Dynamic Information Display

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The Video screens and sophisticated computer technology offer new display media for typographic information transfer. However, the design attributes for composition employed by the new media take little advantage of this new technology; instead, they tend to emulate conventional design attributes established for print.

In new media, the state of an information display changes because the three-dimensional structure of its information (the two dimensions of the display plane and the time dimension) is revealed in temporal segments on the display screen; Its communication is *dynamic*. New design attributes for composition must be identified by considering this *dynamic* nature. These and a new design process in which programmed rules assist the designer to create visual patterns in a *dynamic layout* are explored in this paper.

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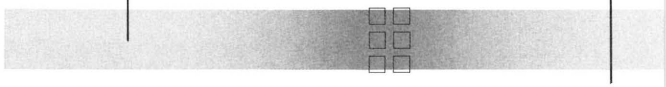


New Typographic Possibilities

'The new book demands a new writer.' (El Lissitzsky, 1923)

Due to the recent development of electronic information handling, more and more people are viewing typographic material displayed on video screens linked to computer systems. Information services such as videotext, computer aided instruction (CAI), electronic mail, and computer-assisted reference service are in practical use[1]. In the near future, electronic media will take over dissemination of much of the typographic information which is presently received through print media.

In the introductory phase of a new typographic medium, established patterns of typographic design for conventional media are directly applied to the new media; familiar design features are reproduced. Once the unique characteristics of a new medium are identified, new patterns of typographic design are introduced in order to take full advantage of the new technology.

The purpose of this study is to examine the new typographic possibilities that electronic information handling and the computer afford. The goal of this research is twofold: first, to identify the characteristics of the new media in comparison with those of print and to develop new design attributes that enhance the quality of typographic transfer on a display screen; and second, to develop a framework for a design process and programmed tools for designers which provide interactive assistance in typographic layout generation.

Performance Measures For Typographic Design

The unique characteristics of the electronic display media can be analyzed from the perspective of communication modes. Communication modes are the ways in which communication takes place; they can be classified by static–dynamic and sequential–presentational relations.

Static and Dynamic Communication Modes. Static and dynamic communication modes are explained by Doblin[2] as follows:

The messages of static media are tangible, and as permanent as the materials used. They need only ambient light to operate. The messages of dynamic media are transient, only there in real time as presented. They require simultaneous conditions: program, equipment and power.

In the static mode of communication, information is persistent on a medium such as a painting, a photograph, and printed text. In the dynamic mode of communication such as in a movie, a televison program, or a videotext, information is not permanent on the medium and is distributed in the dimension of time.

Sequential and Presentational Communication Modes. Doblin also introduces another classification of communication modes, the sequential and the presentational communication mode, based on the character of information reception by a viewer[2].

A presentational medium, such as a poster, is seen at once. It gives a total impression, then the eye tracks over it, picking up details in order of their perceived importance. Sequential media–books for example–are a string of meaning units in time or space. These

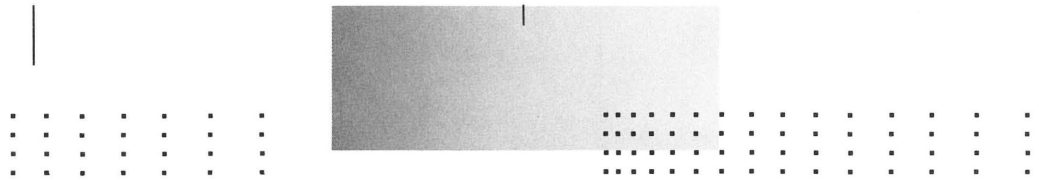
are perceived and matched to stored meaning units in our memories and then accumulated into a total message.

The sequential mode of communication requires or allows a specific order of information reception for efficient comprehension of the contents. The presentational mode of communication, on the other hand, allows an arbitrary order of information reception.

Through the combination of these two classifications, four different types of communication modes are derived:
- Static-Sequential Mode
- Static-Presentational Mode
- Dynamic-Sequential Mode
- Dynamic-Presentational Mode

A conventional book is an example of a medium with a static-sequential mode because understanding of contents assumes a certain order of reading. On the other hand, a poster allows for arbitrary scanning of a static layout of information; a static-presentational mode. The last two modes provide new possibilities for typographic design.

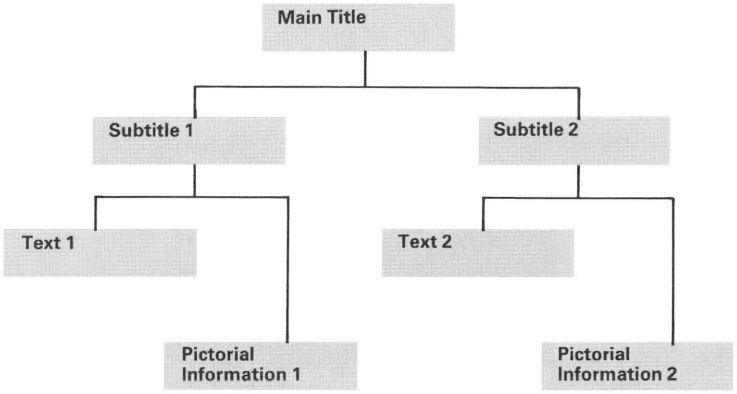
The dynamic-sequential mode is characterized by its linear distribution of information over the time.. This mode is, for example, found in a movie and a T.V. program where total meaning is comprehended by accumulating images presented sequentially. On the other hand, the dynamic-presentational mode is characterized by its non-linear distribution of information. In other words, the dynamic-presentational mode allows viewers to choose a pattern of information presentation by the interactive capability of the medium. The Czechoslovakian branching-movie shown at the 1967 Montreal World's Fair is an example of this type of presentation[3]. At a number of branching



points the audience voted on what was to happen next. With the advancement of computer and media technology, the dynamic-presentational mode has been implemented in various forms such as interactive information service systems and electronic books.

