

Temporal Typography

Characterization of time-varying typographic forms

by Yin Yin Wong

B.F.A. Graphic Design
Carnegie Mellon University
May 1988

Submitted to the Program in Media Arts and Sciences
School of Architecture and Planning
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Abstract

Text is no longer limited to a static presentation in electronic communication. Typographic form can change in size, color, and position according to a reader's interaction in real time. This thesis proposes *temporal typography* as an area of study which incorporates the dynamic visual treatment of written language. Presently, graphic design lacks ways to conceptualize and describe temporal typography in a systematic way. This thesis presents a *characterization scheme* which provides a set of concepts and terminology which allows for the description of typographic expressions that change dynamically over time. A software tool along with a scripting language was implemented based on the scheme. Design experiments exploring dynamic treatment of text were generated using the tool. The results are then described and discussed using the terminology of the scheme. This scheme is intended to serve as a dialogue between designers and design solutions as well as a communication tool between designers. The research contributes to a deeper understanding of temporal typographic design in electronic media.

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Chapter | Introduction

1.1 What do you see?

Dynamic visual treatment of written language, or *temporal typography*, is a presentation approach we are unfamiliar with. It is only within recent years with the broad introduction of electronic media that we have been able to consider typography in non-static terms in our day-to-day settings. Since we are limited to a paper medium in writing a thesis, alluding to an experiential sense may yield a more evocative depiction as to the effects of temporal typography. Imagine you are looking at a small area on a computer screen. Words appear and disappear on the screen one by one. As they appear, meaning is expressed as forms change dynamically over time (Figure 1). The combined effect of the message, form and rhythm express a tone of voice, emotion or personality as if you hear a person speak. Although the two mediums, spoken and written words, are vastly different, the analogy may give you a sense of the expressive potential of temporal typography.



Figure 1: An example of a time-varying typographic form.

1.2 Motivation

Graphic Design history is rich with examples of experimenting with visual treatment of written language, or *typography*. The use of type in posters, books, and identity logotypes have all contributed to a deeper understanding of text's communicative and expressive range. However, its development has focused mainly on a fixed presentation medium, i.e. print. Graphic designers apply fixed typographic attributes such as position and size in order to structure information being conveyed. In contrast, electronic media extends the expressive potential of text by enabling typographic forms to change dynamically over time. For example, type size may increase quickly to attract a reader's attention. Moreover, words may undergo changes based on viewer input in real time.

Designers have begun to explore temporal presentation of text in television and film media. However, these designs are often intuitively crafted. Characteristics of temporal forms have not been generalized to allow for analytically crafted solutions in which changing forms can be described in a systematic way. Over time graphic design has developed a set of terms in order to establish a conven-

tion for the discussion of typographic form. Graphic design uses a system that effectively describes the physical spatial characteristics of type. For example, "leading" describes the physical space between two lines of text. By naming these characteristics, they can be used to describe and discuss a design solution. For example, "leading" enables a discussion on whether a particular measure of leading makes it difficult for the reader to find the next line. In contrast, graphic design has not identified a similar set of terms to describe the temporal characteristics of the simple sequence in figure 1. Electronic communication design requires temporal forms to be described for a general purpose. Presently, the field of graphic design lacks ways to think about and systematically describe the temporal presentation of text.

This thesis presents a *characterization scheme* for temporal typographic design. There are two basic parts to the scheme: *structural* description and *behavioral* description. *Structural* description provides a framework for building up temporal presentations. The framework consists of a hierarchy of formal details. Each layer defines a unit of form details to attend to. This framework allows designers to compose complex temporal presentations out of smaller units. *Behavioral* description provides a set of terms which characterizes temporal form. Terminology enables designers to describe the behavior of temporal forms and create analytically crafted solutions. This scheme was evaluated implementing a software tool, *exPress*, along with a scripting language based on the scheme. Design experiments on various temporal presentation methods were constructed using *exPress*—again testing the scheme.

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One way to evaluate the characterization scheme is to use the proposed set of concepts and terms to describe concrete examples. I discuss the communication goals for each experiment and explain decisions on treatment of temporal form using the scheme. Qualitative discussion adds to an understanding of temporal typographic design.

1.3 Problem statement

Electronic communication brings forth two unique design opportunities: real-time communication in text, and presentations tailored to users' actions.

The first opportunity for dynamic treatment of text results from the use of written language as a real time communication medium. It affords the opportunity to add dynamic expressivity to the forms. Current design solutions in computer based applications that take advantage of the expressive capabilities of temporal presentations on computer based media are limited. One extreme example is in the domain of multi-chat environments, where many participants use text to converse in real time. A typical presentation solution can be found in multi-chat environments such as Internet Relay Chat (IRC). IRC supports multiple conversation channels connected through the Internet, yet all dialogue channels are merged and presented on a first-in/first-out basis in a linear scrolling format as shown in Figure 2. Written communication systems such as electronic mail remains typographically constrained. In general, only one kind of typeface at a

