stands in her mother's shadow as she makes her debut. Tudi, who tipped the scales at 68 pounds, is the first rhino ever born in New England and one of only 13 in captivity throughout the world in the last three years. Her mother, Miradadi, is one of 12 adult rhinos at Franklin Park. (Globe photo by Bill Curtis)

**Correction**  
A story in the morning and all Boston Globes yesterday listed an erroneous title for one of the candidates for the post of chief of Suffolk Superior Court by Charles Business. The error was John F. Shannon is assistant chief of that court. He is not. He is employed at the probation department of the Boston Municipal Court. The assistant chief of Suffolk Superior Court is Michael J. Donagan, a son of a candidate for the post.

**S. Boston backs Naval Annex industrial plan**  
By Stephen Cramton  
Globe Correspondent  
South Boston residents and elected officials last night voiced unanimous approval of a plan proposed by the Boston Economic Development and Industrial Corp. (BEDIC) for redeveloping the former Naval Station Naval Annex.  
BEDIC wants to convert the Naval Annex, make necessary repairs, and then rent space at the site to private industry. It approved the plan and provided some 2000 jobs by 1980 according to BEDIC officials.  
The plan now requires approval by the City Council. The plan is expected to be approved when the US Navy signs the lease. Michael Wrigley, BEDIC executive director, said.  
At a public hearing called by the City Council, Government Land Bank at the 200 South Boston School

combined P2-and-S2 area is five columns. Because both of the given associated pictures are two columns wide, the area for S2 is, at most, three columns wide and either 5.5-inches high (if the picture associated with Election is chosen) or 4.0-inches high (if the picture associated with Farmer is chosen). In either case, the specified story area for Election or Farmer does not fit into the S2 area. Consequently, a layout following the structure of T4 cannot be made.

## 9.2 Layout Experiment 2

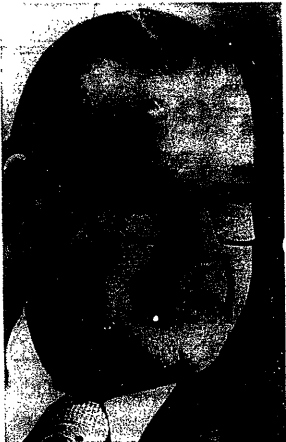
The second test of the template-driven layout techniques uses news items from page three of the July 27, 1976 issue of the Boston Globe. Again, there are five stories, two of them with an associated picture, and one stand-alone picture on the page. The input data of the news items are listed in Table 9.2, and the two templates, T5 and T6, used in the layout experiment are drawn in Fig. 9.6.

Table 9.2 Input Data for Experiment 2

News Item	Classification	Area, Column-inches	Importance Ranking
Kennedy	Story	29.4	1
	Associated Picture	2 X 3.6	
Patients	Story	17.4	2
Police Patrols	Story	15.9	3
	Associated Picture	3 X 3.4	
Linear Case	Story	8.7	4
Housing	Story	25.6	5
Summer	Stand-Alone Picture	2 X 6.4	6

Note that template T5 has the same structure used by the Globe in its layout of page 3 of its July 22 issue. Compare Figs. 9.3 and 9.6a. In other words, an attempt is made to lay out the news items from the July 27 page in the same structure as the July 22 page. The successful template-generated layout dummy is drawn in Fig. 9.7 along with the page dummy actually used by the Globe. During the layout process an additional embedded operator was assumed, one in which the embedded item is located in the top middle of the other item, such as the "Kennedy" picture in Fig. 9.7. Although we failed to include this operator in our embedded set, it should be obvious that the operator set can be easily augmented and the layout technique extended to allow this structure.

# Burke has election opponents



REP. JAMES A. BURKE... "there's no race"

By Maria Karagianis  
Globe Staff

Egr nearly two decades, US Rep. James Aloysius Burke, the 66-year-old, cigar-smoking Democrat of Milton, has represented the 11th Congressional District.

Virtually unchallenged, except for the doomed candidacies of three Republicans running against him in a heavily Democratic district and a token fight in the last primary, Rep. Burke has sailed into office every 24 months for the past 18 years as surely as the swallows return to Capitoline.

But times have changed—Nixon, Watergate, Congressional scandals—all have taken their toll on the good boys in Congress, many of whom have been picked off in recent years by younger, more aggressive candidates.

In the generally conservative 11th District, the question now is whether or not a politically astute washes like Jim Burke can best the challenge at not one, but two new faces.

Running against him in the Democratic primary Sept. 14 is Patrick Henry McCarthy, a 28-year-old Harvard Law School graduate and Vietnam veteran. Schooled in politics as former chief aide to US Rep. Joe Moakley, McCarthy is bright, ambitious and articulate.

Also on the ballot, as an independent in the general election, is Danielle di Benedetto, 30-year-old attorney from Milton. Bright, energetic and determined, she is a former assistant attorney general, a founder of the First Woman's Bank and former counsel to the state Public Utilities Commission.

Jim Burke is known for quiet diligence and a near-perfect attendance record.

At home, in a district stretching south from Dorchester and Hyde Park, to Quincy, the shoe-manufacturing city of Brockton and such working-class suburbs as Holbrook, Stoughton and Whitman, he's Rep. Jimmy Burke, an old-style political veteran known in the hurly-burly of Boston politics. Always willing to do a favor or shake a hand, he's the kind of Congressman, who remembers to send constituents a baby, graduate from college or turn 100.

He is also known as a congressman who takes full advantage of his franking privileges, sending constituents reams of newsletters at the public expense.

Although Burke is rumored to have a solid grip on the district, some observers are speculating privately that the solid organization he is purported to have has withered and died.

Like many of his colleagues, Rep. Burke has not been without his problems recently.

Some of his stands have been controversial and his critics have accused him of having a pro-big-business voting record.

Also, not long ago, he was forced to deny allegations made by a former Gulf Oil employee, who said he had turned over to a Burke aide an envelope filled with an unspecified amount of cash from an illegal slush fund in 1982.

Burke also has been forced to deny recent reports that he dyes his hair.

Over the years, much of Rep. Burke's success—besides the obvious fact that 11th district voters have had few other choices on the ballot—has come from his carefully cultivated

Among the messages McCarthy is bringing to the voters is that Rep. Burke voted recently to raise the price of gas, milk and bread; that he votes more like a big business Republican than a northern Democrat and that he has brought less Federal revenue into the district than many of his more junior colleagues.

"Burke is saying that he has muscle and Massachusetts needs muscle," said McCarthy. "I say we need muscle, not fish."

Neither Burke nor his aides would respond to these charges.

Saying she is campaigning on the issues, particularly the economy, di-Benedetto said last week she is not conducting a media-oriented, old-style political campaign.

"To me, McCarthy is a younger version of Burke," she said, claiming McCarthy has repeatedly asked her to drop out of the race. "I'm advocating a system of two, four-year terms for Congressmen."

"I think we should stop breeding another generation of professional politicians," she added, saying, "I'd like to do away with the buddy system altogether."

The 11th District, which voted overwhelmingly for Gov. George Wallace in the last presidential primary, is a largely working-class area inhabited by second and third generation Jews, Italians and Irish. Many of them are working-class people, refugees from such city neighborhoods as Dorchester and Hyde Park.

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Vowing to defeat Burke on the issues, McCarthy has been in the district 14 hours a day, seven days a week since December. At scores of coffee parties, on street corners and outside factory gates, he's telling voters what he calls "the other side of the story about Cong. Burke."

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"There's no race as far as I'm concerned," said Burke last week, reiterating his pledge not to spend a dime and not to begin campaigning until Labor Day, which is less than 10 days before the primary election.

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On Capitol Hill, where he is second-ranking Democrat on the powerful House Ways and Means Committee,

# Farmer can't buy water to save Hingham corn

By William B. Hamilton  
Globe Staff

Bill Costa waved his hand disgustfully at the rows of waist-high corn stalks that stood motionless in his Hingham field yesterday in the muggy afternoon air.

"There's nothing here," he said. "There's not even 10 percent. You can see that. If I'd had water last Friday morning when I asked for it, I could have saved this field."

Costa didn't get that water, not because there was none available, but because the Hingham Water Co. wouldn't sell it to him. As a result, he says he stands to lose some \$22,000 on the 20 acres of corn he has planted in Hingham.

The issue to him is clear: His fields are dusty for lack of moisture. There are three fire hydrants within 100 feet of his fields. Why shouldn't the Hingham Water Co., a private utility which supplies the town with water, allow him, for a price, to use the hydrants and save his crop?

To James Cypher, manager of the water company, the issue is just as clear: "The point is," he said yesterday, "the inconvenience to our customers day in and day out wouldn't be right."

The inconvenience, he said, would come in two ways. First, taking any substantial amount of water from the hydrants would stir up sediment and

contaminated fields in Halifax, Plymouth, Scituate, Norwell, Marshfield and Plympton. He sells some of the corn wholesale and the rest at Penman Hill Farm, a stand on Route 53 in Hingham.

Ironically, in Hingham, much of the land farmed by Costa, who also works in the Boston Globe composing room, is owned by the Hingham Water Co.

According to Paris, the Agriculture Department official, there are a few vegetable farmers such as Costa whose fields are not irrigated, but most truck farmers are coping successfully.

Paris emphasizes that, although it

result in dirty water for consumers within a half-mile radius of Costa's fields.

Second, the amount of water that Costa would need for his 20 acres—Cypher says it would be a million gallons—would reduce pressure in the area and would deplete reserves that might be needed later this summer.

"Could you guarantee me that we're going to get 4 inches of rain next week? It's a long-range thing. You don't know what's going to happen in September," he said.

Lined up in support of Cypher's position is Fletcher K. Patch, Hingham's acting fire chief, who said: "Mr. Cypher feels that it would impair that area with low water pressure and I have to agree with him. I feel sorry for him (Costa). I feel sorry for everybody who has burned leaves. But I have no control over it."

In Costa's corner, however, is the Massachusetts Department of Agriculture.

"A guy in a situation like that, he's dead. He's got no other choice — he loses it," said Guy Paris, the department's assistant director for marketing, who spent a lot of time this week trying to help Costa out.

But, he said yesterday: "I don't know what the heck you can do."

Even if Costa does lose most of his crop in Hingham, he still has about 180 additional acres of corn planted in irri-

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"It" is the raw sewage (John McLean didn't call it that) that kept backing into their home in Centreville Park, Dorchester, after a city contractor apparently broke the sewer pipe while laying electrical line outside.

"I swept it out; I shoveled it out; I hosed it out. It was 3 inches deep on the cellar floor," McLean said of his five-day ordeal.

Between shovelings, McLean tried to get help from the city, the contractor, Legal Aid. Meanwhile, his 12-year-

old sons, Danny and Shawn, carried buckets and the whole family used buckets instead of their useless toilets.

It was Tuesday when McLean, a skilled craftsman who is unemployed, decided that raising a stink about the stink was not going to solve his problem.

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"He said I needed a building permit but that I can't get one anyway," June McLean said. "We're here



Farmer William Costa of Hingham holds stunted corn. (Globe photo by Ted Dully)

# S. Boston backs Naval Annex industrial plan

By Stephen Crimmin  
Globe Correspondent

South Boston residents and elected officials last night voiced unanimous approval of a plan, proposed by the Boston Economic Development and Industrial Corp. (EDIC), for redeveloping the former South Boston Naval Annex.

EDIC wants to purchase the Naval Annex, make necessary repairs, and then rent space at the site to private industries. If approved, the plan would provide some 2000 jobs by 1980, according to EDIC officials.

Thus far nine companies, with 500 jobs, have been recruited by EDIC. Of these 300, 45 percent of the jobs are held by Boston residents, as compared to 17 percent when the US Navy owned the base. Michael Westgate, EDIC executive director, said.

At a public hearing held by the Massachusetts Government Land Bank at the Joseph P. Ryan School in South Boston, Westgate asked Land Bank members to approve its plan and

to provide EDIC with \$4.8 million to finance purchase of the annex site.

If Land Bank approves the plan, it will purchase the site from the Federal government's General Services Administration (GSA), and then resell the property to EDIC, a city organization created by the Massachusetts Legislature to aid private industrial development in Boston.

# Correction

A story in the morning and afternoon Globes yesterday listed an erroneous title for one of the 10 candidates for the post of clerk of Suffolk Superior Court for Civil Business. The story said John P. Shannon is assistant clerk of that court. He is not. He is employed at the probation department of the Boston Municipal Court. The assistant clerk of Suffolk Superior Court is Michael J. Donovan, also a candidate for the clerk's post.

# Two Bay Village bars ordered by court to stay closed 60 days

The doors of two controversial bars in the Bay Village section were indented last night in apparent compliance with a Federal bankruptcy court ruling ordering them closed for 90 days.

US District Court Judge Walter Jay Skinner ruled yesterday that the state Alcoholic Beverages Control Commission may enforce 60-day suspensions of the liquor licenses of the two bars.

Boston police vice squad detectives were not immediately available last night to confirm whether the licenses had been surrendered.

Attorneys for Jacques and The Other Side, located opposite each other in Bay Village, had petitioned a Federal bankruptcy court to block the closings ordered by the ABCC for violation of a midnight closing order issued by the Boston Licensing Board.

Residents have complained repeatedly that the two bars, which are frequented by homosexuals, attract an undesirable element that leads to noise and rowdiness in the neighborhood.