The real time interaction with the media is classified into transposition and transformation by Owen[3]. The transpositional operation allows the viewer to observe an information model from different positions in space and time. For example, a video tape recorder can alter the real time sequencing of a T.V. program by executing such transpositional operations as slow motion, backward procession, and freezing. On the other hand, the transformational operation allows the viewer to alter the features of a model to see "what-if". For instance, interactive design processes could change the rules of a typographic generation system to create new typographic formats in a complex presentation system.

A relational structure of information contents



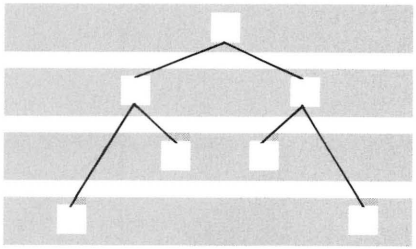
Typographic Presentation of Information

Typographic design is an interpretation process between an original message and its projected meaning for the viewer. Once the information is translated to a visual form such as printed text, all the visual elements and the relations between them develop their own statements. As the content becomes complex, it needs structural organization for efficient communication. A layout is a form of structural representation of underlying information; it defines the nature of the system.[4] Typographic presentation systems need a mechanism to interpret information content. Such a mechanism is shown in ***Figure 1***.

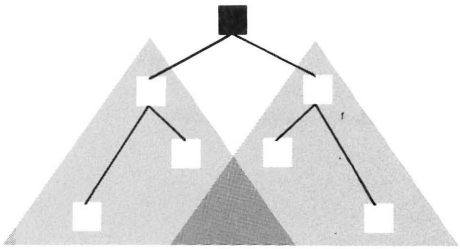
In the hierarchical structure of information contents, there are many ways to compose meaningful groupings of layout units. For instance, layout units in the same level of the hierarchical structure compose groupings (***Figure 2a***), those in a local hierarchy also compose groupings (***Figure 2b***), or the whole structure may also be considered as one cluster in relation to a hierarchy of other information (***Figure 2c***).

The layout units in each grouping are visually united by the consistent quality of their visual patterns. Each group is visually distinguished from the others. Comprehension is enhanced only when these patterns are logically organized. In conventional media, various grid systems are used to produce a logical order.

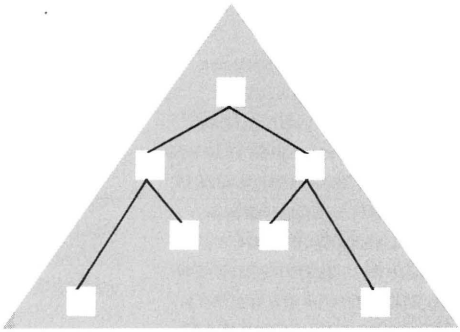
Groupings of layout units in a hierarchical structure



(a) Levels

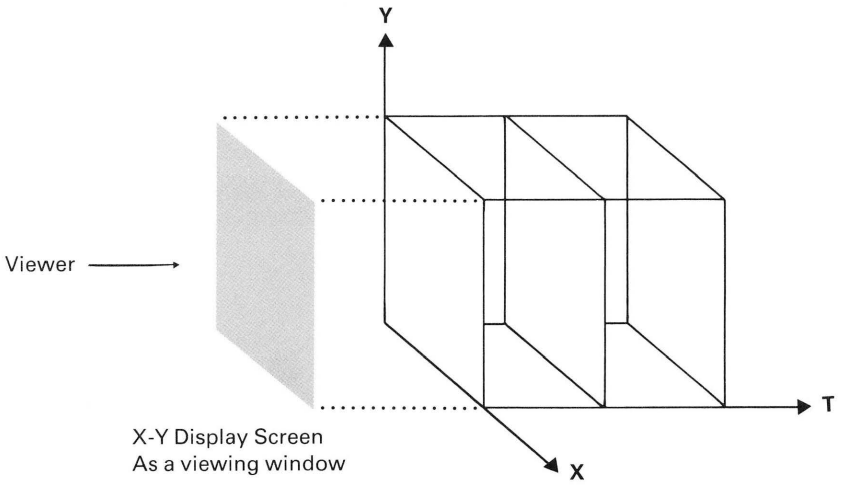


(b) Local Hierarchies



(c) The Whole

Figure 3.
Presenting a layout in an X-Y-T field



A layout in an X-Y-T Field

Dynamic Display Mechanisms and Typographic Variables

Typographic information transfer in dynamic communication modes is complex and is an area in which few designers have experience. Since there are no effective guidelines and tools to manipulate and layout typographic elements in time, it is difficult for designers to produce a dynamic layout with accurate prediction of its performance along the time axis. In order to develop effective methods for this class of design problem, it is essential to identify underlying mechanisms and variables of typographic design in dynamic communication modes.