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<Corwyn> Eldi: London, Paris, Waterloo, Dublin, Exeter, are all
in Ontario
<eldi> Ontario!! haha! Paris, France, London, England, Dublin,
Ireland are all better than SF, CA, US
<yariy> the coffeeshops! :-)
<Corwyn> Eldi: Don't you like San Francisco?
<eldi> well, it's like anything else. If you're around it too
much, there's no novelty in it.
<Corwyn> Eldi: I guess so
<eldi> I'm going to Paris in a few days. I'm gonna this that's
the greatest thing I've ever seen, I'm sure
<Corwyn> Eldi: never been further west than Hannibal, MO I am
afraid
<eldi> but I'm gonna be living with a host family (studentmt echa
exchange) history and philosophy
<eldi> at their summer home.
<Corwyn> Eldi: parlez-vous francais?

```

Figure 2: Current interface for Internet Relay Chat.

fixed sized is supported. This constraint limits the expressive capabilities of typographic communication. User's get around this constraint by inventing symbols. Current ethnographic studies have shown the development of symbols, such as "smileys", at the end of text messages can qualify the tone of voice of content (i.e., friendly, sarcastic, hostile) [Reid]. Another approach as proposed by this thesis is to add dynamics and temporal qualities to text forms. By introducing a tone of voice to the text itself it is hoped a larger range of expressivity can be achieved.

The second opportunity arises from the use of interactive visual systems. The Visible Language Workshop's Information Landscape is an example of a three-dimensional typographic presentation which responds to a user's interaction [Cooper]. Typographic forms can change dynamically as a user moves through the space. A question german to this problem is "how should text be treated in 3D space?" Designers choosing this form of communication will now have to decide on treatment of typography as type moves in relation to a reader's movement in 3D space. Issues of orientation and legibility, such as backwards type, will have to be addressed.

Given these two opportunities brought on by electronic communication, designers must consider dynamic treatment of type. Graphic design's current limited contribution to the design of electronic communication may simply be the result of a lack of experience designing dynamic treatment of text. Another reason, albeit more conceptual but more relevant to future developments, may be a lack of conceptual devices and terminology which allow designers to describe and discuss the characteristics of temporal forms analytically.

1.4 Models and languages

In traditional graphic design, the development of theories and language for discussing spatial qualities of type have helped designers create, articulate and reflect on design solutions. An example is a theory of visual composition based on polarity of form. Polar qualities such as "order" and "disorder" are used by designers as a language within the composition to communicate the information

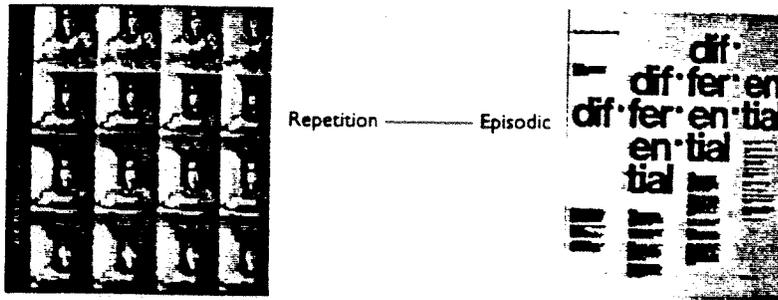


Figure 3: These two are examples of the use of polar qualities as a composition element.



Figure 4: The grid on the left is used as a structure for layout of elements.

[Dondis]. Figure 3 shows an examples of polar qualities, "repetition" and "episodic" in which the qualities are used as a compositional element to reinforce the meaning of the content. Structural devices have also been developed to aid the design of spatial relationships. Devices such as grids were developed to help designers organize spatial elements [Müller-brockmann]. The example in Figure 4 shows two layouts using the same grid. The grid is used as an underlying structure for the placement of typography and photographs on a page. Moreover, the development of analytical devices help designers analyze design solutions as well as to suggest other form possibilities. Hiebert provides a matrix of formal variations applied to visual marks (Figure 44) [Hiebert]. The matrix suggests a range of possible form manipulations during exploration and serves as a tool to systematically evaluate solutions.

A hierarchical set of terms describing spatial qualities of typography has also been developed to enable designers to discuss spatial characteristics of a layout. For example, the concept of "alignment" is used to describe the spatial relationship between text; "leading" describes the space between lines; "kerning" describes the space between characters, etc. This set of terms comes from the physical mechanics of setting type and is specific to describing the physical characteristics of typography. Designers use these terms to discuss particular spatial qualities of a composition in a systematic manner. The same terms are used by computer based layout tools such as QuarkExpress™ to allow users to manipulate spatial characteristics of type.

These conceptual as well as concrete devices have developed over time to aid the process of designing. In this research, I argue for the need to develop a similar set of devices to enable designers to think about and describe typographic forms that change dynamically over time.

Recently, researchers have begun to propose ways to approach this new dynamic form of communication. Bork proposed a taxonomy of terms used to describe treatment of text on computer screens [Bork]. For examples, "scrolling" is a term which describes a technique through which text overflow is handled on screen. Ishizaki proposes an abstraction of temporal forms and multi-agent theories of design [Ishizaki]. He provides a structure for describing temporal forms. Members at the Visible Language Workshop are exploring issues of design of computational media [Cooper]. Graphical techniques such as transparency and blur are used to layer and present information in a continuous manner. Colby and Scholl used the techniques in one experiment to shift information focus from one area of the screen to another [Colby and Scholl]. Methods for creating synthetic typography such as a model based on spring simulation have been investigated [Small]. In spite of all this effort, research on describing dynamic typographic forms in a systematic way has not been emphasized.

1.5 Research overview

In this thesis, I provide a framework for temporal design and present concrete design solutions illustrating the expressive potential of temporal typography. The explanation is divided into two parts. The first part presents a characterization scheme—a set of concepts and terms which designers can use to conceptualize and describe temporal forms. The second part illustrates the use of the scheme in a series of concrete examples which are then described using the concepts and terms proposed in the scheme.

Although this work is presented in a linear format, the research method is an iterative design process. The cycle began by making design solutions to explore various treatment of temporal form. Analysis of the forms suggested ways to define the temporal characteristics. The research arrives at a set of concepts and terms by generalizing the specific experiments. A preliminary scheme was developed and used as a basis for implementing a software tool, exPress. The cycle was iterated using exPress to construct new design experiments thereby testing both the usability of the tool and the characterization scheme. The tool was useful in quickly generating a range of new experiments. Since each part informs the others, preliminary schemes were re-evaluated with each successive iteration.

Characterization scheme

Models and languages developed in graphic design have given designers an understanding of visual communication. This helps designers create solutions that communicate visually. An example is the Munsell color model which defines color as having a three dimensional structure: hue, value, and saturation.

This structure enables designers to think about and discuss color along each dimension. A set of terms have been developed based on this structure which describes the visual behavior of color. Terms such as contrast, complimentary, gradation and subtraction allow designers to discuss the visual qualities of color in a systematic manner. Without a model, description and discussion of color would be difficult.

The characterization scheme proposed in this thesis is conceptually similar to the Munsell model. The scheme consist of two basic parts: *structural* description and *behavioral* description. *Structural* description provides a conceptual framework for building temporal typography analytically. *Behavioral* description provides a set of terms for describing the temporal behavior of dynamic typographic forms.

In structural description, the framework consists of a hierarchy of formal details ranging from a primitive description of physical form to a global composition. Design of temporal presentation is thought of as having levels of descriptive granularity. Each layer of the hierarchy defines a level of form detail to attend to. This framework allow designers to compose global expressions out of solutions local to the form.

Behavioral description is a set of terms which characterizes how dynamic typographic forms change. The proposed terminology enables designers to discuss temporal characteristics in visual treatment of form. Solutions can be analytically crafted and allow for a conceptual understanding of temporal form.

Similar to the Munsell model, I expect the set of concepts and terms proposed in the characterization scheme can be used by designers to conceptualize, describe and analyze temporal typographic solutions.

Design experiments

In design research, qualitative discussion of design issues may be more useful than specific solutions or guidelines. This is because design is not about finding the best local solution. Instead, designers make trade-offs in order to solve the overall communication goals of the design. In order to make design decisions, it is essential for designers to understand the expressive range of form rather than to remember guidelines. For example, finding the point where the blurring of a typographic form becomes illegible is not as useful as understanding the range of blur and what it can communicate at each level.

This thesis presents experimental design solutions using temporal typography. To explore and develop the communicative aspects of dynamic treatment of text, I was motivated by one particular experimental paradigm: Rapid Serial Visual Presentation. The RSVP method of reading bypasses eye movement. One or more words are presented at the same location in succession. This method was used as a basis to start from. In addition, design experiments were also motivated by visual experiments in the VLW and traditional typographic experiments on expression and quality of voice. This thesis discusses issues raised in the process of these iterated experimental solutions. In particular, I discuss why cer-

tain form decisions were made, what the forms communicated, what I learned and issues to consider. Design solutions are described using the concepts and terminology proposed in the characterization scheme.

This thesis provides a preliminary set of concepts and terms for temporal design. The goal is to provide a framework which designers can use to as they experiment making analytically crafted temporal typographic solutions. The work presented contributes to a deeper conceptual understanding of temporal forms and the development of temporal typographic communication on computer-based media.

1.6 Organization of this thesis

The next chapter present a characterization scheme for temporal design. The explanation includes: structural descriptions for building a temporal presentation, behavioral descriptions which characterize the behavior of temporal form, and a discussion of the description issues. Chapter 3 discusses form and communication issues for each design experiment using the set of concepts and terms defined in the scheme. Chapter 4 provides related information on visual design and in reading. Finally, Chapter 5 concludes with a summary of contributions. This is followed by a bibliography and an appendix describing the implementation of a software tool.

Chapter 2 Characterization Scheme

This Chapter presents a characterization scheme which designers can use to think about and describe temporal typography. As previously mentioned, the scheme consists of two parts: *structural* description and *behavioral* description.

Structural description, provides a conceptual framework for building up temporal expressions analytically. Design of temporal expressions can be thought of as having levels of descriptive granularity. The structural description is a hierarchy of formal details ranging from simple to complex. Each layer of the hierarchy defines a level of form detail to attend to. This conceptual framework allows designers to compose global expressions out of local units as well as to break down a complex temporal expression into smaller units.

While structural description provides a conceptual framework to think with, we still need to specify terminology for describing the behavior of temporal forms. A set of terms are defined which identify categories of temporal characteristics. These terms can be used to describe how the form changes at each conceptual level. By decoupling the structure and behavior of a temporal expression from a particular piece of content, design solutions can be analytically crafted and discussed.

This chapter is organized in the following way. In Section 2.1, I begin with an explanation of the research method I followed in conducting this thesis. The characterization scheme is explained in two parts. In Section 2.2, I present a conceptual structure for thinking about temporal expressions. In Section 2.3, I define a set of terms for describing the behavior of temporal forms. Finally, in Section 2.4, I discuss descriptive issues raised by the scripting language developed based on the scheme.

2.1 Research method

The research method is an iterative design process modeled after a process often used in the field of graphic design. Initially, the process is driven by making a variety of concrete visual solutions to investigate the range of possibilities. Visual treatment of these solutions are then grouped and analyzed. General characteristics of form are identified as a result of this analysis [Hiebert]. The process is then repeated by structuring further experiments along the characteristics identified.

Following the iterative design process model, I began the cycle by generating experimental design solutions on temporal presentation methods. Visual solutions were expanded by exploring various treatment of the same form. For example, I explored a method in which text is presented at one location serially. This method was expanded by studying particular dimensions such as changes in color, size, timing, and transparency. I also varied the information chunk by presenting a word, a phrase or a sentence at a time.

The experience of constructing concrete design solutions allowed for reflection on the process of designing temporal forms. Analysis of the various visual treatment suggested ways to characterize temporal forms. A preliminary scheme was derived by generalizing the specific experiments and from design experience of temporal typography.

In order to have precise control over the description of temporal typography, a software tool for constructing temporal forms was then implemented. As an interface to the tool, a scripting language was developed based on the characterization scheme. I was able to test the usability of the tool and evolve the scheme at the same time. For example, the notion of an external information source was added to the description to accommodate various methods of driving the presentation, such as time, distance, user input. A range of new design experiments was quickly generated using the scripting language thus tightening the iterative design loop. Since each part informs the others, preliminary schemes were re-evaluated with each successive iteration.

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2.2 Structural description

At the core of the structural framework is a physical description of the form based on the notion of *dimension*. Dimension is the notion that typographic form is not fixed. Rather, physical attributes such as color, weight, size, and position can change dynamically over time thus giving text a dimension it was previously lacking in its static state. Temporal presentations are described by building up a hierarchical description of dimensional changes. The conceptual structure is a hierarchy of formal details for describing typographic presentations. Each level is a conceptual unit which defines a boundary of descriptive details. Starting from the lowest level of the hierarchy, the four levels are visual technique, visual action, expression and presentation (Figure 5). Each successive level is made up of one or more descriptive units from the previous level. Building up from the basic unit, a visual action is composed of visual techniques, an expression is composed of one or more visual actions, and a presentation is a composition of expressions. Since the conceptual structure is based on describing dimension as the primitive unit, my description starts at the visual technique level.

 Presentation

 Expression

 Visual action

Visual technique

Figure 5: A conceptual hierarchy representing levels of descriptive details designers can attend to. Visual technique is the primitive unit used to build a complex presentation.

Visual technique: A *visual technique* is a primitive unit which describes how a specific typographic dimension changes over a period of time. Figure 8 shows a simple example of a visual technique in which the dimension of size changes. This level is the most detailed and focuses on describing changes to each dimension.

