UNIVERSITY OF Southampton

Richer Links

COMP3220 Web Infrastructure

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Beyond Navigation

Spatial Hypermedia

What is Spatial Hypermedia?

Tools for supporting emergent structure (implicit structure -> explicit relationships)

Visual/spatial metaphor allows people to express ambiguous or partial structures
- Focus on creation of structure
- Focus on visual and spatial properties: position, colour, border, shape, font

Distinctive line of spatial hypermedia systems in the literature:
- Notecards, gIBIS, VNS, Aquanet, VIKI, VKB

Marshall, C.C. and Shipman, F. (1993) Searching for the missing link: discovering implicit structure in spatial hypertext. Proceedings of the 5th ACM Conference on Hypertext, pp. 217-230.

Visual Knowledge Builder

Shipman, F. et al (2001) *The Visual Knowledge Builder: A Second Generation Spatial Hypertext*, Proceedings of the 12th ACM Conference on Hypertext and Hypermedia, pp. 113-122.
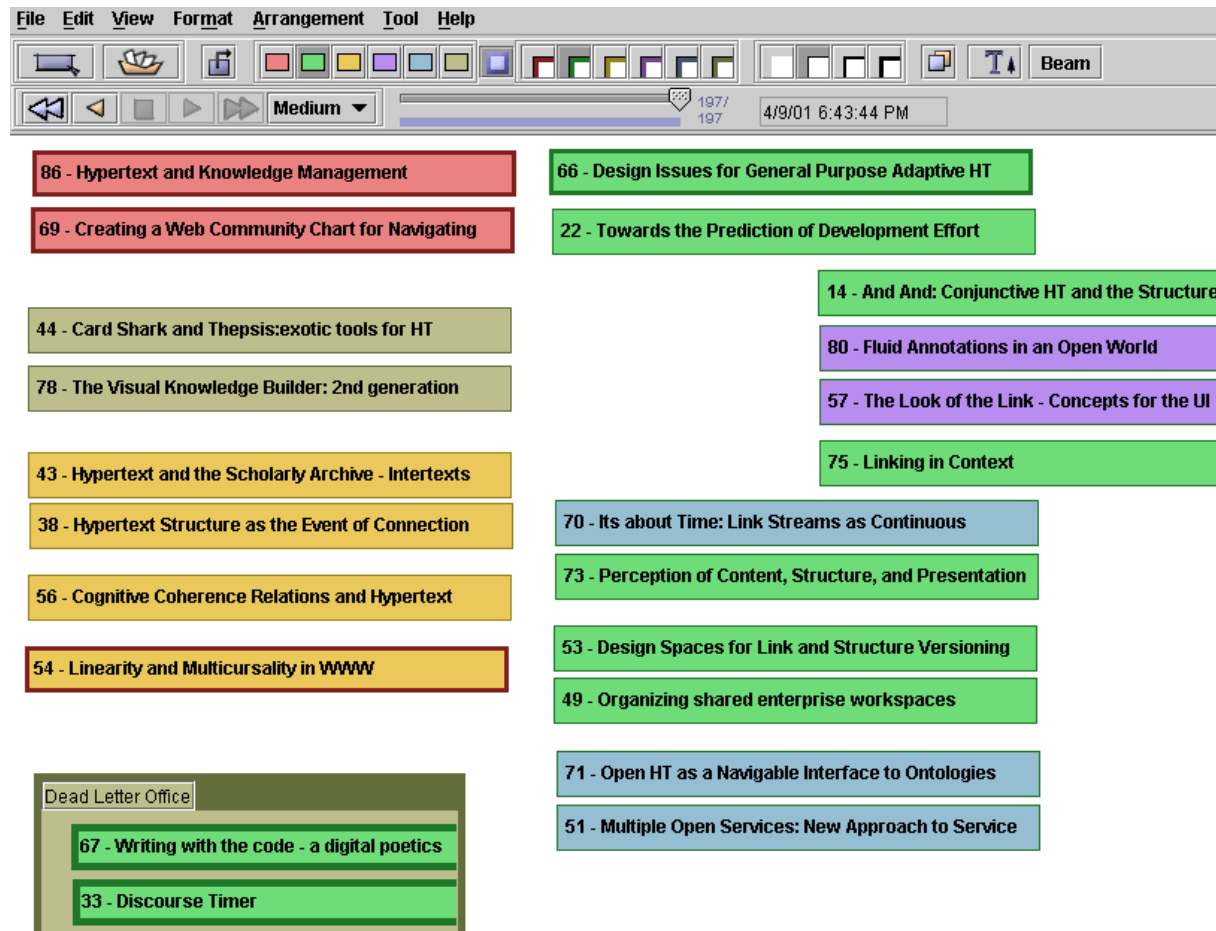
Storyspace (www.eastgate.com)
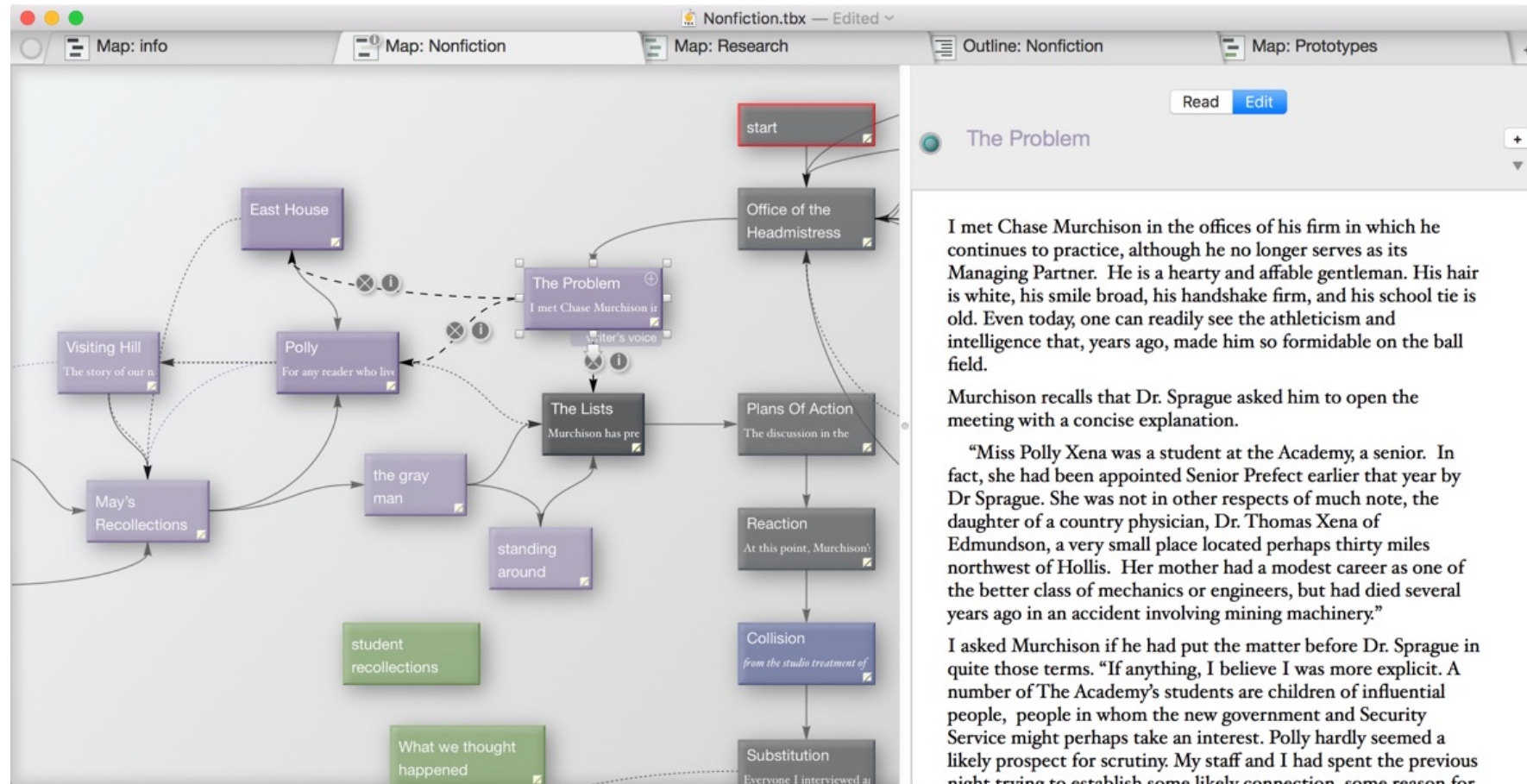
Tinderbox