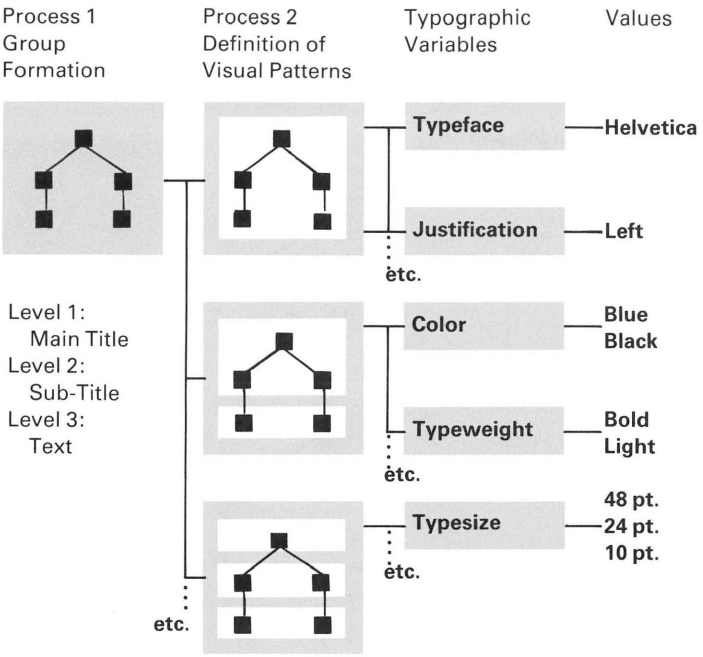
A dynamic layout is generated in (X-Y-T) three-dimensional space, where (X-Y) represents the two-dimensional display plane and (T) represents the time dimension along which a presentation sequence proceeds.[5] A viewer, therefore, observes a three-dimensional layout of typographic elements only through the two-dimensional viewing window as indicated in ***Figure 3***.

Typographic variables are fundamental visual parameters which determine a visual pattern for a layout. There are morphic, dimensional, and allocational variables.

In dynamic mode, typographic variables in the time dimension also need to be handled. Although static and dynamic information media share some of the variables for the representation of typographic configurations, there are some variables inherent in dynamic information media (marked by * in the listing below).

Morphic variables. These determine the morphic characteristics of a layout

Figure 4.
The generation of visual patterns



unit. Typical morphic variables are:

- Typeface (font, weight, and angle)
- Typesizes
- Text density (spaces between letters, words, and lines)
- Color
- Text-block format (justification, paragraph indentation)
- Blinking*
- Flashing*

Dimensional Variables. These specify dimensional properties of typographic elements. Some examples of the variables are:

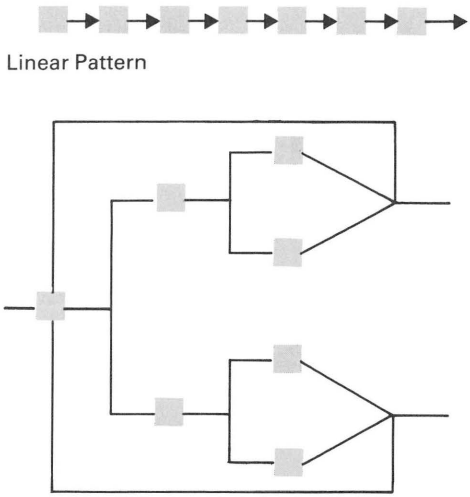
- Horizontal size (text-block width)
- Vertical size (text-block height)
- Duration*
- Line length
- Zoom rate*

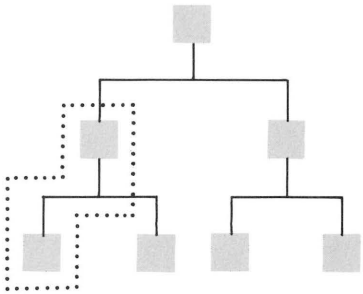
Allocational Variables. Variables of this class specify locations of typographic elements in the layout field directly or indirectly. Examples of these variables are:

- Horizontal location
- Vertical location
- Time location*
- Scrolling mode (saccadic or smooth scrolling)*
- Output rate*

The consistency of a visual pattern in a grouping and the differentiation of a visual pattern among groupings are created by assigning specific values to the typographic variables introduced above. This process is explained in ***Figure 4.***

Figure 5.
Display patterns of layout units





Layout Generation Process for Dynamic Information Display

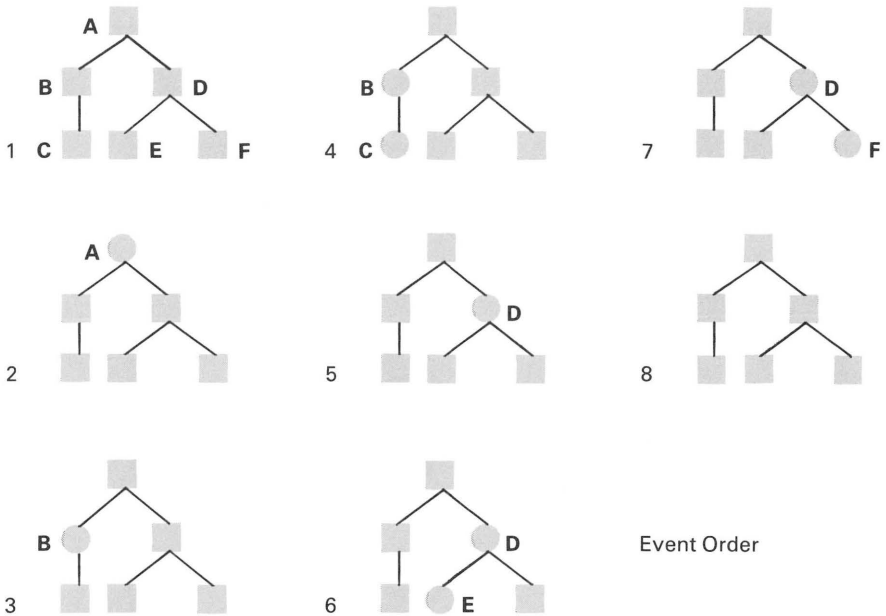
When design situations are complex, like the ones in dynamic layout generation, the designer's manipulation needs to be assisted by logical rules. In the proposed design process, both logical rules and the designer's decision are incorporated in the layout generation.