Figure 6 is a chart of the dimensions that give a typographic form its visual appearance. They are grouped into four categories: shape, color, edge definition, and composition. Each dimension has a range in which the form can be changed. For example, value can range from light to dark and width can range from condensed to extended.

A visual technique is described not only by what dimension to change but also by what manner over time. Manner describes how the form changes. In section 2.3 I provide a set of terms in which the manner of a visual technique can be described. Visual techniques are described for a general purpose. The description is uncoupled from a particular piece of content. Once a technique is specified, it can be applied to any piece of text. Visual techniques are the primitive units used to build up a temporal presentation.

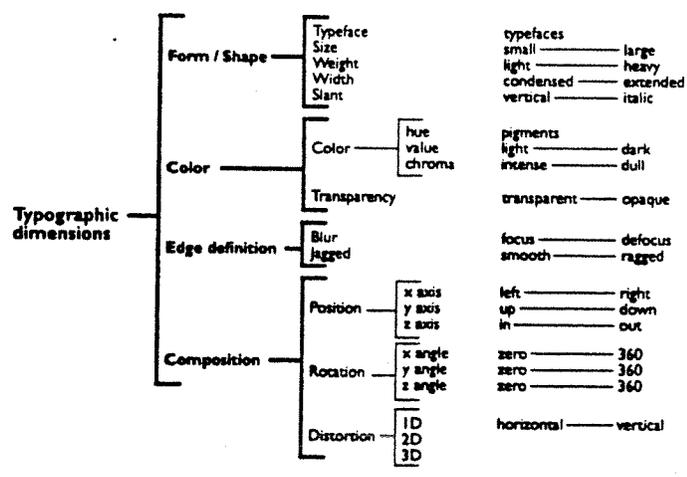


Figure 6: The physical dimensions of typographic forms.

Presentation

Expression

Visual action

Visual technique

Visual action: While the first level focused on describing the physical treatment for each dimension, this level focuses on combining them to create a complex expressive behavior. A *visual action* is a unit of temporal form. The form is described by a collection of visual techniques and how they relate over time. Figure 7 is a schematic diagram of a visual action. The diagram shows three visual techniques combined to create a complex temporal form. By combining techniques, the overall form can be perceived as dynamic. Figure 8 shows the result of a form that changes transparency, size and rotation. As shown in the example, the desired expressive behavior for the word "dizzy" is achieved when visual techniques are combined to create a visual action that is consistent with the message.

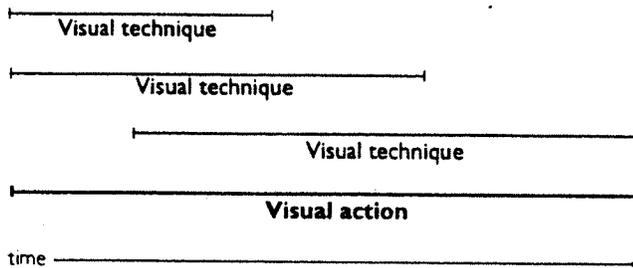


Figure 7: A schematic diagram of a visual action composed of three visual techniques.

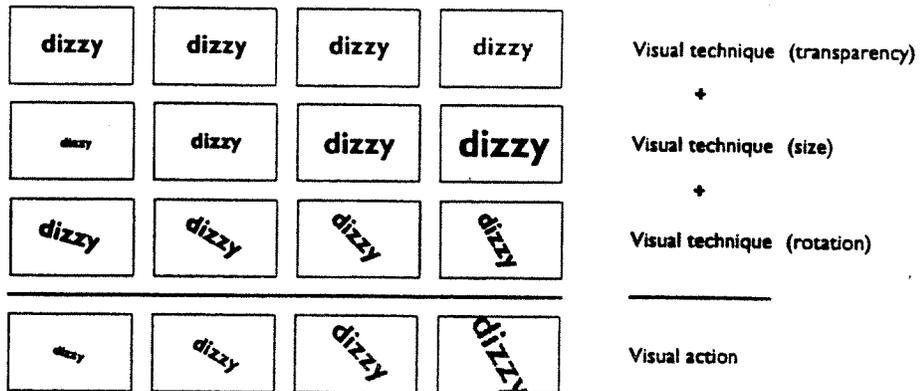


Figure 8: An example of a visual action composed of three visual techniques that changes transparency, size and rotation.

Presentation

Expression

Visual action

Visual technique

Expression: The third level shifts from focusing on the description of form to composing an expressive meaningful series of actions. An *expression* is composed of one or more visual actions as shown in Figure 9. This level focuses on the overall expressive behavior of a piece of text and what it communicates. For example, a piece of text appears and moves to a corner and compresses against the edge of the screen is a set of visual actions conceptualized as one expressive unit such as "squash".

The boundary between a visual action and an expression is defined as a hierarchical relationship with expression always maintaining its position over visual action. However, the frame of reference can shift from a finer grain to a coarser grain depending on the particular design. For example, a piece of text moves to the center of the screen, bounces, then moves off the screen can be described as one complex visual action or an expression composed of three visual actions: enter, performance and exit.

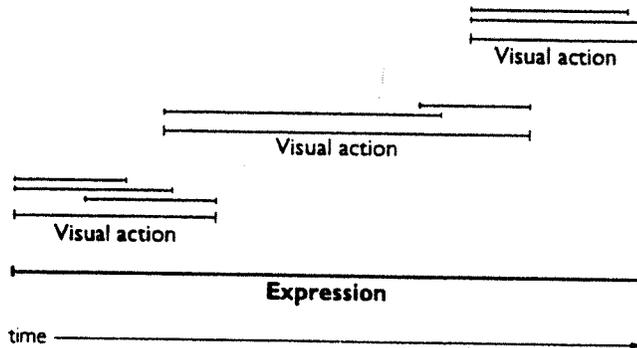


Figure 9: A schematic diagram of an expression composed of three visual actions.

Presentation

Expression

Visual action

Visual technique

Presentation: While the first three levels describe the dynamic form of a piece of text, the fourth level focuses on the relationship between these pieces. A *presentation* is a composition of expressions presented in an integrated manner for the purpose of visual communication. Designers coordinate the individual expres-

sions by attending to the overall temporal rhythm and expressive qualities. Figure 10 shows the hierarchical relationship of these four conceptual levels.

These four conceptual levels provide a structure for building temporal typography. A hierarchical structure allows design solutions to be approached in levels of descriptive granularity. As in the design of a layout in graphic design, individual aspects can be isolated and discussed with regard to each part's contribution to the overall composition. Similarly, these four levels of description allow complex temporal presentation to be thought of as layers of local solutions which can be assembled into an overall design.

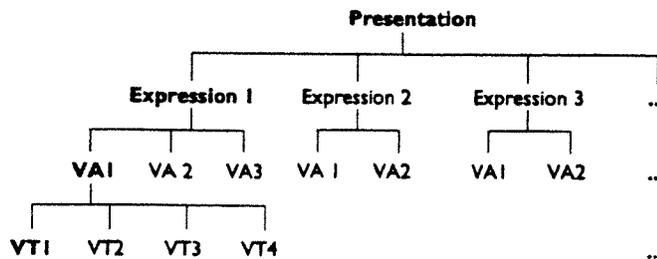


Figure 10: A schematic diagram of the structural hierarchy.

2.3 Behavioral description

As mentioned briefly in the previous section, the characterization of temporal forms is described by two basic concepts: *dimension* and *manner*. Dimension describes the physical attributes of typographic form such as color, weight, size and position. While dimension describes 'what', *manner* describes 'how' the form changes. The previous section identified a conceptual structure based on a description of dimension. This section on the other hand provides terminology for describing the behavior or manner of a temporal form.

Manner is a broad concept that can be used to describe the quality of change at each conceptual level. It can be described from subjective perspectives such as emotional quality and expressive behavior. For example, at the presentation level, manner may refer to the overall rhythm as being *confident* and *steady*. At the expression level, manner may refer to the perceived behavior of an expression such as *hesitant* or *quiet* manner. At the visual action level, it may refer to the physical action of the form such as *bouncy* or *flashing* manner. A visual technique may be qualified as changing *quickly*. These are subjective descriptions base on the perceived quality of change. Many of these descriptions are used in Chapter 3 to describe the manner of changing forms. However, an extensive characterization of manner from a subjective perspective of perceived expressive qualities is outside the scope of this thesis.

This section identifies basic categories of terms which characterizes manner from a form-oriented point of view. Terminology is provided which characterizes manner at three conceptual levels: visual technique, visual action and presentation. Terminology which characterizes the manner of expression level in the hier-

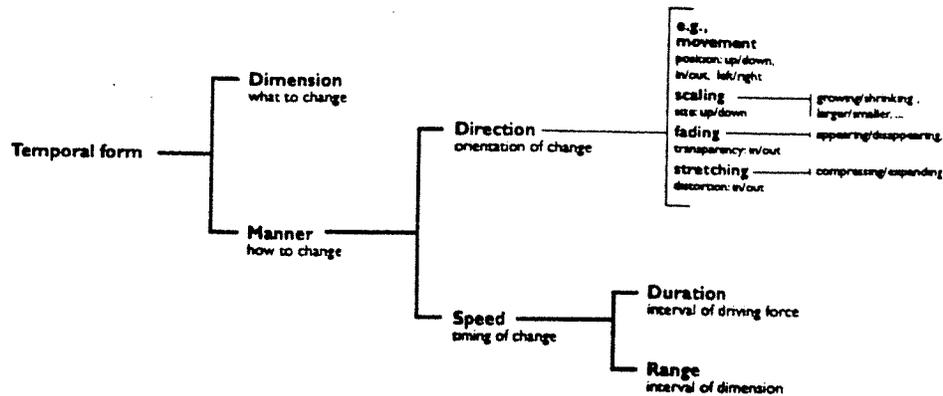


Figure 11: A set of terms which describe characteristics of a temporal form.

archy is missing because expression is focused on meaning. The characterization in this scheme is from the point of view of form. Meaning is outside the scope of this scheme.

Visual technique: At the visual technique level, manner describes how a particular typographic dimension changes over time. For example, the dimension of size can change in a "constant" or "accelerated" manner. Manner is created either by a fixed sequence or generated by an algorithm. Figure 11 shows categories of terms which characterize the behavior of temporal forms.

Manner is determined by what *direction* a dimension changes toward and at what *speed*. Each typographic dimension can have a range of graphical treatments. *Direction* describes to which end of the range the change is shifting towards. For example, size can either increase or decrease and color value can get lighter or darker.

When a particular typographic dimension is described, the description of direction can have levels of specificity. For example, fade is a particular term describing transparency. Direction of transparency is a two direction description because it can be described both as fading in and fading out. Terminology is more specific when change is in a particular direction. For example, appearing and disappearing are one direction descriptions.

Speed describes how fast the dimension changes. It is defined by the relationship between range and duration. *Range* describe an interval of graphical treatment and *duration* describe an interval of time in which the change occurs. For example, we perceive the speed to be very slow if a small change in size occurs over a long period of time.

In addition to the basic set of characterizations, there are two other notions which contribute to the description. The first is the catalyst which initializes and continues to motivate the change. This is referred to as *driving force*. A visual technique can change as a function of time, distance, user input or some other variable specified by the designer. For example, a visual technique driven by dis-

tance expresses the piece of text in relation to the distance from the viewer. By uncoupling the description of a temporal expression from the driving force, design solutions can be thought of as dynamic forms that respond to the environment and not as a pre-defined presentation.

The second notion involves making explicit an assumption this scheme adopts. It assumes a model in which the end state of a temporal change persists and does not revert back to its initial state or some default state. At the end of a visual technique, the visual treatment stays constant until the next change. With this assumption, only actions involving change need to be specified. For example, a piece of text moved to the center stays there until the next visual action. This model conforms to our expectations of how objects behave in the real world.

In order to see the relationships of these terms, I describe a simple example of the visual technique "grow" represented as a diagram. The diagram in Figure 12 shows a sequence of "grow" described using terminology proposed in this section. The vertical axis is mapped to the physical dimension of size. Time is the driving force mapped along the horizontal axis. The direction is an increase in size. What you see is a piece of text which grows slowly at first but speeds up toward the end. The manner of growth is generated by a quadratic growth function. Since the range of growth is small and the duration of time is short, the overall speed is quick. At the end of the visual technique, the word "grow" keeps the end size because this scheme adopts the notion of keeping the end state persistent. Terminology used to describe the visual technique "grow" is in the basic set of terms.

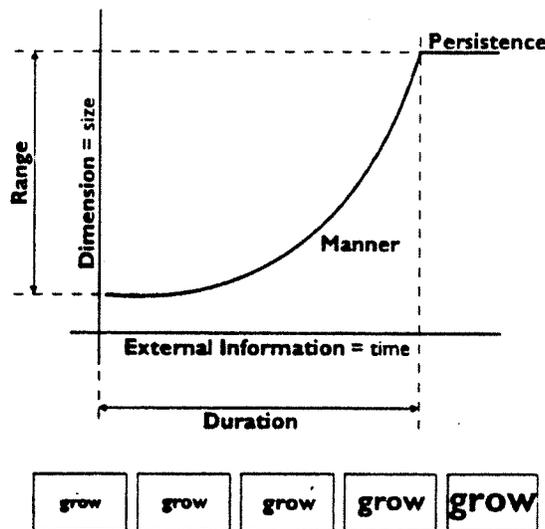


Figure 12: A schematic diagram of a visual technique describe by the set of temporal characteristics.

Visual action: One way to characterize the manner of a visual action is from the point of view of formal identity. A form can be perceived to have a certain identity. For example, a particular polygon may be identified as a "square". Similarly, a particular combination of dimensions give a typographic form its formal identi-

ty. When a form changes dynamically over time, it's formal identity may be perceived as changed or preserved. A "square" may be perceived to have a different identity (i.e., "triangle") or the same identity at the end of a change. The manner in which the formal identity changes can be divided into two basic categories: variation and transformation (Figure 13).

The term *variation* refers to changes within the form; it does not alter the way we perceived the formal identity. For example, when text is scaled up proportionally, we recognize the end shape as the same except it is larger. In a similar vein, a square scaled up is just a larger square. In general, dimensions which we do not perceive as having discreet states such as color value, saturation and transparency are transitions.

The term *transformation* denotes changes which result in a perceived shift in the formal identity. I have further divided this category into two sub-categories: *transition* and *deformation*. *Transition* refers to a *closed* non-linear change from one state to another, each being perceptually distinct from the other. For example, a change from one hue to another or from one font to another. Helvetica and Times are two different typefaces which can be morphed but the two end states are perceived as having different formal identities. This can be compared to a change in form such as from a square to a triangle.

Deformation refers to an *open-ended* change of the form through distortion. A letter form may be stretched and distorted to a point of losing its original identity. The sequence in Figure 14 shows a piece of text being distorted over time. This movement is generated by a mathematical model simulating the physically based motion of springs.

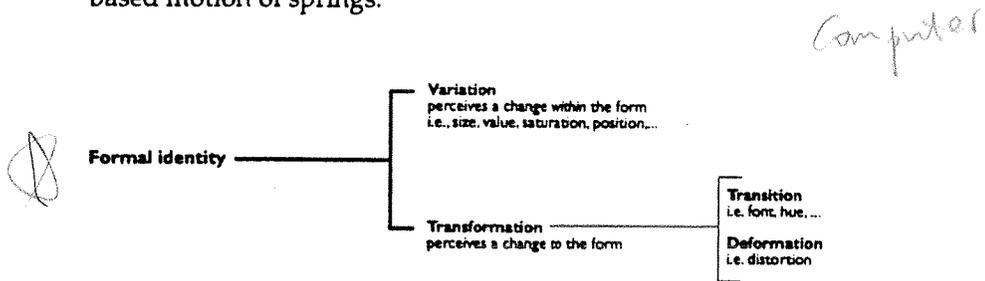


Figure 13: A set of terms which describe kinds of temporal change from the perspective of how the form is perceived to change, or formal identity.



Figure 14: An example of an open-ended motion. This sequence shows a deformation of typographic forms generated by a physical simulation of springs.

Presentation: While formal identity is a characterization of manner local to the form, presentation method characterizes the global behavior of presentations. Presentations can be characterized from multiple perspectives due to their complex form. The terms provided in this scheme were derived from analyzing the design experiments and generalizing the manner of presentations. Presentation is characterized by the two categories of terms: *display* and *interaction* (Figure 15).

Display characterizes the way information is presented with respect to time and distance. Display can be further broken down into two ways of conveying the change; *sequential* which is related to time and *landscape* which is related to distance. *Sequential* describes a presentation in which information changes based on time. Time is perceived through change. A series of text flashed in succession is an example of a sequential display. *Landscape* describes a presentation that changes with respect to distance. Information is placed in a three dimensional space and presented based on a viewer's action or movement through the space. Time is perceived through direction and speed of viewer's movement. Figure 35 is an example of a landscape display where text is placed one after another in the z-dimension and as if the viewer is flying over the text.

Interaction characterizes the level at which a user controls the system. Interaction can range from *passive* to *active* involvement. At the *passive* end a reader views a pre-defined presentation sequence. If the interaction is *active*, readers have non-linear access to the information by controlling the sequence of presentation in real time. For example, interaction is passive if a presentation is presented automatically. Interaction is active if the reader controls the pacing and the order in which information is presented.

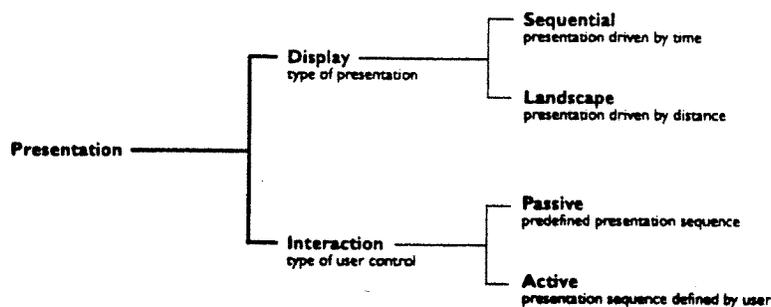


Figure 15: Characterization of the overall manner of a presentation.

In addition to the proposed set of terms for describing the behavior of temporal form, I identified a set of terms which characterizes temporal information. These terms were developed when trying to find the range of information problems to address in making design experiments.

The following set of characteristics identifies the way incoming information is represented as it arrives into the workstation. It is defined along two characteristics: *streams* and *events* (Figure 16).

Stream singular ————— multiple (in number)

Event narrative ————— simultaneous

Figure 16: This diagram shows a characterization of temporal information.

Stream describes the physical number of message arriving into the workstation. The number of streams can range from *singular* to *multiple*. For example, a piece of electronic mail is one message stream while a multi-chat conversation has as many streams as there are participants.

Event describes how the information is represented when it arrives into the workstation. Events can be described as *narrative* or *simultaneous* depending upon whether the information requires a specific order or not. A *narrative* denotes one temporal event and requires a specific order when presenting the information. The order of events matters and meaning is comprehended over time. *Simultaneous* refers to a series of discrete temporal events. The order of presenting the events does not matter and meaning is comprehended in discreet chunks. For example, a piece of e-mail is a narrative event while a series of news headlines are simultaneous events.

Three examples illustrate the combination of these characteristics: 1. e-mail is delivered as a singular stream and it is packaged as one narrative; 2. one multi-chat conversation is delivered as many streams depended on the number of participants but it is still one narrative; 3. lastly, multiple multi-chat conversations are delivered as multiple streams and although each conversation is a narrative, the total is a package of simultaneous narratives. Each of these examples is illustrated in Chapter 3.

To summarize, this section provided a set of terms for describing manner from a form-oriented perspective. At the base level are categories of terms which characterizes manner of a visual technique. In addition to this basic set, manner is characterized from two other perspectives: formal identity and presentation methods. Also included is a set of terms which characterizes temporal information.

The terms provided in this scheme serve two purpose. First, temporal expressions can be conceptualize and built analytically. Second, design solutions can be analyzed and described using these terms. I have used the scheme in both capacities. I constructed a range of design experiments using a scripting language based on the conceptual structure and characterization of manner. Also, I used terminology defined in this scheme to describe and discuss design experiments of temporal typography in Chapter 3.

This set of terms is far from exhaustive. I expect designers to develop additional terminology characterizing manner along other formal qualities to enhance their discussion.

2.4 Discussion

