HYPERTEXT
Solution/Dissolution

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Taking my cue from the problematic outlined by Ted Nelson, I attempt an analysis of hypertext, not as a dataspace, but as a class of operations.[1] This class is viewed from two perspectives: that of the author-composer and that of the user. I show that these perspectives cannot be subsumed, the one by the other. The analysis obliges us to establish four different dataspaces for hypertext.

I further demonstrate that this interpretation is not merely speculative but permits us to understand the compositional procedures of certain digital author-composers. The work of Jim Rosenberg is analyzed in this manner.

This unraveling of the concept of hypertext then shows it to be a particular case that illustrates certain characteristics of the devices of e-literature, as described in my recently elaborated general theory, the "Procedural Model."

Finally, certain developments in French digital poetry are presented. The familiar fundamental characteristics of classic hypertext play a marginal role in this work. More importantly, hypertextual characteristics appear to dissolve in this poetic.

Hypertext: a particular solution

The solution of a problem

We recall the problematic as outlined by Nelson:

> I was looking for a way to create a document without constraint
> from a vast collection of ideas of all kinds, unstructured, non-

sequential, expressed in forms as diverse as those of film, audio tape, or pieces of paper. For example, I wanted to be able to write a paragraph with doorways behind each of which a reader might discover much more information that was immediately apparent from reading the paragraph.[2]

Hypertext is Nelson's response to a problem. It is defined, classically, as an assemblage of nodes held together by a collection of links which are activated by the user in a process of navigation. This definition invokes both a user and a dataspace. "Wandering" sometimes replaces the term "navigation" in deference to the supposed psychological disposition of the user. The concept of hypertext thus brings to the dataspace, at one and the same time, functional, ergodic aspects of its devices, and cognitive characteristics of the mental appropriation of this dataspace. This entanglement is often masked by the vocabulary typically used to speak about hypertext. Thus, we speak of "navigation within a hypertext," which implies that the hypertext is reduced to a graphic form (like a flowchart) consisting of nodes and links, and that navigation is a procedure independent of the form. However not all such graphic forms are hypertexts (think of the graphics that allow the "navigation" of vending or sales machines). "Navigation" is entirely subsumed within hypertext and thus it would be preferable to speak of "hypertextual navigation." Hypertext is not, therefore, reducible to a graphically structured, charted dataspace.

We can now ask two questions: Is there another way of understanding hypertext's three elements? And, if so, can we define hypertext without reference to the concepts of nodes, links, and navigation?

We will provide two equally correct answers which are also contradictory in a number of ways: a paradox which will be resolved by a more general theory of communication, the Procedural Model.

Hypertext as a class of operations

Proto-hypertext and the text-of-inscription

These questions lead us to wonder whether or not there might be a structurally abstract definition of hypertext. The definition given in the introductory remarks allows us to conceive of hypertext as a class of opera-

tions applied to the dataspace constituted by the "vast collection of unstructured ideas of all types" evoked by Nelson, and which we may call, for reasons of convenience, proto-hypertext. The class of operations envisaged instantiates two particular methods: a structuring of proto-hypertext and a mode of accessing the data it contains.

The structuring consists in arranging the data of proto-hypertext into a graphic form or chart. This form constitutes a new dataspace which we will call, for the sake of compatibility with the more general "Procedural Model" outlined below, a hypertextual "text-of-inscription." This is, classically, hypertext in so far as it is seen as a dataspace and not a class of operations.

The mode of access, navigation, amounts to projecting, from the non-linear structure of the charted dataspace, a sequential structure of nodes that will be isomorphic with a structure produced by the temporalities of reading. We must insist that this projection is an operation internal to the dataspace. Whether or not this projection is realized in reading does not matter: it exists. This is what is produced by the composer-author of the hypertext when she creates the links and establishes the properties of her anchors.

From this point of view, hypertext has no need of a user; it is entirely delineated in terms of data and structure. It constitutes an organizational class of operations characterized by its complex determinate structure (its text-of-inscription) and its fundamental organizing principle (navigation). Supplementary structures which can be added to the class of operations, such as the representation of the graphic form as a micro-universe, simply reveal internal properties of the form. In the same way, various generative algorithms and navigational constraints reveal internal properties of the functions to which they are bound.

The understanding of hypertext as a class of operations applied to a dataspace describes fairly clearly and exhaustively the existing hypertextualization of documentary space, of the actually existing docuverse.[3] There is nothing surprising in this, since hypertext was a response to a documentary problem. When hypertext is created *ab nihilo*, as in the case of literary hypertext, what we call the proto-hypertext is created at the same time as the hypertext. In effect one can conceive of hypertext as the structuring, in nodes and links, of a diffuse dataspace, one that may even be entirely indeterminate. It is not necessary for the proto-hypertext to be complete before a hypertext is generated. The hypertext may be devel-

oped as the proto-hypertext is reaching completion. The Internet could not have existed without this property.

How hypertext manages the global and the local

The indeterminacy described above is a consequence of the relationship between global and local which hypertext instantiates. The graphic form is a global structure but the projection realized by navigation is a function applied locally. Thus, at one and the same time, the link possesses global structural characteristics in so far as it is identified with an arc of the graphic form, and local functional characteristics in so far as it is identified with vectors of navigation.

Navigation translates as the imposition of a logical, that is, algorithmic, structure on the link anchors. This structure manages their potential activation. It awaits a potential event and produces a potential displacement. It is in fact the reader who, as navigator, is, logically, a potential agent who composes the hypertextual structure. From this perspective, navigation appears as a strategy for the administration, by the writer, of reading, one that exemplifies the programmatic character of all such strategies of reading. It is the ergodic aspect of reading which is administered in the course of navigation, not its mental aspect. The generalized form of this logical structure can be formulated as follows: ((if (anchor is highlighted and linking is permitted) then anchor is activated) or (if (linking is permitted and anchor is activated) then linking proceeds)). One can say that navigation administers the reader's virtual local displacement in the proto-hypertextual dataspace but that navigation is constituted, in the heart of the text-of-inscription, by a collection of operational commands associated locally with the graphic form.