The logical rules provide a frame work for visual order. For example, rules employed in the design process help the designer to form consistent visual patterns in a layout. Individual aesthetics are employed in the design process because the degree of freedom for generation of visual pattern is extremely large. For instance, such questions as "what typesize should be used for a headline" and "what sort of a grid pattern should be employed for locating layout units" are resolved primarily by the designer's aesthetic sensitivity.

The logical rules only give a designer the formal possibilities of visual pattern. The logical rules can be implemented efficiently in a computerized design system; thus they are call *programmed rules*. With precise and versatile programmed rules, a designer can produce layouts with uniform quality.

Dynamic visual patterns of a layout are sub-classified into dynamic morphic, dimensional, and allocational patterns. Dynamic morphic patterns are determined by assigning specific values to time variables such as blinking and flashing. The dynamic allocational and dimensional relations between layout units are described by the patterns of appearance order and contextual range. Appearance order of layout units is represented by networks in which independent layout units are linked in progressive continuity. These

Figure 6.
Contextual range



patterns are grouped into a linear pattern and a network pattern (see ***Figure 5***). The dynamic presentational (transpositional) mode is required to include a branching network for user interaction. Contextual range concerns the range of a field in which layout units are displayed. The range is defined by values which indicate levels in a hierarchical structure of layout units. For instance, in ***Figure 6***, the layout units in the second and the third levels are simultaneously displayed.

When the patterns of appearance order and contextual range are combined, a pattern of event order is created. In the pattern of event order, both dynamic allocational and dimensional relations between layout units are described. In ***Figure 7***, appearance order for a three-level hierarchical structure is set to a linear pattern (A-B-C-D-E-F).

Assume the contextual range is declared as the second and the third levels. The pattern of event order is shown sequentially: layout units indicated by circles are the ones displayed on screen (on-state), and layout units indicated by squares are the ones not displayed (off-state). Since the contextual range is defined as the second and the third levels, A is displayed by itself, C is displayed while B is on-state, and E or F is displayed while D is on-state.

The accurate time-locations and durations of layout units are determined by giving specific values to two kinds of pauses: a pause of display after a layout unit appears (Pause 1), and a pause of display after a layout unit disappears (Pause 2). By deciding upon a unit of time (one second) and setting the values of Pause 1 and Pause 2 to a multiple of the unit (two or three seconds), a grid pattern of time is constructed.

Figure 7.
Event order and display image

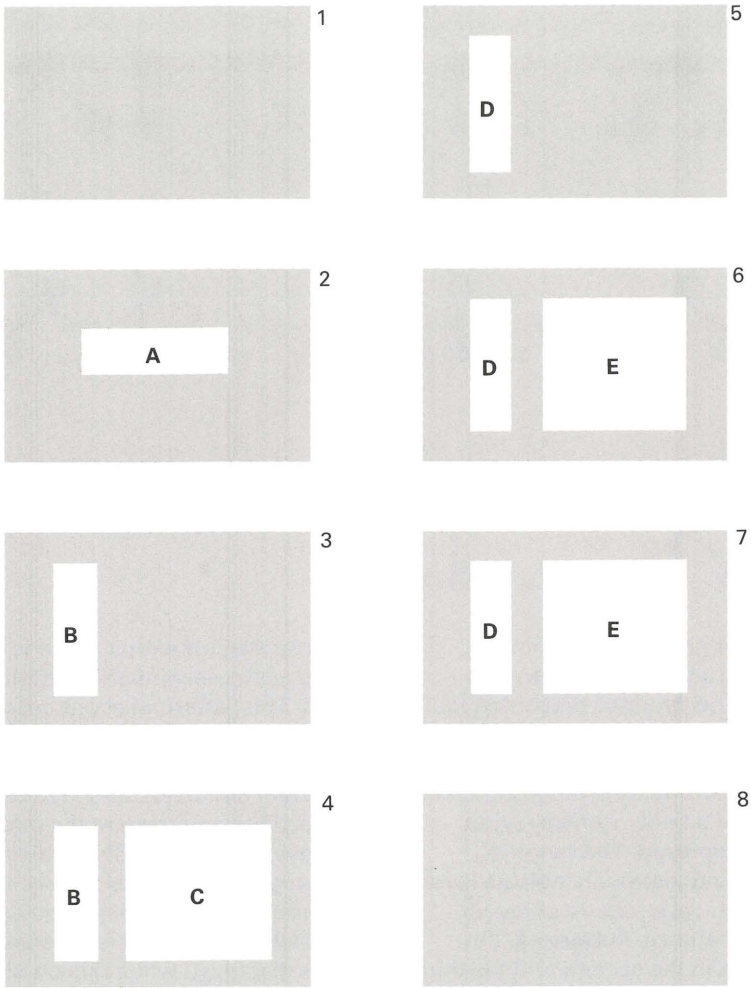
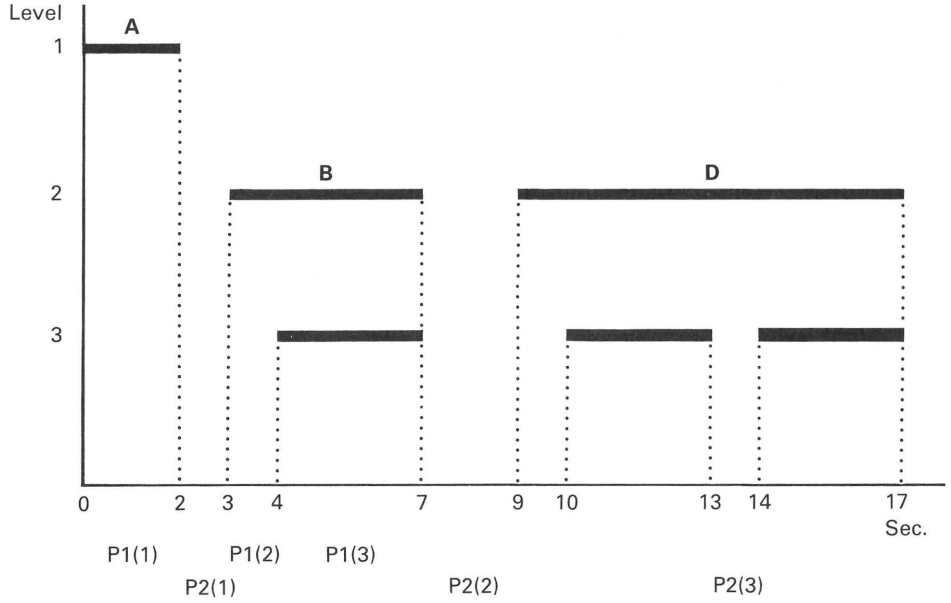