Sculptural Hypertext and Hypertext Patterns

Sculptural Hypertext

Considerations for the writing of hypertext:

- Conventional (calligraphic) hypertext adds links between nodes until the desired structure is achieved

- Sculptural hypertext assumes that all nodes are linked to each other, and removes links until the desired structure is achieved

Card Shark

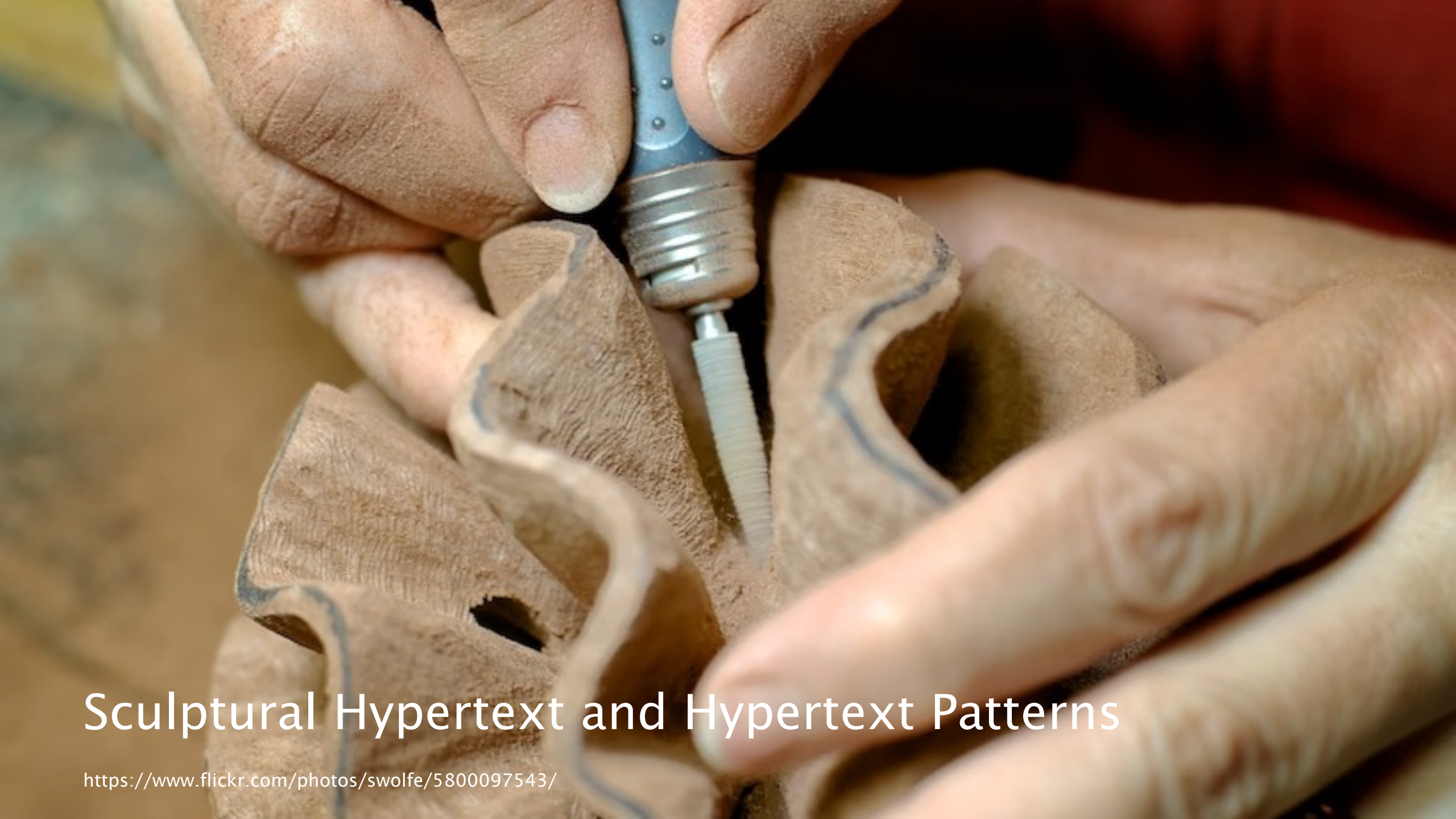A Card Shark node (or card) contains:
- A brief, focused passage of text
- Optional constraints on the context in which the card may be read

Reading is like playing a solitaire card game
- Reader dealt a hand of seven random cards
- Chooses a card to play (i.e. node to read) based on card constraints
- Deals a replacement card, repeats

Social Shark: collaborative, competitive reading
- Readers take it in turns to play cards
- Points awarded to readers for the playing of particular cards

Bernstein, M. (2001) *Card Shark and Thespis: exotic tools for hypertext narrative.* Proceedings of the 12th ACM Conference on Hypertext and Hypermedia, pp 41-50.   11

Temporal Hypermedia

http://www.flickr.com/photos/rachelpasch/2405915548/

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Time-Based Hypertext

Linking into temporal and continuous media (sound, animations, video)
- Providing hypertext jumps to other contexts
- Annotation of the current item playing
- Synchronization of multiple media

Issue: embed the links or point from outside?
- If embedded, what media format does this?
- If linking by reference, how to describe the place the link is?

Issue: quality of Service
- Will things happen when they should?

Microcosm Sound Viewer (1993)

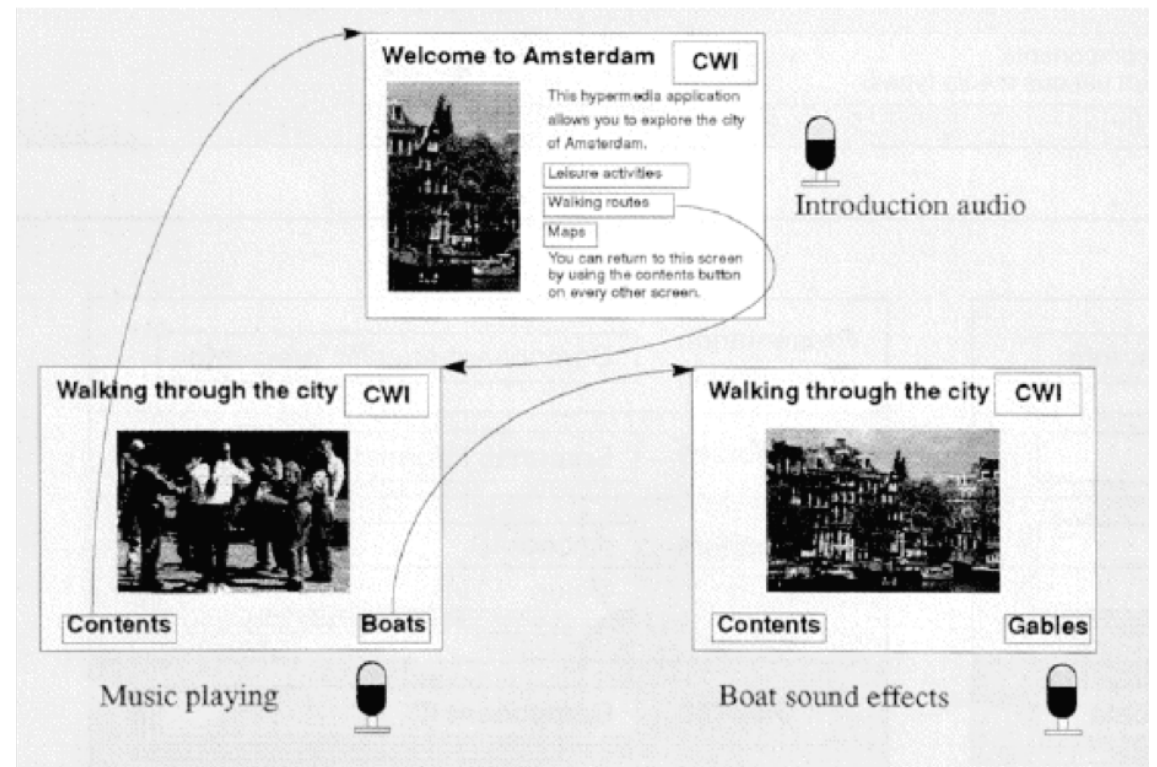Early innovative work on putting jump links into sound files