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A temporary restraining order barring the ABCC from closing the bars was issued in May by Bankruptcy Court Judge Paul W. Glennon. He later rescinded the order, but kept it in effect, pending the outcome on appeal to Skinner.

"I'm delighted with it (the ruling) because it shows that the Vavas aren't going to be able to use a phony bankruptcy to frustrate the laws of Massachusetts," Rep. Barney Frank, D-Buck Bay, said last night.

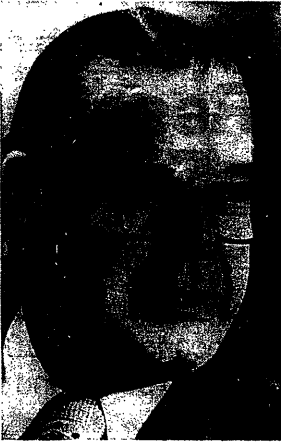
Neither Francis Kirby, attorney in the bankruptcy, nor Frank Cashman, manager of the bars, could be reached for comment last night.



Tudi, a female black rhinoceros born yesterday at Boston's Franklin Park Zoo, stands in her mother's shadow as she mixes her food with a bucket of water. She weighs 50 pounds, is the first rhino ever born in New England and one of only 13 born in captivity throughout the world in the last three years. Her mother, Miradadi, is one of three adult rhinos at Franklin Park. (Globe photo by Bill Curtis)

Fig. 9.4 Experiment I layout using template T1

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Also on the ballot, as an independent in the general election, is Danielle di Benedetto, 30-year-old attorney from Milton. Bright, energetic and determined, she is a former assistant attorney general, a founder of the First Woman's Bank and former counsel to the state Public Utilities Commission.

Jim Burke is known for quiet diligence and a near-perfect attendance record.

At home, in a district stretching south from Dorchester and Hyde Park, to Quincy, the shoe-manufacturing city of Brockton and such working-class suburbs as Holbrook, Stoughton and Whitman, he's Rep. Jimmy Burke, an old-style political veteran groomed in the hurly-burly of Boston politics. Always willing to do a favor or shake a hand, he's the kind of Congressman who remembers to send congratulations when his constituents have a baby, graduate from college or turn 100.

He is also known as a congressman who takes full advantage of his franking privileges, sending constituents reams of newsletters at the public expense.

Although Burke is rumored to have a solid grip on the district, some observers are speculating privately that the solid organization he is purported to have has withered and died.

Like many of his colleagues, Rep. Burke has not been without his problems recently.

Some of his stands have been controversial and his critics have accused him of having a pro-big-business voting record.

Also, not long ago, he was forced to deny allegations made by a former Gulf Oil employee, who said he had turned over to a Burke aide an envelope filled with an unspecified amount of cash from an illegal slush fund in 1962.

Burke also has been forced to deny recent reports that he dyes his hair.

Over the years, much of Rep. Burke's success—besides the obvious fact that 11th district voters have had few other choices on the ballot—has come from his carefully cultivated

Among the messages McCarthy is bringing to the voters is that Rep. Burke voted recently to raise the price of gas, milk and bread; that he votes more like a big business Republican than a northern Democrat and that he has brought less Federal revenue into the district than many of his more junior colleagues.

"Burke is saying that he has muscle and Massachusetts needs muscle," said McCarthy. "I say we need muscle, not fish."

Neither Burke nor his aides would respond to these charges.

Saying she is campaigning on the issues, particularly the economy, di-Benedetto said last week she is not conducting a media-oriented, old-style political campaign.

"To me, McCarthy is a younger version of Burke," she said, claiming McCarthy has repeatedly asked her to drop out of the race. "I'm advocating a system of two, four-year terms for Congressmen."

"I think we should stop breeding another generation of professional politicians," she added, saying, "I'd like to do away with the buddy system altogether."

The 11th District, which voted overwhelmingly for Gov. George Wallace in the last presidential primary, is a largely working-class area inhabited by second and third generation Jews, Italians and Irish. Many of them are working-class people, refugees from such city neighborhoods as Dorchester and Hyde Park.

That his health is failing and that he's too old for another term.

Vowing to defeat Burke on the issues, McCarthy has been in the district 14 hours a day, seven days a week since December. At scores of coffee parties, on street corners and outside factory gates, he's telling voters what he calls "the other side of the story about Cong. Burke."

Using the \$31,000 he has raised so far (he plans to raise and spend about \$84,000) and relying on advice from political advertising wizard John Macatella, McCarthy is running an aggressive, grassroots campaign based on bread-and-butter issues. At the same time, McCarthy has launched a direct frontal attack on Burke's voting record in Congress, which the Congressmen, so far, has chosen to ignore.

"There's no race as far as I'm concerned," said Burke last week, reiterating his pledge not to spend a dime and not to begin campaigning until Labor Day, which is less than 10 days before the primary election.

Ignoring the opposition, of course, is an old political tactic. Relying on the power of his incumbency not wanting to promote the name of Pat McCarthy, Burke is refusing publicly to comment on the primary race or to defend his record. Some observers believe it is a wise move. However, organizers in the McCarthy camp say Burke will eventually be forced to defend himself before the end of the campaign.

Although Burke says he has not been campaigning, he has recently been frequenting the district, holding regular post office hours, marching in parades and otherwise greeting his constituents.

reputation as a man who takes care of his constituents.

On Capitol Hill, where he is second ranking Democrat on the powerful House Ways and Means Committee,

# Red tape helps broken sewer to pollute home

By Walter V. Robinson Globe Staff

John McLean, his wife, June, and their seven children would like the Boston city bureaucracy to know that they will not have to commandeer a City Hall bathroom after all.

Yesterday, five days after "it" happened, their sewer line was fixed, and their toilets were restored to order—despite the best efforts of a city sewer inspector.

"It" is the raw sewage (John McLean didn't call it that) that kept harking into their home in Centerville Park, Dorchester, after a city contractor apparently broke the sewer pipe while laying electrical line outside.

"I swept it out; I shoveled it out; I broomed it out. It was 2 inches deep on the cellar floor," McLean said of his five-day ordeal.

Between shoveled, McLean tried to get help from the city, the contractor, Legal Aid. Meanwhile, his 12-year-

old sons, Danny and Shawn, carried buckets and the whole family used buckets instead of their own toilets.

It was Tuesday when McLean, a skilled craftsman who is unemployed, decided that raising a stink about the stink was not going to solve his problem.

So, shovel in hand, he began to dig out front of his white garrison colonial on the tree-lined street in an attempt to find and repair the sewer pipe himself.

After nine hours of digging, he was about to uncover the broken pipe yesterday morning when the bureaucracy interceded.

"Bill Hannigan from the Sewer Department came by and said it was against the law for me to dig here," McLean said.

"He said I needed a building permit but that I can't get one anyway."

June McLean said: "We're here

with no plumbing for five days, and he tells us we need a building permit."

Hannigan could not be reached for comment at City Hall yesterday afternoon. Someone at the Sewer Department said he had gone home.

McLean said Hannigan then ordered the contractor's backhoe operator to fill in the hole McLean had dug. "So I jumped in," McLean said.

Hannigan called police, who arrived and persuaded McLean to get out, and the hole was filled again.

The McLeans' German shepherd, Trip, was the only family member untroubled by the ordeal.

"He owned every tree and hydrant," a chuckling Mrs. McLean remarked.

After yesterday morning's confrontation with the city, McLean found a city employee willing to fight for him—Barry Aaron, assistant manager of the Fields Corner Little City Hall—and yesterday afternoon—the original

contractor, Strytek Inc., arrived to fix the pipe.

The sewer pipe was not the only problem, of course. Because it was broken, the McLeans could not use the water in their house, since draining water only caused more sewage to back up.

On Tuesday night, June McLean said, she called the Sheraton Tara Motel in Braintree and made a reservation for a room for yesterday so her children could shower, "but when they got there this morning they were told we didn't have a reservation until tomorrow."

Then daughter Kathleen came home from work with a severe toothache and was sent to a dentist. Mrs. McLean shook her head, sighed, smiled and said: "The kids say to me, 'Do what you tell us to do. Count your blessings.'"

John McLean shrugged as he watched the men work and said: "The contractor told me he's going to send me a bill for this work."

# Farmer can't buy water to save Hingham corn

By William B. Hamilton Globe Staff

Bill Costa waved his hand disgustfully at the rows of waist-high corn stalks that stood motionless in his Hingham field yesterday in the muggy afternoon air.

"There's nothing here," he said. "There's not even 10 percent. You can see that. If I had water last Friday morning when I asked for it, I could have saved this field."

Costa didn't get that water, not because there was none available, but because the Hingham Water Co. wouldn't sell it to him. As a result, he stands to lose some \$20,000 on the 20 acres of corn he has planted in Hingham.

The issue to him is clear: His fields are dusty for lack of moisture. There are three fire hydrants within 100 feet of his fields. Why shouldn't the Hingham Water Co., a private utility which supplies the town with water, allow him, for a price, to use the hydrants and save his crop?

"To James Cypher, manager of the water company, the issue is just as clear. "The point is," he said yesterday, "the inconvenience to our customers day in and day out wouldn't be right."

The inconvenience, he said, would come in two ways. First, taking any substantial amount of water from the hydrants would stir up sediment and

result in dirty water for consumers within a half-mile radius of Costa's fields.

Second, the amount of water that Costa would need for his 20 acres—Cypher says it would be a million gallons—would reduce pressure in the area and would deplete reserves that might be needed later this summer.

"Could you guarantee me that we're going to get 4 inches of rain next week? It's a long-range thing. You don't know what's going to happen in September," he said.

Listed in support of Cypher's position is Fletcher K. Patch, Hingham's acting fire chief, who said: "Mr. Cypher feels that it would impair that area with low water pressure and I have to agree with him. I feel sorry for him (Costa); I feel sorry for everybody who has burned lawns. But I have no control over it."

In Costa's corner, however, is the Massachusetts Department of Agriculture.

"A guy in a situation like that, he's dead. He's got no other choice—he loses it," said Guy Paris, the department's assistant director for marketing, who spent a lot of time this week trying to help Costa out.

But, he said yesterday: "I don't know what the heck you can do."

Even if Costa does lose most of his crop in Hingham, he still has about 180 additional acres of corn planted in Irri-



Farmer William Costa of Hingham holds stunted corn. (Globe photo by Ted Dully)

gated fields in Halifax, Plymouth, Sciatauc, Norwell, Marshfield and Plymouth. He sells some of the corn wholesale and the rest at Pennington Hill Farm, a stand on Route 33 in Hingham.

Ironically, in Hingham, much of the land farmed by Costa, who also works in the Boston Globe composing room, is owned by the Hingham Water Co.

According to Paris, the Agriculture Department officials, there are a few vegetable farmers such as Costa whose fields are not irrigated, but most truck farmers are coping successfully.

Paris emphasizes that, although it

is a serious situation, the lack of rain is not yet critical throughout the state.

Last night's downpour, which followed a day of intermittent showers, did not have any significant effect on the lower-than-average rainfall total the Boston area has received, according to the National Weather Service.

Those most affected right now, he said, are dairy farmers, particularly those in Worcester County and in the southeastern part of the state. There has been less rain in those areas, Paris explained, and the expense makes it impossible for those farmers to irrigate their pastures.

# Correction

A story in the morning and afternoon Globes yesterday listed an erroneous title for one of the 10 candidates for the post of clerk of Suffolk Superior Court for Civil Business. The story said John P. Shannon is assistant clerk of that court. He is not. He is employed in the probation department of the Boston Municipal Court. The assistant clerk of Suffolk Superior Court is Michael J. Donovan, also a candidate for the clerk post.

# S. Boston backs Naval Annex industrial plan

By Stephen Crimmin Globe Correspondent

South Boston residents and elected officials last night voiced unanimous approval of a plan, proposed by the Boston Economic Development and Industrial Corp. (EDIC), for redeveloping the former South Boston Naval Annex.

EDIC wants to purchase the Naval Annex, make necessary repairs, and then rent space at the site to private industries. If approved, the plan would

provide some 2000 jobs by 1980, according to EDIC officials.

Thus far nine companies, with 300 jobs, have been recruited by EDIC. Of these 300, 75 percent of the jobs are held by Boston residents, as compared to 15 percent when the US Navy owned the base," said Michael Westgate, EDIC executive director, said.

At a public hearing called by the Massachusetts Government Land Bank at the Joseph P. Tynan School in

South Boston, Westgate asked Land Bank members to approve his plan and provide EDIC with \$1.8 million to finance purchase of the annex site.

If Land Bank approves the plan, it will purchase the site from the Federal government's General Services Administration (GSA), and then resell the property to EDIC, a city organization created by the Massachusetts Legislature to aid private industrial development in Boston.



Tudi, a female black rhinoceros born yesterday at Boston's Franklin Park Zoo, stands in her mother's shadow as she makes her debut. Tudi, who tipped the scales at 50 pounds, is the first rhino ever born in New England and one of only 13 born in captivity throughout the world in the last three years. Her mother, Miradadi, is one of three adult rhinos at Franklin Park. (Globe photo by Bill Curtall)

# Two Bay Village bars ordered by court to stay closed 60 days

The doors of two controversial bars in the Bay Village section were bolted shut last night in apparent compliance with a Federal bankruptcy court ruling ordering them closed for 60 days.

