Do you have the time?
Composition and Linking in Time-based Hypermedia

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What is the problem?

How can we combine timing and linking in multimedia?

Author:
• chronological development of the narrative
• temporal arrangement of media elements

Hypertext system designer:
• add concurrent media streams to document
• include temporal aspects in model

Multimedia system designer:
• add links to linear multimedia presentation

Three cases
• timeline of single linear multimedia presentation
• navigation among linear multimedia presentations
• navigation within and among non-linear multimedia presentations
Document vs. presentation time

*document*—underlying storage representation perceived by an author

*presentation*—perceived by a reader

Document needs to contain information for directing playback
- which elements
- when displayed
- for how long
- when removed

Presentation time

<table>
<thead>
<tr>
<th>Media element time</th>
<th>Document time</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram of Media element time" /></td>
<td><img src="image2" alt="Diagram of Document time" /></td>
</tr>
</tbody>
</table>

Rendered time

| ![Diagram of Rendered time](image3) |

Runtime

| ![Diagram of Runtime](image4) |
**Media element time**

![Diagram of Media element time]

**SMIL clip-begin and clip-end**

**Document time**

![Diagram of Document time]

**SMIL repeat and duration**
Temporal composition

SMIL \textit{par}, \textit{seq}, \textit{begin}, and \textit{end}  
Par and seq have implicitly defined synchronization constraints  
Par and seq can also have \textit{duration} and \textit{repeat} attributes  
Soft vs. hard synchronization
Multiple synchronization arcs

Second arc constrains indefinite duration of lowest component or scales intrinsic duration.
Further sync arcs are invalid.
More complex model could allow different tempos within component.

Implicit synchronization arcs

par Document time

seq Document time
Interaction within a linear multimedia presentation

Runtime

Runtime
Linking among linear multimedia presentations

Replace

Continue

Rendered time

Runtime

music1

music2

image
Conclusion

Four types of presentation time
• media element time, document time, rendered time, runtime

Document time needs to be incorporated in document model

Runtime most important from reader’s point of view
• traversing time axis
• linking among multimedia presentations
• linking within and among non-linear multimedia presentations

Behaviour has consequences for document model
• temporal and atemporal composition
• link definition