Note also that in classic hypertext fiction, within the space of language, the hypertextual form establishes a syntagmatic relationship between nodes. In effect, a node has a sequential relationship with any other linked node.

The result of hypertextualization

The author is entirely responsible for what results from the application of this class of operations – which we call hypertext – on the dataspace of proto-hypertext. This is the hypertextual text-of-inscription. Phenomenologically, it exists as a mental representation. This text-of-inscription en-

compasses a charted structure and a set of navigational commands. It remains open, to-be-completed; this is as much a function of its graphic form as a result of given navigational commands. Thus, in the present analysis, reading remains entirely a matter of what is potential, and hypertext is a strategy of writing. The global level is an object for the author; the local is subjective.

In a hypertext fiction, the sequence of nodes produced by a reading operation may result in a rendition which is not readable as hypertext *per se*. There is no necessary equivalence between the linearization produced by hypertextual navigation and the linear rendition of data in the proto-hypertext. This difference may be exploited in writing strategies intended to resolve problems of semantic coherence. For example, in the earliest known French hypertext, *Fragments of a Story* by J. M. Lafille, semantic branchings are realized in the body of the nodes and not via links.[4] Rather, links always represent a semantic continuity with their anchor and follow a theme to be taken up in the destination node. For example, a link whose anchor is the phrase "*photo de Doisneau*" will develop the theme "photo." This local continuity guarantees coherence without the author having to be concerned with what has previously been encountered. But the generation of narrative continuity requires that the reader takes in the node in its entirety before activating a link. The latter's activation charges it with all of the node's contextual significance, and following from this a narrative continuity is realized in navigation. Such an operation of reading/re-reading is facilitated by the typographic concealment of links. It is the inverse of the strategy encouraged by HTML, which favors the marking of links over the reading of nodes. The latter operations are better adapted to documentary continuities, the former to a narrative continuities. We should note, in passing, that a poetic continuity, for instance the sort of cut-up sometimes seen in digital poetry, reveals a third way in which reading proceeds when the anchor of a link is, for example, incorporated into the subsequent node. The result of such a practice is analogous to that performed by Loss Pequeño Glazier during his live recitals of texts which do not display for long enough to be read in their entirety. When the display changes, Glazier follows the current line and simply takes up the new text. Such a reading represents a loss of data from each of the displayed texts. It is the equivalent of activating a link which is anchored by the words that one is in the middle of reading as the display changes.

As we have noted, none of the three modes of reading hypertext is same as the reading of a particular rendition as constituted by the activation of a sequence of nodes. Considered as a class of operations, hypertext is purely and simply an original strategy of writing which provides the opportunity for any number of strategies of reading, just as original, blended from the three modes of reading: documentary, narrative, poetic.[5]

Hypertext as an unfolding[6]

Reading as imperception

All of what is considered above can only, in practice, be managed by the author-composer of hypertext. Implicitly, our point of view was that of the author. Let us now turn and adopt the other viewpoint, that of the reader. I have always been struck, in my readings of hypertext, by the disproportionate visibility of nodes over links amongst the various phenomena observable on the screen.[7] As a general rule, at least in the case of classic hypertext, nodes are perfectly displayed and legible, whereas the operation of the link is indexed only by the properties of its anchor, and not even always as such. The link does not manifest in any way its characteristics as an arc between two nodes. In fact, the node appears as screen-page or a sequence of pages, and the link manifests itself as an instantaneous change of page or sequence. The graphic structure of the text-of-inscription entirely disappears, giving way to the actualization of transitory visual states, the current page or sequence, situated at the same temporal point as the reader, and concealing all the proto-hypertext. Navigation as such does not manifest itself, in the first instance, as a displacement within a dataspace, nor as a logical structure, but as a set of commands for rendering data. It is clear, therefore, that the phenomena observed on screen constitute a different dataspace to that of the text-of-inscription as outlined above. In the Procedural Model, this newly observed space is called the text-of-visualization. The reader, therefore, in no way addresses the text-of-inscription, which is entirely unknown to her; the reader addresses the text-of-visualization.

A final – "perceptible" – informatic space, the only one which pertains to the reader, is constructed, bit by bit, by the reading of the text-of-visual-

ization. In the Procedural Model, this informatic space is known as the "text-of-reception." It is a mental representation. There is no other informatic space which exists for the reader. Depending on its particularities, it may appear to be entirely linear, or as the instantiation, in itself, of a hypertextual structure. In the case of "classic hypertext," this structure is a subset of the text-of-inscription. However, it may be entirely distinct in structure, as in the case of poems with unique readings or in the works of Jim Rosenberg. Thus, the process of navigation, which may be seen as the displacement of the reader's point of view within an informatic space, might equally be seen as commands that instantiate an observable phenomena. The observed phenomena, or text-of-visualization, constitute the informatic space that is manipulated cognitively by the reader in a process of perception which constructs the text-of-reception.

From this new perspective, the local aspect of hypertext as a class of operations is revealed and becomes "transactive." It becomes objective to the reader. By contrast, the global aspect of the text is the object of a process of mental reconstruction. It is subjective. There is, therefore, no globally apparent graphic structure to the manipulated space. The data forms instantiated by the actions of the reader (in her capacity of reader-actor) are shown to be emergent. Each moment of reading is anticipated, virtually, in the initial moment. The ergodic activity of reading, which realizes the successive instances, is indeed a creative and indeterminate activity, the result of the reader's interpretation of the course of her prior reading. Thus, for the author, the acts of the reader are potential and the data structure is real; by contrast, for the reader, her reading is real and the data structure is a potentiality. Formations of data that are not instantiated do not exist. The reader is entirely unable to have any real idea of those formations that she has not yet instantiated. Sometimes, it is impossible for her to know whether or not she has "explored" all the data of the author's text-of-inscription. The concept of navigation cannot, therefore, recuperate its supposed initial sense of a displacement in dataspace, except in particular cases – which are undoubtedly in the majority – those in which the author allows the reader the possibility of constructing a text-of-reception that is itself hypertextual and isomorphic with the text-of-inscription. In the Procedural Model this is known as a "mimetic" writing strategy. If a mimetic writing strategy is successful, then the texts-of-inscription, visualization and reception are three equivalent results of applying the same class of hypertextual operators to the same proto-hypertext. This is clear-

ly the dominant intention in the *documentary* application of hypertext; while often it is far from being the intention in literary applications.