US District Court Judge Walter Jay Skinner ruled yesterday that the state Alcoholic Beverages Control Commission may enforce 60-day suspensions of the liquor licenses of the two bars.

Boston police vice squad detectives were not immediately available last night to confirm whether the licenses had been surrendered.

Attorneys for Jacques and The Other Side, located opposite each other in Bay Village, had petitioned a Federal bankruptcy court to block the closings ordered by the ABC for violation of a multi-million dollar order issued by the Boston Licensing Board.

Residents have complained repeatedly that the two bars, which are frequented by homosexuals, attract an undesirable element that leads to noise and readiness in the neighborhood.

Both bars, owned by the Vasa liquor interests, claim that they are insolvent and are seeking to reorganize

under Chapter 11 of the bankruptcy statutes.

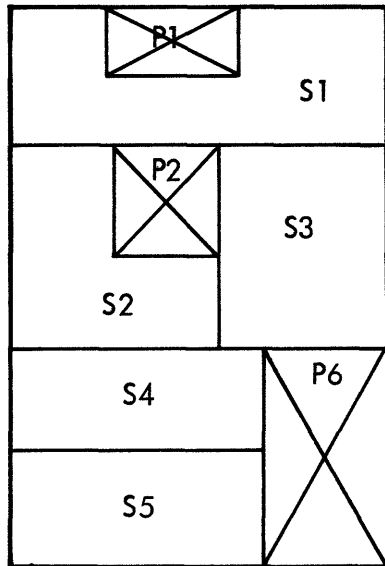
Attorneys for the bars claimed that Federal bankruptcy laws prohibited the state from closing them, but Skinner said the "Bankruptcy Act was never intended by Congress to subvert the valid police power of the states in this manner."

Skinner said that if the arguments of the bars' attorneys were adopted, "Chapter 11 would provide an instant, by available, cheap and easy sanctuary from all state regulatory enforcement proceedings."

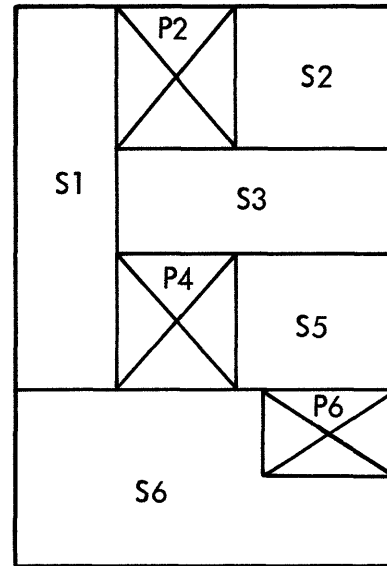
A temporary restraining order barring the ABC from closing the bars was issued in May by Bankruptcy Court Judge Paul W. Gleason. He later rescinded the order, but kept it in effect pending the outcome of an appeal to Skinner.

"I'm delighted with it (the ruling) because it shows that the Vases aren't going to be able to use a phony bankruptcy to frustrate the laws of Massachusetts," Rep. Barney Frank, D-Bay, said last night.

Another Francis Kirby, attorney in the bankruptcy, nor Frank Cashman, manager of the bars, could be reached for comment last night.

$$(S1 \text{ } \square \text{ } P1) = ((S2 \text{ } \square \text{ } P2) \parallel S3) = ((S4 = S5) \parallel P6)$$


(a) T5

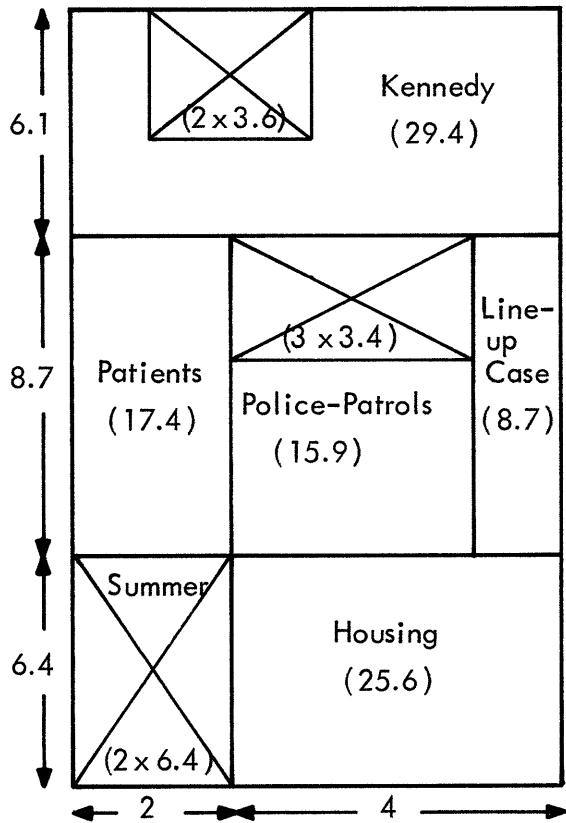
$$(S1 \parallel ((P2 \parallel S2) = S3 = (P4 \parallel S5))) = (S6 \text{ } \square \text{ } P6)$$


(b) T6

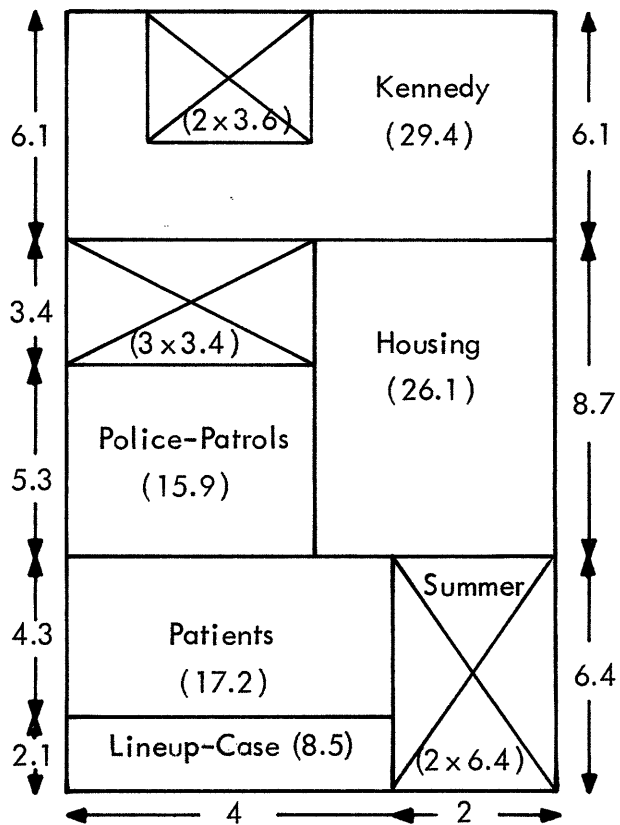
Fig. 9.6 Layout templates used in Experiment 2

The original page three of the July 27 issue and the manual paste-up of the template-generated results are shown in Figs. 9.8 and 9.9. Note that the picture associated with Police Patrols in Fig. 9.9 is positioned above the story text, despite the call by template T5 for an embedded layout at the upper-right corner (S2 and P2 in Fig. 9.6a). This occurs because a three-column area is constructed for the news item Police Patrols (story and picture combined) during its layout, and the associated picture is also three-columns wide; consequently, the picture occupies the entire top part of the area.

Template T6 in Fig. 9.6b is the same as T4 in Fig. 9.1d. It again fails to produce a successful layout because of the large story-text areas of Kennedy and Police Patrols and their relatively small associated pictures. Again, as in Experiment 1, neither of these two news items can fit into the upper-right corner (S2 and P2 in Fig. 9.6b) in the structure required by template T6.



(a) Page as laid out by the Globe



(b) Template-generated page using T5 as a guide

Fig. 9.7 Layout dummies of Experiment 2

# Kennedy's busing stand hurting him in some Boston wards

By Charles Claffey  
Globe Staff

On Sept. 9, 1971, US Sen. Edward M. Kennedy was struck with a tomato and punched and kicked when he tried to address opponents of the city's school desegregation plan at a rally at City Hall Plaza.

Last February, a group of busing foes broke up an anti-face hearing by Kennedy at the JFK building in Boston almost before it began.

And last April, Kennedy was jostled and poked by a crowd of anti-busing demonstrators in Quincy as he tried to elbow his way to his car outside a junior high school where he had given a speech.

Kennedy's support of court-ordered school busing to achieve desegregation has cost the senior senator from Massachusetts support in some of Boston's Democratic wards which traditionally have been part of the Kennedy power base in Massachusetts.

As a result, his bid for re-election this year to a third six-year term has lured four Democratic opponents into the Sept. 14 primary, all of whom are opposed to court-ordered busing.

Although none of the four is considered a serious threat to Kennedy's



Sen. Kennedy discusses court-ordered busing with group of South Boston High School students in photo taken in his office in January. At second left is Robert Dinsmore, attorney for South Boston Home and School Assn. (UPI photo)

incumbency, the number of token opponents is viewed by some as a sign of erosion in the senator's improbable hold on public office in Massachusetts.

Only one of Kennedy's opponents in the primary is a professional politician, Boston City Councilman Frederick C. Langone.

It is Langone that Kennedy campaign aides reportedly feel poses the

County town of Berkley.

Besides Langone, the challengers are:

Robert E. Dinsmore, 44, of Milton, a Boston attorney active in handling cases for opponents of busing.

Albert J. Onessimo, 54, a Somerville real estate man.

Bernard Shannon, 44, president of a Stoughton construction firm.

Langone, a 12-year council veteran, said he feels he has a chance to win because "there is a lot of antagonism towards Kennedy."

The councilman said Kennedy's primary consideration "is his national image. He can't do anything that would hurt his image with a black in New York City or a chicano in Los Angeles."

"I have no national image to protect," Langone said. "What affects the people of Massachusetts would be what concerns me."

He said it is not school busing as such that is at issue "but giving the people of Boston a day in court where they did in Louisville and Detroit. We never got that opportunity."

Langone was critical of the announced closings of military installa-

tions in Massachusetts and said that as senator, he would work on keeping them open, "and I won't have to trade votes on national issues to get it done."

Dinsmore, like the other candidates, believes that "people want a change," while adding that in opposing Kennedy he is "fighting a brand name."

He has never run for public office before and acknowledges that "I'm not going to get help from any (political) pros."

Helping in his campaign are legal associates, Les Gold, his wife, Helen, and several of his eight children, as well as members of his office staff.

Dinsmore feels that governmental social policies "forced on the people of Massachusetts are repugnant."

Among other things, he believes in the right of people to decide "the manner and place in which their children will be educated."

His interpretation of freedom of choice also extends to gun control. He favors legislation that would set reasonable criteria for people desiring to carry guns.

Onessimo's only bid for public office was as a sticker candidate for mayor in Somerville.

He calls himself an "ambibureaucrat" and contends that New England residents are paying the price of bureaucracy in high fuel oil and gasoline costs.

Onessimo also opposes forced busing and said he would work hard to prevent the announced closings of military bases in the state.

Thus far, his campaigning has been confined to Greater Boston communities, but he said he plans to extend his operations to the state's central and western parts.

Shannon, whose campaign bumper stickers describe him as "A Man for All Reasons," says Kennedy is "leading our nation's headlong plunge toward socialism by espousing programs which allow the Federal government to infiltrate every facet of our private lives."

A self-characterized liberal turned moderate-conservative, he has charged that Kennedy is at the "forefront of those who are perverting social legislation into socialist legislation."

He opposes the Equal Rights Amendment, calling it "the most important issue before this country since slavery."

## Loans, purchases reported

# Fernald patients' funds misused, Buczko says

By Nita Bruszelius  
Globe Staff

Officials of the Walter E. Fernald State School made a number of "questionable" expenditures with funds belonging to the retarded residents of the school, State Auditor Theodosius Buczko said yesterday.

The expenditures included three small loans to employees of the school in "clear violation of the residents' rights," the report said, and the purchase of washing machines, dryers and furniture for the school. Noting that two of the loans had not been repaid, the auditor said, "Future actions of this sort should be punished harshly."

The loans totaled \$340. Buczko and others have repeatedly found improprieties in the handling of patients' funds at the institutions of the state Mental Health Department, and new regulations are being drawn up to cope with the allegedly questionable expenditures.

The audit report, which covered a 12-month period up to February 24, 1976, said it found a number of discrepancies in accounting and instances of inadequate record keeping.

"It is quite obvious that better record keeping is needed to insure proper internal controls and to protect the rights of the residents," the report said.

Fernald is one of two state schools for the retarded that is threatened with the loss of up to \$10 million in Federal funds because of major failings in patient care, numbers of staff, pharmacy services, food handling, medical records and other services.

Acting Superintendent John Gracey said he could not comment specifically on the allegations of misuse of patients' funds because he had not yet seen the auditor's report.

He said, however, that to conform with recently issued departmental guidelines, the Fernald administration

has "developed an entirely new set of policies and procedures governing expenditure and accounting by clients' funds." He said they are expected to be issued within 10 days.

Since he became acting superintendent a month ago, Gracey said he has personally approved all expenditures of patients' funds and "to my understanding there have been no irregularities" in that period.

In addition to the loans, the audit report said it found a number of other questionable expenditures from personal funds belonging to the retarded residents of the school. It cited \$575 spent on "washers and dryers" and \$2400 spent on "tutoring services." Patient funds were also reportedly used to purchase a color television set, a dishwasher and wall fans.