This section is a discussion of issues of raised by the scripting language based on the scheme. The way designs are described affects how designers think about making solutions. In the process of implementing exPress, I was able to see how decisions in the description affected how one thinks about designing temporal forms. Three of these decisions are described here. As the tool was used, it became clear that certain decisions promoted thinking of temporal presentations as a fixed sequence.

This first decision in the choice of description made explicit an assumption that was implicit in the scheme. In a preliminary scheme, a visual technique describes how the form is treated but was not explicit about what happened to the form at the end of a change. Due to an implementation artifact, the form reverted back to a default set of values for each dimension at the end of a visual technique. This was not expected. What was expected was the persistence of change. Objects have persistent behavior until an action is performed. This model conforms to our expectation of objects in the physical world. The persistence-until-acted-upon model may be more appropriate for thinking about design solutions that address problems as they are presented.

The next decision shows that even a small change in the way duration is described altered the way the presentation was thought of. Initially, duration was specified by a begin and an end value. This resulted in thinking of design solutions as a fixed presentation in which the begin and end points are anchored, similar to an animation score. The description was then changed from an end value to an interval or delta value. Now a temporal action can be thought of as an entity with a certain duration rather than as having specific fixed points. Instead of thinking "move from here to there from this time to this time", it became "move this amount for a certain amount of time". The notion of an "end" is implicitly defined. The implication of this change is one between thinking of temporal presentations as a fixed sequence and as actions triggered by some external driving force.

The last decision describes an inherent problem in the description. In the scheme, temporal form is described from the point of view of visual techniques. A composite action can be described by layering a collection of visual techniques. This becomes a problem when two techniques use the same dimension at the same time are specified. I considered two solutions suggested by Ishizaki: 1. to impose a restriction rule and 2. to include a notion of order to produce a more predictable result [Ishizaki]. Since this is a tool for the purpose of conducting experimental designs, I hesitate to apply any restriction. However, I did want the results to be predictable for debugging purposes. Rather than the notion of order, visual techniques which overlap and affect the same dimensions are combined and presented. For example, if one technique rotated a piece of text by 90 degrees and another technique rotated the same text by 40 degrees at the same time, the result is a piece of text rotated 130 degrees. This solution produces a visually apparent result.

These decisions and others have shaped the tool's description and how I think about designing temporal forms. Overall, I have found exPress useful for constructing a range of design solutions. I was able to compose a complex visual action by combining visual techniques. Since actions can be designed for a general purpose, I was able to create a repertoire of actions and reuse them. I find the conceptual levels defined in the scheme an intuitive way to think about constructing a temporal presentation. I can build complex solutions by building up local solutions. The structure allowed me to attend to different levels of formal details. I found it natural to be able to jump between local details and global concerns. For the purpose of experimental design, the current representation of exPress is sufficient.

Chapter 3 Design Experiments

3.1 Organization

This chapter describes design experiments of temporal typography. They are constructed using a scripting language based on the scheme previously described. The spirit of these design experiments was to explore the range of ways typography can be visually presented over time.

Two basic presentation methods were explored. The first referred to in the scheme is sequential display where information is presented in succession and time is perceived through change of information. The second is referred to as landscape display where type is placed in a three-dimensional space. Time is perceived through direction and speed of the viewer's movement in the space.

The communicative goals of these experiments on temporal typography can be grouped into four main categories, each of which has a particular communicative goal.

- Expressive messages: how can time-varying typographic expressions of narrative messages express emotional qualities and tone of voice of the writer.
- Dialogue: how can different qualities of voices be conveyed through form and rhythm.
- Active reading: how can readers actively control the pace of the presentation.
- Real time conversations: how can a continuous flow of multiple streams be presented in real time.

In general, typographic expressions can be more effectively studied if the information is taken from concrete domains. Thus, I have selected three domains that are readily available: electronic mail, on-line news, and multi-chat environments. Each domain serves a different interest. Electronic mail provides informal content arriving in a singular stream as a narrative event. On-line news provides structured content which arrives in multiple streams as simultaneous events. Multi-chat provides time-dependent informal content flowing into the workstation in real time. A conversation arrives in multiple streams as one narrative event.

Since it would be too much to describe every experiment in detail, I have chosen a few experiments and selectively highlighted specific issues uncovered in each.

The explanation is organized in the following manner. First, I present the communication goal for the experiment. It defines what I wanted to communicate and the form qualities I attended to. Second, I briefly describe the general presentation method. Third, I describe specific form details and issues I uncovered in the process of making. I conclude the discussion with general comments on the results of the solution.

This thesis was initially motivated by reading research in cognitive science. Specifically, dynamic presentation methods which involved movement of text on a screen. I have been highly influenced by a method which bypasses eye movement during reading. Rapid serial visual presentation (RSVP) is a method which presents one or more words in the same location sequentially [Forster 1970; Potter et al. 1980]. Design experiments leverage off these findings but do not attempt to measure readability and comprehension.

The goal of this discussion is not to find the best reading method or to identify guidelines for creating temporal forms. Rather, the discussion introduces design concerns in making temporal typography. By describing concrete communication goals and temporal forms used to achieve these goals, designers can gain an understanding of the range of issues through specific examples.

I use the concepts and terminology proposed in the scheme to describe these experimental designs. It would be difficult to describe these experiments and provide a discussion on temporal forms without the scheme.

3.2 Design experiments

Experiment I: Expressive messages

This section describes two electronic messages that were interpreted as temporal presentations. Both messages conveyed emotional qualities and tone of voice of the writer through the use of rhythm and time-varying typographic forms.

Expressive messages I: Janemail

Information
Type: electronic mail
Event: narrative
Stream: singular
Presentation
Display: sequential
Interaction: passive

Hey Yin Yin,
I just found out about the aiga thing!
By the way, loooooooooooooooooong time NO see.
I was talking with Lauralee Alben last night,
and she mentioned that she is going to speak
in Boston at a three day AIGA Design Conference
in December -- and that you are too.
The conference sounds interesting?
Can you do me a favor and send me
some information?

Hope to talk to you soon.

jane

The goal of this experiment is to see how quickly words presented in RSVP method can be read and to uncover timing issues. A secondary goal is to add

emotional quality to the words by varying its form in time; hence setting up an expressive rhythm to the reading. I wanted to explore how time-varying typographic forms can get across the personality of the writer. I discuss one timing issue and describe two instances in which meaning was enhanced by temporal presentation. The content is taken from a piece of electronic mail sent to me by a friend.

This experiment uses the basic format of an RSVP method. Text is displayed one word at a time in sequential order as shown in Figure 17. Words are flashed for less than one tenth of a second. The overall default speed is such that someone can read with their eyes but the duration is too short to pronounce the words in their head.

Selected words are expressed as they appear. For example, the word "see" appears, fades out slightly and fades back in. This visual action in combination with the content is perceived as a 'blink'. By juxtaposing expressive words in the presentation, sentences are punctuated with a reading rhythm. Figure 18 shows a diagram of the sequence in Figure 17. The length of the line represents the proportional duration of each word. The first six words are presented without changing the form. The seventh word "AIGA" is expressed as a different color and presented for a slightly longer duration. Then "thing" is expressed using spring simulation. The manner in which it distorts is described by a mathematical model based on the action of springs.

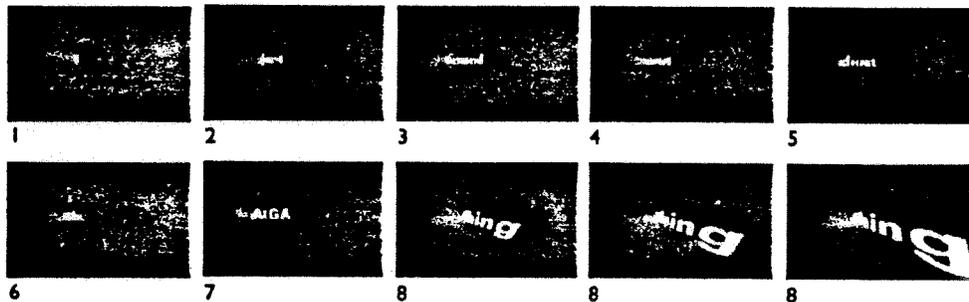


Figure 17: Screen shots from an experiment in which words are presented serially.

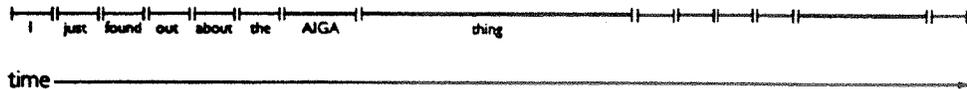


Figure 18: This diagram shows words with different the time scale presented serially.

Each expression in the message is carefully crafted. For example, at the end of the message, the sender's name moves up and down slowly as if dangling from a spring. I had to adjust the manner so that "Jane" appears friendly rather than

frantic. I slowed down the springy motion by loosening the tension of the spring. The combination of these forms gives the message a playful personality.

One issue in particular became apparent by flashing the words at less than one tenth of a second pace. I found that I missed reading certain words. Specifically, a word with many characters or the word following the lengthy word. For instance, it was difficult to read the word "loooooooooooooooooong" because the word extended beyond the area of focus causing my eyes to move to the right. When I extended its duration, I found that I completely missed the following word "time". This was because my eyes moved from the area of fixation to follow the length of the word. When the next word "time" was flashed, my eyes were unable to move back to the original position in time to read it before it disappeared. In this solution, I also increased the duration for "time". One could take a different tactic. I hypothesized that if the duration for a lengthy word is too short to move the eyes, the word would still have been registered. It would also prevent the eyes from moving and keep it fixated in order to catch the next word. More systematic experiments are needed to evaluate this hypothesis. I was not able to find a discussion of this issue in Reading research. This may be because the method was measured from the perspective of overall comprehension given a consistent speed unit.

In this experiment, I explored two ways of adding meaning to the reading of a word. The first method is to embellish the meaning of a word through its temporal form. For instance, a visual technique that specifies how the size dimension changes is applied to the word "favor" in the sentence "Can you do me a favor?" The word grows in a quick, accelerated manner. The viewer reads "favor" and "big" is implied by an increase in size. The word fills the edges of the screen, giving the reader a sense of magnitude. The transition was not smooth and continuous because the size range was large and the duration was short. However, the choppy effect was not noticeable due to the fast speed of the presentation.

The second method explored simultaneous presentation of two words. I wanted to achieve parallel reading similar to hearing a person say a word and ask a question by increasing the pitch of her voice. I presented the word "interesting" in the foreground while "?" was presented as a centered transparent overlay. The sequence in Figure 19 shows how the word "interesting" fades in as the symbol "?" becomes more transparent. The effect is such that the word "interesting" becomes a question.



Figure 19: An example of reading two words in parallel. The screen shots shows a sequence which uses transparency to shift the words from foreground to background.

This simple experiment shows that words can "speak" through timing and motion in form as well as through the content of the word. Terminology proposed in the characterization scheme allowed me to analyze the form and communication issues explored in this solution.

Expressive messages 2:Whitmail

Information
 Type: electronic mail
 Event: narrative
 Stream: singular
Presentation
 Display: sequential
 Interaction: passive

Glug! glug! glug! Apologies for being so tardy!
 We got into a big crunch that just overwhelmed us.
 Hopefully, things are back on track!

Whitman

One problem I experienced with reading a text word-by-word using the RSVP method is that I had to keep the sentence context in my mind as each word is presented. This experiment overlaps expressions in parallel time as a way to maintain a meaningful context. The main goal is to see if temporal presentation can use both foreground and background to communicate. In addition, I described two ways the content of this message determined the temporal forms and rhythm. The content is an e-mail message in which the writer was asked to describe the meaning he intended to convey. The writer's description was used as a basis for translation into a visual presentation.

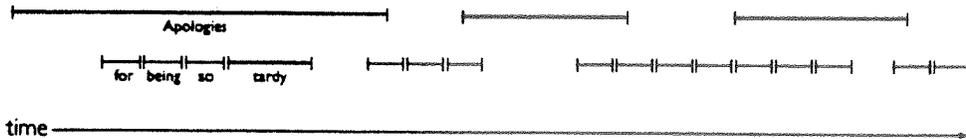


Figure 20: This diagram shows words with different time scale overlapping in a serial presentation.

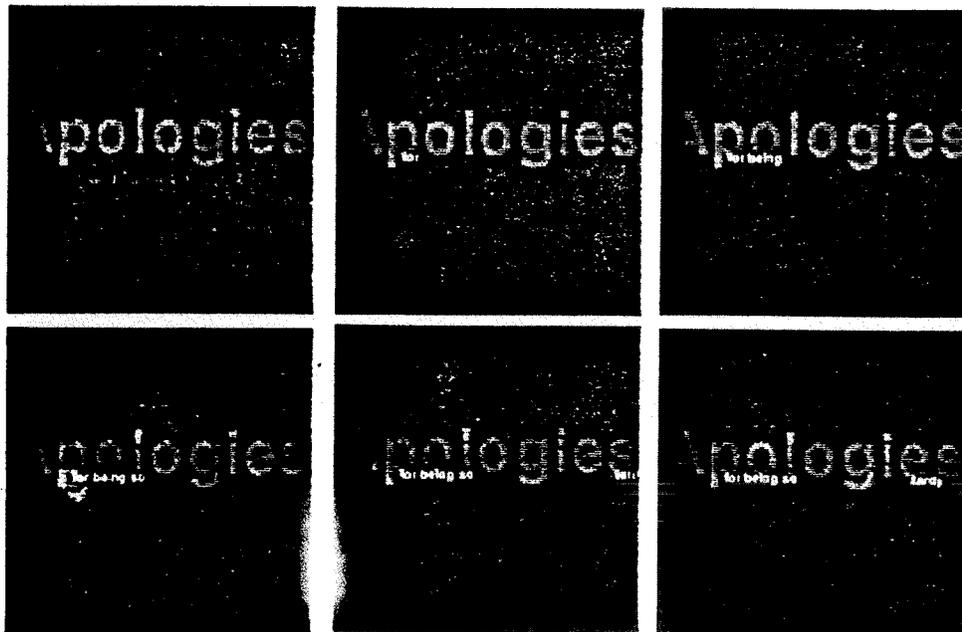


Figure 21: This sequence of screen shots show an expression in the background while words are presented serially in the foreground.

The presentation method is basically a sequential display of words. Since expressions can have different time scales. Rather than having expressions presented one after another, they overlap as depicted in Figure 20. Words are introduced one by one, but unlike the RSVP method, words add up until a meaningful chunk is expressed. For example, the sentence "Apologies for being so tardy" is a meaningful chunk. Figure 21 shows key frames from the sequence. First, the word "Apologies" fades in and becomes more intense. As it starts to fade to the background, the next three words are flashed quickly one word at a time. The word "tardy" then enters from the right in a slow manner. Meaning is added with each word and previous words are kept as context in the background until the sentence can be read as a whole. The word Apologies in the background shades the emotional content of the entire sentence. This experiment points to the potential to overlap reading of non-emotional text over the text that expresses an emotion. It suggests that regular words may be processed in parallel while an expression continues to be conveyed in the background.

In reading the original message, there appears to be two aspects that can be used to visually help structure the presentation. First, the message has two decisive tones. Second, the message contains a number of physical metaphors.

First, the message can be interpreted as having two major rhythms. The initial part of the content expresses a sluggish apologetic tone while the following part expresses a confident recovery. This interpretation is expressed in the timing of the visual actions. The overall speed of movement in the initial part of the presentation is slow. For example, the words "glug! glug! glug!" are dropped and bounces in a slow manner (Figure 22). In contrast, the movements are concise and fast in the following part. For example, the words "we're back on track" are presented in succession moving directly pass the reader quickly (Figure 23). This

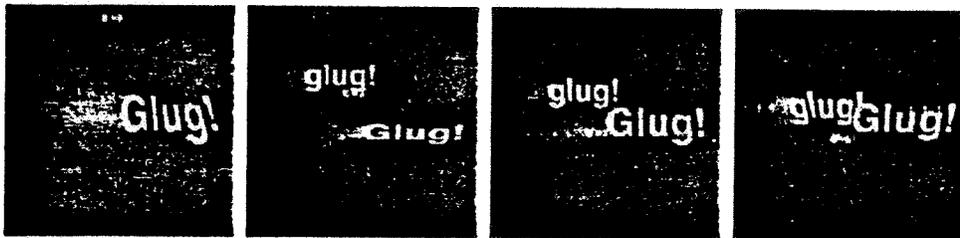


Figure 22: This sequence shows a solution in which the presentation is perceived as having a slow rhythm. Each word bounces in a slightly different manner but the overall speed is slow.

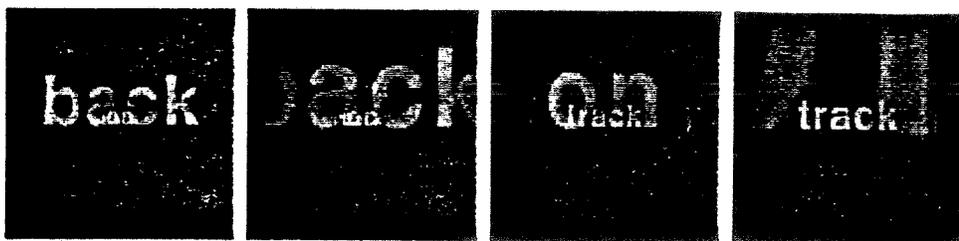


Figure 23: This sequence shows a solution in which the presentation is perceived as having a slow rhythm. Words line up behind one another and move toward and past the viewer quickly.



Figure 24: The words depict a literal image.

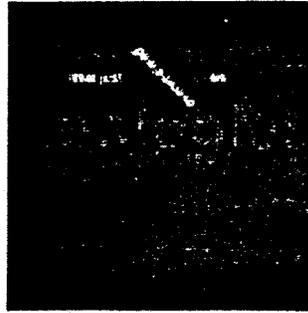


Figure 25: The word "overwhelmed" is expressed using the physical metaphor of being upside-down.



Figure 26: The word is expressed using a serif typeface.

combination of timing and presentation method communicated a "confident" disposition. This division of rhythm gave the message an overall temporal structure.

Second, since the message contains a number of references to physical metaphors, I used graphic metaphors to enhance the meaning of the message. The following examples highlight the conventions used in this example.