Table 1.
Values of pauses

	Pause 1 (sec.)	Pause 2 (sec.)
Level 1: A	2	1
Level 2: B & C	1	2
Level 3: C, D, E, & F	3	1

Figure 8.
Time map



As an example, the values for pauses, given in ***Table 1*** determine the pattern of event order in ***Figure 7***. The accurate time assignment of the layout units are diagrammed in the time map shown in ***Figure 8***. In the time map, P1 and P2 represent Pause 1 and Pause 2, and numbers in parentheses represent hierarchical levels: for instance, P1(1) stands for Pause 1 of level 1. When more than two layout units disappear at the same time, Pause 2 of a layout unit in the highest level of the hierarchy takes priority. In ***Figure 8***, display pauses two seconds after B and C disappear; Pause 2 for layout unit B takes priority.

These dynamic patterns allow for consistency in planning information display. These patterns also become basic design attributes for layout generation in a dynamic presentational communication mode.

Figure 9.
The design proces in DYNAM

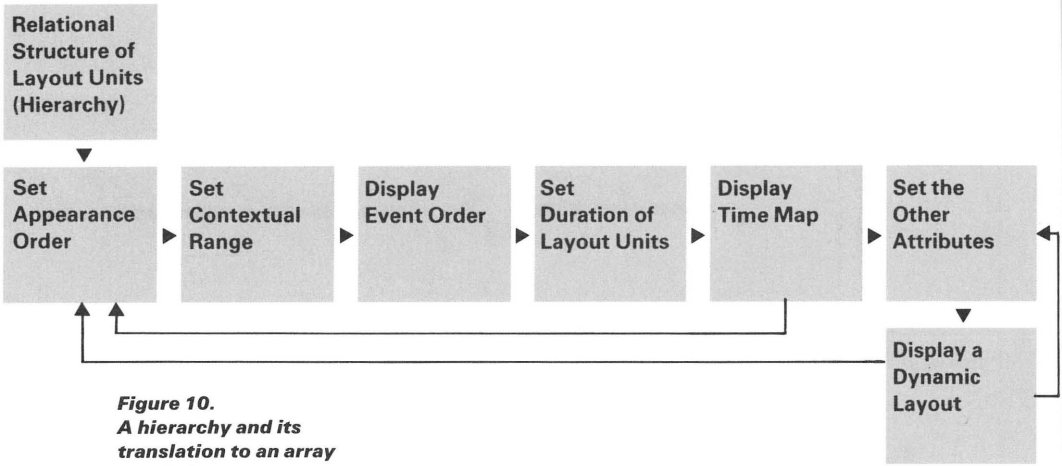
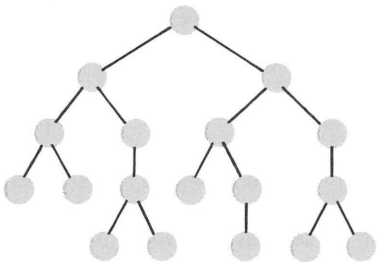
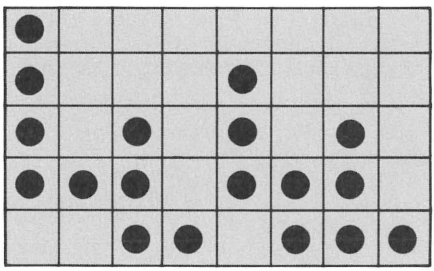