The various instances of reading that appear in the text-of-visualization have a paradigmatic relationship with actual moments. There is no spatial displacement of data but the substitution of data formations by others that are, in a certain sense, equivalent. This equivalence is indexed by the presence of anchors: the activation of a link prevents the simultaneous activation of other links, with the result that the substitution of a particular data formation is exclusive of all others, and this characterizes a paradigmatic relationship. Thus, the sequential structure that follows from the local temporal activity of reading generates a paradigm that is perceived as syntagmatic, but is based on non-linear relationships that are dependent on the spatial, a-temporal characteristics of the global graphic form that is addressed by the author. Surely here we have an example of a poetic relationship with language. And this relationship is not established by the author or the reader, but by the device which transforms a global/structure/space into a local/action/temporality. Clearly, this transformation may be considered as a function of the device and its technologies. However, it is jointly constituted by the author's strategies of writing and the reader's strategies of reading. The sense that the relationship between nodes is paradigmatic allows us to understand the feeling of futility which sometimes arises during the reading of hypertext: "What's the point – since all paths are equivalent?"

Note that this description of hypertext in terms of a linear unfolding of a virtual dataspace resonates with Nelson's description when he speaks of "doorways behind each of which a reader might discover much more information that was immediately apparent." As he says this, Nelson uses none of hypertext's defining concepts (nodes, links, navigation). The only concept cited is that evoked by the word "doorway" which relates to the anchor, a derivative concept that guarantees the relationship between the global and local characteristics of the link.

Toppling preconceptions

The two points of view outlined above are entirely equivalent and relevant to understandings and functions that are completely distinct. The paradox of an equivalence of contradictions is removed once we remember that they do not function from the same point of view. Another way to put this

is to say that all hypertext can be analyzed as emergent unfolding when we view it from the perspective of reception, but as a class of operations when viewed from the point of view of conception. This dialogic way of analyzing hypertext in entirely in accord with the methodology recognized in the Procedural Model as set out below.

However, it could easily be objected that many hypertexts can be analyzed, in their reading, without recourse to anything outside the classic concepts. This is true, but the reason for this is not the inapplicability of the notion of emergent unfolding, but the mimetic character of these hypertexts. Other works, by contrast, cannot in any way be analyzed as interpretative readings using the classical concepts. My own work *passage* is clearly a significant example. The structure of the text-of-inscription is composed of a hypertext in which the nodes and links are associated through generators.[8] The reader cannot make any study of these generators. It would be difficult for her to reconstitute the graphic structure and impossible to reconstruct the logic of the generative algorithms, despite their relative simplicity.

The passage from mimetic hypertexts to non-mimetic electronic works can be effected in three phases. This is the case with all type of electronic literature.[9] The strategy of writing is the same in each case. It consists in questioning previous conceptions of textuality in order to put forward a paradigm that is more particular and specific to informatic media.

Authors of the first phase question the book as device along with the classical paradigm of text as it has been analyzed and deconstructed by Roland Barthes, Gerard Genette, and Umberto Eco. Classic fictional hypertext, conceived as text-of-inscription rather than as a class of operations, is one of the paradigms proposed as substitute. Other paradigms have been proposed: automatic generators, which may be seen as elaborated from the algorithms conceptions of Paul Valéry, and poetic animation which, by creating a temporality assimilable to the interior orality of writing, provides reading and writing for the screen with performative characteristics that are traditionally conferred by the author in the performances of sound poetry. These three paradigms are more complementary than antithetic. In putting forward mimetic hypertextual works that are still very much marked by their correspondence with the book as media device, authors do not bring out the full and specific potentialities of *informatic* devices. This is why these paradigms were developed as if they were separate genres during the 1980s, each promoting differing fundamental characteristics of such devices.

Then, in a second period, towards the middle of the 1990s, authors put into question ideas such as those above in order to evoke a more complex paradigm that would be more specific to informatic devices. This is the paradigm that the Procedural Model sets out to describe. It establishes a blend of fundamental forms, and thus a relative dissolution of separated genres in works which are analyzed as aspects of a more complex model. This phase insists on the notion of material process as opposed to algorithm generation. The perceptual investment of the text-of-visualization does not rest in the unfolding of an algorithm that entirely determines and administers its interactive possibilities. Instead, it gives equal semiotic weight to the ergodic activity of reading. The semiotic investment of the text is no longer reduced to the relationship between the meta-structure and its product as generated by an algorithm. The reader is explicitly implicated, through the perceptual and ergodic choices she makes, in the construction of the global signification of the work. Notably, works of the second phase introduce strategies of writing such as "interface foregrounding," where the visual interfaces of works from the preceding phase are perceived to be fundamentally constitutive of a work's meaning.[10] Equally, they introduced a "double reading" in which the ergodic activity of the reader is itself read as a sign. Double reading has implications for signification beyond what can be achieved by works of the previous phase: the ergodic activity of reading becomes constitutive of the representation entailed by the work. In works of the third phase, this will lead to what might be characterized as an "aesthetics of frustration." These works will no longer address a reader; the simple activity of reading will constitute the work. These two new elements – interface foregrounding and double reading – intervene equally in phenomena associated with the author's strategies of writing, not merely with actual readers' reading activities.[11]

The informatic version of Jim Rosenberg's *Diagrams Series 5* (1993) is typical of the transformation of hypertext during what I call the second phase. Rosenberg's work necessitates an opening out of the hypertextual paradigm and a move towards a more general Procedural paradigm. He realized this by putting forward what is a mimetic hypertext, when seen from the point of view of its unfolding, while at the same time reconfiguring hypertext as the visualization of local processes. In so doing, the work approaches the condition of animated literature, and also gravitates towards the work as an activity that constructs a dataspace in the process of its unfolding, and which, in turn, brings hypertext closer to forms such as those produced by text generation.