- Top window shows clickable links and bar is the "now point"
- Bottom window shows top window in context of whole file
- Links can be user activated or automatically invoked (decided by author)
- Link anchors described as start and finish times in seconds through file
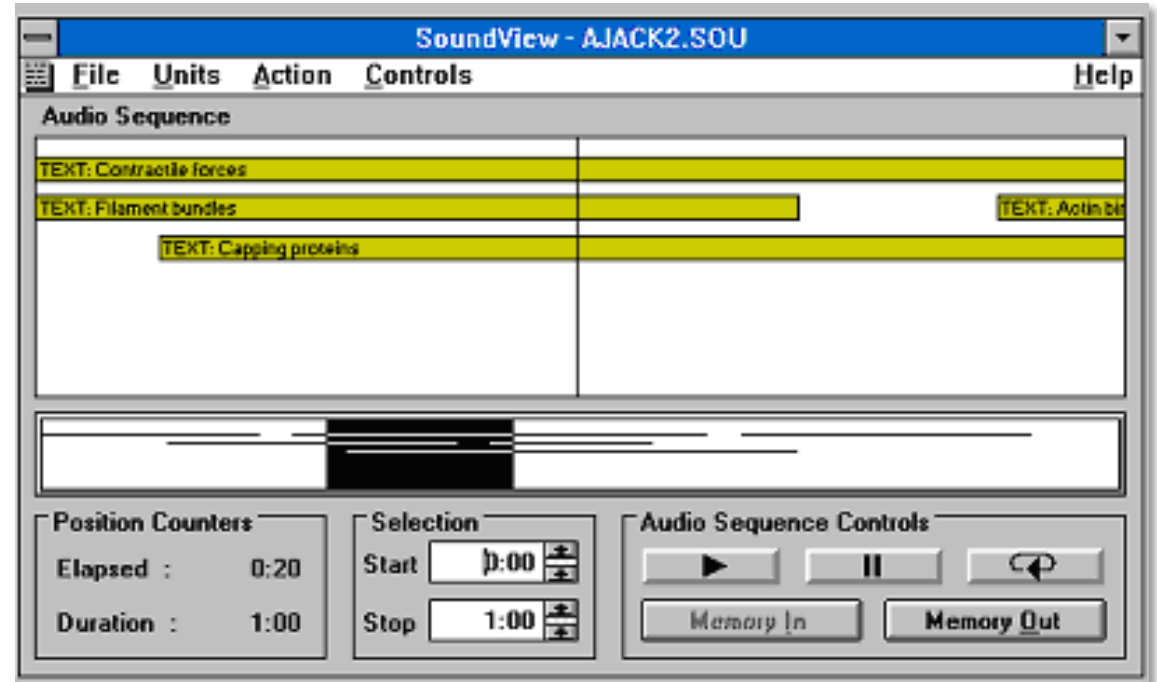
The Amsterdam Hypermedia Model (1994)

Concerned with provision of systems to author multimedia presentations and synchronise multiple data streams

- Parallel "channels"
- Offset links into temporal media
- Stationary hotspots in media
- Inspired SMIL

Hardman, L. et al (1994) *The Amsterdam Hypermedia Model: Adding time and context to the Dexter model*. Communications of the ACM, 37(2), pp. 50-62.

HyTime

Hypermedia/Time-based Structuring Language ISO/IEC 10744:1992 (and v2 in 1997)
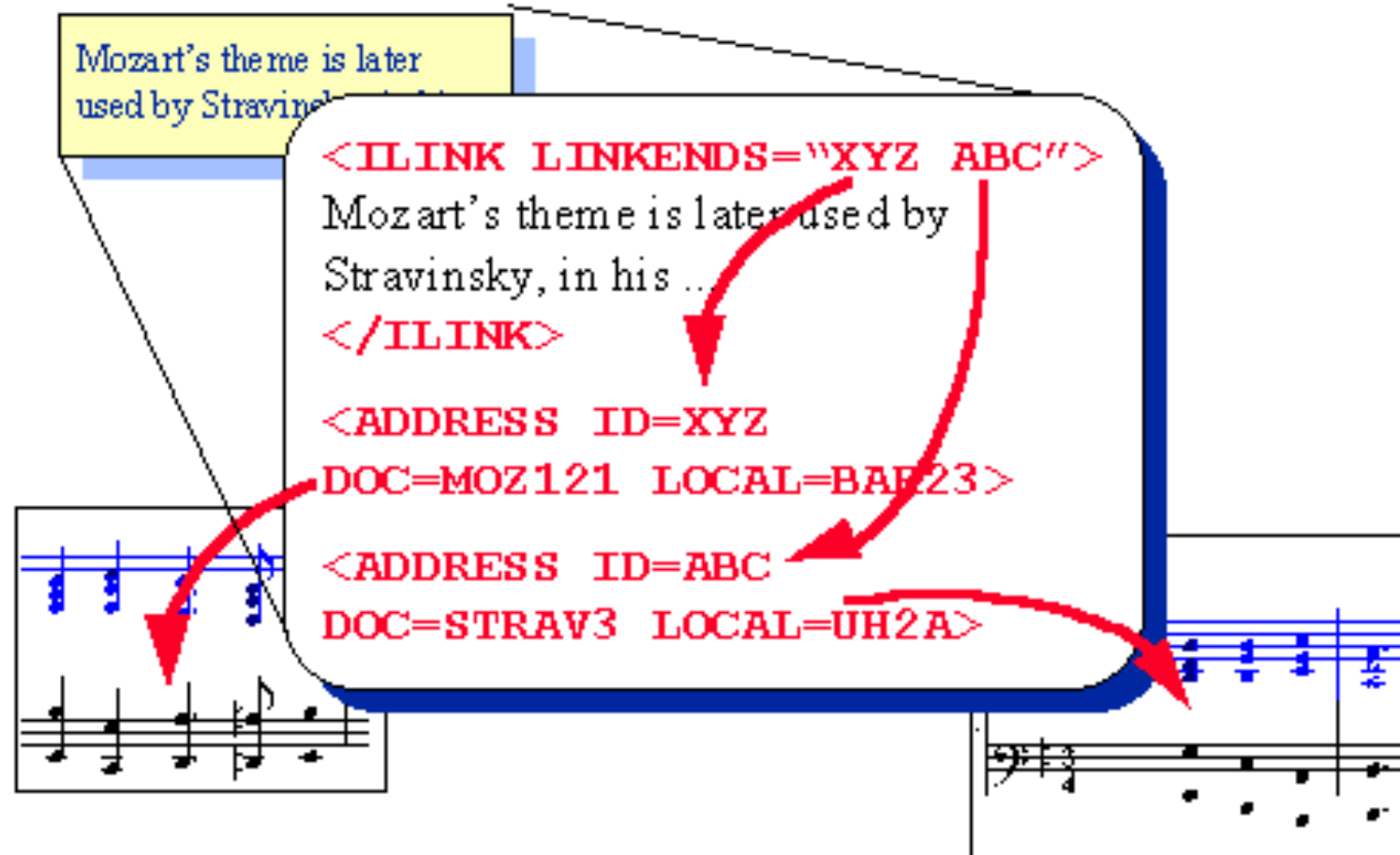- Added cross document links to SGML
- Contextual links (c.f. HTML a element) and independent links (c.f. XLink extended links)

Multiple ways of addressing locations:
- Named elements (c.f. `name`/`id` attribute in HTML)
- Using document structure – `treeloc` and `dataloc`
  (c.f. XPath/XPointer expressions)
- Using queries (HyQ query language, later supplanted by DSSSL – c.f. Xquery/XPath)
- Indirectly via a series of steps – `nameloc`

HyTime link mechanism inspired that of XLink/XPointer

Goldfarb, C.F. (1991) *HyTime: A Standard for Structured Hypermedia Interchange*. IEEE Computer, 24(8), pp. 81-84.