Figure 10.
A hierarchy and its translation to an array matrix form



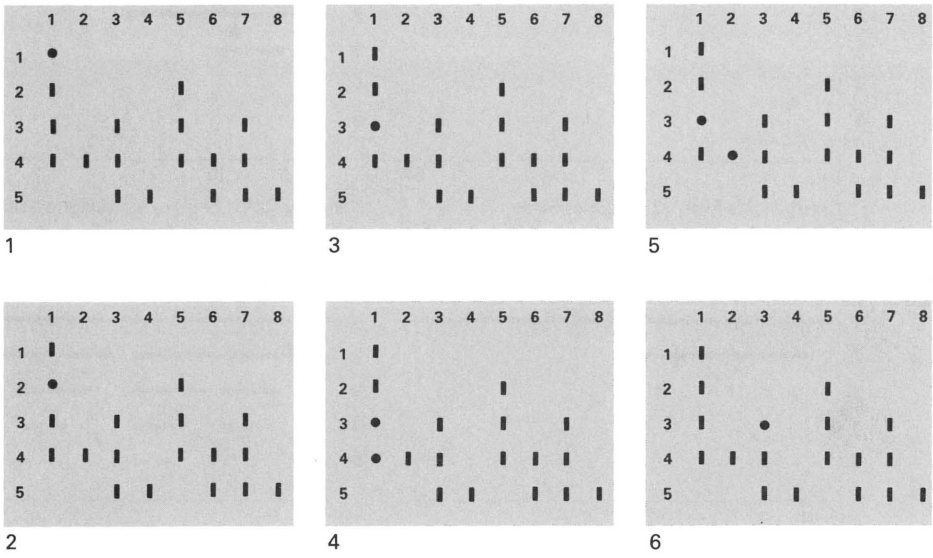


DYNAM Program

DYNAM is a demonstration program to illustrate the proposed process for typographic layout generation. It provides interactive assistance for a designer in creating a dynamic layout on a display screen. A set of simple graphic elements such as lines, rectilinear blocks and circles are used to represent layout units for simplicity in the development of this prototype program.

The design process in DYNAM is depicted in ***Figure 9***. In this process, two kinds of intermediate patterns are graphically displayed on a screen. The first sequentially illustrates the pattern of event order as shown in ***Figure 7***. The second shows the pattern in which the accurate temporal relation of layout units (a time map) is described. These patterns graphically help a designer confirm his decisions in the inter-

Figure 11.
Displayed event order



mediate states of the design process, if he wishes, they can be altered by interactive means represented by feed back channels (dashed) lines in ***Figure 9***. The production of a dynamic layout is performed by the eight steps described below.

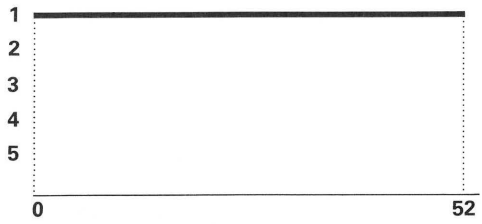
1 The hierarchical structure of the information contents is interpreted into a hierarchical structure of layout units represented by an array matrix as shown in ***Figure 10***. The maximum size of a matrix is 10 rows by 50 columns.

2 The pattern of appearance order is automatically assigned to the hierarchical structure by a programmed rule incorported into DYNAM. (Currently, DYNAM creates only linear patterns.)

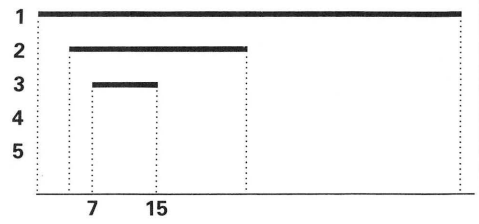
3 A pattern of contextual range is determined. The system prompts the user to specify levels of the hierarchy to be displayed together.

4 One of the program rules automatically generates the pattern of event order by combining the linear appearance order and the contextual range specified by the designer. The pattern of event order is dynamically shown on the screen by coloring the hierarchy of layout units: the colored layout units are ones being displayed on a screen (on-state) and the colorless layout units are ones not being displayed (off-state). ***Figure 11*** shows an example pattern of event order (part) in a sequential order. In the diagram, a rectangle represents the off-state of a layout unit, and a circle represents the on-state. ***Figure 11*** shows a linear appearance order with the contextual range of the third, fourth, and fifth levels of the hierarchy.

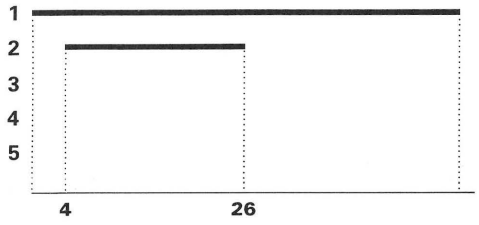
Figure 12.
Time map



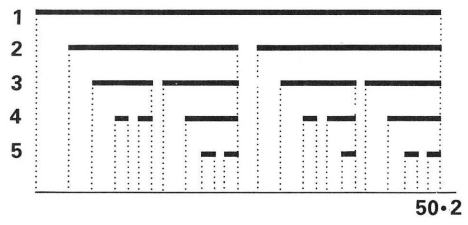
Entity (1,1): From 0 to 52 seconds



Entity (3,1): From 7 to 15 seconds



Entity (2,1): From 4 to 26 seconds



Entity (5,8): From 50 to 52 seconds

5 The display timing of layout units are determined by assigning values to Pause 1 and Pause 2 of all layout units.

6 The program displays the time map of a dynamic layout. The accurate temporal relation of layout units are graphically displayed on a screen, and the exact appearance and disappearance time (in seconds) for each layout unit are also presented at the bottom of the time map. ***Figure 12*** is an example of a time map for the hierarchy shown in ***Figure 10*** with the specification in ***Table 2***. On the actual screen, a different color is used for each level of a hierarchy to increase the readability of a diagram. This pattern can be altered by the designer's interaction. See the feedback in ***Figure 9***. ***Figure 13*** shows examples of the altered patterns.

7 The other attributes of layout units as listed below are determined by the designer. DYNAM assigns user-specified values to each layout unit.

(The variables marked with asterisk (*) are related to time-pattern.)