The syntactic hypertexts of Jim Rosenberg

Diagrams Series 5 was issued by Eastgate in 1993. The first poem in this series was published in *alire10/~~DOC(K)S~~: Diagrams Series 5 # 1*, and another in *alire 11*: *Diagrams Series 5 # 4*.

The foregrounding of interface is clearly apparent. At each stage of reading, the reader is presented with a graphic structure as the text-of-visualization. Such a structure only reveals itself in classic hypertexts under certain conditions, for instance, in the guise of a mapping of the hypertext, often as an aid to navigation. Such a graphic form, placed in a paratextual relation with classical hypertext, can only be read as external to the text-of-visualization and to the fiction (typically). It appears in Rosenberg's *Diagrams Series* as identical with the text-of-visualization, and "within" the constituents of the sign. This translation of visual elements from a paratextual to a textual position is typical of the way in which interface foregrounding is effected.

However, this graphic form does not implement a mimetic structure of classic hypertext in the text-of-visualization. The hypertextual links are not set up between nodes of data but refer to the inner workings of phrases and sentences (Figure 1a). The graphic form constitutes a syntax of the text-of-visualization. That is its textual function. It is this form in an abstract structure (Figure 1b) and not a node elaborated in natural language that is presented to the reader. The interface foregrounding seems thus to be accompanied by a foregrounding of the global and local properties of the class of operations that instantiate hypertext. In fact, this graphic form constitutes the first level of an imbricated structural system, through the levels of which the reader is able to descend by reading actively, ergodically.

The graphic form is fully coded such that the reader can, effectively, read the entire structure like a phrase composed of words composed of phrases. The work amounts to a systemic structure characterized, in the words of Edgar Morin, by the "hologrammatic principle" (1986, 104). This implementation of a syntax repositions the nodes within the same paradigmatic level while creating relationships between the assemblages of their constituent elements, such that the activation of those links that are accessible by clicking corresponds to a change of level in the system and to a syntactic "zoom."

A visual structure such as this clearly makes use of the characteristics of locality that are inherent in hypertextual reading. The graphic syntax can be considered as a program for reading, which, at run time, generates

the appropriate propositions and phrases. Thus one can be made aware of how the descent through the systematic levels of enclosure is accompanied by the instantiation of a set of rules, of how the reading develops a grammar, following a deep structure to its realization on a surface. This mechanism produces nothing in itself, however; it is instantiated only by the local activity of the reader. The syntactic structure is, in effect, doubled with a paradigmatic superimposition. The set of possible constituent elements are present simultaneously on the screen, providing thus a glimpse of the global characteristics of the structure (Figure 1c). Paradigmatic exploration is effected by the approach of the mouse. The reader moves to the surface of a paradigmatic element which comes to the surface – opaque and legible – but conceals the other paradigmatic elements of the superimposition, although their presence remains marked by the adjacent outlines of rectangles that delineate them (Figure 1d). The reader's activity masks any results previously encountered and prevents the comparison of different solutions in the choice of active paradigm, as if the text were too large to allow itself to be read. The reader is obliged to make good use of her short-term memory in order to produce a coherent reading. The paradigmatic nature of this activation is indexed by the modality of the anchor. It is not a click or a rollover that unlocks the link, it is the proximity of the cursor which effects the passage from "visible" to "legible" at the same time as effecting a shift from "global" to "local." The data is visible globally, but it can only be read locally.

We are defining the node here in terms of graphic form, with two nodes linked by an arc. It should be pointed out that they are constituted by words, paragraphs and graphic form. To the extent that the text-of-visualization of a hypertext – we are speaking of the phenomena as observed on the screen – is represented as a recursive fractal structure, from moment to moment, a single node of data is activated. It is up to the reader, by way of her ergodic activity and through a purely cognitive procedure, to produce the text that is delineated by the graphic form. The node, as a terminal unit of data, does not exist. The activity of reading is not, therefore, a matter of navigation in data; rather it is a productive activity that transforms the visible/legible graphic form and allows the reader to unfold and elaborate the data in the mind. Because, clearly, the extent of this unfolding exceeds the capabilities of a typical reader's memory, the reader who wishes to exhaust the data contained in the hypertext is confronted with the inevitability of failure.[12]

Figure 1a, b, c, d: Screen captures from *diagram series 5#1*
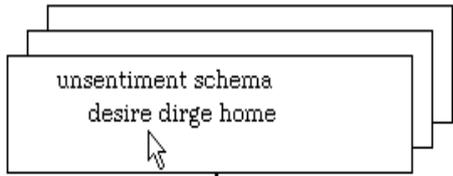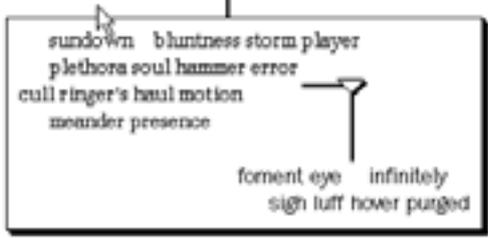
In a complex such as:
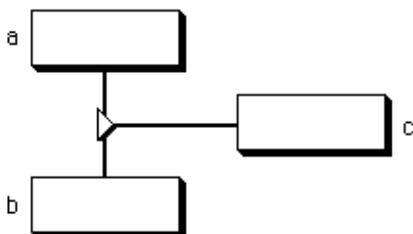
c acts as the verb, relating a and b. (The relationship between a and b is basically symmetrical.) To get to the element that acts as the verb, follow the point of the triangle, whichever way it points.
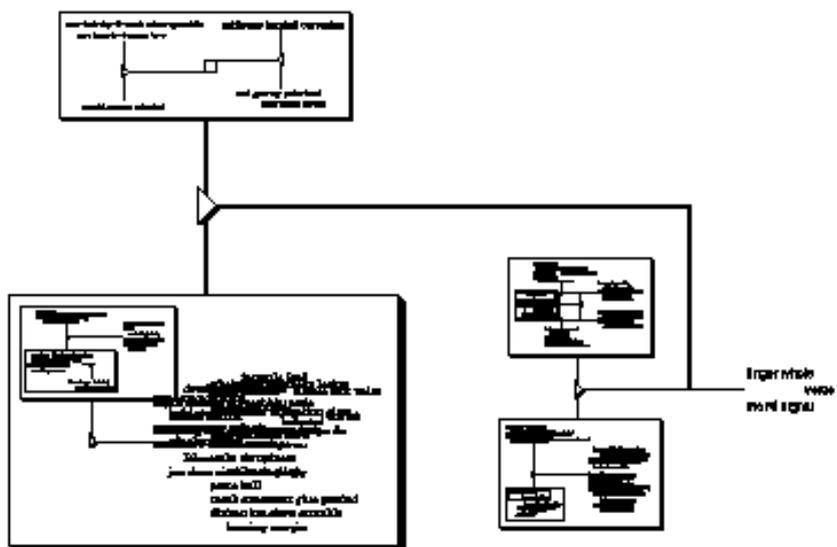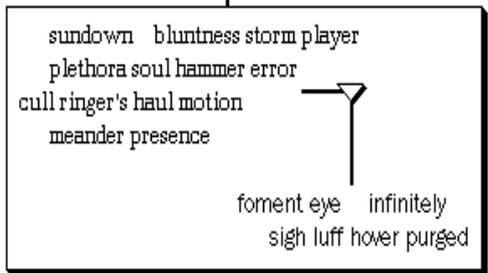
heart slave
unsentiment schema loot murmur scavenger
montage target hinge
desire dirge home