HyTime ilink example

Synchronized Multimedia Integration Language (SMIL)

XML format for multimedia on the Web
- Timing, screen layout, interaction of media elements
- Nested parallel and sequence elements
- Switch element for alternative media (e.g. for different users or different displays)
- Uses CSS, XPointer and XLink

Now largely supplanted by HTML5 (but does things that HTML5 cannot)
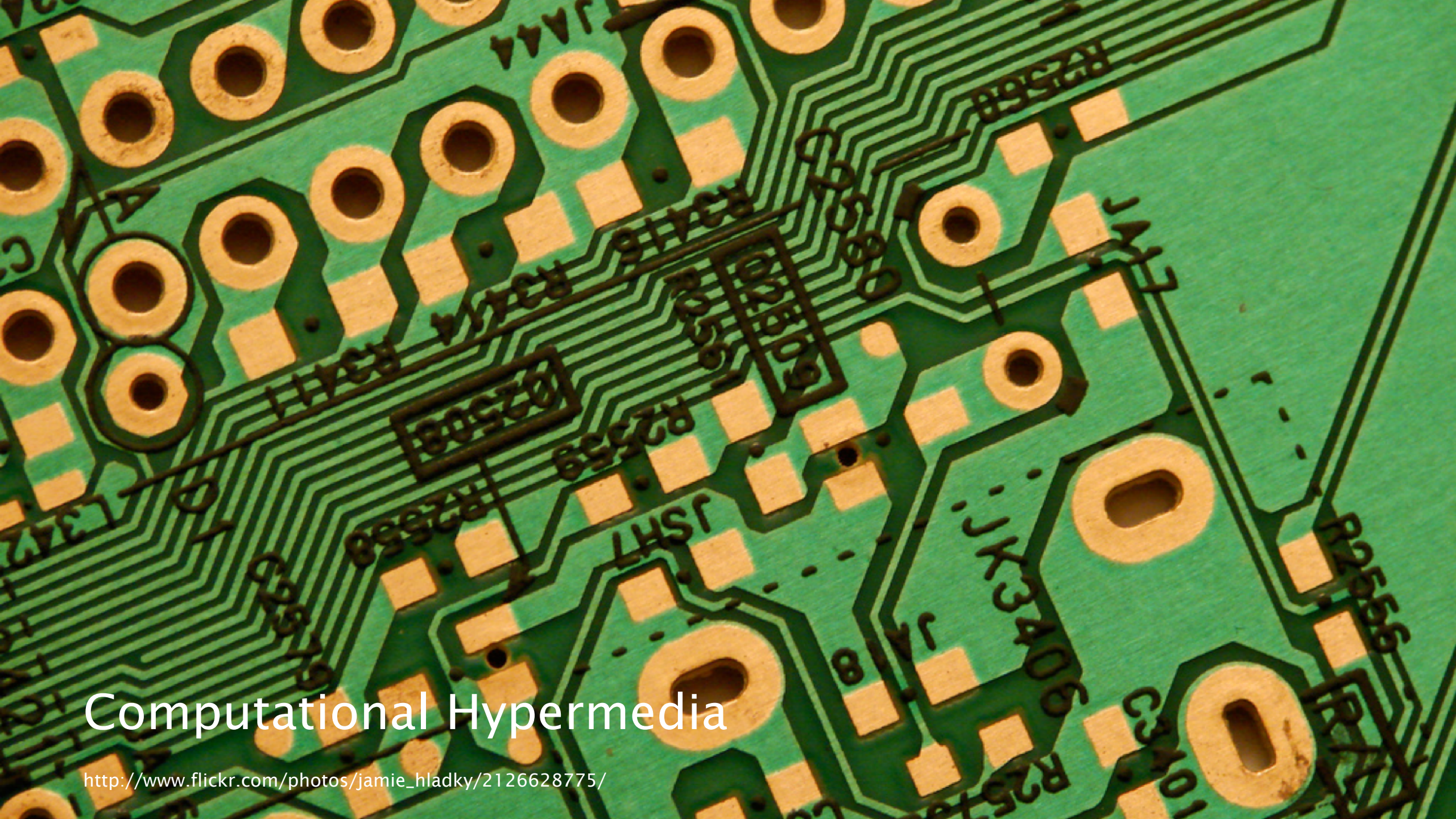
Still used for animating SVG

Bulterman, D. et al (2008) *Synchronized Multimedia Integration Language (SMIL 3.0)*. W3C Recommendation. Available at: https://www.w3.org/TR/SMIL3/

SMIL example

media to
be played
in parallel

alternative audio
based on language

```xml
<?xml version="1.0"?>
<smil xmlns="http://www.w3.org/ns/SMIL">
  <body>
    <par endsync="first">
      <switch>
        <audio src="greeting-en.mp3" type="audio/mpeg" systemLanguage="en"/>
        <audio src="greeting-de.mp3" type="audio/mpeg" systemLanguage="de"/>
      </switch>
      <seq>
        <switch>
          <text src="greeting-en.txt" dur="2s" systemLanguage="en"/>
          <text src="greeting-de.txt" dur="2s" systemLanguage="de"/>
        </switch>
        <video src="titles.mp4" type="video/mp4"/>
      </seq>
    </par>
  </body>
</smil>
```

media to
be played
sequentially

19

Computational Hypermedia

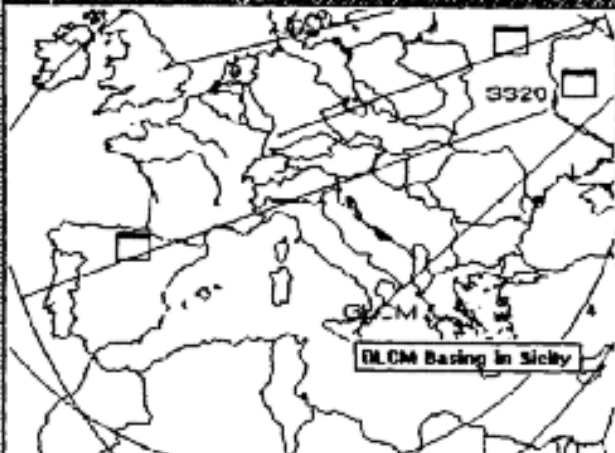# Seven Issues

Issue 4: Computation in (over) hypermedia networks

- The idea is to provide APIs to allow cards to be orchestrated and scripts to be executed when certain events occur

- Interactivity

- Adaptivity

- Generated nodes and links

Halasz, F. (1989) *Reflections on Notecards: seven issues for the next generation of hypermedia systems*, Communications of the ACM, 31(7), pp. 836-852.

NoteCards

Script cards that orchestrate the display of other cards

- Used to determine what material to show next
- Scripting engine separate from hypertext system

Halasz, F.G. et al (1986) *NoteCards in a Nutshell*. SIGCHI Bulletin, 18(4), pp.45-52.

Trellis

Petri Net-based hypertext

- Variant finite state automata
- Vertex types: places/transitions
- Places labelled with tokens
- Directed edges are either place->transition or transition->place
- Tokens follow edges from place to place through transitions
- Transition can only be activated if all predecessor places have tokens
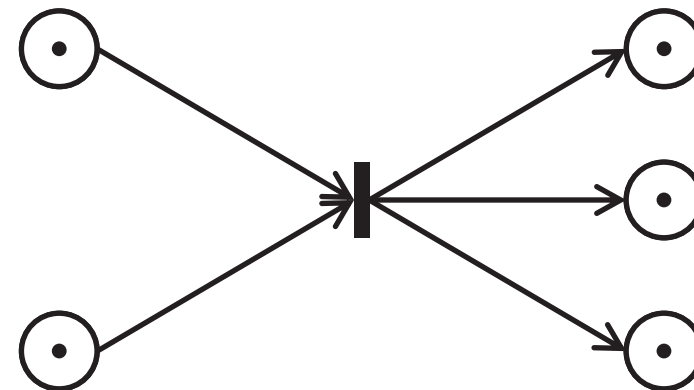
Petri Nets as hypertext

- Places correspond to nodes
- Nodes with tokens are visible to reader
- Transitions correspond to (n-ary) links

Stotts, P.D. and Furuta, R. (1989) *Petri-net-based hypertext: Document structure with browsing semantics.* ACM Transactions on Information Systems, 7(1), pp. 3-29.

Change labels on trans and places.

review1
recommend
talents

John Smith has worked for MegaLith for 17 years
and has been a productive worker the entire time.

Early in his career upper management saw him as
a strong candidate to move from technical work
into policy making levels of management.

His progress was slower than expected in the first
five years, but his productivity picked up and
now Mr. Smith has caught up to the early projected
schedule and is believed ready to "make his mark"
on MegaLith Corporation.

review3
recommend
talents

John Smith:
Incidents requiring corporate discipline:

None.

review2
recommend
talents

Performance on corporate sports teams was outstanding.
Smith is generally a good team player, which can spell
    success for both him and MegaLith off the field.

Softball: 25 games played, 27 homeruns, 47 RBIs.
Bowling: average 187, season high 215
Golf: handicap 7, season best 76

Missed both company picnics.

TAG

intro
personal
s1
personal
evals
continue
talents
review1
education
talents
review2
projects
review3
projects
recommend
patents
s2
patents
salary   back
future   history
return

Change labels on trans and places.

future return

John Smith has performed his work to a satisfactory
level on all tasks given him. His co-workers find
him a pleasant person to work with, and this attitude
contributes greatly to the success of Mr. Smith's team.