Morphic Variables

- Shape: circle, square, rectangle, triangle, and line
- Color: black, blue, red, magenta, green, cyan, yellow, and white
- Writing Pattern: curves and lines can be set in a specific writing pattern like dots, dashes, and a solid line. When combined with shading, it creates a shading pattern.
- Shading: interiors can be shaded.
- Blinking*

Proportional Variables

- Size

Allocational variables

- X-Y location

Figure 13.
Alternated patterns of a time map

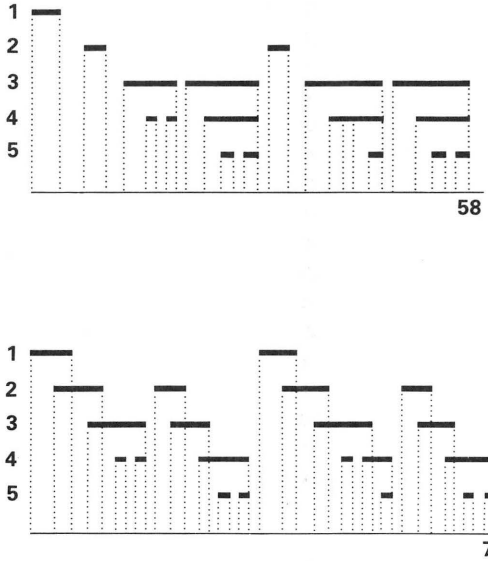


Figure 14.
Displayed image

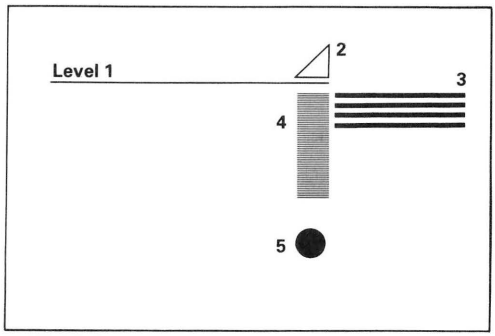


Table 2.
Specifications of Dynamic Patterns

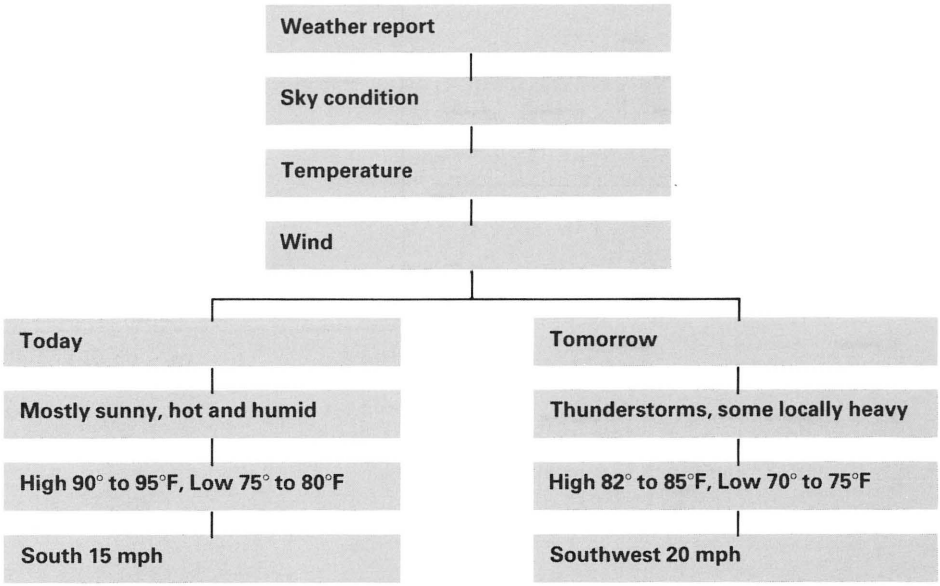
Appearance order	Linear Pattern	
Contextual Range	Level 1, 2, 3, 4 & 5	
	Pause 1 (sec.)	Pause 2 (sec.)
Level 1	4	0
2	3	2
3	3	1
4	2	1
5	2	1

8 The dynamic layout is presented on a screen. ***Figure 14*** shows an example of a displayed image. Each shape represents attributes of the layout units in each level of the hierarchy. These shapes dynamically appear and disappear following the time map pattern shown in ***Figure 12*** and ***13***.

A dynamic layout with actual type could be generated by replacing the symbolically represented layout units with real typographic elements. For practical generation of a dynamic layout, textual information with a specified array matrix needs to be input at **step 1**, and typographic variables such as typeface, typesize, space between lines, and scrolling mode need to be determined in ***step 7***.

Currently, the programmed rules incorporated into DYNAM create only linear appearance order, relatively simple patterns of contextual range, and consistency of visual patterns in hierarchical levels.

Figure 15.
Hierarchical structure of "Weather Report"



Demonstration of Dynamic Layout

A hypothetical design system generated the next example of a dynamic layout, *Weather Report*. In the system, actual type and additional graphic elements are assumed to be available. The information content to be displayed is shown in ***Figure 15***.

This information can be organized into various hierarchies. With specification of typographic variables as shown in ***Table 3***, the time map in ***Figure 16*** is generated. By assigning the static attributes of the layout units to each level of the hierarchy, a dynamic layout, a series of screen images which are observed at specified moments in time (as shown in ***Figure 17***), is generated.