arc madness reflex curl
at exile
control knot slake
omen ware shim service
evolve dance cutoff
accreting

sundown   bluntness storm player
plethora soul hammer error
cull ringer's haul motion
meander presence

foment eye   infinitely
sigh luff hover purged

unsentiment schema
desire dirge home

arc madness reflex curl
at exile
control knot slake
omen ware shim service
evolve dance cutoff
accreting

sundown   bluntness storm player
plethora soul hammer error
cull ringer's haul motion
meander presence

foment eye   infinitely
sigh luff hover purged

Recent developments in new media poetry in France:
towards a no-media multimedia

The evolution of hypertext has its counterparts in all the other fundamental electronic genres. The paradigms for these genres were established in opposition to the book as media device, in response to specific problematics, and following, as they did so, lineages of the historical avant-gardes of the twentieth century, before becoming absorbed and diluted within a larger overarching paradigm. The majority of today's works employ techniques and strategies belonging to divergent electronic genres of this type within the broader global pattern. While many authors of electronic literature of the 1980s and 1990s have made works reliant on abstract global structure without encountering or generating serious aesthetic challenges, the recent work of certain authors represents a profound modulation of multimedia conceptions and practices. These authors employ strategies based on local temporal structures and, in developing their approach to multimedia, come from the traditions of sound and visual poetry rather than hypertext or generative literature. In France, I am thinking of the work of P. H. Burgaud, X. Malbreil and A. Gherban, to cite only a few.

These developments are based on the concept of the object, which takes precedence over some global notion of screen-based sound and vision. The work is inscribed in a tradition of collage, emerging from animated poetry and grounded in a literary visual tradition. There would be nothing new in this approach if informatic systems did not, as is their wont, add a *functionality* to the perceptual aspects of phenomenological structure. This seems to me to characterize informatic art which associated with private reading from its origins. It is this necessary complementarity between object and function – as exemplified even in hypertext's complementarity of graphic form and navigation – which renders the traditional notion of the sign incapable of analyzing semiotic behavior in the recent work I am addressing. The functionality, as it operates, that comes to complement the notion of the object and to direct the aesthetic of this work, is that of *behavior.*

It was Alexandre Gherban who was the first to bring to my attention the importance of behavior as a motor of informatic creativity. However,

on closer inspection, such an approach is not entirely novel. Perhaps today what we are witnessing is simply the realization of an underlying tendency in the third generation of electronic literary work. The first generation here consists of the works of initial exploration created in the 1960s and 1970s; the second comprises the pioneering works in the three genres of the 1980s and beginning of the 1990s; and the third is made up of hybrid works that shattered the genres in the mid-1990s. The realization now taking place in the recent work can only have a production influence on creative developments.

One can discover an initial proposition based on a notion of the object in *IO* by André Vallias. This work dates from 1995 and was published in *alire 10/~~DOC(K)~~S* in 1997. Later, in 2000, writing about *h*, as published in the magazine *lit&ratique*, Eric Sérandour points to the use of interactivity as a disturbance of static processes: the program itself effects an automatic transitional phase, returning to equilibrium. At this time, he invokes the behavioral independence of the work relative to the actions of the reader: the perceptible processes of the work do not respond to a reader's will. The autonomy of a work's observed processes was already fundamental to animated poetry and this notion of independence put forward by Sérandour is fundamental to the functioning of work in the form of unique readings that I have been developing myself since 1995. It is, therefore, a tradition which has, little by little, revealed the emergence of a new definition of multimedia that is certainly closer to its informatic nature and further from the classic concepts of hypertext, as also from those of algorithmic literature, as they are felicitously translated by Jean-Pierre Balpe in his theory of meta-writing.

In order to be able to understand the functioning of these works and the research which they have engendered, it will be useful, first, to recall certain results of applying the Procedural Model to the analysis of works published in France between 1985 and 2000.

Some results of applying the Procedural Model

This systematic model is founded on a postulate: mental representations are, at root, strategies of writing and reading. On the other hand, the technical function of media devices conditions, in large measure, the observable events of a work, to the extent that one cannot appreciate the work