- "glug! glug! glug!"—Since the word is an onomatopoeia, it already sounds (and looks) like what it means. By bouncing the words in a slow manner, it helped qualify the sound. (Figure 22)
- "Apologies"—The word is used in the background as coloration for the first part of the message to give an overriding apologetic tone. It fades in and out in a slow manner. (Figure 24)
- "big crunch"—I use a literal image of the mouth. "Big" moves down and crushes the word "crunch". (Figure 24)
- "tardy"—The word is perceived as an actor in a sentence by its physical enactment of the meaning. It enters slowly as though it is trying to catch up with the rest. (Figure 21)
- "overwhelmed"—The form uses the metaphoric relationship of being "upside-down" or "on your back". (Figure 25)
- "hopefully"—The use of typefaces to convey a tone of voice is a convention used in graphic design. In this case, the word appears to convey sincerity and hope with the use of an italic serif typeface. (Figure 26)
- "back on track"—The words line up and moves toward the reader as though on a "track". This imagery references a technique conventionalized in film to depict the perceptual feel of riding on a train track. (Figure 23)

It was important that the forms worked even if the reader was not familiar with these conventions. One thing became apparent in using more concrete imagery. I

expected to see more naturalistic movements when a word played upon physical imagery. For example, the visual technique used to rotate "overwhelm" did not support physical motion. It just rotated the word in a linear manner. The form was noticeably stiff for something that was supposed to fall over.

This experiment shows the potential for reading in parallel foreground and background temporal expressions. In addition, I described the use of temporal rhythm and visual metaphors to communicated emotional qualities.

Experiment 2: Dialogue

This section presents one experiment on representing quality of voice and personality through rhythm and temporal form.

Dialogue: Red Riding Hood

Information
Type: electronic mail
Event: narrative
Stream: multiple
Presentation
Display: sequential
Interaction: passive

Red: Hello grandmother
Red: I've just come to bring you this basket
of goodies and some nice flowers
Wolf: come closer
Red: oh granny what a strange voice you have
Wolf: that's because I'm sick, my dear
Red: oh granny what big eyes you have
Wolf: the better to see you with, my dear
Red: oh granny what big ears you have
Wolf: the better to hear you with, my dear
Red: oh granny what big teeth you have
Wolf: the better to eat you with
Red: help! help! help!

The goal of this experiment is to see how temporal rhythm can be used to represent two distinct voice qualities. In addition, I explored the use of transparency to pre-cue the reader to the location of the next speaker. The content is a piece of dialogue from the story "Little Red Riding Hood". Specifically, the part in which Red Riding Hood remarks about the wolf's eyes, nose, ears and teeth. I thought the repetitive phrasing would be an interesting element to play with.

The basic format sets up the two characters as typographic symbols. Each character 'speaks' by presenting one word at a time in sequential order at two fixed positions. The conversation moves back and forth quickly with no pauses in between to give it a sense of urgency. With each phrase, the pace is speeded up slightly.

Because it is a story, the characters are introduced at the beginning. I wanted to communicate that the wolf enters quietly and takes over the scene steadily from grandma. When the story starts, the word "Grandma" is displayed in a soft lilac color. "Wolf" appears by fading in slowly over "Grandma". Since the duration is long and the range goes from transparent to almost opaque, the fade in technique is slow and continuous. The same technique is used to fade out the word "Grandma" until it is almost transparent. However, I shorten the duration; hence "Grandma" faded at a faster speed. This allows "Wolf" to continue to get brighter and dominate the scene until red riding hood enters (Figure 27).



Figure 27: These screen shots are from a sequence in which the word "Wolf" fades in over "Grandma".



Figure 28: These screen shots are from a sequence in which the words "red" runs in with the words "riding hood" chasing behind.

I wanted to contrast this slow steady movement by having Red Riding Hood enter as though she rushed and is a bit flustered. Initially, I treated the three words "red riding hood" as an expression having one visual action. The set of words moved quickly into the scene in one movement. The manner appeared stiff and awkward. Then, the words were treated separately with each having a visual action. As shown in the sequence in Figure 28, "red" comes in first with the words "riding" and "hood" moving close behind. The three speeds are slightly offset as though she is rushing. Red overruns her position and comes back. This series of visual actions make the motion appear more physically natural. When text is used to emulate a character, animation principles offered by Disney animators seem to be applicable [Thomas].

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I wanted to communicate each character's disposition through the presentation's rhythm of the words. Red riding hood 'speaks' in a quick and simple manner. I achieved this voice quality by flashing one word after another using a simple cut (Figure 29). I used the repetitive phrasing in this conversation to create a rhythmic pattern within the sentence. The same parts are emphasized and its duration is lengthened. For example, each time Red calls "grandma", the word increases to twice its size and pauses for a longer period. Only references to the wolf's physical features (i.e. eyes, teeth) are expressed differently within the sentence. Red's voice is characterized by a combined effect of a rhythmic pattern and a speedy delivery.

In contrast, I achieved a voice quality that is deliberate and sinister for the wolf by cross fading from one word to another in a slow rhythm. Initially, the words were presented at the same slow rhythm but I cut between the words instead of cross fading them. The words appeared discreetly which made it a frustrating reading experience. As a reader, I became aware of being controlled and forced to read at a slow pace. Then I tried fading in the next word as the current word fades out. As shown in Figure 30, the word "come" fades out as the next word

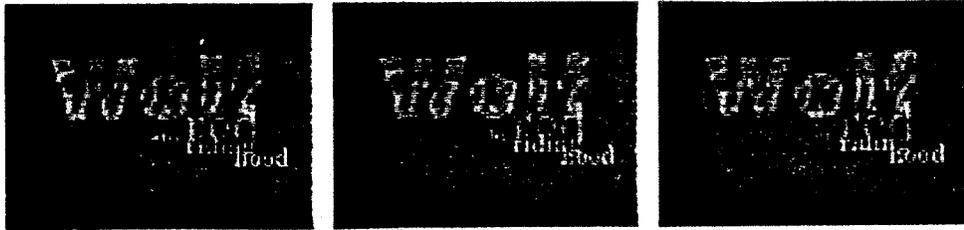


Figure 29: This sequence shows a solution in which words are presented quickly with cuts in between to attain a clear and simple voice quality.

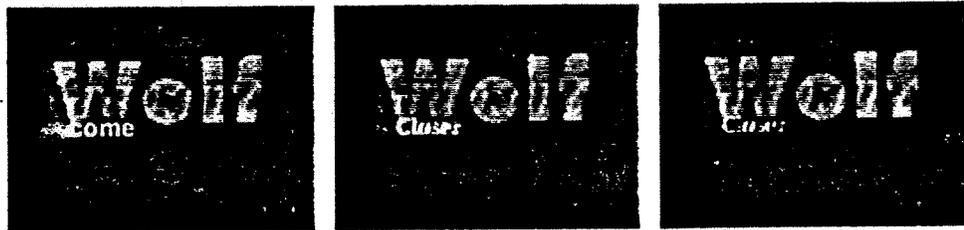


Figure 30: This sequence shows a solution in which words are cross faded slowly to attain a deliberate and sinister voice quality.

“closer” fades in. The combination of these two visual techniques allowed the text to be read visually as a continuous transition between the words; hence decreasing the reader’s frustration.

One issue in particular had to be addressed. I found that I would miss reading the first few words of a sentence when the conversation shifted from one character to the other. Unlike audio which can be heard from any direction, the reader has to focus on the words to read it. The reader had to be alerted of an upcoming change in order to move her eyes to the proper location. In this experiment, I used transparency to pre-cue the reader. When Red is about to speak, I increase the opacity of “red riding hood”. At the same time, I fade out the word Wolf to the background. This draws the eye to Red. When wolf is about to speak, “Wolf” becomes more opaque and “red riding hood” is faded into the background.

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I also use transparency to create a visual play between “Grandma” and “Wolf”. When Red speaks, “Wolf” is faded making grandma a little bit more prominent. When wolf speaks, “Wolf” becomes more opaque and visually suppress “Grandma”.

This experiment shows the potential for temporal typography to express ‘spoken’ qualities such as tone of voice qualities and personality of the speaker.

Experiment 3: Active reading

This section describes three experiments that explore the issue of giving readers active control over the speed of the presentation. The first experiment addresses the issue of speed and anticipation in a serial presentation method such as RSVP. The second experiment introduces a presentation method which expresses time through movement. The third experiment addresses the issue of colliding a designer’s temporal presentation with a reader’s self pacing through the presentation.

Active reading I: RSVP news

Information

Type: electronic mail

Event: simultaneous

Stream: multiple

Presentation

Display: sequential

Interaction: passive and active

Investing

Market roars on fed rate hike

Wall street backs rate hike

Economy may force another move

Hewlett-Packard stock surges

Cyclical stocks spark market

Technology

Intel plans semiconductor plant

Keyboard warnings on way

IBM CEO fights complacency

Gerstner seeks cooperation

Health

Alzheimer's ranks third in cost

Crossing the cocaine line

Rrports spur new FDA hearing

Estrogen offers many benefits

C-sections can be reduced

The goal of this experiment is to explore RSVP method using a more systematic approach to the experiments. This experiment consist of seven solutions. Each solution explores how typographic dimensions such as color, size, transparency and position can address the issue of speed and anticipation in a serial presentation. How can the visual treatment of text show meaningful information even if the presentation speeds by? How can temporal treatment of text prepare the reader's expectation for the next event before it occurs? The content is taken from Clarinet news and articles are divided into five categories such as "investing" and "technology". I wanted to see if RSVP is useful for presenting simultaneous events serially rather than one continuous narrative event.

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The basic format for each solution is to keep the eyes fixated at one location and have text, in the form of a complete headline, presented serially. News headlines are grouped by category and presented one after another. The reader can control the speed of the presentation. Two modes of reading are supported. A reader can choose between automatic or manual presentation. The manual mode allows the reader to interactively control the pace. Headlines are presented according to the reader's mouse input. In the automatic mode, the reader selects the duration a headline is displayed. Headlines are then presented at one consistent speed. This presents a problem because lengthy headlines are missed if the speed is too quick. This same problem is described in Janemail in which words are missed. The manual mode bypasses this problem by giving the reader control over the duration of each headline.

I experimented with color, size, transparency, and position to address two issues raised by a serial presentation: speed and anticipation. The first issue is concerned with the speed of the presentation. When headlines are flashed at a speed that is too quick to read, very little useful information is extracted. At that speed, I wanted to be able to communicate the structure of the presentation. The first experiment assigns a different color to each category. As the reader whizzes past, color of the headlines changes. I found the color change to be too subtle as a cue.

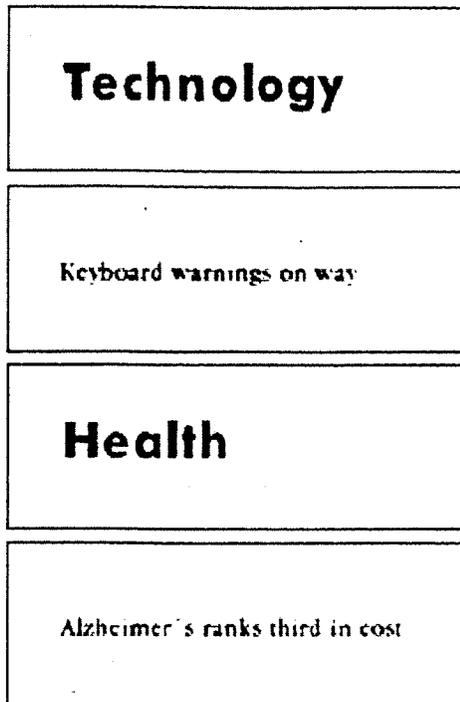


Figure 31: A few key frames from a serial presentation of news headlines. Categories pop out of the presentation due to its size and font change.

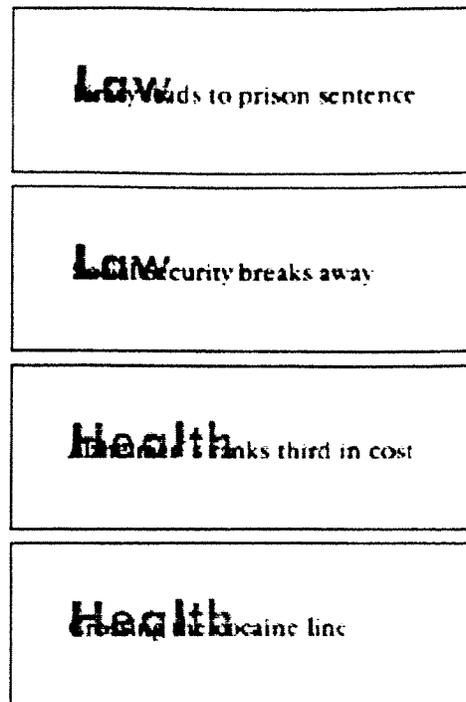


Figure 32: These key frames show that news headlines are presented in the foreground while categories are presented in the background using transparency.

In the second experiment, I decided to emphasize the category (i.e. technology, health, etc.) at the beginning of each section. I added two visual techniques. One technique increased the size of the category by four times. The other technique changes the font from a serif font to sans serif font (Figure 31). As the presentation whizzed by, the word for each category popped out of the blur to indicate the next category.

In the third experiment, I tried keeping the category as a static element that can be read in the background even if headlines are presented too quickly to be read. Categories are semi-transparent and visible behind the headlines as shown in Figure 32. While the previous solution is still a temporal element (i.e., periodic flashes) this solution allows me to read the word for each category because it is treated as a static element in a temporal presentation.

The second issue is concerned with preparing a reader's expectation of the next event in a temporal presentation. In one experiment, I start to introduce the next category just before headlines for the current category ends. I introduce the next category by fading in the word in the background as shown in Figure 33. This warns the reader that the current category of headlines is coming to an end. It also allows the reader to anticipate the category for the following set of headlines.

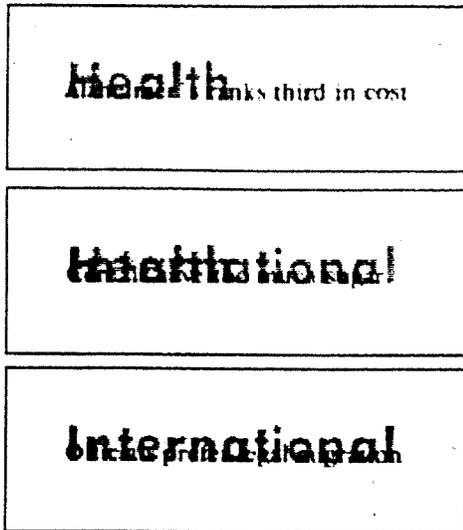


Figure 33: This sequence shows a serial presentation which prepares a user's expectation of the next event. The category "international" fades in just as "Health" headlines are finished.

This series of experiments suggests the potential of using the RSVP method to present simultaneous events and not just narrative messages as described in previous experiments. By providing a manual mode, the reader can vary the speed of the presentation in real time. In addition, issues of speed and anticipation can be addressed with temporal treatment of text.

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Active reading 2: Highway news

Information
 Type: electronic mail
 Event: simultaneous
 Stream: multiple
Presentation
 Display: landscape
 Interaction: active

The goal of this experiment is to explore the use of landscape display to present text. How should text be treated as a reader moves over or through it in a three-dimensional space? How should text move with respect to the reader? This experiment contains three solutions. Each solution investigated a different treatment of text as it moves toward the reader. The content is news headlines taken from Clarinet news.

This solution uses three-dimensional perspective to view text. The reader controls the viewpoint and can choose to view the scene from above or below the horizon. Figure 34 shows three possible perspectives. The default viewpoint is slightly above the horizon.

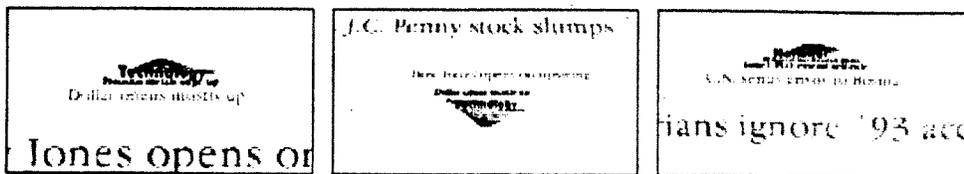


Figure 34: This experiment allows readers to view the scene from any perspective. These screen shots show three example perspectives.

News headlines are placed one after another in the z-dimension. Headlines are presented serially according to active input from the reader. The reader presses a mouse button to fly through the rows of headlines—as if flying over a highway of text. Movement is confined to one degree, forward and backward. The speed at which the reader moves can be adjusted. Since the reader can move and stop as she chooses, she is able to determine her own pace through the information.

In this presentation method, a three-dimensional model helps differentiate between transitional and communicative actions. Headlines move in a regular pattern toward the reader and grow until they move past the reader. This behavior becomes a predictable structure representing transitions. This consistent behavior allows the reader to differentiate between the communicative parts of the presentation vs. the transitional parts. Irregular movements are easily picked out from the repetitive structure. The reader is able to de-emphasize the regular movement and focus on the communicative aspect of the reading.

I experimented with three visual treatments of text as it moves toward the viewer. 1. Text moves in continuous motion past the reader. There is no specific point of focus. 2. Text moves in the same continuous manner. The difference is that I have selected a focal range and use transparency to indicate the area. Text is half transparent until it reaches this focal range, it then becomes opaque in one discreet step. Once a reader moves pass this range, text switches back to a semi-transparent form (Figure 35). 3. Text moves in discreet jumps past the reader. I have also defined a specific point of focus. Text is semi-transparent before and after that location. The headline at the focus point is opaque (Figure 36).

The first treatment allows the eyes to wander up and down the highway because there is no defined area to look at. Depending on the reader's viewpoint, opaque text is problematic. As text moved past the reader, it blocked the text behind. The second treatment solves the opaque problem by making text semi-transparent. It does, however, define an area of focus. I found the discreet change in transparency problematic. Instead of reading the next line, my eyes were attracted to the previous line when it switched back to a semi-transparent form. A discreet

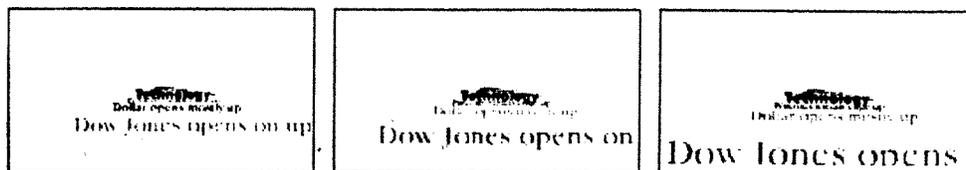


Figure 35: In this sequence, news headlines move in a continuous motion toward viewer.

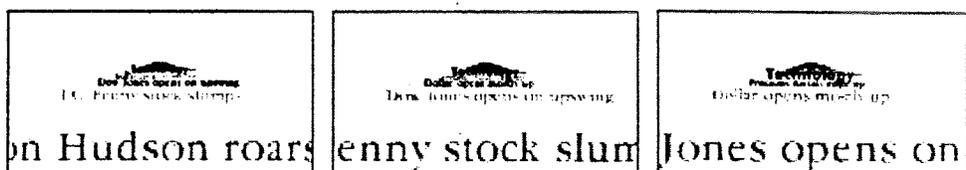


Figure 36: In this sequence, news headlines move in discreet jumps toward the viewer.

change draws too much attention. A gradual change may create a more subtle transition. Another plausible reason may be the use of 3D perspective, the form in front is larger and more prominent.