My recommendation is to continue to promote John Smith
to higher levels of management, perhaps on a schedule
as rapid as to see him in a Marketing Vice-President by
this time next year.

Bill Jones,
Corporate Personnel and Planning
MegaLith Corp.

history return

Salary Schedule:

1972-1974	$25,000 per annum
1975-1977	$35,000 per annum
1978-1981	$42,500 per annum with bonuses of $5,000
1981-1985	$53,000 per annum with bonuses of $11,300
1986-present	$62,500 per annum with bonuses of $14,000 and additional company stock of 500 shares

TAG

FIRE

B

intro
personal
personal
continue
s1
evals
talents
education
review1
talents
projects
review2
review3
projects
recommend
patents
s2
patents
salary   back
future   history
return
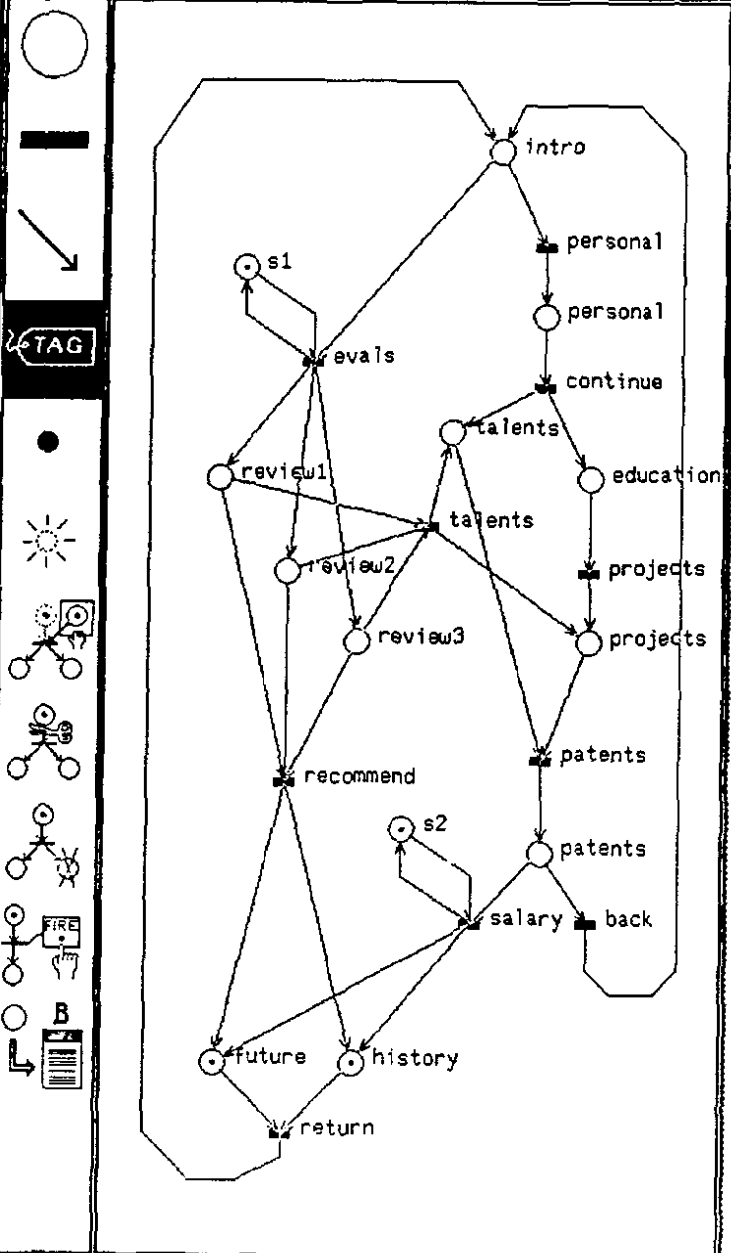
ILEX

Dynamic hypertext system that generates both nodes and links at run-time

- Text generation from structured knowledge
- Hypertext is history-aware

O'Donnell, M. et al (2001) *ILEX: An Architecture for a dynamic hypertext generation system*. Journal of Natural Language Engineering, 7(3), pp.225-250.
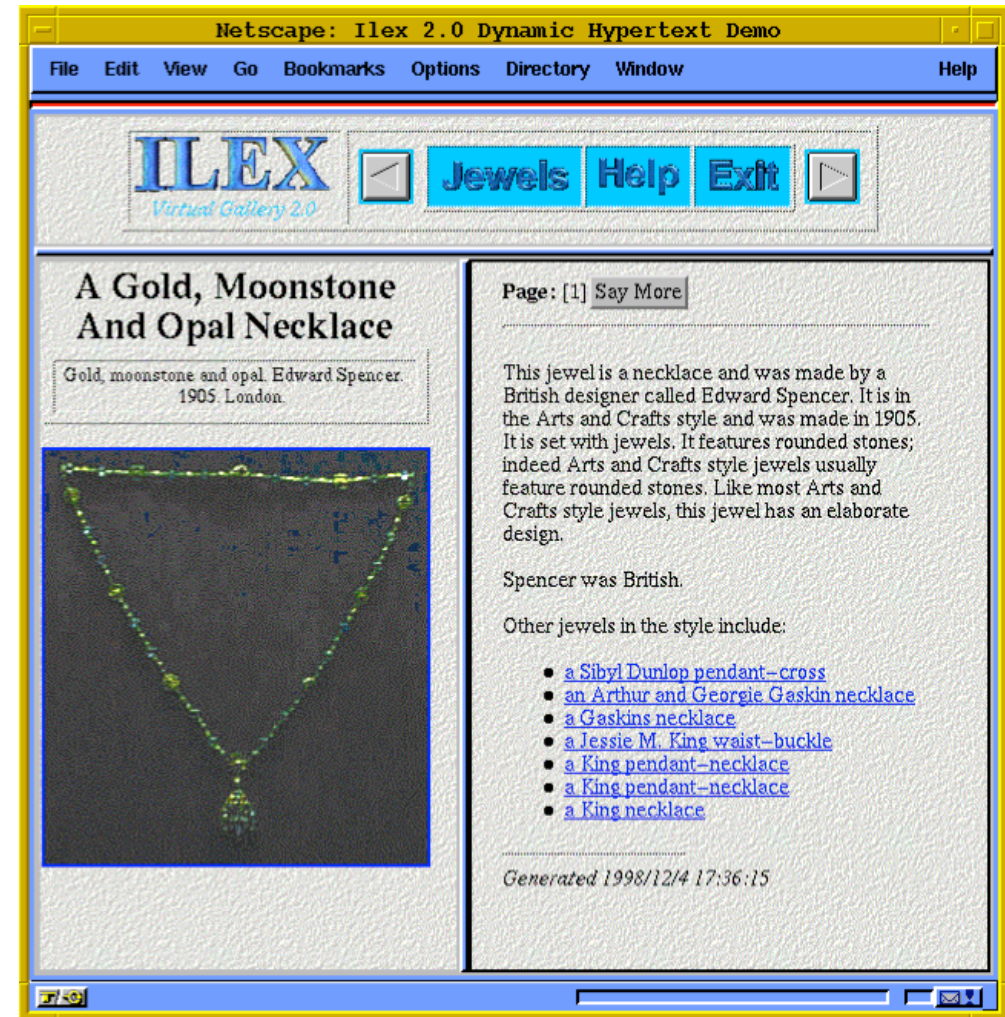
PageRank