The report said "it appeared" these items should have been paid for with expenditures from the "maintenance appropriation."

The personal patients' funds held by the school come from several areas, according to mental health department sources. Some of the funds represent the \$25-a-month allowance received by residents having Supplemental Security Income, some are funds provided by residents' families, and some come from other sources such as Social Security.

Individual bank accounts maintained for 161 of the 1400 patients at the school totaled nearly \$688,000 as of Feb. 28, the report said.

Buczko's audit also questioned a number of expenditures from funds donated to the school "for the benefit of patients." Without citing amounts or providing details, it listed expenditures for such items as "loans to employees, Activity Center dedication, payment for travel and luncheons, advertising for hospital" and "loans to Walter E. Fernald State School for postage."



Standing in Copley Square before members of Boston Police Department's mounted patrol, Police Comr. Robert J. McGreevy (left) and Mayor White tell reporters about increase in size of unit.

# Mounted police patrols expanding

Covering Newbury and Boylston streets, Jamaica Pond

By David A. Rogers  
Globe Staff

The mayor said a few words, the police commissioner added a few of his own, the mounted patrolmen smiled, and the horses said nothing.

Lined up in Copley Square across from the Boston Public Library yesterday, they were the silent stars of a coming out party for the city's mounted patrol, which, after more than a century of service, seems to be an idea old enough to be considered new again.

Led by Sgt. Alfred J. McNeil, riding a big chestnut Morgan with the title Fairfield Fortitude 3d, the unit has grown in the last year from about 10 mounts to 18, completed in mid-June by officers to ensure permanent patrols in some sections of the city.

Yesterday's party was to make the announcements of five new patrolmen to the unit, including the second woman officer and to celebrate the institution of permanent horse patrol.

"The deployment of mounted police as crime deterrents is a relatively new idea in Boston and has been welcomed

as a much needed addition to foot and car patrols," said Mayor Kevin White, in a statement released for the occasion. "The officers and horses have been extremely popular with residents, businessmen and visitors," he said.

"Mounted officers can see and be seen for three blocks. This not only discourages criminal acts but adds to the overall sense of security for the people living, working or shopping in the downtown and Back Bay areas," White said.

While the patrol has been used historically on the Boston Common, its role has been expanded in the past year, first at the prompting of the city's theater district, which had complained of prostitutes and muggers driving away patrons. Since April, the patrols have been added on an experimental basis in commercial areas of the Back Bay, and these will now be permanent on Newbury and Boylston streets as well as the Fenway. Aside from the Common, the Jamaica Pond area will be patrolled daily, on Sunday's the new Waterfront Park and Arnold Arboretum.

"People always said the horses were good, but it has taken a while before anything was done for them," said Joseph McLennan, a hostler at the Brandegee Estate in Jamaica Plain, where the animals are stabled and trained. "How the feed is better and we have a few extra dollars to care for them. Things are looking up."

Still less than one percent of the city's police budget, the patrol often relies on horses donated by private owners. These include a grade Morgan named Prescott, first given by the mayor to his wife as a Christmas present.

White, who has used such occasions as small press outings, seemed content to share the good reception enjoyed by the animals and pose alongside Comr. Robert diGrazia, who has recently been reported on the outs with the mayor.

"There's only friction, Bob" asked White.

"Why, I adore you," said diGrazia. The mounted patrolmen smiled and the horses said nothing.

## Charges may be dropped

# Lineup case is deferred for police

Eighteen Boston patrolmen charged with disobeying a direct order to participate in an identification lineup pleaded no contest to the charge yesterday and prosecution of the matter will be deferred for six months.

If the officers avoid any similar complaints in the next six months, the charges will be dropped. The arrangement was proposed by the police and accepted by Police Comr. Robert J. diGrazia.

"I'm satisfied with the disposition and I'm pleased that the men are," diGrazia said.

The charges were leveled by superior officers after the men refused to stand in a lineup in connection with complaints that two officers assaulted several Charlestown residents last October.

The officers who refused to take part in the lineup are all members of the Mobile Operations Patrol. They refused the order on advice of their attorney, Frank McGee, saying the order was unconstitutional.

Stephen Dunleavy, an aide to diGrazia, said last week the commissioner's agreement is not part of his attempt at reconciliation with the patrolmen's union, but is solely a decision on a single case.

diGrazia and Chester J. Broderick, chairman of the Boston Police Patrolmen's Assn., agreed last week to meet regularly in the future to discuss police department matters and to attempt to end the bitterness which sometimes characterized their relationship over the past four years.



Mime Kathryn Martin performs in graceful silence at Boston's Prudential Center. Martin and members of National Mime Theater entertained visitors last night as part of the center's Summer Show series. (Globe photo by Stan Grossfeld)

# South End housing: Haves vs. have-nots, Round 2

By Anne Kirchheimer  
Globe Staff

The lull is over. The battle between the haves and the have-nots in Boston's South End has begun anew after a year of relative calm.

What got the troops going this time was a recently issued Federal housing directive, made public late last week, that apparently puts an end to building any more subsidized housing in the South End.

The directive, based on little-used US Department of Housing and Urban Development (HUD) guidelines, is aimed at guiding the construction of subsidized housing away from neighborhoods with high concentrations of poor persons and subsidized living units.

If strictly enforced, the guidelines have wide-ranging implications for the character of other, poorer Boston neighborhoods and their residents, and for the state.

And in the South End, where more than half the residents are low income and a growing number of others are middle- and upper-middle-class homeowners, the implications of the HUD ruling are already becoming known.

The directive on subsidized housing would now put the haves one step ahead of the have-nots.

The basic controversy is simple. One group of residents, who have called themselves Citizens for a Bal-

anced South End in the past and the Section 8 Committee more recently, say they want to make sure the area maintains a "balance" between the poor and the affluent, an aspect that has characterized the South End.

The other group, made up of poor persons and more affluent advocates of the neighborhood, want to see the South End's subsidized housing improved to ensure that those who came to the neighborhood before townhouse living became fashionable have the opportunity to remain.

These are not the only players in what would be termed a class struggle. The battle is further complicated by city policies, speculators, realtors, HUD and the Boston Housing Department (BHD), which has directed the South End Urban Renewal plan since its inception in 1965.

For two of the last three years, the

South End factions have been in open battle. Most of the fights were waged in the courtroom, where the Citizens for a Balanced South End tried to halt construction of three subsidized housing projects. Each suit was based on environmental impact of the proposed projects, but the group lost each case.

Today the front line has moved from the courtroom to HUD offices. There a lawyer representing the South Enders who oppose more subsidized housing for their neighborhood recently pointed out to housing officials that they were not following their own guidelines on the Federal Section 8 subsidy program.

As David Parker, a property owner and relative newcomer who led the fight against subsidized housing, said, "I don't support ghettoes or racism and economically imbalanced housing."

But what was not pointed out by

the lawyer, Thomas Philip DeGnon, or mentioned in the HUD directive is what happens to persons living in more than 4300 remaining subsidized housing units in the South End and more than 3000 South Enders who qualify for subsidized housing and cannot find it.

The BRA will first appeal the HUD directive by letter. But BRA officials say court action may follow.

Charles Speleotis, BRA director of housing and general counsel, said: "Economic and undue concentration are all nice words and nice concepts but... it's our obligation to improve the conditions for people living there."

State Rep. Mel King (D-South End) says it is unlikely that South Enders will be able to force HUD to reverse the directive.

State Rep. Mel King (D-South End) says it is unlikely that South Enders will be able to force HUD to reverse the directive.

Right now, the only certain thing is that 150 units of subsidized housing for the South End have been halted, and the future of hundreds of more additional planned units is uncertain.

### 9.3 Layout Experiment 3

In order to test the layout of pages with ads, data are taken from page eight of the July 28, 1976 Boston Globe and used as inputs for the layout algorithm. The page as laid out by the Globe has an eight-column format and contains six ads, three stories, and one stand-alone picture. Table 9.3 lists the areas or dimensions of the news items and ads, as measured from the original page, and Fig. 9.10 shows three layout templates, T7 through T9, used in the experiment. The minimum overhead and latency distances specified for this experiment are 1.1 and 0.6 inches, respectively.

Table 9.3. Input Data for Experiment 3

News Item or Ad	Classification	Area, Column-inches	Importance Ranking
Rent Hike	Story	21.2	1
Car Insurance	Story	15.5	3
Metco Cuts	Story	10.9	4
Children's Zoo	Stand-Alone Picture	3 X 4.5	2
Stearns Coat	Ad #1	3 X 14.4	
Stearns Glasses	Ad #2	3 X 7.0	
Sears	Ad #3	2 X 10.6	
Lakes Region	Ad #4	2 X 6.8	
Congressman	Ad #5	2 X 3.8	
Simpson's	Ad #6	1 X 1.9	

The dummy for the original page layout as it appeared in the paper is drawn in Fig. 9.11a. The ads area is shaded and the news-hole depth per column is described by the numbers at top of the figure. Use of template T7 yields the layout of Fig. 9.11b. Figures 9.12 and 9.13 show the original news page of the Globe and our algorithmic layout results after the dummy was pasted up manually.

In the second test case in this experiment, the ads dummy of the original page is modified and template T8 is used. Although the positions of ads are slightly different from the original layout, the total ads area and hence the news-hole area, is retained. A successful layout was achieved and is shown in Fig. 9.11c. Again the layout dummy was used to guide the pasteup of the news items, and the resultant news page is shown in Fig. 9.14.

# Kennedy's busing stand hurting him in some Boston wards

By Charles Claffey  
Globe Staff

On Sept. 9, 1974, US Sen. Edward M. Kennedy was struck with a tomato and punched and kicked when he tried to address opponents of the city's school desegregation plan at a rally at City Hall Plaza.

Last February, a group of busing foes broke up an airline-fare hearing by Kennedy at the JFK building in Boston almost before it began.

And last April, Kennedy was jostled and poked by a crowd of antibusing demonstrators in Quincy as he tried to elbow his way to his car outside a junior high school where he had given a speech.

Kennedy's support of court-ordered school busing to achieve desegregation has cost the senior senator from Massachusetts support in some of Boston's Democratic wards which traditionally have been a part of the Kennedy power base in Massachusetts.

As a result, his bid for re-election this year to a third six-year term has lured four Democratic opponents into the Sept. 14 primary, all of whom are opposed to court-ordered busing.

Although none of the four is considered a serious threat to Kennedy's



Sen. Kennedy discusses court-ordered busing with group of South Boston High School students in photo taken in his Hub office in January. At second left is Robert Dinsmore, attorney for South Boston Home and School Assn. (UPI photo)

incumbency, the number of token opponents is viewed by some as a sign of erosion in the senator's impregnable hold on public office in Massachusetts.

Only one of Kennedy's opponents in the primary is a professional politician, Boston City Councilman Frederick C. Langone.

It is Langone that Kennedy campaign aides reportedly feel poses the

only half-serious opposition.

Kennedy workers, concerned that his supporters might be so confident of an easy victory that they won't bother with the primary, are working to get out the vote.

If the senator, as expected, wins the primary, he will face a political unknown, Michael Robertson, a Republican businessman in the Bristol

County town of Berkley.

Besides Langone, the challengers are:

Robert E. Dinsmore, 44, of Milton, a Boston attorney active in handling cases for opponents of busing.

Albert J. Onessimo, 54, a Somerville real estate man.

Bernard Shannon, 44, president of a Stoughton construction firm.

Langone, a 12-year council veteran, said he feels he has a chance to win because "there is a lot of antagonism towards Kennedy."

The councilman said Kennedy's primary consideration "is his national image. He can't do anything that would hurt his image with a black in New York City or a chicano in Los Angeles."

"I have no national image to protect," Langone said. "What affects the people of Massachusetts would be what concerns me."

He said it is not school busing as such that is at issue "but giving the people of Boston a day in court the way they did in Louisville and Detroit. We want that opportunity."

Langone was critical of the announced closings of military installa-

tions in Massachusetts and said that as senator, he would work on keeping them open. "and I won't have to trade votes on national issues to get it done."

Dinsmore, like the other candidates, believes that "people want a change," while adding that in opposing Kennedy he is "fighting a brand name."

He has never run for public office before and acknowledges that "I'm not going to get help from any (political) pros."

Helping in his campaign are legal associate, Les Gold, his wife, Helen, and several of his eight children, as well as members of his office staff.

Dinsmore feels that governmental social policies "forced on the people of Massachusetts are repugnant."

Among other things, he believes in the right of people to decide "the manner and place in which their children will be educated."

His interpretation of freedom of choice also extends to gun control. He favors legislation that would set reasonable criteria for people desiring to carry guns.

Onessimo's only bid for public office was as a sticker candidate for mayor in Somerville.

He calls himself an "antibureaucrat" and contends that New England residents are paying the price of bureaucracy in high fuel oil and gasoline costs.

Onessimo also opposes forced busing and said he would work hard to prevent the announced closings of military bases in the state.

Thus far, his campaigning has been confined to Greater Boston communities, but he said he plans to extend his operations to the state's central and western parts.

Shannon, whose campaign bumper stickers describe him as "A Man for All Reasons," says Kennedy is "leading our nation's headlong plunge toward socialism by espousing programs which allow the Federal government to infiltrate every facet of our private lives."