The second and third treatments of motion brings up an issue about our perception of movement in the context of a purely visual interaction. Are you (the reader) moving or is the information moving? In the first case, information is perceived to be static and you are moving toward (or away from) the information. In the second case, you are stationary and information is perceived to be moving toward (or away from) you. One reader reported that he perceived himself to be moving over the text when the motion is continuous and his viewpoint is slightly above the horizon. However, his perception changed with the third treatment. When text moves in discreet jumps, he perceived the text moving and himself as stationary. He found himself switching perceptually from an active role (i.e. flying over text) to being a passive receiver (text is presented by the system). One reason for this shift in perception may be that continuous motion in combination with a specific perspective mimics the perceptual view of "flying" over something. What are the cues that can cause these perceptual switches? An understanding of these cues could lead to its use as a communicative part of design solutions.

This experiment equated time with movement. Text is presented temporally as the reader moves in the z-dimension. In contrast to the RSVP methods in which text appears and disappears, this method allows for a 'window' of attention. The viewer is able to 'sense' what is coming (e.g. text in the distance) and maintains a bit of the past (e.g. translucent type that has moved toward the user but is still visible in front.) This affords the reader to selectively attend to different parts of this window. This solution shows potential for temporal reading which could map time to movement.

Active reading 3: Sorry message

Information	Sorry
Type: electronic mail	I am sorry.
Event: narrative	I was distracted lately (dental, thesis, visitors, movies)
Stream: singular	OK!
Presentation	OK!
Display: landscape	I am sorry!
Interaction: active	I said I am sorry!
	sorry! sorry! sorry! sorry!
	Satisfied?

This experiment is an expressive message in which the reader controls the pacing through the message. The goal of this experiment was to explore how temporal expressions can be designed to allow readers to read at their own pace. This experiment tries to address the conflict between a writer's temporal expression and the reader's own rhythm of reading.

This is a landscape presentation in which phrases are placed one after another in the third dimension. Similar to the previous experiment, readers read by controlling their movement forward and backward through the text. Words get

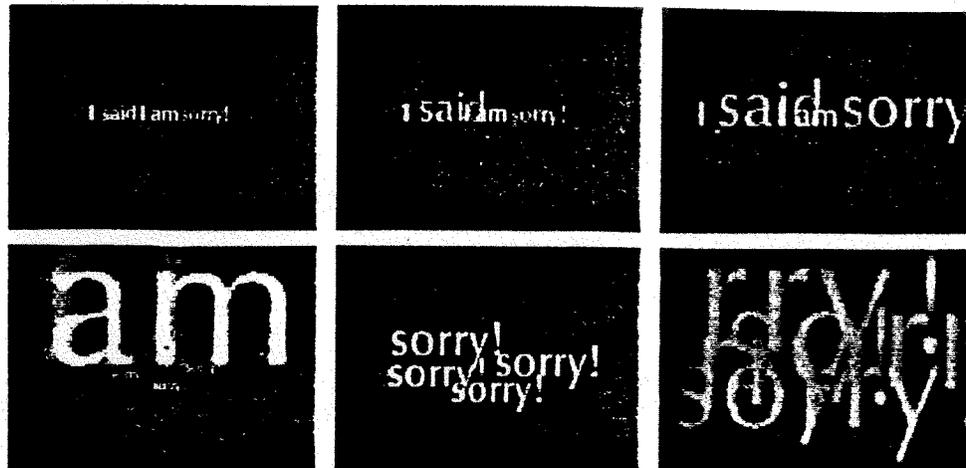


Figure 37: These key frames show a sequence in which text gets expressed as the reader moves through the message.

expressed depending on distance from reader's viewpoint (Figure 37). The pace is determined by how quickly the reader moves through the message.

Active control on the reader's part can become problematic because meaning can be lost or worse yet re-interpreted. Temporal expressions may rely on a presentation timing to impart meaning. For example, in experiment 2, the expression "we are back on track" is presented with a specific rhythm. The timing and manner of movement suggest a confident tone. If the timing can be manipulated, i.e. slowed down or stopped in mid phrase, the meaning changes. In fact, as in this case, the meaning may be reversed. A slowed presentation speed may express uncertainty.

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It is not too meaningful to control a temporal presentation of text in the same way video can be played, paused and fast forwarded frame-by-frame. The solution used in this experiment tries to overcome this limitation by having two ways to drive temporal forms. Temporal forms can either be triggered by or mapped to the driving force.

An example of a triggered temporal form in this experiment is shown in Figure 38. When the reader's viewpoint is within a certain distance, the phrase "I was distracted" is given the signal to start. Once it is triggered, the expression is driven by time and gets expressed as specified by the designer. In this example, each word rotates in a seemingly random manner. While the reader does not control the speed of the form, she can choose to pause and read the temporal form or move on past the phrase.

In contrast, a mapped temporal form is driven based on distance from the reader's viewpoint. An example of a mapped temporal form in this experiment is shown in Figure 39. The word "sorry" stretches at the speed of the reader's movement. If the reader moves slowly, then the word stretches slowly and vice versa. These forms are useful when the expression is not dependent on a specific timing. The combination of triggered and mapped forms afford designers the

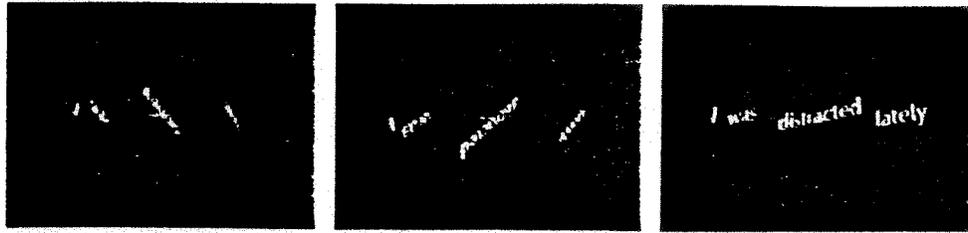


Figure 38: This sequence shows an expression that is driven by time. The form rotates in a seemingly random manner.



Figure 39: This sequence shows an expression that is driven according to distance from viewer. The form expands as the reader moves through it.

flexibility to communicate with temporal forms driven by time or by active input from the reader.

This experiment is one example of allowing a reader active control over the pacing of an expressive message. It shows the potential for developing a new way we might interactively read temporal presentations.

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Experiment 3: Real-time conversations

The following two experiments simulate a conversation in a multi-chat environment. Each solution explores a different way of presenting multiples streams of text as it flows into the system. The first experiment represent a conversation as a separate entity. Participants "throw" their messages to a central location. In contrast, the second experiment represents messages as belonging to specific individual and the conversation is not represented as an explicit entity.

Real-time conversation 1: Flying chat

Information
 Type: electronic mail
 Event: narrative
 Stream: multiple
Presentation
 Display: landscape
 Interaction: active

The goal of this experiment is to explore the visual treatment of text in the periphery. I focused on using peripheral cues to guide the eyes toward an area.

This experiment uses a three-dimensional perspective with the reader's viewpoint slightly above the horizon. This experiment places the participants in a circle around the reader. When a participant contributes to the conversation, this information comes in from the direction of the speaker, pauses at the center, then moves away from the reader as shown in Figure 40. The reader's position is

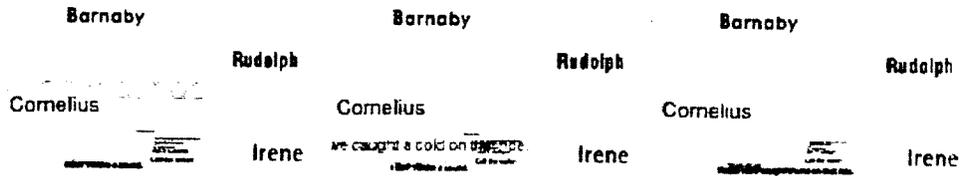


Figure 40: This sequence shows a solution in which text flies in from the sides to a center position, pauses and then moves back in the z dimension.

directly in front of the screen. Therefore the reader's message comes in as though moving in from directly outside the screen to the center. Each participant is mapped to a color. This mapping may not be too useful if there are too many participants.

Movement into the center is not two-dimensional, text appears to move in from behind and to the side of the reader toward the center of the screen. The direction from which the text comes from can be detected in the periphery before it arrives at the center of focus. Initially, my eyes wanted to follow the movement rather than focus at the center. Movement attracts the eyes. Then I increased the speed of the movement so that it moves quickly once it enters the peripheral area. To make the moving text less prominent, I added a visual technique which slowly decreased the transparency level of the form as it moves toward the center. It becomes opaque once the piece of text arrives at the center point. I found this change helped keep my eyes at the center. Another reason may be that once the communicative value of a movement is understood I am able to ignore it. In this solution, movement from a particular direction is a transitional element used mainly to indicate who sent it. Due to its repetitive structure, the visual action fades into the background. The reader is able to de-emphasize the consistent movement and focus on the communicative aspect of the reading.

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In this solution, the conversation can be followed by focusing on a central area, the eyes only need to shift slightly horizontally. I found that my eyes were cued by the peripheral movement to shift in time to catch the text as it arrives. By having the conversation converge in one area, the rhythm of the information arriving is clearly visible. Especially if two participants contributed at the same time as illustrated in Figure 41.

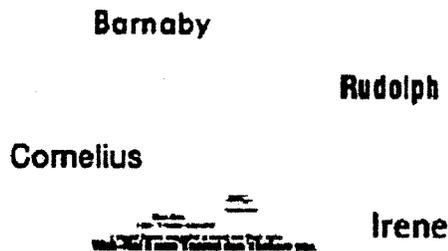


Figure 41: This screen shot shows two messages arriving simultaneously at the center position.

Each stream needed to be perceived as a stream and separable from other streams. This is because the streams merged at the center in this solution. Once I mapped the color and location for each stream, they needed to be consistent within the presentation. From the color and location of the text, I was able to note who sent the message as a background element while reading the message.

When thinking about presenting information as it arrived in the system, it seemed more appropriate to have text move in from the front toward the rear. If new information arrived in the rear, then moved toward you, the delay seemed strange in a real-time conversation context. I wanted to have access to the newest information instantaneously. In contrast, for existing narrative information, the presentation order is reversed. Text is placed one after another in the order of the narrative going back in the z dimension. I read by moving toward the rear. How we want to read information that is created in real time may differ from our previous experience with reading existing information.

Real-time conversation 2: Focus chat

Information
Type: electronic mail
Event: narrative
Stream: multiple
Presentation
Display: landscape
Interaction: active

In this experiment, I placed each participant in front of the reader as though each is situated around a round table as shown in Figure 42. I included an image of each participant rather than just their name as a text symbol to see if this helped to quickly identifying the sender. Ethnographic studies on multi-chat environments point out that the symbolic representation of text adds to the enjoyment of these conversation. A purely textual representation allows participants to create a world of their own making [Bruckman; Reid]. It may be more the case for participants who have never met in person.

Messages are placed with the sender rather than have all streams converge to a central focal location. A message appears in front of the sender and moves toward the rear as shown in Figure 42. Readers move their eyes to the current "speaker". Similar to the Red Riding Hood example, I find that I would miss the beginning of the message because I did not anticipate who would send the next message. To attract the reader's attention, I increased the size and intensity of the image quickly just prior to the start of the message as depicted in Figure 42. I

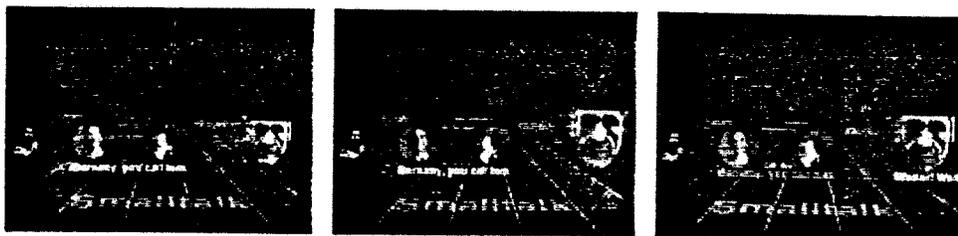


Figure 42: This sequence shows the use of size dimension to attract a reader's attention. A participant's image grow in size to prepare user's expectation of where the next message is coming from.

found that I needed to increase the size substantially and make the visual action appear almost like a flash to draw the eyes quickly to the location. Even with this action, it was difficult to catch the conversation if messages arrived close to one another. It was especially impossible if two messages arrived at the same time. The flashing action at two locations simultaneously can cause some confusion.

Electronic media allows written language to be used as a real time communication medium. As a result there are new design opportunities that require visual treatment of text in real time. As shown in these experiments, the addition of dynamic, temporal typographic forms can enrich this written communication. The scheme proposed in this thesis is to be used by designers to conceptualize and describe temporal presentations.

3.3 Summary

This chapter described and discussed issues of temporal typography through concrete design solutions. Each experiment highlighted specific issues I addressed in making the solution. The first three experiments focused on expression. Emotional qualities and tone of voice were expressed by setting up a reading rhythm through timing and temporal expression. I explored the use of overlapping expressions to allow for reading foreground and background simultaneously. The fourth experiment expanded on the RSVP method by addressing issues of speed and reader's expectations. The fifth experiment described a presentation method in which time is mapped to movement in a three-dimensional space. Text is presented as the reader moves in and out of the z-dimension. The sixth experiment is a solution that begins to address the issue of allowing readers to pace their reading of an expressive message. Finally, the last two experiments explored issues of presenting a continuous flow of information into the system.

This set of experiments show the potential for expressive communication by adding dynamic concepts to the visual treatment of typography. I would argue that this discussion would be difficult without the use of concepts and terms proposed in the scheme. The hierarchical structure allowed me to indicate the level of descriptive details I was referring to. For example, a visual technique referred to changes to the physical dimensions of a typographic form. A presentation referred to the global concerns such as overall rhythm. Terminology which described temporal characteristics such as speed and manner were used to characterize the visual treatment of form. In addition, a solution's physical composition was described using the information and presentation perspectives identified in the scheme. I have found the scheme's framework and vocabulary set useful for discussing the design experiments presented in this chapter.

4

Chapter 4 Related Work

This research was informed by two supporting areas of study, each contributing theories and motivation to the work: visual design and reading.

4.1 Visual design

In visual design, I have been influenced by recent design experiment in the Visible Language Workshop as well as traditional typographic experiments in graphic design. In addition, research and theories on dynamic design motivated and supported this thesis.

Recent design experiments

The Visible Language Workshop's research on graphical techniques such as blur, transparency, infinite zoom, and synthetic typography are used in this thesis to achieve communication goals. Colby and Scholl created a prototype in the mapping domain with thirty layers of information [Colby et al.]. Transparency, blur, and intensity are used to highlight information based on a reader's expressed interest. Small, Cooper and Ishizaki developed the Information Landscape which used the metaphor of infinite zoom in the third dimension to progressively reveal more information [Cooper]. Small's thesis investigated methods for creating synthetic typography [Small]. The approach included a physically based simulation model of springs. Text is changed based on the springs motion. This is one example of time-varying form. This temporal form is characterized in the scheme from a formal identity perspective as a "deformation".

Traditional graphic design

Graphic design has a rich history of experimenting with typography to structure and communicate information. These examples encouraged the typographic exploration in this research. An example is *The Bald Soprano* (Figure 43), a play written by Eugene Ionesco and set in type by Massin [Massin]. The typography expresses the 'voice' of the speakers and simultaneity of expression. The expressive use of typography to represent dialogue and particularly the quality of 'voice' motivated design solutions in this thesis. In addition, graphic design has developed conventions such as the use of letterforms (typefaces) and color to represent voice qualities. These conventions heavily influenced my design experiments.

In addition to design experiments, the usefulness of analytical devices in graphic design helped motivate this thesis, in particular, a matrix provided by Ken



Figure 43: An example of expressive typography in print taken from "The Bald Soprano".

Hiebert. It identifies the range of possible formal variations that can be applied to visual marks (Figure 44) [Hiebert]. The matrix suggests possible form manipulations during exploration and serves as a tool to systematically evaluate solutions. Designers can use this matrix to expand on visual treatments and to analyze the elements of a solution.

<p>Central contrast showing form when applied to For some purposes, to form added, in these cases, the change is a formal choice in which the effect on legibility is judged on a case-by-case basis</p>		<p>Stylology A Catalog of Image Options</p>	
		1. Letter Form:	Range applied to CM-B base
<p>Disparate size breaks the consistency of interconnectivity</p>	<p>1.1 size</p>		
<p>Geometric and organic are both useful criteria, but the former is more geometric than the latter. Geometric is more organic needs to support the former</p>	<p>1.2 face</p>		

Figure 44: A sample from Ken Hiebert's matrix on formal variations that can be applied to visual marks.

Models and taxonomy