Figure 16.
Time map of "Weather Report"

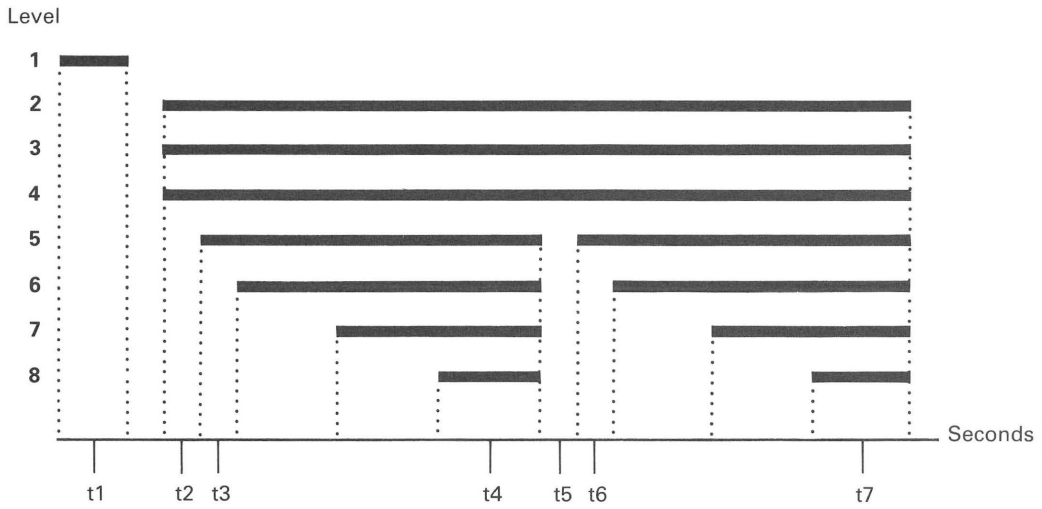
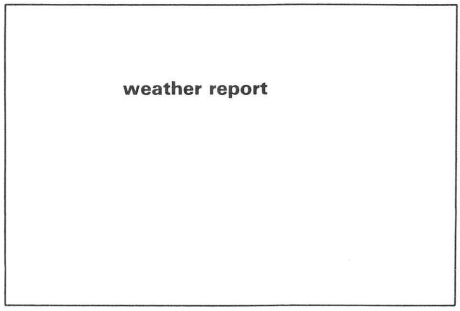


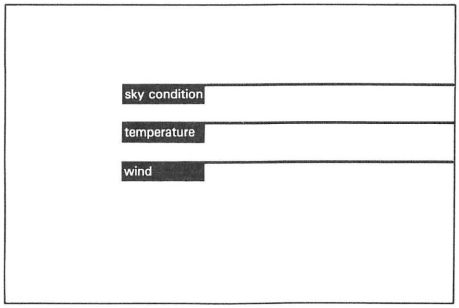
Table 3.
Specifications of dynamic patterns for "Weather Report"

Appearance order	Linear Pattern	
Contextual Range	Level 2, 3, 4, 5, 6, 7 & 8	
	Pause 1 (sec.)	Pause 2 (sec.)
Level 1	2	1
2	0	0
3	0	0
4	1	0
5	1	1
6	3	0
7	3	0
8	3	0

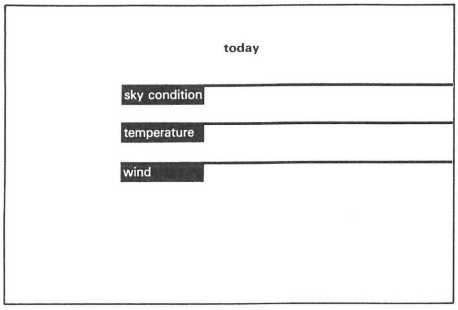
Figure 17.
"Weather Report"



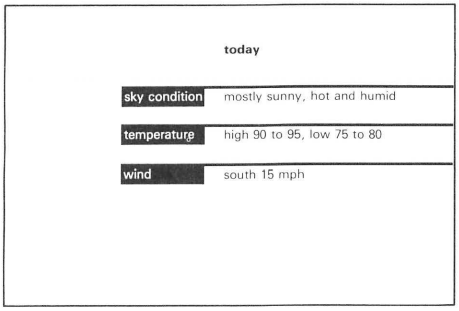
t1



t2



t3



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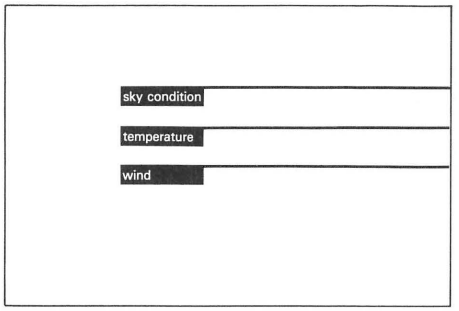

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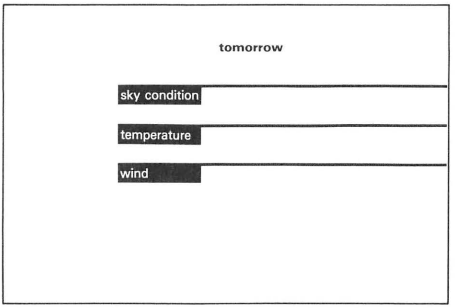

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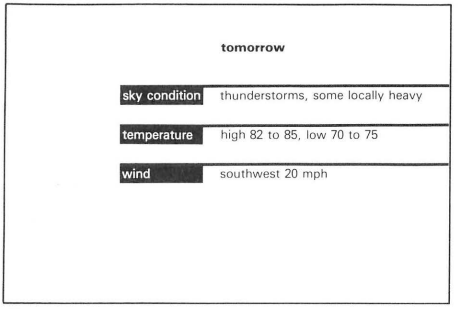

t7

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