A self-characterized liberal turned moderate-conservative, he has charged that Kennedy is at the "forefront of those who are perverting social legislation into socialist legislation."

He opposes the Equal Rights Amendment, calling it "the most important issue before this country since slavery."



Standing in Copley Square before members of Boston Police d'Grazia (left) and Mayor White tell reporters about increase Department's mounted patrol, Police Comr. Robert J. White said.

## Mounted police patrols expanding

Covering Newbury and Boylston streets, Jamaica Pond

By David A. Rogers  
Globe Staff

The mayor said a few words, the police commissioner added a few of his own, the mounted patrolmen smiled, and the horses said nothing.

Lined up in Copley Square across from the Boston Public Library yesterday, they were the silent stars of a coming out party for the city's mounted patrol, which, after more than a century of service, seems to be an idea old enough to be considered new again.

Led by Sgt. Alfred J. McNeil, riding a big chestnut Morgan with the title Fairfield Fortitude 3d, the unit has grown in the last year from about 10 mounts to 18, complemented now by 20 officers to ensure permanent patrols in some sections of the city.

Yesterday's party was to make the announcements of five new patrolmen to the unit, including the second woman officer and to celebrate the institution of permanent horse patrols.

"The deployment of mounted police as crime deterrents is a relatively new idea in Boston and has been welcomed

as a much needed addition to foot and car patrols," said Mayor Kevin White in a statement, released for the occasion. "The officers and horses have been extremely popular with residents, businessmen and visitors," he said.

"Mounted officers can see and be seen for three blocks. This not only deters criminal acts but adds to the overall sense of security felt by people living, working or shopping in the downtown and Back Bay areas," White said.

While the patrol has been used historically on the Boston Common, its role has been expanded in the past year. First at the prompting of the city's theater district, which had complained of prostitutes and muggers driving away patrons. Since April, the patrol has been added on an experimental basis in commercial areas in the Back Bay, and these will now be made permanent on Newbury and Boylston streets as well as the Fenway. Aside from the Common, the Jamaica Pond area will be patrolled daily, and, on Sunday's, the new Waterfront Park and Arnold Arboretum.

"People always said the horses were good, but it has taken a while before anything was done for them," said Joseph McLennan, a hostler at the Brandegee Estate in Jamaica Plain, where the animals are stabled and trained. "Now the feed is better and we have a few extra dollars to care for them. Things are looking up."

Still less than one percent of the city's police budget, the patrol often relies on horses donated by private owners. These include a grade Morgan named Precious first given by the mayor to his wife as a Christmas present.

White, who has used such occasions as small press outings, seemed content to share the good reception enjoyed by the animals and pose alongside Comr. Robert d'Grazia, who has recently been reported on the outs with the mayor.

"Is there any friction, Bob?" asked White.

"Why, I adore you," said d'Grazia.

The mounted patrolmen smiled and the horses said nothing.

## South End housing: Haves vs. have-nots, Round 2

By Anne Kirchheimer  
Globe Staff

The lull is over. The battle between the haves and the have-nots in Boston's South End has begun anew after a year of relative calm.

What got the troops going this time was a recently issued Federal housing directive, made public late last week, that apparently puts an end to building any more subsidized housing in the South End.

The directive, based on little-used US Department of Housing and Urban Development (HUD) guidelines, is aimed at guiding the construction of subsidized housing away from neighborhoods with high concentrations of poor persons and subsidized living units.

If strictly enforced, the guidelines have wide-ranging implications for the character of older, poorer Boston neighborhoods and their residents, and for the state.

And in the South End, where more than half the residents are low income and more than 3000 South Enders are middle- and upper-middle-class homeowners, the implications of the HUD ruling are already becoming known.

The directive on subsidized housing could now put the haves one step ahead of the have-nots.

The basic controversy is simple: One group of residents, who have called themselves Citizens for a Bal-

anced South End in the past and the Section 8 Committee more recently, say they want to make sure the area maintains a "balance" between the poor and the affluent, an aspect that has characterized the South End.

The other group, made up of poor persons and more affluent advocates of low-income housing, want to see the South End's substandard housing improved to ensure that those who came to the neighborhood before townhouse urban living became fashionable have the opportunity to remain.

These are not the only players in what could be termed a class struggle. The battle is further complicated by city policies, speculators, realtors, HUD and the Boston Redevelopment Authority (BRA), which has directed the South End Urban Renewal plan since its inception in 1953.

For two of the last three years the

'Impact and undue concentration are all nice words and nice concepts but . . . it's our obligation to improve the conditions for people living there.'

— CHARLES SPELEOTIS  
BRA official

all nice words and nice concepts but through my familiarity with the South End, I know there are many people living in substandard housing, and it's our obligation to improve the conditions for people living there."

Right now, the only certain thing is that 135 units of subsidized housing for the South End have been halted, and the future of hundreds of more additional planned units is uncertain.

But what was not pointed out by Enders — in particular blacks and Spanish-speaking persons — will move to South Boston, East Boston or Charlestown despite the intent of HUD's directive to disperse poor people and subsidized housing.

Many local political figures, including members of the Massachusetts Black Caucus, and community groups will band together, they say, to try to force HUD to reverse the directive.

State Rep. Mel King (D-South End) says it is unlikely that South

End factors have been in open battle. Most of the fights were waged in the courtroom, where the Citizens for a Balanced South End tried to halt construction of three subsidized housing projects. Each suit was based on environmental impact of the proposed projects, but the group lost each case.

"Today the front line has moved from the courthouse to HUD offices. There a lawyer representing the South Enders who oppose more subsidized housing for their neighborhood recently pointed out to housing officials that they were not following their own guidelines on the Feder. Section 8 subsidy program.

As David Parker, a property owner and relative newcomer who led the fight against subsidized housing, said: "I don't support ghettos or racially and economically imbalanced housing."

## Fernald patients' funds misused, Buczko says

By Nils Bruzelius  
Globe Staff

Officials of the Walter E. Fernald State School made a number of "questionable" expenditures with funds belonging to the retarded residents of the school, State Auditor Thaddeus Buczko said yesterday.

The expenditures included three small loans to employees of the school in "clear violation of the residents' rights," the report said, and the purchase of washing machines, dryers and furniture for the school. Noting that two of the loans had not been repaid, the auditor said, "Future actions of this sort should be punished harshly."

The loans totaled \$340. Buczko and others have repeatedly found improprieties in the handling of patients' funds at the institutions of the state Mental Health Department, and new regulations are being drawn up to cope with the allegedly questionable expenditures.

has "developed an entirely new set of policies and procedures governing expenditures and accountability for clients' funds." He said they are expected to be issued within 10 days.

Since he became acting superintendent a month ago, Gracey said he has personally approved all expenditures of patient funds and "to my understanding there have been no irregularities" in that period.

In addition to the loans, the audit report said it found a number of other questionable expenditures from personal funds belonging to the retarded residents of the school. It cited \$573 spent on "washers and dryers" and \$2600 on "nutriving services." Patient funds were also reportedly used to purchase a color television set, a dishwasher and wall fans.

The report said "it appeared" these items should have been paid for with expenditures from the "maintenance appropriation."

The audit report, which covered a 13-month period up to February 24, 1976, said it found a number of discrepancies in accounting and instances of inadequate record keeping.

"It is quite obvious that better record keeping is needed to insure proper internal controls and to protect the rights of the residents," the report said.

Fernald is one of two state schools for the retarded that is threatened with the loss of up to \$10 million in Federal funds because of major failings in patient care, number of staff, pharmacy services, food handling, medical records and other services.

Acting Superintendent John Gracey said he could not comment specifically on the allegations of misuse of patients' funds because he had not yet seen the auditor's report.

He said, however, that to conform with recently issued departmental guidelines, the Fernald administration

the personal patients' funds held by the school come from several areas, according to mental health department sources. Some of the funds represent the \$25-a-month allowance received by residents having Supplemental Security Income, some are funds provided by residents' families, and some come from other sources such as Social Security.

Individual bank accounts maintained for 161 of the 1400 patients at the school totalled nearly \$688,000 as of Feb. 28, the report said.

Buczko's audit also questioned a number of expenditures from funds donated to the school "for the benefit of patients." Without citing amounts or providing details, it listed expenditures for such items as "loans to employees, Activity Center dedication, payment for travel and luncheons, advertising for hospital" and "loans to Walter E. Fernald State School for postage."

## Lineup case for police is deferred

Eighteen Boston patrolmen charged with disobeying a direct order to participate in an identification lineup pleaded no contest to the charge yesterday and prosecution of the matter will be deferred for six months.

If the officers avoid any similar complaints in the next six months, the charges will be dropped. The arrangement was proposed by the police and

accepted by Police Comr. Robert J. d'Grazia.

"I'm satisfied with the disposition and I'm pleased that the men are," d'Grazia said.

The charges were leveled by superior officers after the men refused to stand in a lineup in connection with complaints that two officers assaulted several Charlestown residents last

October.

The officers who refused to take part in the lineup are sergeants and the Mobile Operations Patrol. They refused the order on advice of their attorney, Frank McGee, saying the order was unconstitutional.

Stephen Dunleavy, an aide to d'Grazia, said late yesterday the commissioner's agreement is not part

of his attempt at reconciliation with the patrolmen's union, but is solely a decision on a single case.

d'Grazia and Chester J. Broderick, chairman of the Boston Police Patrolmen's Assn., agreed last week to meet regularly in the future to discuss police department matters and to attempt to end any bitterness that has sometimes characterized their relationship over the past four years.



Mime Keynon Martin performs in graceful silence at Boston's Prudential Center. Martin and members of National Mime Theater entertained visitors last night as part of the center's Summer Showcase series. (Globe photo by Stan Greenfield)

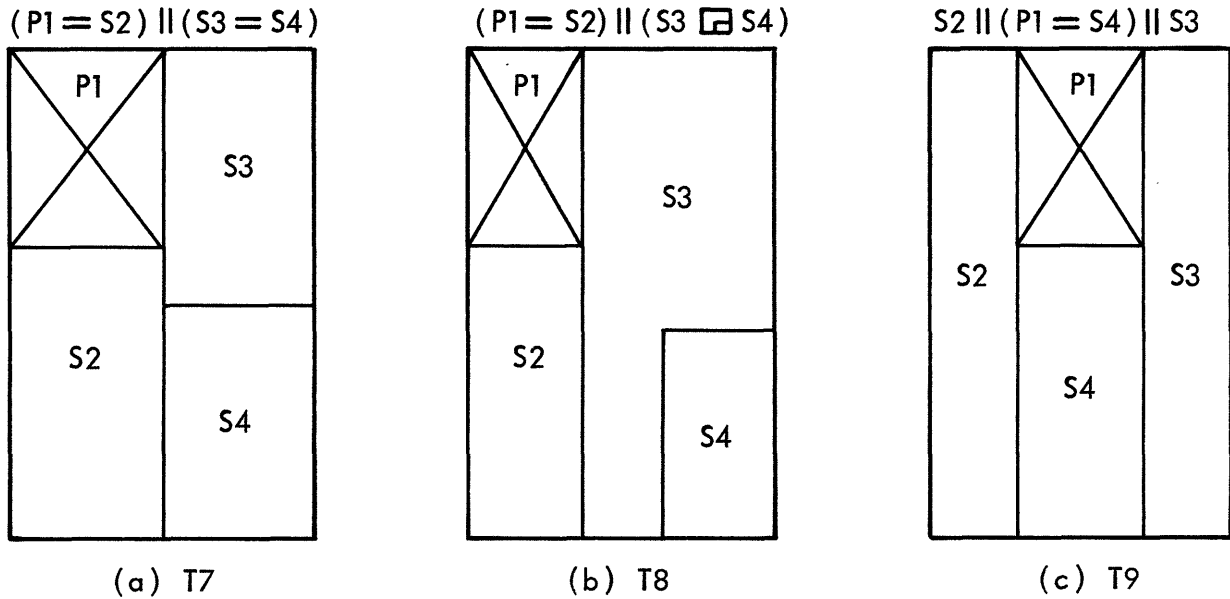


Fig. 9.10 Layout templates used in experiment 3

As another test case, the modified news hole in Fig. 9.11c is laid out using template T9 (Fig. 9.10c) as the layout guide. This time the layout fails. After the virtual pages for stories Rent Hike and Car Insurance are constructed on each side of the given news hole, the remaining area (denoted by the shaded area in Fig. 9.15) is only two columns wide. Although the 24.6 column-inch area comes very close to the total area 24.4 column-inches of the remaining story and picture (Metco Cuts and Children's Zoo), the picture will not fit into the area because of its specified three-column width.