This thesis has also been influenced by researchers who have proposed models and characterizations for design on electronic communication. Ishizaki proposes an abstraction of temporal forms as a descriptive model [Ishizaki]. This model borrows concepts and language from the performing arts to describe temporal units. For example, the notion of "phrase" and "form" are temporal concepts borrowed from music. Although the work here approached the research from an experiential point of view, the results are similar. The descriptive structure arrived at in the proposed characterization scheme identifies a similar set of conceptual levels. While Ishizaki only provides a structure, in addition to the struc-

ture, this research provides terminology which characterizes the behavior of temporal form.

Bork specifies a taxonomy on various treatments of text displayed on computer screens [Bork]. The terms describe physical variables of the text as it relates specifically to its display on screen. For examples, "text density" refers to the ratio of screen area occupied with text in proportion to the total screen area. The taxonomy describes specific variables of text but does not provide language which characterizes temporal treatment of typographic form. Sivasankaran and Owen's dynamic diagram system supports dynamic operations on diagrams [Sivasankaran et al]. They list temporal operations that can be applied to diagrams. The operations they identify are from the perspective of manipulating objects in a three-dimensional space (i.e., panning, zooming, etc.) The descriptions are general manipulations and not specific to typography. Nishimura et al. provide a characterization of electronic display media [Nishimura and Sato]. Information and medium of presentation are characterized from the perspective of communication modes. The characterization is general to all types of information and presentation methods. In contrast, the characterization provided in this scheme addresses specifically temporal information and presentation methods. However, these perspectives are complimentary and can be used by designers to measure and analyze typographic design solutions.

4.2 Reading

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This thesis was influenced by research on Reading in cognitive psychology. In particular, early design solutions were motivated by experimental results on dynamic presentation methods. These findings are used mainly to motivate design solutions and form a basis for analysis. My goals are mainly communicative rather than a concern for reading speed and comprehension. I do not intend to draw any conclusions in this field of research. While a focus on specific perceptual tasks is a necessary part of psychology research as a means to understand a visual phenomena, this thesis differs in that design necessitates the use of perceptual phenomena in combination to solve a concrete visual problem.

Reading a line of print is a two-step process: saccades move the eyes in sequence along a line in a jerky motion while eye fixations allow the eye to receive the stimuli which then processes the visual image in the brain [O'Regan]. Research on reading is measured by its legibility and readability of text. This thesis only looks at readability which is measured by reading comprehension and reading speed tasks. Of particular interest is literature on dynamic presentation methods which involve movement of text on a screen. I used the findings as suggestions for things to try in my design solutions. Here I focus on two specific methods.

Times Square method

The first method is referred to as the Times Square method. This method moves text from right to left in a continuous manner. Sekey and Tietz found that subjects read significantly slower than average (page format) using the Times

Square scrolling method [Sekey et al 1982]. They found that it is better to scroll smoothly rather than in discreet jumps. It is also better to scroll an entire text block rather than line by line. This method is widely used commercially because text can be presented in a small area. In addition, computer applications have adopted an up/down scrolling method to move text on the screen. I have used a variation of this method in my design solutions. I find that smooth scrolling allows me to select where I focus my eyes. This may be because the movement is predictable.

Rapid Serial Visual Presentation

The second method bypasses eye movement during reading. Rapid Serial Visual Presentation (RSVP), coined by Forster in 1970, presents one or more words in the same location serially. The line of text remains on display for a certain period of time. A general finding is that adults can read text presented in RSVP mode at speeds similar to those for normal text without losing comprehension [Forster 1970; Potter et al. 1980; Sekey and Tietz 1982]. These findings suggest RSVP as a potentially viable method of reading.

Cocklin et al. have reported the optimal window size using the RSVP method appears to be an average of 12 characters. This result is based on criteria of maximum retention and understanding per unit time. Additional findings suggest that it helps to present text in chunks according to idea units rather than arbitrary chunking [Cocklin et al]. I have tried presenting different line lengths: word by word, phrases and sentences. I found that word by word works fairly well for short messages but it became difficult to concentrate on a long message presented word by word.

Masson found that comprehension was better when a blank window is inserted between sentences [Masson 1983]. One reason proposed is that a visual break between sentences gives the reader time to process the sentence. In one solution, I put an blank window in between a serial presentation of news headlines. I found it easier to read than when I did not put in a blank window.

Sekey and Tietz experimented with giving users control over the speed in RSVP reading; they refer to this method as "saccadic scrolling". They experimented with two modes: automatic and manual. Manual mode allows the user to advance the display line by line. In automatic mode, text is advanced automatically at a uniform rate and the user can set the rate. Much to their surprise, the average speed of automatic and manual modes are about equal. They had expected the flexible self-pacing method to be more efficient than the strict automatic mode. I also included a "manual mode" in several of my design solutions. Since my goal is not reading speed, it was useful to have control over the presentation. It allowed for reading to be self paced.

Finally, I am intrigued by RSVP as a viable method for quickly searching through text. Researchers have reported that subjects can process language at a very rapid rate, capable of occurring at 12 words per second (0.83sec./word) or

faster. However, Potter et al. found that although text can be processed at this speed, it may be more than a reader is capable of recalling. The level of comprehension achieved during RSVP reading may not be effectively retained in memory. Potter suggest RSVP may be appropriate for search tasks. Specific words, names or ideas may be searched by quickly going through a list or texts. However, further investigation is needed in this area to determine if RSVP may prove to be an efficient method for search tasks.

Chapter 5 Conclusion

5.1 Contributions

Temporal typography extends the expressive range of text by adding dynamics to the visual treatment of typography. This thesis has shown the expressive potential of time-varying typographic forms through concrete design experiments. The reason for focusing on typographic expression is because type is the fundamental communication element in graphic design.

This thesis was motivated specifically by two design opportunities in electronic communication: written language as a real-time communication medium and the use of interactive visual systems. In both cases dynamic visual treatment of text in real time must be considered. Current design solutions in computer based media are limited. This is mainly because electronic communication design requires dynamic forms to be described for a general purpose. However, graphic design has not yet identified a set of concepts and terms which generalizes the characteristics of temporal forms.

The goal of this research is to enable designers to create analytically crafted temporal typographic solutions. The proposed characterization scheme would enable designers who use it to reason and discuss temporal characteristics. The scheme identified a set of concepts and terms which allows for the description of typographic expressions that change dynamically over time. The scheme was examined by using it as a basis for a software implementation along with a scripting language used to construct design experiments. Concepts and terminology identified in the scheme were used to describe concrete design experiments. The scheme was found useful as a framework for identifying specific temporal characteristics and allowed for discussion of its communicative value.

The research and the development of temporal typographic communication on computer-based media contributes to the field of graphic design in the two categories of description and communication.

The descriptive contributions consist of two levels of description which can be used by designers to think about and describe temporal typography.

- The structural description is a framework which promotes thinking of temporal presentation as having levels of descriptive granularity. The structural description consist of a hierarchy of formal details. Each layer identifies a level of form detail designers can attend to. This framework

can be used to build complex temporal typographic presentations out of a hierarchy of smaller local units.

- The behavioral description is a set of terms which were defined to characterize how dynamic typographic forms change. The characterization can be used to describe the physical behavior of temporal forms thereby allowing for analytically crafted solutions.

The communicative contributions provide designers with an understanding of temporal design in electronic media.

- Description of design experiments, which explored the dynamic treatment of typography, using the terminology provided by the scheme. These preliminary experiments suggest the potential for developing new methods for expressive writing as well as for new styles of reading.
- Qualitative discussion on form and communication issues uncovered in the process of making design solutions.

Although I have tried to convey in this text the affective aspects of temporal typography, its real power can only be grasped by actually seeing the dynamic forms. A videotape is available at MIT Media Laboratory.

Appendix **A** Implementation

Program

The tool uses the scheme as a basis for its implementation. The representation adopts the levels of design focus as its object hierarchy. The structure of a scripting language is derived from the characteristics identified in the scheme. The program is object-oriented and written in C++, using SGI's Performer, and Ishizaki's libPFfont library. The tool supports two types of design objects: visual techniques and plans. Visual techniques manipulate the dimensions of an object such as color and size. A plan object manages and applies visual techniques to pieces of text or an image. This process is triggered based on key values or external information set in the environment.

Visual techniques

A visual technique is a basic object used to define a temporal change. Similar to the scheme, visual techniques manipulate dimensions of the object, such as size, position change, rotation, color, font. Every dimension can be changed. Changes to the values of the dimensions are driven by the external information set in the environment such as time, distance and selection. The action takes place based on the value of a variable. Most visual techniques have a beginning value and a delta value, which define the range over which the visual technique operates. For example, when time is used as the external information source, the visual technique operates over a period of time, varying from its begin value to its end value over that interval.

The tool supports three ways designers can describe the manner or how a visual technique changes. Designers can craft a fixed sequence, choose from a set of mapping functions, or write an algorithm describing the change. The default function is a linear mapping. Alternate functions such as cosine, quadratic growth and decay are also supported. Additional methods can be added.

A primitive set of visual techniques are provided such as scale and alpha changes. Designers can describe more complex techniques in two ways: 1. by implementing more complex changes, i.e. physically based motion, 2. by combining simpler primitives to create one meta technique, i.e. rotate to center while fading in and out. Beside the primitive set, there are two additional techniques: File and Keyed. The File technique supports the second option by allowing designers to incorporate several techniques into one. The Keyed technique allows a visual technique to be triggered by one type of external information and then driven based on another. For example, a bounce technique can be triggered

by distance to start bouncing when viewer is within a certain distance, then bounce based on duration of time.

Plans

Designers construct temporal presentation of an object by creating plans. A plan is linked to an object that is being manipulated. The tool currently supports text, image and polygon, and grid objects. Each plan is composed of visual techniques that manipulate the object. An object maintains knowledge about its own dimensions such as size, color, font, position, transparency, etc. Plans manage and execute visual techniques based on a local value of the external information. The current implementation collapsed two levels of design focus, visual action and plan, into one plan object. A revised implementation by Doug Soo makes these two levels explicit by introducing sub-plans to this module.

In addition, a presentation manager reads in data files, parses the scripting language and constructs the presentation by creating the plans and techniques. An Interaction manager increments and modifies the external information such as user input and time. Each of the plans and visual techniques are executed according to the values determined by the external information.

Construction language

A scripting language was developed as an interface to the software tool. The language provides a structure for defining visual techniques and plans. The following are variables that need to be specified. The actual description compresses each of these variables into shorthand symbols. First, I introduce each variable, then present the current state of the scripting language.

A visual technique is defined by the following variables derived from the descriptive scheme.

Technique: <name>

This value identifies a particular visual technique to execute.

Dimension: <dimension>

Identifies the specific typographic attribute to be manipulated.

Value: <begin dimension value> <delta dimension value>

The first value specifies the begin value of the dimension and the second value defines the range of change.

Duration: <begin keyed value> <delta keyed value>

These values specify the interval of external information. The change starts at the first value and changes for the duration of the second value.

Keyed: <driving force>

Identifies the type of external information which drives the technique. Currently, the tool supports change based on time, distance and selection.

Manner: <function>

Defines how the dimensions' values change. Current implementation supports the following functions: linear, cosine, quadratic growth and quadratic decay. In the case of a physical simulation such as springs, the movement is described by physics variable such as tension, gravity and mass.

Persistence: <on or off>

The tool allows designers to choose between making the visual technique persistent or revert back to a default state at the end of the change.

A plan is defined by the following characteristics.

Plan: <object type>

Identifies the type of object manipulated. The tool currently supports text, paragraph, images, polygons, and grid objects.

Content: <content>

This variable depends on the object type. Text objects takes a string, an image object takes a file, etc.

Keyed offset: <local keyed value>

This allows designers to set the external information local to the plan. Visual techniques are specified relative to this local value.

In addition, the tool supports global time and camera manipulations in limited ways. Time units can be based either on real-time or unit-time. Real time uses a second as the base unit. In unit-time, unit size is defined by designer. Camera can switch between two ways of behaving: auton and polar. In auton mode, the camera moves with respect to itself. The camera moves with respect to a target object in polar mode.

Time mode: <method>

Current implementation support real-time and unit-time. Real-time units are based on seconds. In unit-time, designers specify the size of the unit.

Speed: <percentage>

This variable allows for temporal units to be stretch and compressed. For example, by increasing the percentage to 200, the presentation will run at twice the speed.

Camera mode: <mode>

Current implementation supports two ways of behaving: AUTON and POLAR. In polar mode, the camera moves and turns in relation to a selected object. The object is always the center of focus. In auton mode, the camera moves free of any target. I have found it useful to be able to switch between these two modes.

Location: <x location, y location, z location, heading, pitch, roll>

This set of values specifies the initial position of the camera.

Running the program

To run the program -> executable is "PFshell"