Algorithm used by Google to rank search results

- Calculation performed over hypertext structure
- Pages 'vote' for each other by linking to each other
- Votes by highly-ranked pages are valued more highly than those by low-ranked pages
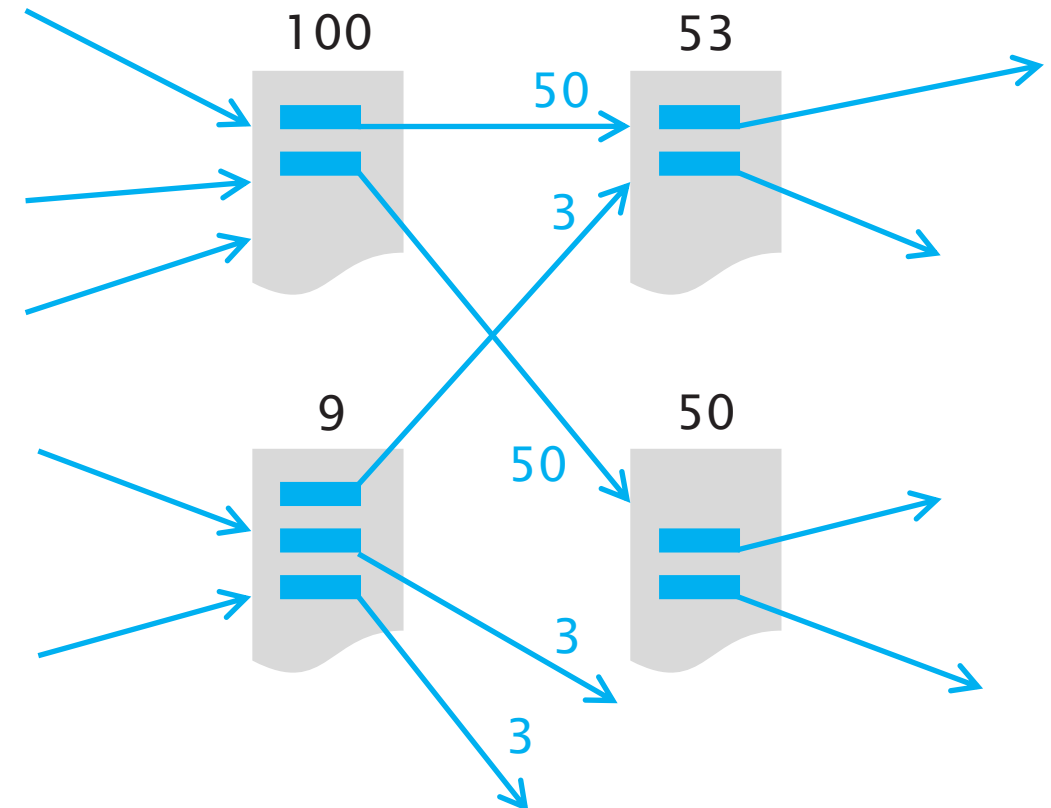
Brin, S. and Page, L. (1998). *The anatomy of a large-scale hypertextual Web search engine*. Computer Networks and ISDN Systems, 30, pp. 107–117.

Conceptual Hypermedia

Origins: typed links

Early hypertext systems allowed links to be "typed"

- Links have meaning (semantics)
- We understand what we get by following a link

We may be able to infer further information

- If the semantics are well defined, then maybe a machine can infer information too

Conklin, J. and Begeman, M.L. (1988) *gIBIS: A Hypertext Tool for Exploratory Policy Discussion*. Proceedings of the 1988 ACM Conference on Computer-Supported Cooperative Work, pp. 140-152.
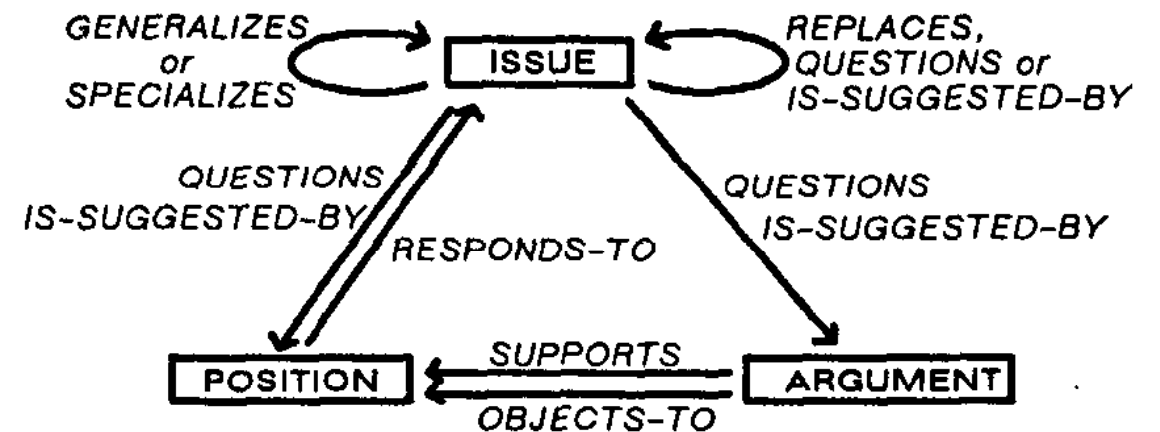
What is Conceptual Hypermedia?

Conceptual Hypermedia = Hypermedia + Ontologies

"An ontology is a specification of a conceptualisation"
- Specification: A formal description
- Conceptualisation: The objects, concepts, and other entities that are assumed to exist in some area of interest and the relationships that hold among them

Ontologies as engineered artifacts:
- A specific vocabulary used to describe a certain reality, plus
- A set of explicit assumptions regarding the intended meaning of the vocabulary

Gruber, T.R. (1993) *A translation approach to portable ontologies*. Knowledge Acquisition, 5(2), pp. 199-220.

What is Conceptual Hypermedia?

Hypertext is the study of what can be said using computer media, databases and links
- Computer-mediated extensions to familiar textual communication

Things that exist have complex relationships with each other
- Complex structures are required for expressing and exploring these relationships
- Ontologies formalise these complex structures

Conceptual Hypermedia is the kind of hypertext whose structure and links are derived from the relationships between objects in the real world
- Hypertext with an underlying ontological model

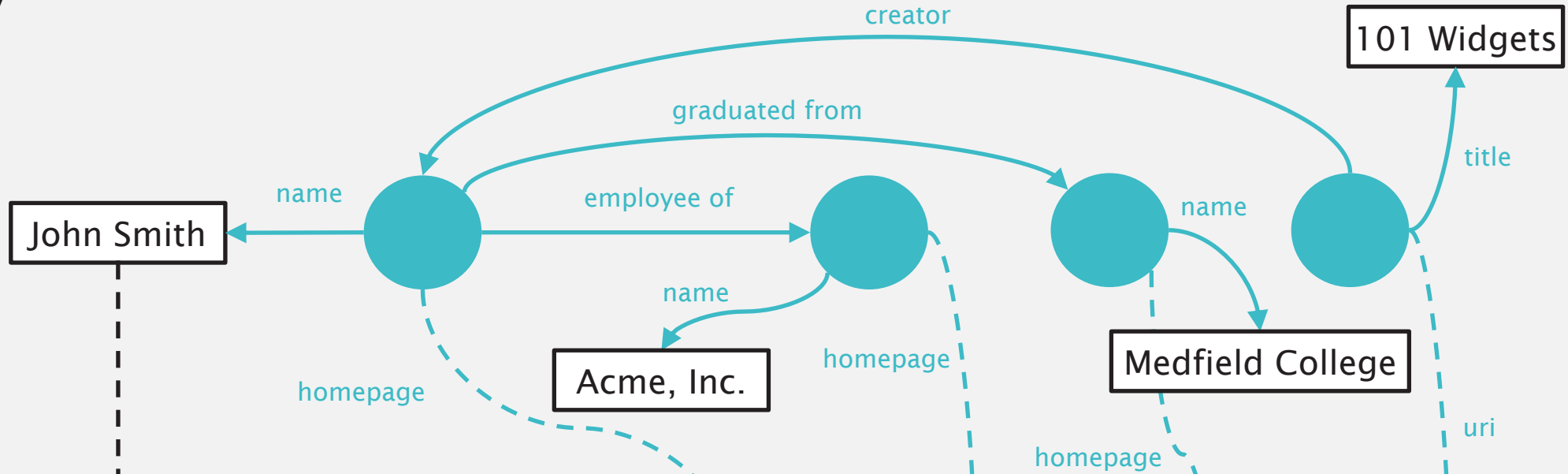# Conceptual Open Hypermedia

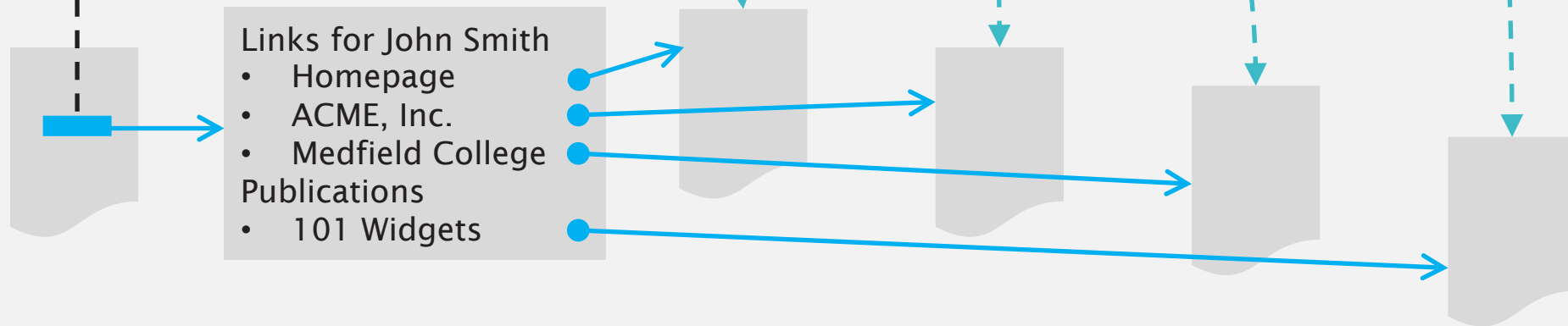Hypermedia links can be viewed as navigable ontology relationships

Ontology used to improve linking
- Concepts used to disambiguate word sense of candidate link endpoints
- Links derived from ontology relations

Carr, L. et al (2001) *Conceptual Linking: Ontology-based Open Hypermedia*. Proceedings of the 10th International Conference on World Wide Web, pp. 334-342.