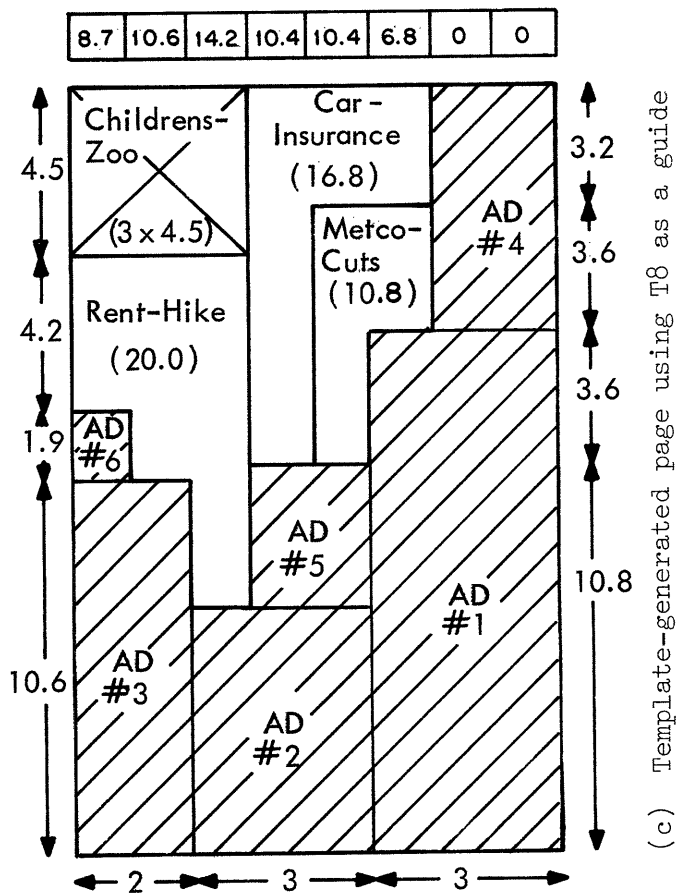
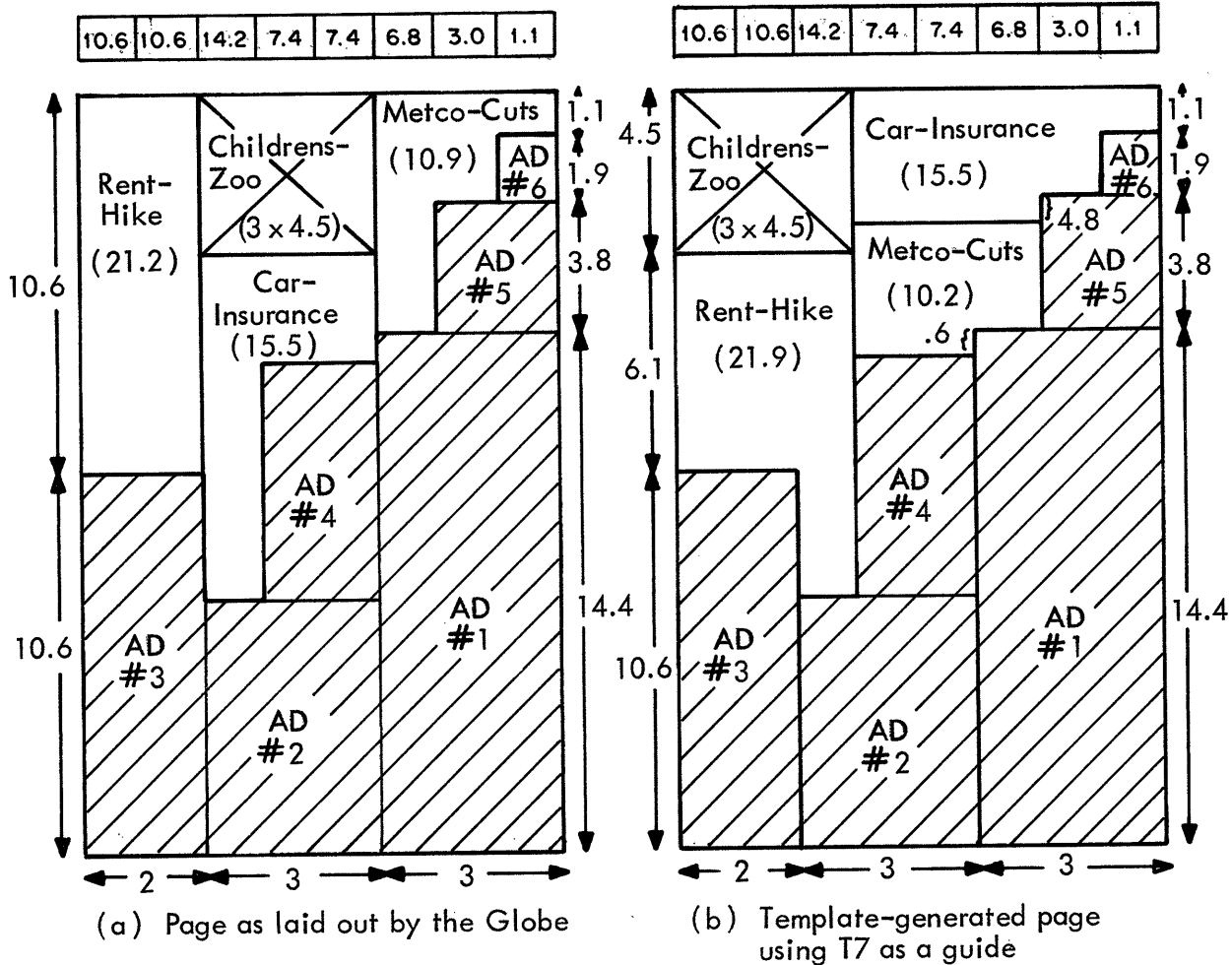


Fig. 9.11 Layout dummies of experiment 3





Seven-year-old Mark Houston, visiting Hub with group from New Bedford, gets kissed by Coffee the camel at the Children's Zoo. (Globe photo by Ted Dully)

# BHA delays hikes in Aug. 1 rents pending review

By Marvin Pave and Walter Middlebrook Globe Staff

The board chairman of the Boston Housing Authority (BHA) said yesterday that a moratorium has been placed on the proposed Aug. 1 rent increases for tenants in the city's public housing projects, pending review of individual cases.

Dominick Pasquocci made the announcement during a hearing before the Boston City Council's Committee on Housing, and he drew a loud response from the overflow gallery of 250 onlookers, most of them senior citizens.

Pasquocci announced the rent freeze after taking a telephone poll of board members who were not present at the hearing.

Jerrold Hickey, a spokesman for the BHA, said the "across-the-board rent delays are pending individual review" of tenants who request them. He said a number of tenants had already come to the BHA and requested reviews since the announcement of the scheduled rent increases.

"A good deal of it is already going on," he said. Hickey said all BHA tenants would be notified within a few days, "probably by mail," of their right to request a review.

When questioned about the legality of such a moratorium, Pasquocci said that the question would have to be answered by the BHA's principal funding sources, the US Department of Housing and Urban Development

(HUD) and the state Dept. of Community Affairs (DCA).

"I'm not sure HUD or the DCA would approve it," Pasquocci said at yesterday's hearing. "I just can't pre-

dict if we'd be overruled."

BHA general counsel K. he couldn't recall any cases from municipal housing at the hearing. He said he couldn't recall any cases from municipal housing at the hearing.

Fifteen tenants of BHA ready filed a complaint in Superior Court to prohibit the scheduled rent increases. Michael Haroz, counsel for the tenants, said the complaint would be filed in Superior Court.

The Tenant Status Review conducted every two years to determine if tenants qualify for public housing, is in accordance with the law. The review was just completed in many of the housing projects.

"Some of the increase in rents is due to the fact that the cost of maintenance and repairs has increased tremendously this year," he said.

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# Car insurance changes approved

## \* AUTO INSURANCE

Continued From Page 1  
But it was apparent that a compromise had already been reached. The new committee adopted the same report with one addition.

The addition guaranteed that safe drivers placed in the assigned risk pool would be charged rates "as closely as the commissioner approves as practicable" to the rates charged to similar drivers from the same area not in the facility.

Insurance Comr. James M. Stone, who lobbied extensively on behalf of the provision, said he was satisfied that it protected safe

"It can't happen here and it can't happen in the House, the votes aren't there." He urged his fellow senators to accept the compromise bill.

The Senate approved the report, 23-6, with four senators from Boston casting negative votes. They are Timothy, William M. Bulizer, Bill Owens and Joseph B. Walsh, all Democrats.

The report was shipped to the House immediately, where drivers in the assigned risk pool.

The second conference committee report was the subject of the lengthy discussion in the Senate.

where it was approved on a voice vote. Enactment in both branches followed within a half hour.

Under the proposed merit rating system, unsafe drivers would be assessed surcharges that would go into a pool to be divided among the safe drivers in the form of rebates. Each geographic area would have a separate pool, Stone said, permitting safe drivers in high risk areas to receive larger rebates.

Sen. Daniel J. Foley (D-Worcester), chairman of the Insurance Committee, made a strong pitch for both the merit rating system and competitive rates, but he argued against the

pool. But he bowed to pressure exerted by supporters of the amendment originally sponsored by Rep. Royal Bolting Jr. (D-Mattapan).

Sen. Joseph F. Timilty (D-Mattapan) objected to the continuation of geographical distinctions in setting rates by rating in the form of rebates. He said he had agreed, noting that he had sponsored a flat rate bill which was soundly defeated last month.

But DiCarlo also said:

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**IMMEDIATE CASH**  
275 North Street, Boston  
Diamonds, Jewelry, Antiques and Old Gold

# Framingham firm on Metco cuts

By Tom Jones Globe Correspondent

The Framingham School Committee last night rejected by a vote of 6-1 a proposal by the Massachusetts Department of Education to reinstate two of the town's Metco staff members at a cost of \$12,000 and also refused to make any payments to Metco's central support office.

In the words of member Charles F. Rousseau, "services are not endangered by last night's vote. We are maintaining 144 stu-

decision was a request by the department of education for the town of Framingham modify its original reduction of the Metco staffing from ten to six and restore two of the eliminated positions.

Jean McCuire, executive director of the 25-member Metco central staff, which the School Committee refused to fund by last night's vote, said that if no compromise is reached, no services for the town of Framingham will be provided and we still have a coordinator to maintain ties to the families."

The vote, which came less than a month after the Newton School Committee cut \$81,000 from the voluntary busing program, will "endanger the validity of the program to youngsters," state Secretary of Education Paul Parks, who was at the meeting, said last night.

School Committee Chairman Joseph P. Condon said the vote was the School Committee re-

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This guide appears in the Tuesday morning, Wednesday morning, all day Thursday, and Saturday morning Globe.

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NARADA INN 102 bedrooms, 10000 pool, restaurant, cocktail lounge, live music 7  
NEW BRICKYARD INN 5 rooms, 10000 pool, health club, bar, 100 mgals. 2  
LAKE WINNIPESAUKEE-GILFORD  
KING'S GRANT INN 24-251 N. H. 2 main, 1000 pool, full sport, food, bar, 1000  
MERRIDITH  
HART'S TURKEY FARM RESTAURANT 20000 Cheshire main, Major credit cards ac-  
HILLTOP FAMILY COTTAGES 3 mi. S. of Hill, 10000 pool, 10000 mgals. 10000  
NEWFOUND LAKE  
WIND-O-WILL HOTEL & COTTAGES 10000 pool, 10000 mgals. 10000  
WEIRS BEACH  
WEIRS ACTIVITIES 10000 pool, 10000 mgals. 10000  
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No handling or sitting fees  
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- Groups taken at the per subject
- Limit 1 per subject 2 per family
- Minors must be accompanied by an adult
- Family groups invited

Studio Hours  
Tuesday and Saturday 10 AM to 1 PM, 2 PM to 5 PM, Wednesday, Thursday and Friday 10 AM to 1 PM, 2 PM to 7 PM.

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**SALE... RENAULD REACT-A-MATIC SUNGLASSES 9.95 reg. 15.00 to 18.00**

Surround your eyes in sunshine, shade and savings. Our Renauld, React-a-matic glasses darken in the sun, yet lighten in the shade to protect your eyes without natural color distortion. Select from featherlight tortoise or metal frames for men and women.

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**R.H. Stearns July Specials**

**SALE... LUXURIOUS CASHMERE 149.00 reg. 190.00**

Enjoy cashmere. Our pre-fall collection is very specially priced, finely detailed and luxuriously rich in 100% cashmere. Vicuna, green, blue, red, navy, and oyster, misses and petite sizes.

Sorry no mail or phone orders.

Fig. 9.13 Experiment 3 layout using template T7



Seven-year-old Mark Houston, visiting Hub with group from New Bedford, gets kissed by Coffee the camel at the Children's Zoo. (Globe photo by Ted Dully)

## BHA delays hikes in Aug. 1 rents pending review

By Marvin Pore  
Ed Walter Middlebrook  
Globe Staff

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Dominick Pasciucio made the announcement during a hearing before the Boston City Council's Committee on Housing, and he drew a loud response from the overflow gallery of 250 onlookers, most of them senior citizens.

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Diamonds, Jewelry  
Antiques and Old Gold

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## Car insurance changes approved

★ AUTO INSURANCE  
Continued from Page 1

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The second conference committee report was the subject of the lengthy discussion in the Senate.

Sen. Daniel J. Foley (D-Worcester), chairman of the Insurance Committee, made a strong pitch for both the merit rating system and competitive rates, but he argued against the amendment.

The original bill, he said, had "adequate protection for every driver in the commonwealth," including those in the assigned risk pool. But he bowed to pressure exerted by supporters of the amendment originally sponsored by Rep. Royal Bolling Jr. (D-Mattapan).

Sen. Joseph F. Timilty (D-Mattapan) objected to the continuation of geographical distinctions in setting rates a rating in stead a flat rate for the entire state. DiCarlo agreed, noting that he had sponsored a flat rate bill which was soundly defeated last month.