```
> PFshell <filename>
```

if you want to specify position and size of window add arguments "-win: xpos ypos width height" (default is 480 X 640 window)

```
> PFshell <filename> -win: 0 0 200 200
```

This file describes the file format that is used for the Plan Presentation manager. It also serves as an example file. The file parser works by searching for keywords. The two most important keywords are "Plan:" and "Technique:"

This is the basic format of the file:

```
Plan: <item type> <offset time or distance>  
<item information>
```

```
Technique: <visual technique>  
<technique info>
```

```
Technique: <visual technique>  
<technique info>
```

```
Plan: <item type>  
<item info>
```

```
Technique: <visual technique>  
<technique info>
```

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The <item information> and the <technique info> are dependent on the type of item or the type of visual technique that is being described. These will be described later. Comments can be put in anywhere between Plans and Techniques. The only major restriction is that they cannot be put anywhere in the information fields (it's a really dumb parser!). Otherwise, you can do anything you like with the comments. As long as a line doesn't contain the keywords "Plan:" or "Technique:" immediately at the beginning, it will be ignored by the parser.

Some global modes can be set for Time, camera mode, and the camera's action when an object is picked. If you don't specify anything, defaults will be set.

For time, you can set either Realtime or unit time. In realtime mode, you can increase the speed of realtime by specifying speedunit.

```
Default:  
TimeMode: REALTIME  
Speedunit: 1.0
```

```
TimeMode: REALTIME  
Speedunit: <time scale> (1.0 is realtime 2.0 is twice realtime)
```

The Camera_mode sets the default camera mode. You have a choice of setting it to POLAR view ->camera moves in relation to a reference point (x, y). In AUTON view ->camera moves autonomously to the scene. PickCamAnim allows you to choose what happens to the camera when an object is picked. You specify two values: the first specifies the Camera's mode to be either POLAR or AUTON. the second specifies whether the Camera should animate to the objects location.

Defaults:

CameraMode:AUTON

Loc: 0.0 0.0 30.0 0.0 0.0 0.0 0.0

PickCamAnimDist: 100 0 20.0

CameraMode: <AUTON> or <POLAR>

Loc: <x> <y> <z> <h> <p> <r>

PickCamAnimDist: <100=AUTON 101=POLAR> <0=no 1=yes> < camera's Z distance from object>

Plans

(if starting time is not specify as third argument on the Plan: line then ->default is 0.0)

Text items:

Plan: Text <starting time or distance>

<text string>

Image items:

Plan: Image

<filename>

Size: <width> <height>

Rectangle items:

Plan: Rectangle

Size: <width> <height>

Normal: <axis> (x=0, y=1, z=2)

Grid items:

Plan: Grid

Size: <width> <length>

Normal: < x=0, y=1, z=2>

Spacing: <space including width of line>

NumRect: <number of lines>

Technique

For each technique, you have a choice of setting: time or distance

Interpolation: manner of how it should change

Persistence: should the last state of the technique persist after the duration specify.

-kt = time

-kz = distance

-il = linear interpolation
-ic = cosine
-iqd = quaddecay
-iqg = quadgrow

-p+ = yes persistence
-p- = no persistence

Defaults:

-kt = time
-il = linear
-p- = no persistence

Example:

Technique: Alpha -kt -ic -p+
Time: 0.0 0.5
Value: 0.0 -0.5

(for 5secs)

(change from opaque to half transparent
(since persistence is turned on, the item
will stay at -0.5 transparency))

General techniques

Alpha: Changes in Alpha are also done relative to a value of 1.0.

Technique: Alpha
Time: <start> <delta time>
Value: <start> <delta value>

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Scaling: Scaling is done relative to a scale of 1.0. For example, scaling from 0.0 with a delta of 1.0 would mean starting from a scale of 1.0 and ending at a scale of 2.0.

Technique: Scale
Time: <start> <delta time>
Value: <start> <delta value>

Translate: Translation is done relative to the coordinates (0.0, 0.0, 0.0), along a single axis. Translation techniques are cumulative, so they can be superimposed on top of each other.

Technique: Translate
Time: <start> <delta time>
Axis: <axis - 0 for x, 1 for y, 2 for z>
Value: <start> <delta value>

Rotation: Rotation is similar to translation, except that the numbers for the axes are different. 0 specifies rotation about the z axis, 1 specifies rotation around the x axis, 2 specifies rotation about the y axis.

Technique: Rotate
Time: <start> <delta time>
Axis: <axis of rotation>
Value: <start> <delta value>

TransAll: Translate all three axis.

Technique: TransAll
Time: <start> <delta time>
ValueBegin: <x_value> <y_value> <z_value>
ValueDelta: <x_value> <y_value> <z_value>

Squash: Stretches type horizontally or vertically.

Technique: Squash
Time: <start> <delta time>
Axis: < width = 0, height = 1 >
Value: <start> <delta value>

Circle: Makes an object "circle" at a specified radius and speed.

Technique: Circle
Time: <start> <delta>
Axis: <axis - 0 for x, 1 for y, 2 for z>
Speed: <speed (radians per sec!)>
Radius: <radius of circle>

Bounce: Makes an object "bounce" with a motion described by springs.

Technique: Bounce
Time: <start> <delta>
InitLoc: <xloc> <yloc>
InitVel: <xvelocity> <yvelocity>
Floor: <floor height> <floor constant>
Gravity: <gravity>

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File: Reads in a list of techniques from a file, to be executed at the offset give

Technique: File
Time: <offset>
<filename>

Example

Technique: File
Time: 0.0 1.0
(/u/yinyin/Performer/PFshell3/VisFiles/dizzy.vis)

Keyed: Executes the visual techniques in the file when the key is in the range given

Technique: Keyed
Time: <begin> <delta>
<filename>

Example:

Technique: Keyed -kp
Time: 0.5 1.0
(/u/yinyin/Performer/PFshell3/VisFiles/spin.vis
(for picking, first time variable for pick = 0.5 , for unpick 0.0)

Random movement: moves item around randomly within a specified area

Technique: MoveRand
Time: <begin> <delta>
ValueBegin: <xloc> <yloc> <zloc>
CycleTime: <delta move time>
Pause: <pause time between next move>
Area: <width> <height> <depth>
Center: <xloc> <yloc> <zloc>

Font specific techniques

Align:

Technique: Align
Time: <start> <delta time>
Align: < left=0 right=1, justified=2 center=3 >

Font:

Technique: Font
Time: <start> <delta time>
Fontname: <fnt>

Switch: Switches an object on and off.

Technique: Switch
Time: <time to switch>
Dir: <direction - 0 off, 1 on>

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Color: Changes the color of an item from one to another.

Technique: Color
Time: <start> <delta time>
Begin: <red> <green> <blue>
End: <red> <green> <blue>

TransCen: Moves text to a location, pauses then continues moving at a constant speed.

Technique: TransCen
Time: <start> <delta time>
ValueBegin: -12.0 5.0 -10.0
ValueDelta: 8.0 -10.0 10.0
Axis: 1
Pause: <pause_time when it reaches end of translation>
Incr: <delta increment after it pauses>

Sample file

Time_Mode: REALTIME
Speedunit: 1.0

CameraMode: AUTON
Loc: 0.0 0.0 0.0 0.0 0.0 0.0
PickCamAnimDist: 101 1 20.0

(camera can move autonomously,
start at center,
when a text is picked, make camera
moves relative to text and animate
camera to the text's position.

Plan: Text
test!

Technique: Align
Time: 0.0 1000.0
Align: 3

(align to center)

Technique: Keyed -kp
Time: 0.5 1.0
dizzy.vis

(when picked do dizzy visual technique)

Technique: MoveRand
Time: 0.0 100.0
ValueBegin: 0.0 .0 0.0
CycleTime: 3.0
Pause: 3.0
Area: 4.0 4.0 0.0
Center: 0.0 0.0 0.0

(start at center, move around randomly
within a 4X4X4 cube at the center, pause
for 3sec after reaching a destination)

Plan: Text
test2

Technique: TransAll -id -p+
Time: 0.0 1.0
ValueBegin: 0.0 0.0 0.0
ValueDelta: 3.0 4.0 0.0

(start text at center then move delta
position in 1 sec., using a quaddecay
manner (accelerate at first then slow
down when close to destination), and
then stay (persist) at that spot until
next action)

Plan: Text 3.0
sigh

(local time starts at 3 sec global time)

Technique: Switch
Time: 0.0
Dir: 1

(show text at 3 sec global time)

Technique: Switch
Time: 10.0
Dir: 0

(hide text at 13 secs global time)

Technique: Align
Time: 0.0 10.0
Align: 3

Technique: Alpha
Time: 0.0 10.0
Value: 0.0 -1.0

(change from opaque to transparent in 10 sec)

Technique: Color -ic
Time: 0.0 10.0
Begin: 0.0 0.0 0.7
End: 0.3 0.3 0.3

(change from blue to grey in 10 sec)

Technique: Scale -iqd -p+
Time: 0.0 10.0
Value: 0.0 1.5

(grow to 1 1/2 times the size in 10 sec)

References

- Ishizaki, Suguru. 1994. *Personal communication*.
- Richards, Whitman. 1995. *Personal communication*.
- Bork, Alfred. 1983. *A preliminary Taxonomy of Ways of Displaying Text on Screens*, Information design journal, Vol. 3/3. pp.206-214.
- Müller-brockmann, J. 1988. *Grid Systems in Graphic Design*, 3rd revised edition ed., Stuttgart: Verlag Gerd Hartje.
- Bruckman, A., Resnick, M. 1993. *Virtual Professional Community: Results from the MediaMOO Project*, Presented at the Third International Conference on Cyberspace in Austin, Texas.
- Colby, G. and Scholl, L. 1991. *Transparency and Blur as Selective Cues for Complex Visual Information*, International Society for Optical Engineering Proceedings, Vol 1460. pp.114-124.
- Cooper, M., et al. 1994. *Information Landscapes. Frames*.
- Cooper, M. 1989. *Computers and Design*, Design Quarterly 142. Cambridge, MIT Press.
- Curtis, P. 1992. *Mudding: Social Phenomena in Text-based Virtual Realities*, Proceedings of DIAC '92.
- Dondis, D. 1973. *A Primer of Visual Literarcy*. MIT Press.
- Ionesco, Eugene., Massin, and Cohen. 1956. *The Bald Soprano*, Grove Press.
- Forster, K. 1970. *Visual Perception of Rapidly Presented Word Sequences of Varying Complexity*, Percep. Psychophys. 8, pp.215-221.
- Hiebert, Ken. 1992. *Graphic Design Processes: Universal to Unique*, New York, NY: Van Nostrand Reinhold.
- Ishizaki, S. 1994. *Typographic Performance: Design Solutions as Emergent Behaviors of Active Agents*, PHD thesis proposal, MIT.
- Lupton, E. *Visual Dictionary. The abc's of the Bauhaus and Design Theory*, Princeton Architectural Press. pp. 22-33.

- Masson, M. 1983. *Conceptual Processing of Text during Skimming and Rapid Sequential Reading*, Memory Cognition 11, pp. 262-274.
- Mast, G. 1983. *Film Cinema Movie: A Theory of Experience*, Chicago, University of Chicago Press.
- Mills, C., Weldon, L. 1987. *Reading Text from Computer Screens*, ACM Computing Surveys, Vol. 19, No. 4, December 1987.
- Nishimura, Y., Sato, K. 1985. *Dynamic Information Display*, Visible Language 19, pp. 251-277
- O'Regan, J., 1990. *Eye Movements and Reading. Eye movement and their role in visual and cognitive processes*, E. Kowler (ed.), Elsevier, pp.395-453.
- Pollatsek, A., Rayner, K. 1989. *Reading, Foundation of Cognitive Science*, MIT Press, pp. 401-431
- Potter, M. 1984. *Rapid Serial Visual Presentation (RSVP): a Method for Studying Language Processing*, New Methods in Reading Comprehension Research. Erlbaum, Hillsdale, N.J., pp.91-118.
- Potter, M., Kroll, J. Harris, C. 1980. *Comprehension and Memory in Sequential Reading*, Attention & Performance VIII, Nickerson, Ed. Erlbaum, Hillsdale, N.J., pp. 395-418.
- Reid, E. 1991. *Electropolis: Communication and Community on Internet Relay Chat*, Honours Thesis. University of Melbourne.
- Sekey, A., Tietz, J. 1982. *Text Display by "saccadic scrolling"*, Visible Language 17, pp.62-77.
- Sivasankaran, V., Owen, C. 1990. *Data Exploration: Transposition Operations in Dynamic Diagrams*, Design Processes Laboratory. Chicago, Illinois Institute of Technology.
- Small, D., Ishizaki, S. 1994. *Typographic Space*, CHI '94 Conference Companion, ACM. pp.437-438.
- Small, D. 1987. *Expressive Typography: High Quality Dynamic and Responsive Typography in the Electronic Environment*, Masters Thesis, MIT.
- Thomas, F., Johnston, O. 1981. *Disney Animation: The Illusion of Life*, New York, Abbeville Press.
- Tufte, E.R. 1990. *Envisioning Information*, Cheshire, Connecticut: Graphics Press.
- Weaver, C. 1980. *Psycholinguistics and Reading: from Process to Practice*, Little, Brown and Company, pp.35-65.
- White, T. 1986. *The Animator's Workbook*, Watson-Guption Publications, Billboard Publications, Inc.