File   Edit   View   Search   Go   Bookmarks   Tasks   Help   Debug   QA

Back   Forward   Reload   Stop   http://potato.cs.man.ac.uk/cohse/diving.html   Search   Print

Home   Bookmarks   COHSE demo page   OS Control   OntologyService   Aircraft Carriers

Sidebar   Tabs   X

▶ What's Related

▶ Search

▶ Tinderbox: SeaMonkey

▶ Tinderbox: SeaMonkey-Ports

▶ Bookmarks

▶ History

▼ COHSE DLS

Settings   ▶ On

Ready...

Link Status
Added 0 (from 0) generic links
Added 0 (from 0) annotation links
No links were suppressed

Version 1.0 Build 115

▶ COHSE Concept Annotator

Scuba Diving

When scuba diving, one must have the correct equipment, for example some kind of wet suit to ensure that you don't get cold. Alternative protective garments are a dry suit (for cold water diving) and skin suits which help to avoid you getting scratched or bitten by marine animals. There are other things that you should have too, including a timing device and an alternate air source.

Make sure you also have a regulator (with octopus) and stab jacket. Using a computer is a good way of avoiding the bends. Of course, one still has to be conscious of things like your air consumption and ascent rate, or you still might end up in trouble. And remember -- you'll be cold without a wet suit!

Walking

You are almost guaranteed to see sheep when you're out on the hills in the UK. Sheep provide us with many useful products. You are almost guaranteed not to see an elephant or a hungry lion in an English field though (unless you happen to walk past a safari park in which case you may well see all manner of flora and fauna from both the carnivore and herbivore families). Your chances of encountering a cow are relatively high. Your chances of seeing a mad cow, however are pretty slim as they've all been shot.

Document: Done (0.13 secs)

Pervasive Hypermedia

Pervasive Computing

HCI vision in which computers are integrated into everyday activities

- "Machines that fit the human environment"
- Computers in everything

What about links in everything?

Weiser, M. (1991) *The Computer for the 21st Century*. Scientific American, September pp. 94-104

Interactive Spaces

Embedding interactive media in physical environments

Halloran, J. et al (2006) The Literacy Fieldtrip: Using Ubicomp to Support Children's Creative Writing. Proceedings of the 5th International Conference for Interaction Design and Children, pp. 17-24.
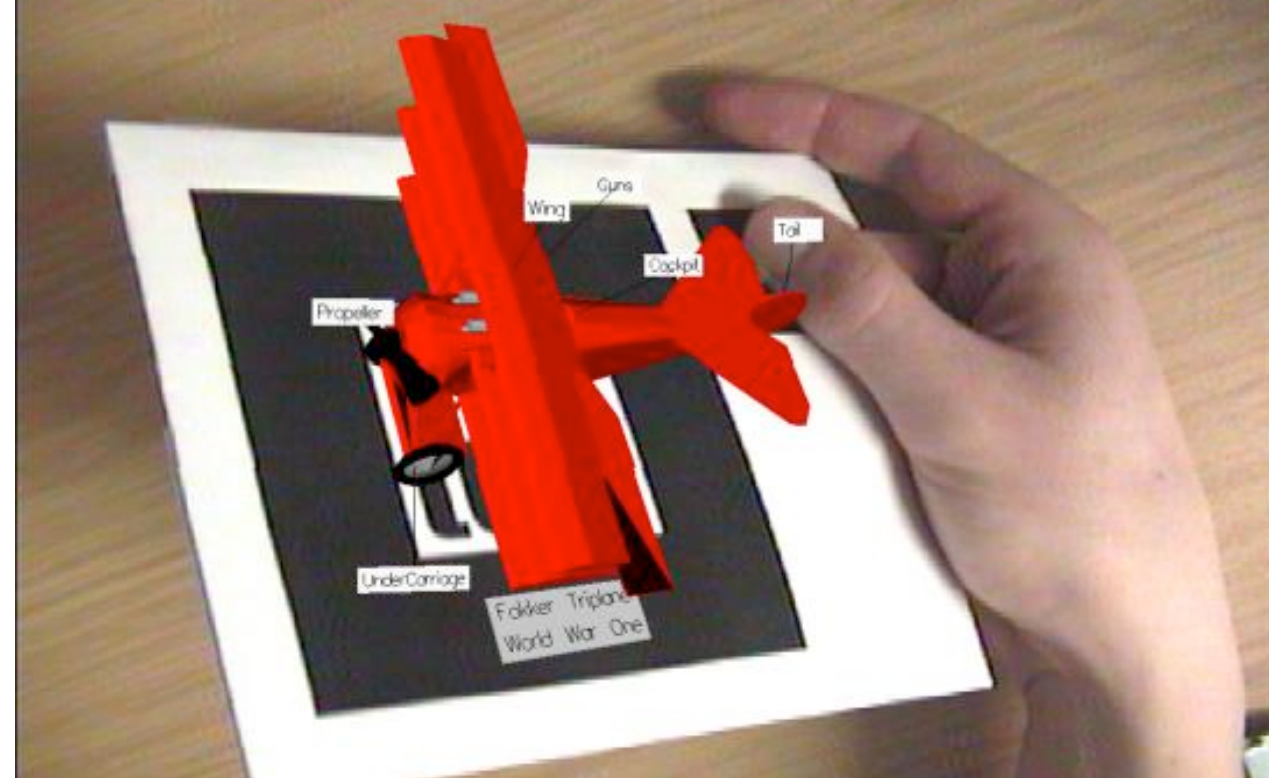
Augmented Reality

Overlaying computer-generated imagery on the real world

- Annotate live video with links

Fifteen years ago, a research curiosity...

Sinclair, P. et al (2003) Augmented reality as an interface to adaptive hypermedia systems. New Review of Hypermedia and Multimedia, 9(1), pp. 117-136.

