Conditional Spatiality

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ABSTRACT

Spatial hypertext systems have tended not to incorporate conditional behavior. When objects occur in a spatial hypertext conditionally, paradoxical effects can occur, with strength of presence working in contradiction to strength of attention. A simple mechanism for achieving conditionality is layering. More complex results can be achieved using rules or queries. Such a system could focus on a novel aspect of emergent structure: behavior upon emergence failure. Presence of conditionality in spatial hypertext produces complex results for time. Appearance and disappearance of objects creates a new kind of event; where objects have their own time-based behavior the study of time becomes extremely complex.

INTRODUCTION

Many forms of hypertext have attached conditionality to various structural elements or forms of behavior. Perhaps the most notable example is the StorySpace abstraction called *Guard Fields* [3], in which the availability of a link can be made conditional on whether some other node has already been visited. Another example is the Connection Kit [5], an authoring framework for conditional links using JavaScript. However, use of conditionality in spatial hypertext is at this writing unusual. For instance both VIKI [7] and VKB [10] allow an object to be a member of a collection; however this membership is absolute: an object either is or is not a member of a collection. Spatial position also tends to be absolute: an object stays where the document author put it, and its location is only conditional on an author's (presumably persistent) choices, made interactively.

There is no reason why conditionality should not play just as strong a role in spatial hypertext as other forms of hypertext. Introducing conditionality affects many aspects of spatial hypertext; among them are attention and emergence of structure. Conditionality can be achieved in a variety of ways, from simple layering to more complex automatic rules.

Consideration of conditionality in spatial hypertext is still in its infancy, and this paper will only begin to raise some of the issues involved.

STRUCTURE VS. ATTENTION

Management of attention is an integral aspect of spatial hypertext. By placing objects near one another, the document author may be organizing materials so that attention is paid to certain items *together*. Analogous to the more formal relationships of argumentation, a spatial hypertext author may be creating a relationship of the form "Don't forget A when considering B." Thus an author may be willing to commit to a relationship of *co-attention* when a more "structured" relationship has not yet been decided. How this plays out with respect to conditionality has yet to be investigated.

Conditional spatiality introduces some odd paradoxes. If the spatial attributes of an object are not fixed, as they change this will introduce an *event* into the spatial hypertext of a kind that does not exist in "unconditional" spatial hypertext. This event is likely to mark the affected object, and perhaps draw attention to it in a way that does not occur for elements with no conditionality. For example, consider a concept of layers, and consider two objects, A and B. A is present in all layers, but B is present in some layers but not others. As conditionality triggers a layer in which B is present, B will seem to appear; when this conditionality is no longer in effect, B will seem to disappear. A, however, will remain visible constantly. These events will continue to draw attention to B, making it appear more "prominent". On the other hand, since A is always present, its presence is "stronger". Thus the paradox: while A has "stronger presence" for lacking conditionality, B has "more prominence" by being associated with events that grab attention.

Our nervous systems are strongly conditioned to pay attention to things that move, and to things that suddenly appear. It is likely this is biological; throughout most of evolutionary history, something that moves has a distinct likelihood of being either a potential meal or something that can make of oneself a potential meal. Thus there are important biological reasons for paying attention to things that move. This "hard wiring" of the brain to favor motion is being exploited in web design, unfortunately, as more and more advertisers use animations to forcibly wrest the reader's attention from the "real" content of web sites that is the reason for the reader's visit, making the advertising parasitic on the

"real" content — notwithstanding that it is the advertising that makes the site possible by paying for it. Thus issues of conditional spatiality are being played out against a backdrop of contention for attention, which may complicate the analysis. (For further discussion on this point see [9].)

The phenomenon that an ephemeral item may receive attention it doesn't "deserve" due to its sudden appearance may be described as *The Flash in the Pan Effect*. How to deal with such effects while harmonizing with the objectives of spatial hypertext document authors and readers is one of the great challenges for user interface design in spatial hypertext.

CONDITIONALITY THROUGH LAYERING

Layering is a familiar user interface paradigm from object-oriented drawing programs. Support for layering in spatial hypertext systems is currently somewhat equivocal. Rather than being an explicit part of the interface, as is typical in drawing programs, layering in systems like VKB tends to be the result of how the user has selected objects. The system maintains an *internal* concept of layering, which it needs to be able to render objects. The user interface for a typical drawing program allows a layer to be hidden or shown; when a layer is hidden, all objects in that layer remain in the drawing but become invisible. Multimedia systems like Flash [6] also allow objects to be hidden and shown, and this behavior is controllable by means of scripting.