from a purely structural, algorithmic perspective, and, neither, on the other hand, through observation of the text-of-visualization delivered by a particular machine. It is necessary to analyze the communicative transactions in a double movement: synchronic and diachronic. Analysis of the evolution of our conceptions reveals that it is impossible to separate mental representations from the technical functions that give rise to them.
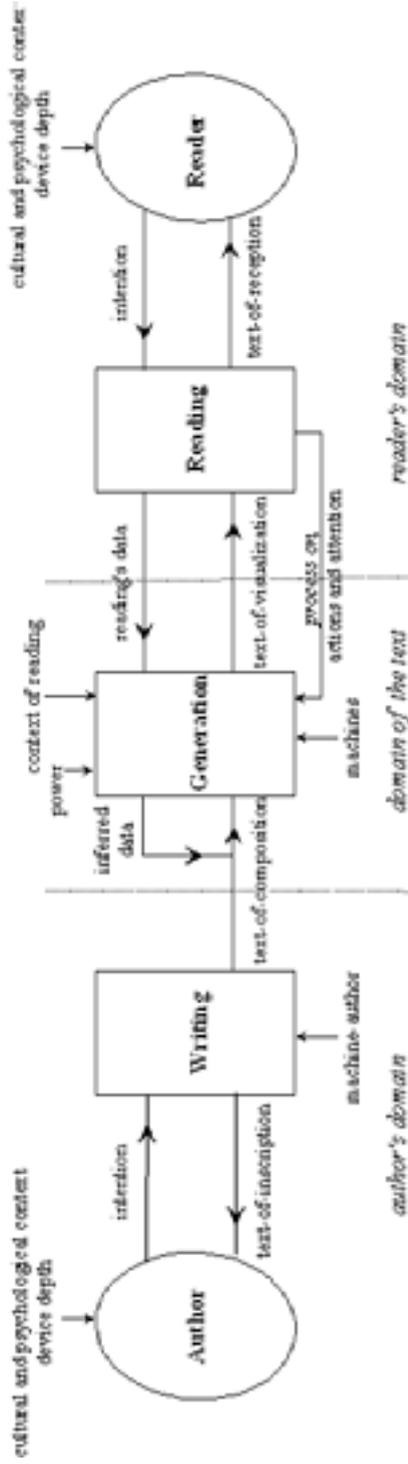
The model puts forward a pycho-semiotic analysis of the relationships between the divergent textual states already outlined above, namely the text-of-inscription, the text-of-visualization, and the text-of-reception. This model is coupled with a functional description of the communicative situation that allows us to set out in a single schema (See Figure 2) the principle properties of this situation.

A fundamental consequence of applying the model is the "separation of domains" that is elaborated in a number of forms. Through one of these, we see that the reader cannot have access – as reader – to the actual work of the author and that the author does not manipulate the observable material of the work such as it is apprehended by the reader. All strategies of writing are obliged to position themselves in relation to this separation. An extreme position is represented by the early works of non-interactive animated poetry which presented themselves as if transparent to their readers. They attempted to set out, through their programs, the observable phenomena of the poem. This effort was doomed to failure because a program is not the structural description of an observable object, but a collection of commands that evoke a process. The observable phenomena are the product of its execution. These phenomena do not constitute an object, they are transitory states with no other permanence than that provided by mental representations (the text-of-reception) which they leave in the memories of those who have read them. The opposite position is represented by that of the automatic generator which uses the separation to entirely conceal the generative algorithm. The approach has suggested to Jean-Pierre Balpe, for example, that he is not the author of the generated texts. The majority of works situate themselves somewhere between the two extreme positions, but none are able to deny the separation of domains.

This separation expresses itself by way of many properties of the work, if by "work" we mean an association of phenomena observed by the author (the source code and source texts: the text-of-composition), by the reader in her multimedia space (the text-of-visualization) and by the gen-

Figure 2: Functional model of the communicative situation (Bootz 2001, 284)

Scheme of the functional model of the communication

The diagram shows the functional model of communication with the following elements:

- **Author** (oval) → cultural and psychological context device depth
- **Writing** (box) — intention, text-of-inscription, machine-author — *author's domain*
- **Generation** (box) — inferred data, power, context of reading, text-of-composition, machines — *domain of the text*
- **Reading** (box) — reading's data, text-of-visualization, process on, actions and attention — *reader's domain*
- **Reader** (oval) — intention, text-of-reception — cultural and psychological context device depth

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erative operations that transform the one into the other and which are constituted principally (but not exclusively) by the executable processes compiled on the reader's machine. The author, no matter what type of computational tool is used, works to produce events that are perceptible to the reader as an association (sequential or parallel) of autonomous objects that are ultimate endowed with behaviors and properties. These objects, depending on the nature of the work, may be recast in any number of forms (notably individual images, texts, or screen pages) and be expressed as any number of diverse informatic forms (sub-programs, scripts, agents and image-objects, maps). This diversity in no way obscures the reality of the phenomena observed by the author: that of an association of autonomous objects endowed with behaviors, interacting with one another in time and space. The author's administration of such observable events is named, in the Procedural Model, "horizontal montage" in order to indicate that the montage in question pertains to sequences of temporal objects and not merely to sequences of images. However, the montage runs in real time and the reader is aware only of its actual production, which constitutes the observable surface of the work. In actually existing examples, the visualization or, more generally, this multimedia event, presents itself as image. Of course, the implicit ambiguity does not prevent the author from working the montage as image, nor does it prevent the reader from perceiving the objects within the image, but these alternative points of view are neither systematically applied nor are they general. Notably, the horizontal montage of objects allows the fabrication of combinatorial or modulated images, as in recent works, without any idea of the reader becoming aware of the objects or of their rules of association. The notion of an enacted image seems very appropriate in order to address the questions of reception, if less useful for describing the programmatic reality of the observable events.

The second important result of applying the Procedural Model is the "autonomy of process." In this phrase, the model evokes a fundamental property of informatic work, previously revealed by theorists of numeric art, that of the autonomy of the work. More precisely, in the Model, autonomy pertains to the generative operations as outlined above. One can affirm that what inscribes the phenomena observed by the reader is created from an association of the author, the reader, and a number of technical mediators. Informatic works are characterized, therefore, by never being entirely dependent on one or other of the human protagonists in the proc-

ess of communication, neither the author nor the reader. This is the reason that the Procedural Model finds those theories very inadequate where they presume either the reader's total operational control – as is the case with the theory of classic hypertext – or where they assign complete operational control of observable events to the program – as does the algorithmic theory.

