

**A Methodology
for
Hypertext Design:
a Case Study**

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**Structures and Contingencies in
Computerized Historical Research**

*IX International Conference of the
Association for History & Computing*

*August 30-September 2 1994
University of Nijmegen
The Netherlands*



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- **a definition**
- **the links**
- **pros and cons**
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p **A design methodology**

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p **Demeter**

- **design**
- **conceptual model**
- **user interface**
- **visiting the hypertext**
- **navigation tools**

p **Conclusion**

What is a hypertext?

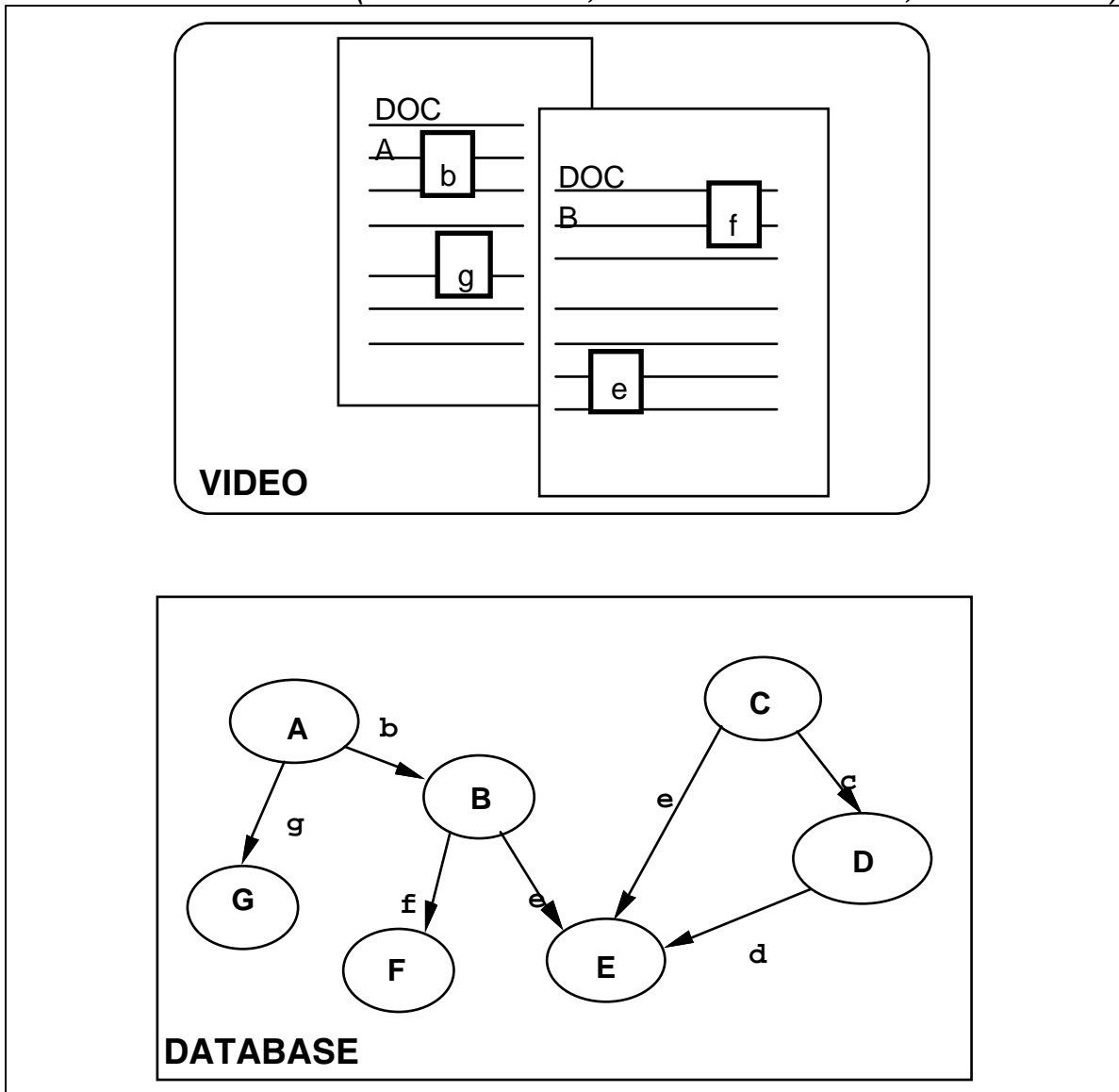
Hypertext is non-sequential writing: a directed graph, where each node contains some amount of text or other information.

The nodes are connected by directed links.

In most hypertext systems, a node may have several out-going links, each of them is then associated with some smaller part of the node, called an anchor.

When users activate an anchor, they follow the associated link to its destination node, thus navigating the hypertext network.