Figure 1 shows an example of conditional spatiality

Figure 1a

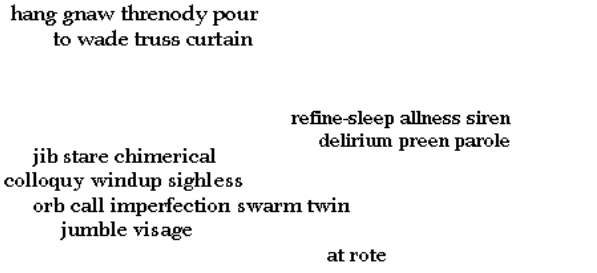

Figure 1b

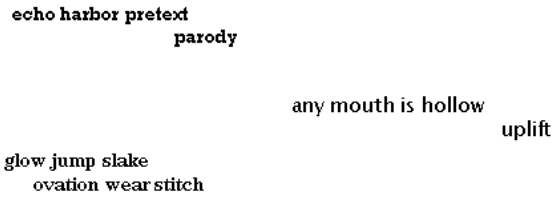

Figure 1c

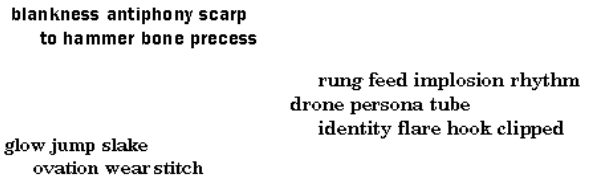

Figure 1d

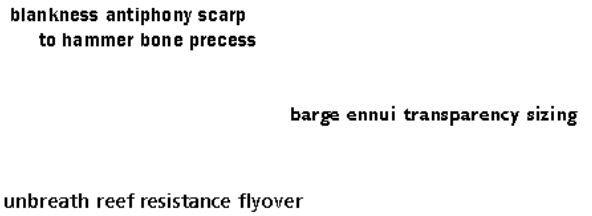

Figure 1e

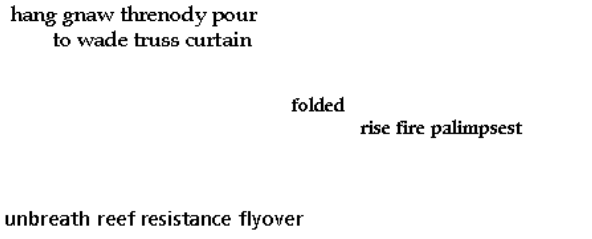

Figure 1f

Figure 1a shows a simultaneity closed; b-f show the layers. The order is randomized. Each "central phrase" occurs once; the "outer phrases" may occur in different layers. The "outer clusters" in 1a are gray because they are not "hot" in the interface.

through layering in an unpublished work in progress of my own currently called *Diagrams Series 6*. 1a shows the simultaneity closed; note the central word cluster appears black and the outer clusters appear gray. This difference is meant to indicate two things to the reader. The central cluster is "active" as a user interface element, while the outer clusters are not active: the region of the central cluster is divided into invisible rectangles which are "on mouseOver" hot-spots activating the layers, whereas moving the mouse over the outer clusters has no user interface effect. The greater "solidity" of "ink" in the central cluster is also meant to indicate that there is no conditionality to layer membership among the phrases in that cluster: each phrase belongs to exactly one layer, whereas in the outer cluster some phrases may appear in more than one layer. Thus the outer phrases may or may not be present, depending on what layer is active. (This is a somewhat weak form of conditionality; what the user *sees* is conditional based on what the user does, but there is no conditionality to the underlying structure, in the sense of "conditional layer membership".) This piece exhibits some of the paradoxical effects already discussed where persistence contrasts with appearance and disappearance; conditional presence in some layers but not others contrasts with appearance unconditionally but only in a single layer.