Certainly, the work of the author cannot be conceived in terms other than those of algorithm (generative algorithms) or structured content (hypertext), but this does not prevent the technical operation of the devices from refusing this logic. This is the reason that the Procedural Model does not deny or dissociate the role of either mental representations or technical operation. Because of this, in 1994, I conceived my first adaptive generator. An adaptive generator is a "pseudo-intelligent" program which attempts to instantiate itself as if it had been preconceived by the author. This refers entirely to internal processes, because output peripherals provide no input for the program. Should the program detect a difference between the states it has instantiated and those that were expected, it attempts to modify itself in order to reduce the divergence. It cannot do this, of course, while having total respect for the wishes of the author. Taking into account this autonomy of process, notably the autonomy of technical mediation, leads us necessarily to adopt a new position and role for the author. The author is not only the designer of the work but also the systems administrator of its failures. The author is forced to organize her exigencies into a hierarchy, to leave some of these to one side if need be, and to acknowledge her loss of authority in relation to the work. The assumption of this role is dramatic, particular in our present society of "information and communication," because it rests on the acceptance and administration of the impossibility of communication. Adaptive generators constitute a special class of constrained generators, perhaps the earliest of their kind.

Constrained generators

Actually, my research is addressed to particular types of behavior. When viewed as the activity or intelligence of objects destined to be read, these behaviors conform to semiotic aims. They are the constituents of writing strategies. Two orientations determine the direction of research in my ac-

tual creative work: that of constrained generation and that of temporal semantics.

Broadly, a generator can be defined as a program that produces an output which is observable to a reader. Multimedia programming environments employ two types of algorithm, most often intermingled: algorithms of synthesis and those of realization. An algorithm of synthesis creates objects for the observable textual event from internally given forms and processes. Typical of such generators are those produced during the 1980s. They represent the algorithmic approach to semiotic manipulation, which is one facet of multimedia endeavor. An algorithm of realization produces the instantiation of an object in a form that is perceptible to reading. This type of generator represents the other side of multimedia creativity: the manipulation of perception. Typical examples of work with such algorithms are found in the animated poetry from the years 1985–90. These two aspects are naturally complementary. No work can do without one or other of them, and often they are intimately interlinked. The programs in actual use by authors often employ an algorithm of generation with a metaphoric dimension – storyboard, screen page, etc. – that relies on the background for visualization provided by the screen.

If authors wish to distance themselves from mechanistic behaviors, they are obliged to "break" the various generative algorithms by applying constrains that may themselves be algorithmic. These constraints may be addressed to each of the co-scribes of the observable events: the author, the reader, and the technical mediations. This procedure can be viewed as a modification of the expression of the initial algorithm by indirect communication between an author and one or other of her co-scribes.

The adaptive generator mentioned above is a constrained generator addressed to the instruments of technical mediation. With the program itself as intermediary, the author modifies the expression of the algorithm in measured response to the influences of this agency at the time of execution. Such modification could, *a priori*, be applied to any type of algorithm, but essentially they pertain to algorithms of realization because these are most greedy of resources, especially temporal resources (avoidance of attention, interruptions of rhythm, untimely desynchronisations, conflicts between program execution times, and so on).

A constrained generator addressed to the author herself is simply a more complex generator. For example, in an extract from a combinatorial generator, *haiku/poncture*, the constraint is manifest in the operation of a

logical if/then loop addressed to a combinatorial algorithm, as the structural analysis of the program unfolds.[13] This loop guarantees the semantic coherence of a course of reading. It renders a semantic compatibility from the non-linearity of its combinatorial structure and the linearity of its actualization as an observable phenomenon. Once more, it is for the sake of a temporal semantics that these constraints are constructed, allowing the generative operation to do without the actions of a reader.

The making of *Variations sur passage* which I realized with the help of Marcel Frémiot at the Laboratoire de Musique Informatique de Marseille (MIM) provided the opportunity to construct a generator with constraints addressed to the reader. These constraints pertained exclusively to the work's perceptible behaviors and therefore to the algorithms of realization. They manifested themselves as an "interpretation" of the product of the algorithms of synthesis after their instantiation. To put it clearly, a combinatorial algorithm constructed a particular sequence of music that possessed a coherence and structure reproduced in each of its occurrences; however, this sequence is filled out by silences to a greater or lesser extent, in correspondence with the semantics of the work's visual behavior. The multimedia assemblage constitutes a combinatorial "focalization." Which is to say that the perception of the visual elements are focused by a sonic scheme, shifting with each rereading, and creating, in fact, semantic variations. Otherwise, the other potential results of the combinatorial algorithms of synthesis, in the sonic layer of the work, are not retained. Some of these are eliminated by rules of selection that are determined by an *a priori* assessment of undesirable perceptible effects (an impression of uniformity of tone). The combinatorial algorithm approaches, therefore, to the condition of a grammar. Here, equally, it is the temporal analysis of observed events which guides the construction of constraints.

Temporal semantic units?

As we have seen, constraints, which are structural elements produced by the work of the author, correlate strongly, from the point of view of the reader, with a temporal semantics of observable events. This new way in which the separation of domains manifests itself leads us to put forward the problem of such a temporal semantics. Independent of all other semantic factors, is a multimedia event subject to a temporal semantics?

This has always been a problem in music and the work of Pierre Schaeffer with musical objects has given rise to many theoretical approaches attempting to identify a temporal semantics. However, the systems on which he worked refer exclusively to experiences of auditory perception and are distinct from any particular theory of writing. However, they are invested in this regard with a strong universal character. They are oriented by following a dynamic semantics of perceptible auditory gestures, or a cinematic semantics of perceptible movement through a particular assemblage.

The work undertaken at MIM led to a semantic classification of audible cinematic TSU (Temporal Semantic Units). This classification can be applied to and illustrated in many examples of classical and contemporary music. Three complete works have in fact been analyzed in these terms.

The work I was able to undertake under the auspices of MIM allowed me to bring to light the close relationships between the behaviors of visual objects programmed in these works and sonic behaviors. This relationship pertains in those cases where the visual behavior is conceived as a temporal development. It seems that, in these cases, the musical TSUs can be applied to visual objects. An instance based on an extract from the newly programmed version of *passage* encouraged research into visual TSUs. In this extract all algorithms of realization for the observable events in each media were blocked with one exception. The analogous behavior based on a single parameter in the visual media with that of the musical TSUs was obvious. These "visual TSUs," if they exist, do not account for the totality of signification. The temporal manipulation of the text, notably, is read as one of the criteria of coherence in a semantic combination. It instantiates a syntactic aspect of the whole.