But DiCarlo also said: "I don't think we should come every two years and vote and yearly for family

"It can't happen here and it can't happen in the House, the votes aren't there." He urged his fellow senators to accept the compromise bill.

The Senate approved the report, 29-6, with four senators from Boston casting negative votes. They are Timothy, William M. Bulger, Bill Owens and Joseph B. Walsh, all Democrats.

The report was shipped to the House immediately,

where it was approved on a voice vote. Enactment in both branches followed within a half hour.

Under the proposed merit rating system, unsafe drivers would be assessed surcharges that would go into a pool to be divided among the safe drivers in the form of rebates. Each geographic area would have a separate pool. Stone said, permitting safe drivers in high risk areas to receive larger rebates.

## firm on Metco cuts

By Tom Jones  
Globe Correspondent

The Framingham School Committee last night rejected by a vote of 6-1 a proposal by the Massachusetts Department of Education to reinstate two of the town's Metco staff members at a cost of \$19,000 and also refused to make any payments to Metco's central support office.

In the words of member Charles F. Rousseau, "services are not endangered by last night's vote. We are maintaining 144 students and we will have a coordinator to maintain ties to the families."

The vote, which came less than a month after the Newton School Committee cut \$81,000 from the voluntary buying program, will "endanger the validity of the program to youngsters," state Secretary of Education Paul Parks, who was at the meeting, said last night.

School Committee Chairman Joseph P. Conlon said the vote was the School Committee responding to its fiscal responsibilities.

"When the state cuts back money, the towns must also cut back," he said.

At stake in last night's

decision was a request by the department of education that the town of Framingham modify its original reduction of the Metco starting from ten to six and restore two of the eliminated positions.

Jean McGuire, executive director of the 25-member Metco central staff, which the School Committee refused to fund by last night's vote, said that if no compromise is reached, no services for the town of Framingham will be provided by the Metco central staff.

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Fig. 9.14 Experiment 3 layout using template T8

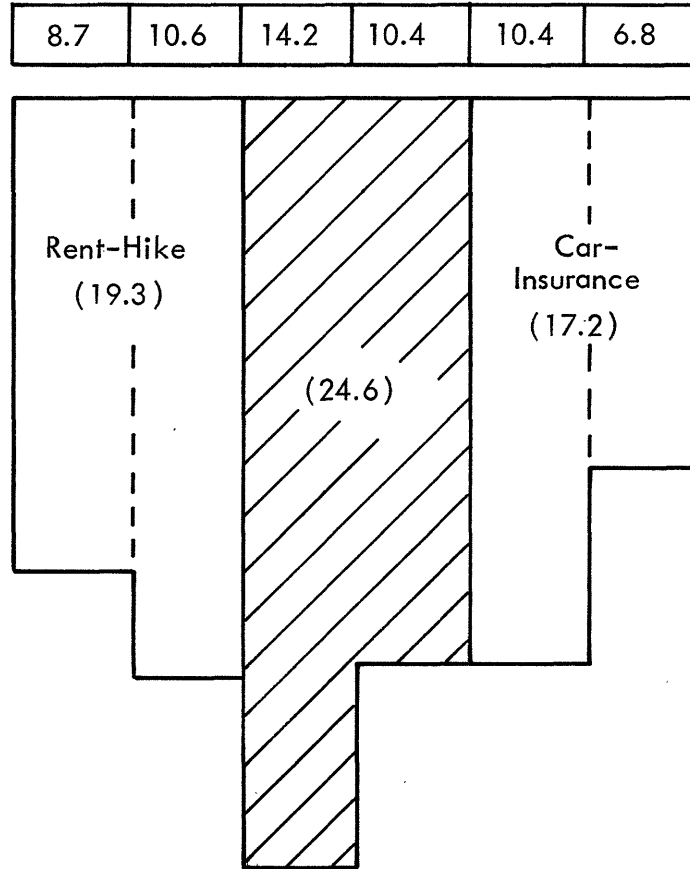


Fig. 9.15 Unsuccessful Experiment 3 layout using template T9

## CHAPTER 10

### THE TEMPLATE LIBRARY

Fundamental to a template-driven news-layout system is a computer-stored template library. Presented in this chapter are issues related to an operational template library and the symbolic templates stored in it. After a discussion of general template-design considerations we give the results of our counting the number of different layout structures that appeared in a typical medium-size newspaper over a period of one month. Based on these observations, the number of templates required in an operational template library is estimated to be in the order of a few hundred. Since a selected layout template does not always generate a successful layout, several templates may have to be tried for a given set of news items assigned to the page before an acceptable layout can be obtained. Therefore, templates must be retrieved from the library in a logical sequence. A straightforward method of organizing the stored templates for achieving a reasonable retrieval time is described. It is shown that the template library itself does not impose any realization problem in the design of an operational template-driven news-layout system.

#### 10.1 Template-Design Considerations

Experimental results verify that a particular layout template does not always generate a successful layout for a given set of news items. Some templates are more suitable than others for laying out a particular combination of story and picture sizes.

In general, pictures are a major bottleneck. Unlike stories, which require only a news block of specified area without any further constraints on dimensions, pictures have fixed dimensions that cannot be adjusted during layout\*. Moreover, because of the existence of fixed-dimensioned pictures on the page, the stories placed in areas adjacent to the pictures are often constrained with respect to the shapes that will form an appropriate news block. As a result, the more pictures on a page, the more difficult is the layout task.

---

\* This assumes that sizing of pictures is done prior to the news-layout process. If cropping at layout time is permitted, the layout process becomes easier.

Some templates are better suited than others for a particular combination of story and picture sizes, even though the template itself is independent of news-item sizes. Hence, in designing an operational template library, one should attempt to include templates suitable for a broad spectrum of possible story- and picture-size combinations. If templates suitable only for story and picture combinations of a limited size range are stored in the library, a news-item combination with sizes outside this range will fail to be laid out.

In the design of templates for pages with display ads, special considerations are required for various ads-dummy styles. Since the news holes of pages with ads generally have inverted-pyramid shapes, it is usually easier to place news items on the upper part of the page than on the lower part where the ads impose tighter constraints. Therefore, templates with more items located in the top portion of the page than the lower portion are suitable for layout of pages with ads. Furthermore, for pages with right-pyramid ads-layout style there is more room, in general, in the left-hand side of the news hole; the reverse is true for a left-pyramid ads dummy.

In general, the template library should contain several templates that are suitable for each category of ads-layout styles used in the newspaper in order to increase the probability of successful layout.

## 10.2 Template-Library Size Estimation

Through use of the news graphic language, layout templates can be described symbolically by the relative position between news items rather than their fixed coordinates on the page. As a result, the number of templates required in a symbolic template library is several orders of magnitude less than the library which would result if precise locations had to be specified.

In order to support this position and also to estimate the size of a template library required in an operational news-layout system, the different layout structures appearing in a local newspaper were analyzed. Specifically, the news department of the 24 weekday issues during the month of July, 1976 of the Boston Globe was surveyed. The daily Globe was chosen because the average number of pages published per day (approximately 45 pages) and its layout styles, consisting of both six-column and eight-column formats, are typical of many newspapers. The layout samples totaled 356 pages; editorial pages were excluded. About three-fourths of the pages (267) contained four news items or less. In the analysis a story and its associated picture were counted as one news item.

A template was drawn for each sample page to match the layout structure on the page. For every issue of the paper, the constructed templates were grouped into two categories: Templates which had not appeared before, and templates which appeared in previous issues. The number of templates in each category for the 24 issues is shown in Fig. 10.1 where the new templates are represented by the single- and double-shaded areas, and the previously used templates are denoted by the white areas. The single-shade and double-shaded areas in the figure represent those newly constructed page templates with either one to four news items or five to seven items, respectively. Since there were no repeats found in the 24 issues for templates with five items or more, all the repetitive templates represented by the nonshaded areas in the figure contain less than five news items.

In specific terms, according to Fig. 10.1, the first issue had three pages (out of the 22 pages in the news department) with five items or more. In the 13 pages of the second issue, there were four pages whose layout structures appeared in the first issue, and nine pages (three pages with one to four items, and six pages with five to seven items) with new layout structures. It is important to note that as the sample grows, the proportion of newly constructed templates with four items or less (the single-shaded area of each issue) tends to decrease somewhat, while the proportion of the repetitive templates (nonshaded area) has a tendency to grow.

Figure 10.2 illustrates how the number of templates with one to four items builds up as the sample size grows. The number of one-item templates is unchanged after the 16th issue; and the number of three-item templates tends to level off between the 18th and 24th issues. More importantly, the figure indicates that the number of templates with four items or less also tends to level off. Through extrapolation of the top curve, it is estimated that the number of templates with four news items or less reaches a limit of approximately 110 to 120 templates. Even though the survey of 24 issues contains insufficient data to provide a clear-cut indication of how the templates with more than four items build up, an extrapolation and analysis of all the data have been used to estimate the size of the template library for a medium-size newspaper. We conclude the number is of the order of 400 to 500 templates.

It should be emphasized that our estimate is based on a limited survey of 24 newspaper editions. The actual number of templates for a particular newspaper could depart from this figure, depending on the size of the paper and the frequency of pages having large numbers of news items. Our purpose