Augmented Reality

…today, a commonplace reality

- Smartphones with cameras and location/position sensors
- Conventions for embedding links in/on physical objects
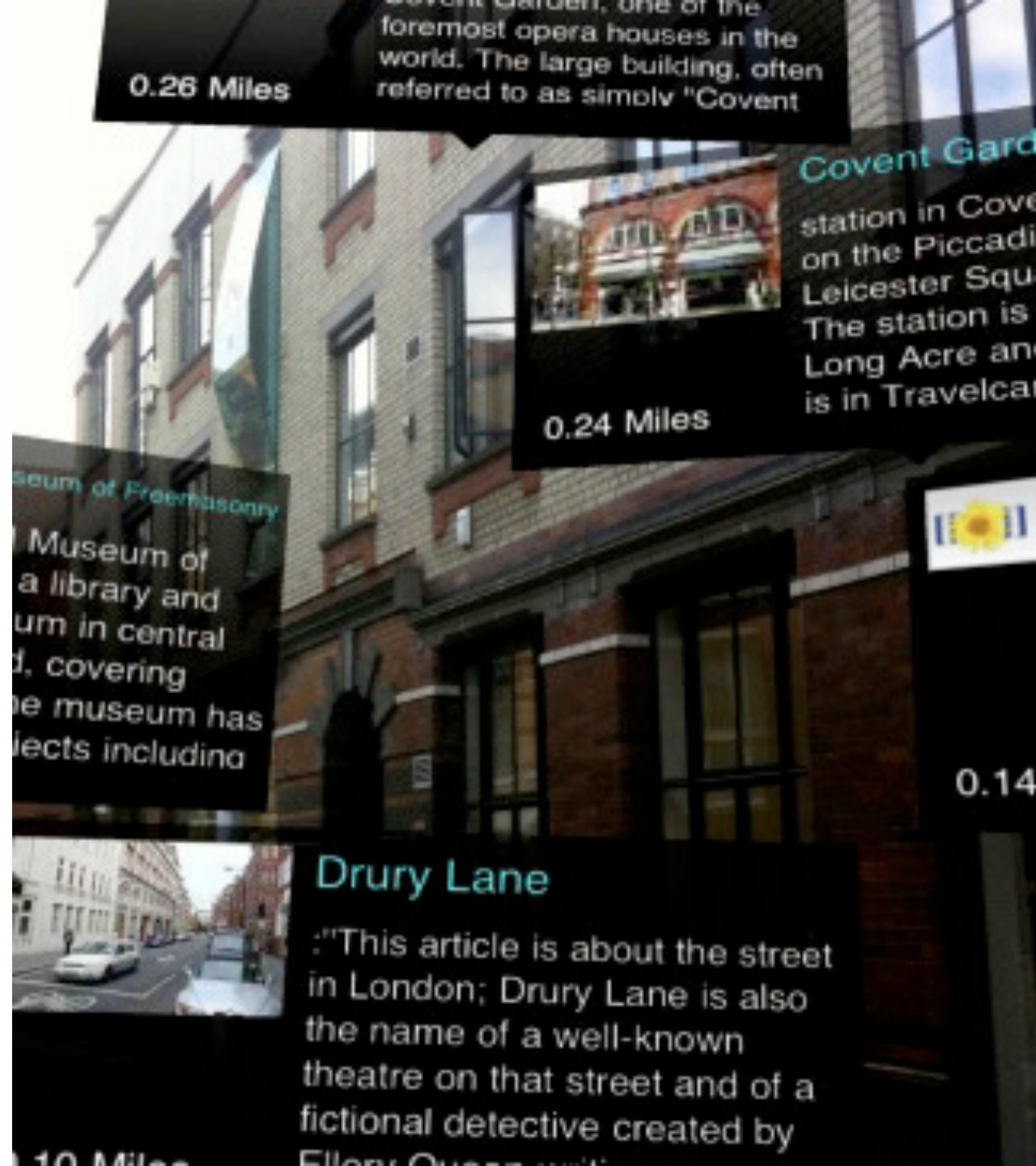
StoryPlaces

Sculptural hypertext system for location-based narratives

Card constraints based on:
- Location
- Environmental factors
  (time, weather, etc)

Try it out - http://storyplaces.soton.ac.uk

Hargood, C., Hunt, V., Weal, M. and Millard, D. (2016) Patterns of sculptural hypertext in location based narratives. Proceedings of the 27th ACM Conference on Hypertext and Social Media.
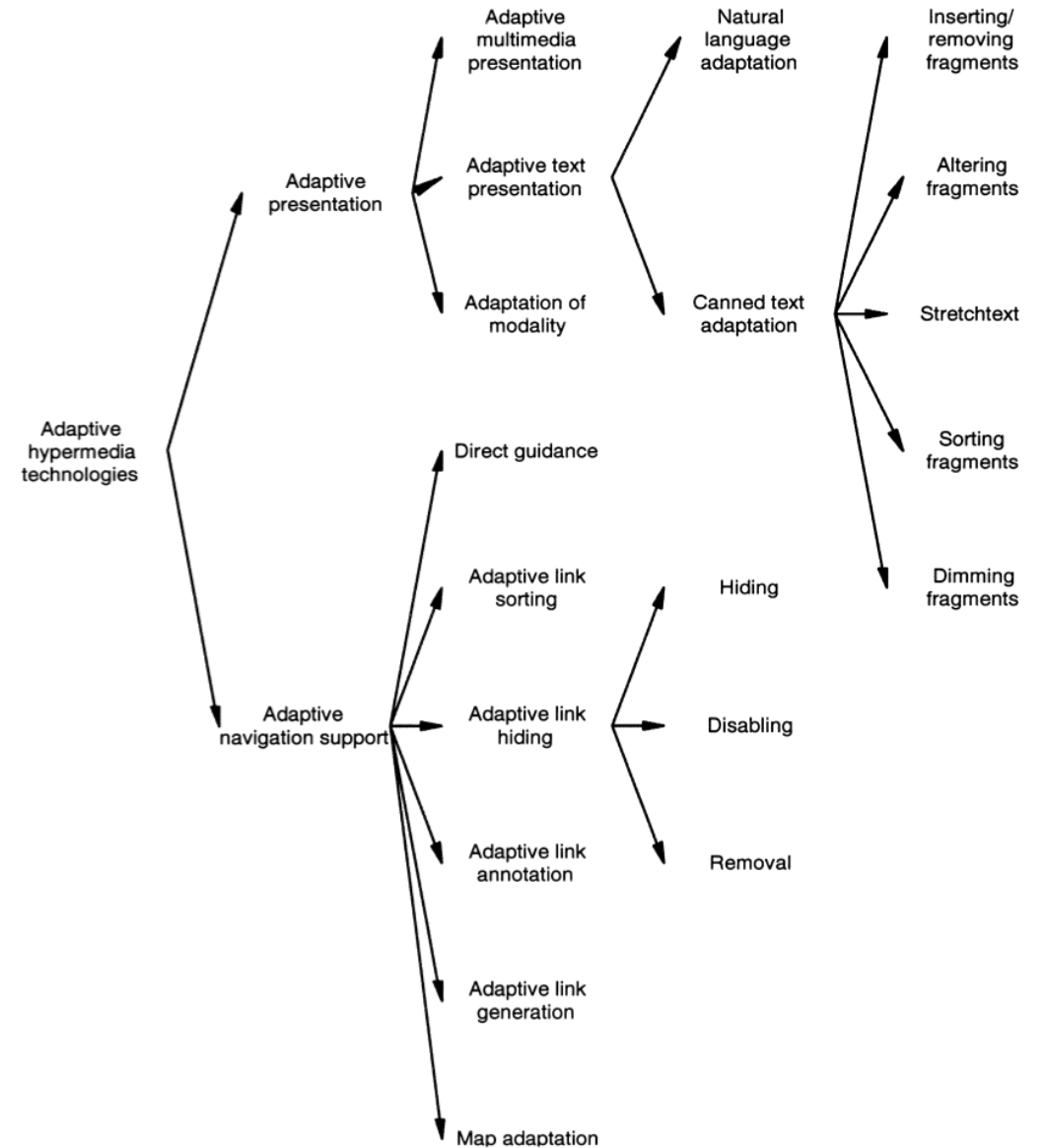
Adaptive Hypermedia

Adaptive Hypermedia

Hypertext systems which adapt:
- Links
- Nodes (content)
- Presentation of links or nodes

Adaptation based on some user model (static or dynamic)

Brusilovsky, P. (2001) Adaptive Hypermedia. User Modeling and User-Adapted Interaction, 11, pp.87-100.

Intelligent Tutoring Systems

Adaptive hypermedia often based on ideas of "intelligent tutoring systems"

(see also: programmed instruction)

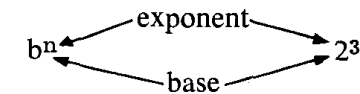Limited uptake due to difficulty/cost of authoring (for both AH and ITS)

We have defined the symbol b^n as meaning "the product reached by using the number b as a factor n times." Thus, for example

$$2^3 = 2 \text{ x } 2 \text{ x } 2 = 8$$
$$3^3 = 3 \text{ x } 3 = 9$$
$$b^2 = b \text{ x } b$$

We have also learned that in an expression of the form b^n, the number b is called the base and the number n is called the exponent.

exponent
b^n 2^3
base

Finally, we have seen that a number expression such as 2^3 is called "the 3rd power of 2" or "2 raised to the 3rd power," and so on. Now, here is a question on this review material. Pick an answer and turn to the page number given after the answer you choose. The question is: If the base of an expression is 2, and the exponent is 3, what is the expression equal to?

Answer	Page
8	5
9	9
I have no idea	13

Adaptive Navigation

- Direct guidance (where should the reader go next?)
- Link sorting (in order of value to the reader)
- Link hiding (don't show links that aren't relevant to the reader)
- Link annotation (tell the reader about the links)
- Link generation (make new links for the reader)

Adaptive Presentation

- Stretchtext (text can be expanded or summarised using predetermined fragments)
- Natural language adaptation (generated text)
- Adaptive modality (video to audio, audio to text, etc)

Summary

Hypertext links aren't necessarily explicit, static and textual

- They may be derived from underlying relationships: spatial, conceptual, temporal
- They may be computed on the fly
- They may change depending on who is looking at them, or what they're trying to do
- They may point to physical objects, or be embedded in physical contexts

Next Lecture: Telling Tales