GENERIC SPATIALITY

The term "generic spatiality" is meant to provide an analogue to the more familiar generic link [4]; by generic spatiality is meant a mechanism of providing spatial information in response to an algorithm, whose parameters are given in lieu of explicit spatial parameters. An example is the concept from Web Squirrel [1] of agents. An agent is essentially a collection determined dynamically by a query. Membership in a Web Squirrel agent list is "by reference" — besides its listing in the agent list, a member has a "real" location and clicking on it in the agent list takes you to that location. Tinderbox [2] also has agents.

The kind of generic collections present in Web Squirrel or Tinderbox as agent lists are not "true" generic spatial collections, in that they don't have a full set of spatial attributes in their context in an agent list. The only attribute that is determined by query is collection membership. (Tinderbox allows the user to open a spatial view of an agent list, but members of the list cannot be manipulated spatially in the same way as a "manual" collection.) A fuller form of generic spatiality would allow for all of the spatial attributes that can be manipulated interactively to be determined by query criteria. Currently no spatial hypertext systems support this form of generic spatiality.

It may be argued that there is a total clash of principle between this concept of spatiality by query and the usual approach to spatial hypertext as the vehicle for implicit and emergent structure. Part of the motivation for spatial hypertext is the unwillingness of users to commit "in advance" to structure [8]. Here we are asking the user not simply to commit to structure, but to actually commit to a *rule* for how the structure is constituted. Be that as it may, the kind of queries found in agents such as those in Web Squirrel may be described as *secondary* in the sense that membership in the universe available to the query is already determined by a "spatial decision" of the kind familiar in spatial hypertext. E.g. a query might match the rule: "adjacent to an object whose name contains the string 'formula'". The question of what constitutes adjacency would presumably be determined by a spatial parser, which in turn is acting on the "raw data" originally provided by the familiar kind of spatial interactive placement. The exact relationship between implicit spatial structure and explicit query rules remains to be worked out; surely it seems wrong to "prohibit" agent rules from spatial hypertext due to an "ideology" of implicit structure. It will be up to users to determine how this gets worked out.[1]

EMERGENCE VS. CONDITIONALITY

Support for emergent structure has long been an important motivation for spatial hypertext. A natural component of the concept of emergence is *completion:* a structure may be incomplete, but is "growing". What happens if completion never occurs? Consider a collection containing summary thoughts for what is meant to be a section of a paper. The collection currently has two members. As the document author, you feel that two is too small a number for the finished collection, but aren't worried because you expect more members of the collection to materialize. However: if these members *don't* materialize, the members already in the collection need to be "reassigned". Perhaps if the emerging structure "fails", its current members should be assigned to the parent collection and their current collection deleted. Thus we have members of a collection where the membership is conditional on completion of the collection, and a specific behavior in mind if the collection can't be completed: the members are moved to the parent collection and the collection is deleted. Unfortunately, existing spatial hypertext systems have no way to indicate either this conditionality or the kind of behavior that should occur if the condition is not met. In the case we are discussing, as document author you must (1) *decide* that a collection has failed; (2) *remember* that you intended to move the members to the parent upon failure; (3) *execute* the failure behavior *by hand*.

By contrast, a spatial hypertext system that supported conditionality would allow you to have an attribute of a

[1] It is interesting to note in this context that the explicit structuring of links has reemerged in more recent versions of VKB.

collection — call it "accepted", set the initial value to yes, and include in the collection a rule that if the accepted attribute changes to no, the members of the collection should be transferred to the parent and the collection deleted. Membership in the collection is conditioned on the collection being accepted. The entire hypertext could have a global constraint that when the entire hypertext has the attribute "closed", a collection must have at least 3 members in order to be accepted. Closing the hypertext would clean it of too-meager collections all at once. Note that for this to work correctly, it is crucial that the constraint requiring a collection to have at least 3 members be executed *depth first*. (A collection with only 2 members may acquire more if one of those 2 is a collection which is "failed" under this scenario.)

CONDITIONALITY AND TIME

Many of the issues already discussed have to do with time. Given that VKB makes explicit reference to time as an "operator dimension", some explicit discussion of time vs. conditionality is in order. VKB allows the timeline to be set to the point at which an object changed. The assumption is that if an object changed, it was the user that changed it — presumably interactively. However if an object or collection can be subject to rules, it may be changed as the result of an interactive change to some *other* object. VKB records each change as an event. As rules cascade changes through other objects, do we have a single event or multiple events? Note that *ordering* becomes an issue here. Where all changes occur interactively, there is no ambiguity to ordering. However if an interactive change to one object results in changes to other objects through the application of rules, the order of application of the rules affects the time sequence of changes to other objects.