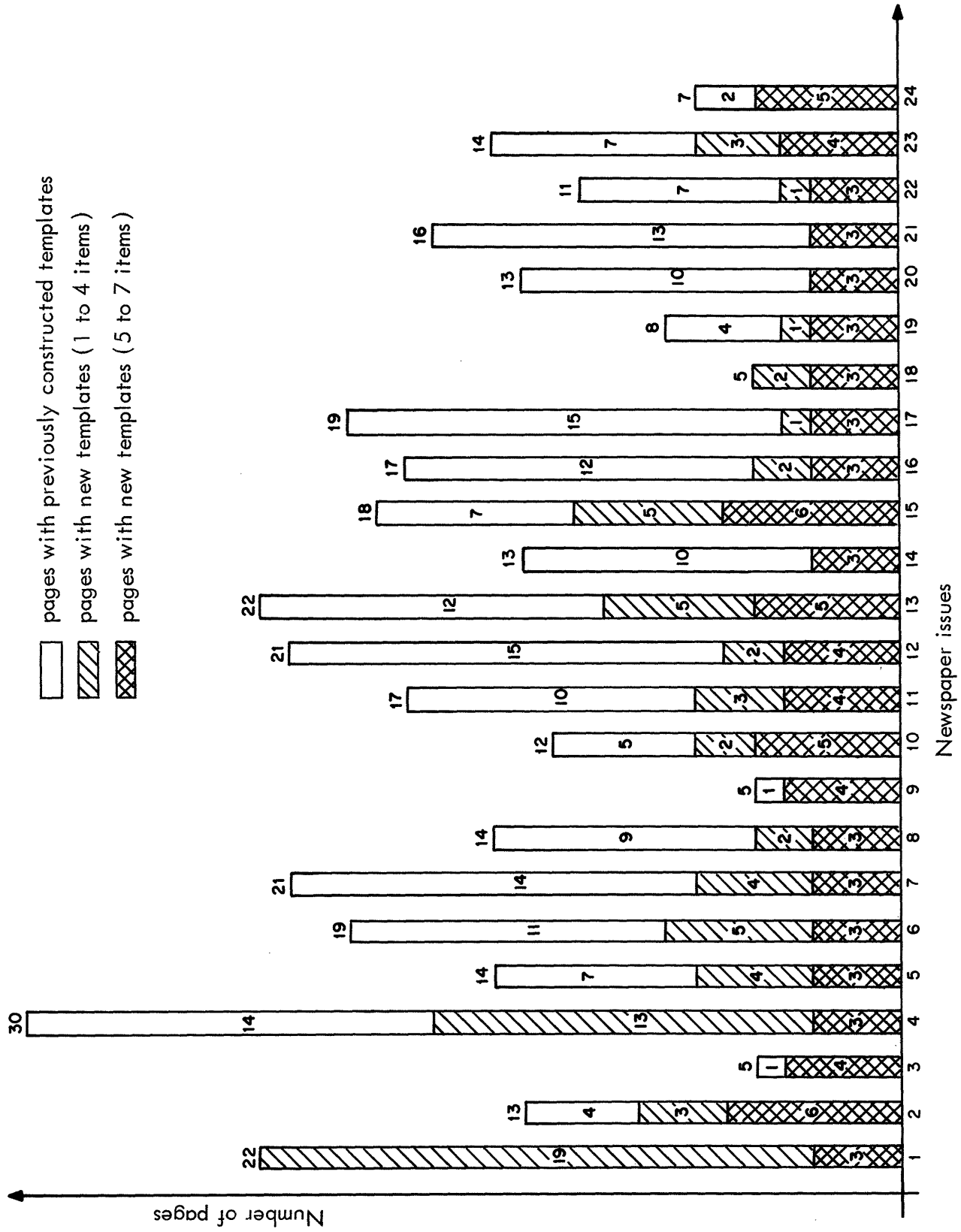


Fig. 10.1.1 Page layouts of July, 1976 issues of the Boston Globe

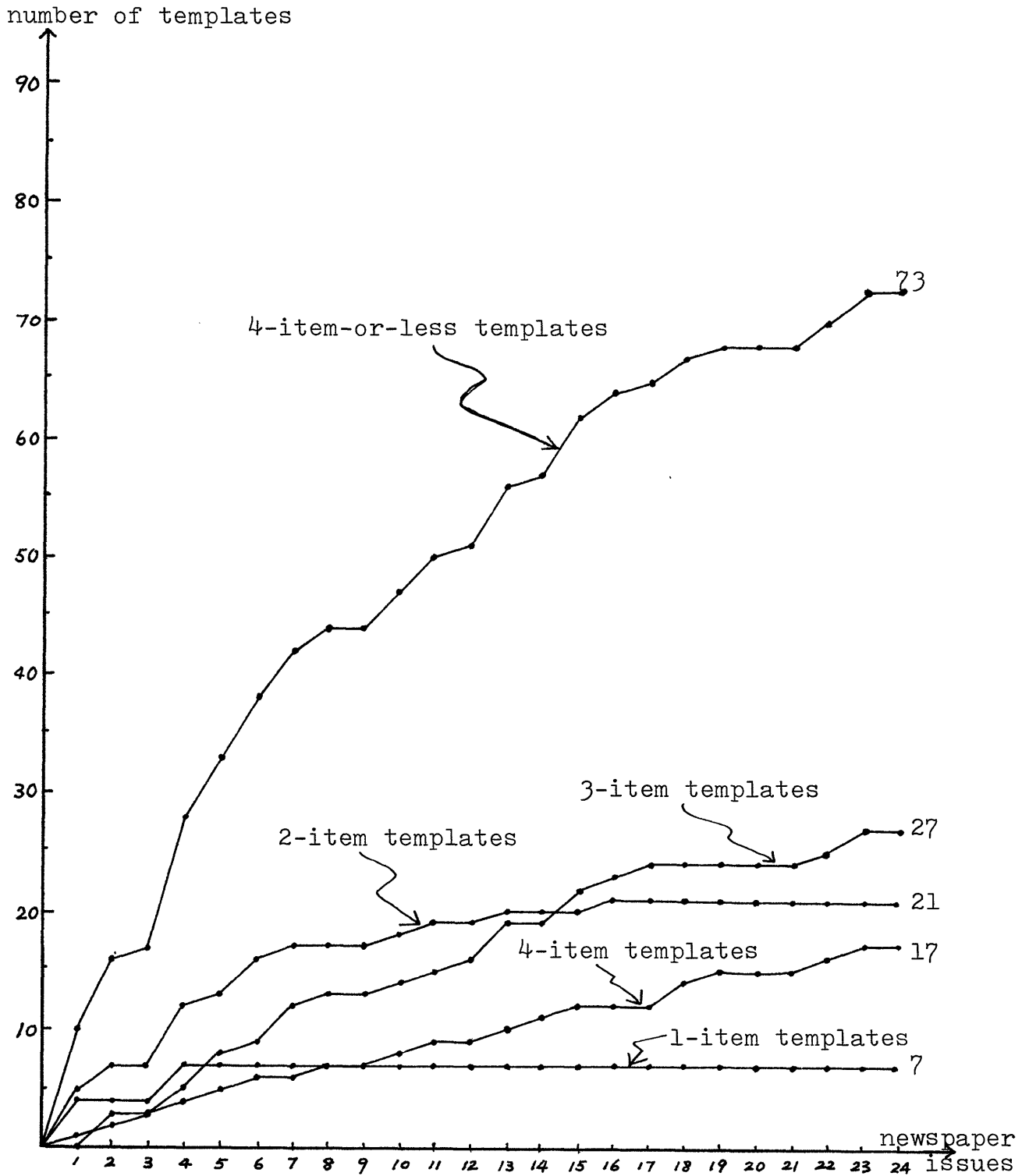


Fig. 10.2 Profile of the 24-issue template library

here is to show that the size of the template library is manageable and imposes no realization problem in designing an operational template-driven news-layout system. However, we recognize further analysis based on a more complete survey is needed.

### 10.3 Template-Library Organization

As a result of the story-and-picture-assignment process, a set of stories and pictures whose total area matches the available news hole is assigned to a page for layout. A template with the same number of story and picture items as the assignment is retrieved and used as a structure guide for the actual story and picture placement. In general, several templates are defined in the template library for a particular story-and-picture combination, and hence they are retrieved as a group. After being retrieved, template-selection rules establish a priority among this subset of templates. The template with the highest priority is tried first, then that with the second-highest priority, and so forth, until a satisfactory layout is obtained or no more retrieved templates are available.

Because of the way in which templates are retrieved and used, the most straightforward method of organizing the template library is to group templates according to the number of story and picture items they contain. Figure 10.3 depicts a tree structure representing such an organizational scheme. Templates with a particular story-picture (S-P) combination are grouped together and can thus be retrieved easily as a group. The number of templates required for each story-picture combination varies, but the maximum number defined for a particular S-P combination is perhaps in the range of 15 to 20. Because the number of templates in an S-P combination group is small, there is no need to further index the templates within the S-P combination groups. For a newspaper with 500 to 1000 templates, the organization scheme shown in Fig. 10.3 should be adequate to achieve a reasonable template retrieval time.

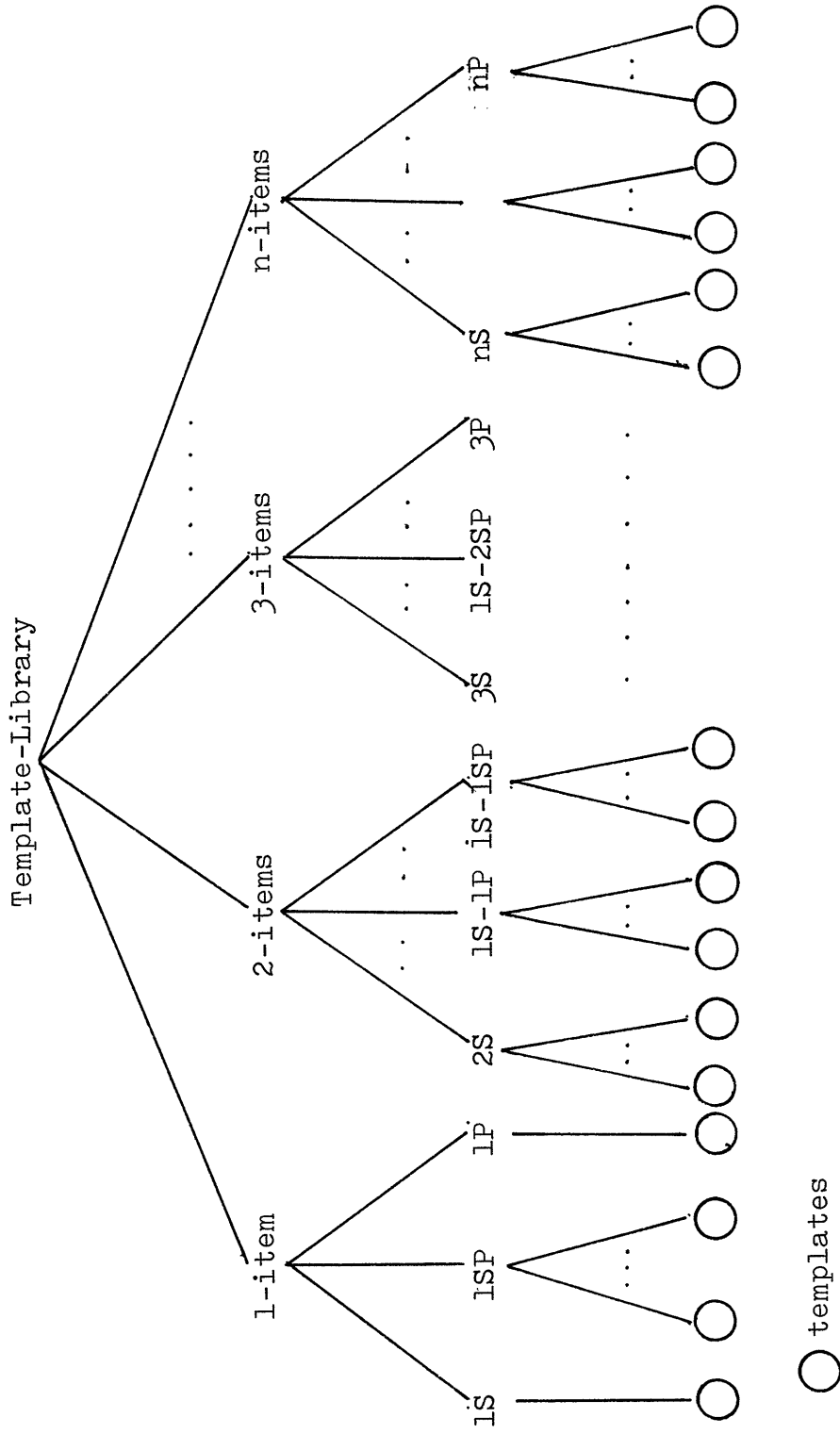


Fig. 10.3 Organization of a template library

## APPENDIX A

### THE BACKUS-NORMAL-FORM DEFINITION OF A LANGUAGE

Backus-Normal-Form (BNF) is a notation of writing grammar that is commonly used to specify the syntax of languages. In BNF, intermediate-language constructs are written as names enclosed in the corner brackets  $\langle$  and  $\rangle$ . The production (or rewrite) rules are string-transformation rules with the symbol  $::=$  (read "is replaced by") separating the left-hand and right-hand side. The rules are used to describe how language constructs can be formed or produced. The string on the left-hand side of the rule represents a particular language construct to be transformed, and the right-hand side string indicates a replacement for the construct on the left-hand side. Alternative ways of rewriting a given language construct are separated by a vertical bar,  $|$ , (read as "or").

Taking English syntax for example, assume that the language construct "sentence" can be defined as a "noun phrase" followed by a "verb phrase"; also assume "noun phrase" is an "article" followed by a "noun", and that "verb phrase" is a "verb" followed by an "adverb". In the BNF notation, these grammar rules for English syntax can be expressed by the following production rules:

- |                                 |       |   |     |
|---------------------------------|-------|---|-----|
| $\langle$ sentence $\rangle$    | $::=$ | $\langle$ noun phrase $\rangle$ $\langle$ verb phrase $\rangle$ | (1) |
| $\langle$ verb phrase $\rangle$ | $::=$ | $\langle$ verb $\rangle$ $\langle$ adverb $\rangle$             | (2) |
| $\langle$ noun phrase $\rangle$ | $::=$ | $\langle$ article $\rangle$ $\langle$ noun $\rangle$            | (3) |

For the purpose of illustration, let us further assume that the only article we have in the English vocabulary is the word "The", the only noun is "student", the only verb is "studies", and that the adverbs are the words "hard" and "slowly". Then, in BNF notation, these rules can be written as the following productions:

- |                             |       |                 |     |
|-----------------------------|-------|-----------------|-----|
| $\langle$ article $\rangle$ | $::=$ | The             | (4) |
| $\langle$ noun $\rangle$    | $::=$ | student         | (5) |
| $\langle$ verb $\rangle$    | $::=$ | studies         | (6) |
| $\langle$ adverb $\rangle$  | $::=$ | hard $ $ slowly | (7) |

To generate a string in our English, one can take a particular language construct from the left-hand side of rules (1) through (7) and replace it by the

string on the right-hand side to form a new string. This process is repeated until all the symbols in the string are words in the vocabulary. For example, to generate a noun phrase in English, first apply rule (3) to replace `<noun phrase>` by `<article> <noun>`, then use rules (4) and (5) to produce a noun phrase "The student". As a more complex example, the English sentence

"The student studies hard"

can be derived by a sequence of applications of the rewrite rules (1) to (7), as shown in the tree structure of Fig. A.1; where the numbers indicate the production rules to be applied at each stage of the generation process.

According to our English syntax specified by the BNF production rules listed above, the only other allowable sentence of the language is

"The student studies slowly".

Other combinations of the words in the vocabulary are considered illegal sentences. Thus, by having a formal specification of language syntax such as the BNF notation, one can define the language syntax rigorously and then express the legal sentences of a language precisely.

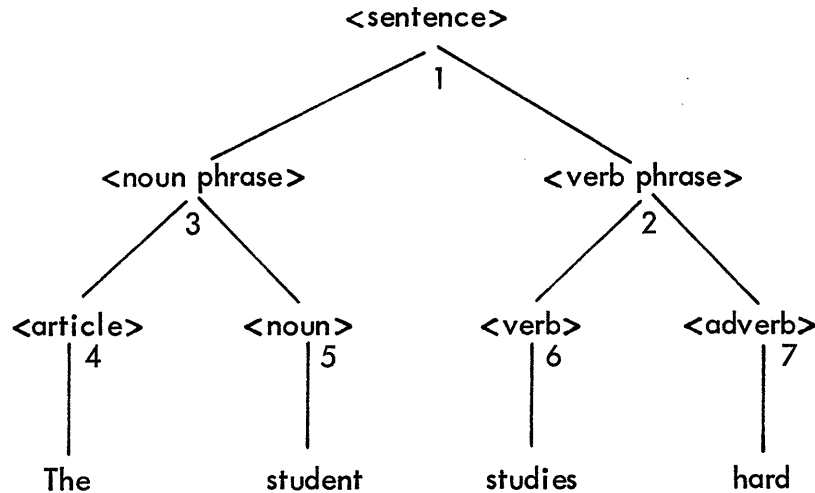


Fig. A.1 Generation of an English sentence