A multidisciplinary program of research has been initiated at MIM with the aim of corroborating such intuitions and to set out a formalization of TSUs independent of the media in which they are expressed. Such a formalization could allow the design of generators of multimedia objects that are not determined by particular media, objects which might therefore be designated "no-media" and whose behaviors, produced by the processes of synthesis, could be realized in a variety of different media. This conception broadens the definition proposed above which treats multimedia as an association of autonomous objects (of which a number may now be "no-media") endowed with behaviors, in interaction with one another and their readers. This definition now generalizes the notion of behavior: a behavior is a simple rule of displacement in the space represented by the phases of

the object, that is to say, a rule of variation in one or more of an object's parameters that are pertinent to a semantic point of reference.

We can confirm that this definition correctly describes the operation of *haiku/poncture*. The objects are three in number: two propositions (text objects) and a rectangle of separation. The parameters are – for the rectangle: the opacity, chromatic value, geometric position; and for each proposition: the extent, the position, and the chosen template. The behaviors of the rectangle are the rules of geometric movement, the variation of chromatic value (definitely describable in terms of TSU); the behavior of each text is produced by a constrained generator delineated by an analysis of the work's structure.

Conclusion

One would have thought, given the pronouncements of certain young authors, that multimedia poetry had given up its status as the poetry of media devices in order to take its more traditional place with poetry as content. This would be to claim that the devices of multimedia poetics were entirely understood and that authors would be better off concentrating on their content. This claim seems a little simplistic, to say the least. Admittedly, elements prefigured in these discussions do not represent as radical a departure for the reform of literature as was proposed by the work and research of the 1980s. However, they do open doors to new structures and new uses of multimedia devices. How then to best characterize the true dominant tendencies in this poetic practice? Is it still a literature of devices? Is it a literature of structural form? Is it already a literature of content?

NOTES

1. Translator's note: There are a number of terms in Bootz's original French which are difficult to translate. I will not attempt to justify my decisions in detail. However, I will set out here a few of the equivalents I have made, however provisionally, in order that they may be easier for the critical reader to deconstruct. I have preferred to translate (French) "*information*" as "data," rather than (English) "information" despite the technological connotations, because I believe Bootz's register is technical when it is theoretical, and that, generally speaking, one of the contributions he makes is to provide a discourse that is simultaneously, unashamedly, and equally invested in the technological and the literary. Hence "*espace d'information*" usually becomes "dataspace." Bootz also uses the singular, mathematical term "opérateur" where I have used "class of operations." Bootz's usage is technical and exacting. I have assumed that the primary audience for this paper (myself included) will not be as familiar as Bootz with the mathematic sense of "operator." "Class of operations" conveys more of the sense of the technical term in a literary critical register; in mathematic operators act on a mathematical dataspace and may also act on other operators. For Bootz's special set of terms for the text of a work as viewed by the various phases of his "Procedural Model" (Bootz's overarching theoretical framework), I make the following translations: "*texte-écrit*" becomes "text-of-inscription"; "*texte-auteur*" becomes "text-of-composition"; "*texte-à-voir*" becomes "text-of-visualization"; and "*texte-lu*" becomes "text-of-reception." Generally, this use of hyphenated terms is intended to signal that these are particular to the theoretical framework of the Procedural Model. Purely for purposes of comparison and in case this helps with the understanding of Bootz's text, I will also give an alternative (fanciful, techno-metaphoric) set of equivalents I considered: "firmware text," "software text," "interface text," and "wetware text." Interface text is a term I use in my own theoretical discussions.

Apart from this, I would just like to warn the reader that I have often translated freely and for comprehension, in some cases my own idiomatic comprehension, such that this translation should probably be considered interpretative. I did have a draft translation into English by the author to which I referred, but all errors are my own. (JHC)

2. Bootz's source for this is as follows: It was quoted, in French, in Bariault (1990) which, in turn is quoted in Laufer (1992, 42).

3. Translators note: I have inserted this reference to Nelson's term although it should always be remembered that the Web is far from realizing Nelson's preferred vision of a docuverse.

4. Published on PC floppy disks in *alire* 8, Mots-Voir, Villeneuve d'Ascq, 1994.

5. I am not suggesting that this is an exhaustive analysis of the modes of hypertextual reading.

6. Translator's note: the French here is "*deploiement*" – unfurling, spreading out, unfolding. An English equivalent with the right-seeming subliminal metaphoric associations is difficult to choose. I marginally prefer "unfolding" since plots unfold, but this should *not* be taken as binding Bootz's remarks more tightly to the narrative mode.

7. Please note that I am referring to links, not anchors.

8. *Passage* is analyzed in detail in (Bootz 1998).

9. This transition is analyzed in detail in my intervention, "Three correspondences of work and interface," in the proceedings of "Interfaces: aesthetic and political mediation" which took place at the University of Paris 13 from 30 to 31 January 2001. The text is available on line on the Web site of the University of Paris 13.

10. Translator's note: The French is "*interface inversion*." We need to bring out Bootz's sense that the interface was once submerged as invisible paratext and comes to prominence as part of the signifying process in his second phase; his "interface inversion" is the transposition of text and paratext.

11. A number of works have been analyzed in this way, showing that strategies of writing are disengaged from their reading and from an analysis of their code, and that they rely on the phenomena of reception. I refer the reader to my recent articles

and interventions: Bootz (2000); the intervention at the University of Paris 13 (January 2001) already cited; "Lecteur/lecteurs," a contribution to the *p0es1s* colloquium, 13 September 2001, University of Erfurt (article at the p0es1s Web site); and "Esthétique de la frustration/frustration," a contribution to the colloquium *De la création à la reception*, March 2000, Laboratoire de Musique Informatique de Marseilles (MIM, text on its Web site).

12. This remark is the expression, based on a particular case, of a property of the aesthetics of frustration.

13. An extract from the work may be seen at the Web site of the "paragraphe" group, University of Paris 8. The site also has a structural description of the work.