There are other issues related to time which are likely to be subject to severe aesthetic differences among possible authors. Suppose some of the objects that can appear in the same space are multimedia player objects of some kind — i.e. they have their own timelines, with activities programmed based on time. How should these timelines be synchronized? What kind of event handling framework is required to account for what should happen when objects "appear" or "disappear" as the result of conditional behavior? Time behavior could also be used as an "associating" attribute in a spatial hypertext, in the same way that such attributes as color and alignment are now. Consider a "scene" in a spatial hypertext in which several different objects are exhibiting time-based behavior. Some are in sync and some are not. The eye will clearly associate those that are in sync, in the same way that the eye will associate objects of like color. This type of association is likely to be *extremely* conditional, in that it may be related to when various objects were "set playing". Like color, the association by the eye of synchronized objects can occur at a distance. Far more subtle effects than synchronization are possible; the rhythms of time-based objects may overlay in slowly shifting patterns, similar to the rhythms in the music of composer Steve Reich. Such "time structures" can be implicit, ambiguous, and emergent — exactly the kind of concepts that have been central to spatial hypertext since its inception. These effects can produce a kind of "layered time".

Of course some of these effects may be unintentional: objects may be synchronized simply by happenstance rather than an overt decision of the document author. Another complicating factor is that events may occur with a timing determined by the *reader*. If a spatial hypertext contains time-based multimedia objects, a great deal about the timing of when players are started and stopped will be in the hands of the reader.

CONCLUSION

Conditionality may be introduced into spatial hypertext by a variety of methods, from layering to explicit rules. As conditions change, objects may appear or disappear or be subject to other forms of behavior; this introduces new aspects of time to spatial hypertext which can interact with spatial aspects in complex ways. There can be odd effects in which attention attributes seem to be working at odds with structural attributes. Clearly, there is much room for further investigation here as more spatial hypertext systems acquire aspects of conditionality.

REFERENCES

1. Bernstein, Mark, *Web Squirrel*, Eastgate Systems, Watertown, MA, 1996.

2. Bernstein, Mark, *Tinderbox*, Eastgate Systems, Watertown, MA, 2002.

3. Bolter, Jay David, Bernstein, Mark, Joyce, Michael, and Smith, John B., *Getting Started with Storyspace*, Eastgate Systems, Watertown, MA., 1996.

4. Fountain, Andrew, Hall, Wendy, Heath, Ian, and Davis, Hugh, "Microcosm: an Open Model with Dynamic Linking", *Hypertext: Concepts, Systems and Applications*, A. Rizk, N. Streitz, and J. Andre, Eds., France, 1990, pp. 298-311.

5. Kendall, Robert, and Réty, Jean-Huges, "Toward an Organic Hypertext", *ACM 2000 Hypertext Proceedings of the Eleventh ACM Conference on Hypertext and Hypermedia*, ACM, New York, 2000, pp. 161-170.

6. Macromedia, Inc., *Flash*, San Francisco, http://www.macromedia.com/support/flash/documentation.html.

7. Marshall, Catherine C., Shipman, Frank M. III, and Coombs, James H., "VIKI: Spatial Hypertext Supporting Emergent Structure", *European Conference on Hypermedia Technology 1994 Proceedings*, ACM, New York, 1994, pp. 13-23.

8. Marshall, Catherine C. and Rogers, Russell A., "Two Years before the Mist: Experiences with Aquanet", *ECHT '92 Proceeding of the ACM Conference on Hypertext*, ACM, New York, 1992.

9. Rosenberg, Jim, "And *And*: Conjunctive Hypertext and the Structure Acteme Juncture", *Hypertext '01: Proceedings of the 2001 ACM Conference on Hypertext*, ACM, New York, 2001, pp. 51-60.

10. Shipman, Frank M. III, Hsieh, Haowei, Maloor, Preetam, and Moore, J. Michael, "The Visual Knowledge Builder: A Second Generation Spatial Hypertext", *Hypertext '01: Proceedings of the 2001 ACM Conference on Hypertext*, ACM, New York, 2001, pp. 113-122.