(Jacob Nielsen, CACM Vol. 33 N. 3, March 1990)



Hypertext is ...

- p **Nodes**
(atoms of information: text, sound, movies, images, ...)

...and ...

- p **Links**
- **the “essence” of the hypertext**
(enrichment of the knowledge, user’s interests stimulation)
 - **implement various types of connections among the nodes**
 - **two fundamental classes:**
 - *extensional (explicitly stored)*
 - *intensional (deduced from the context)*

Nothing more
...and...
much more

The original idea

p **A personal instrument to manage the information relevant to the specific interests of a single researcher.**

p **The “memex” of Vannevar Bush:**

A device in which an individual stores his books, records, communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.

p **Some obvious consequences:**

- the associative mechanism is the most important
- the user has a complete knowledge of the semantic domain and of the associations existing among the nodes

p **Each node can be associated to many other nodes for many different reasons.**

p **A usage note:**

- if you store a book in the bookcase,
“near to other documents related to the same topics”
- are you sure to be able to find it immediately?

Hypertext: pros and cons

p **Hypertext supports computer based links among documents**

p **Pros:**

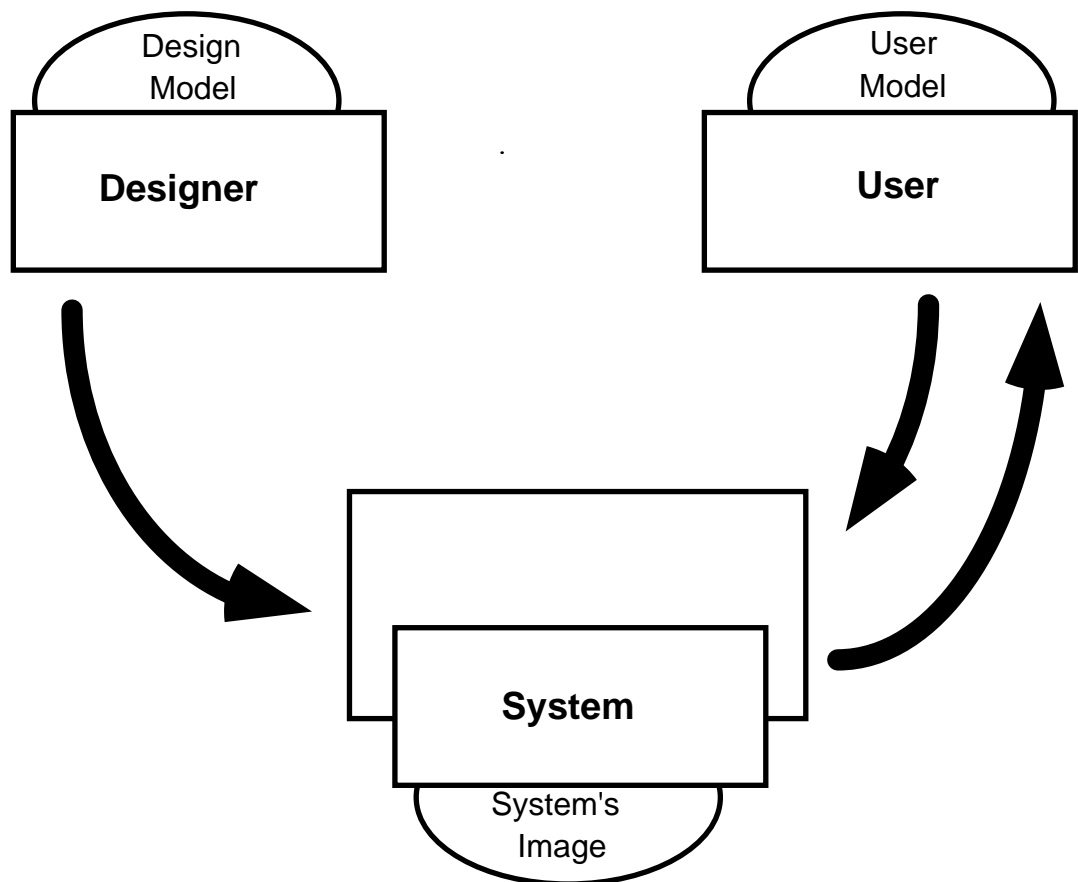
- **Link activation gives immediate access to the relevant information node**
- **Non-linear data organisation**
- **Several mechanisms of access to the data:**
 - *Navigation*
 - *Browser*
 - *Query*

p **Cons:**

- **“Lost in the hyperspace”**
- **Cognitive overhead**
(too many links to follow)
- **The designer’s knowledge is hard-coded in the implemented links**
- **Complexity in the query definition and results’ analysis**

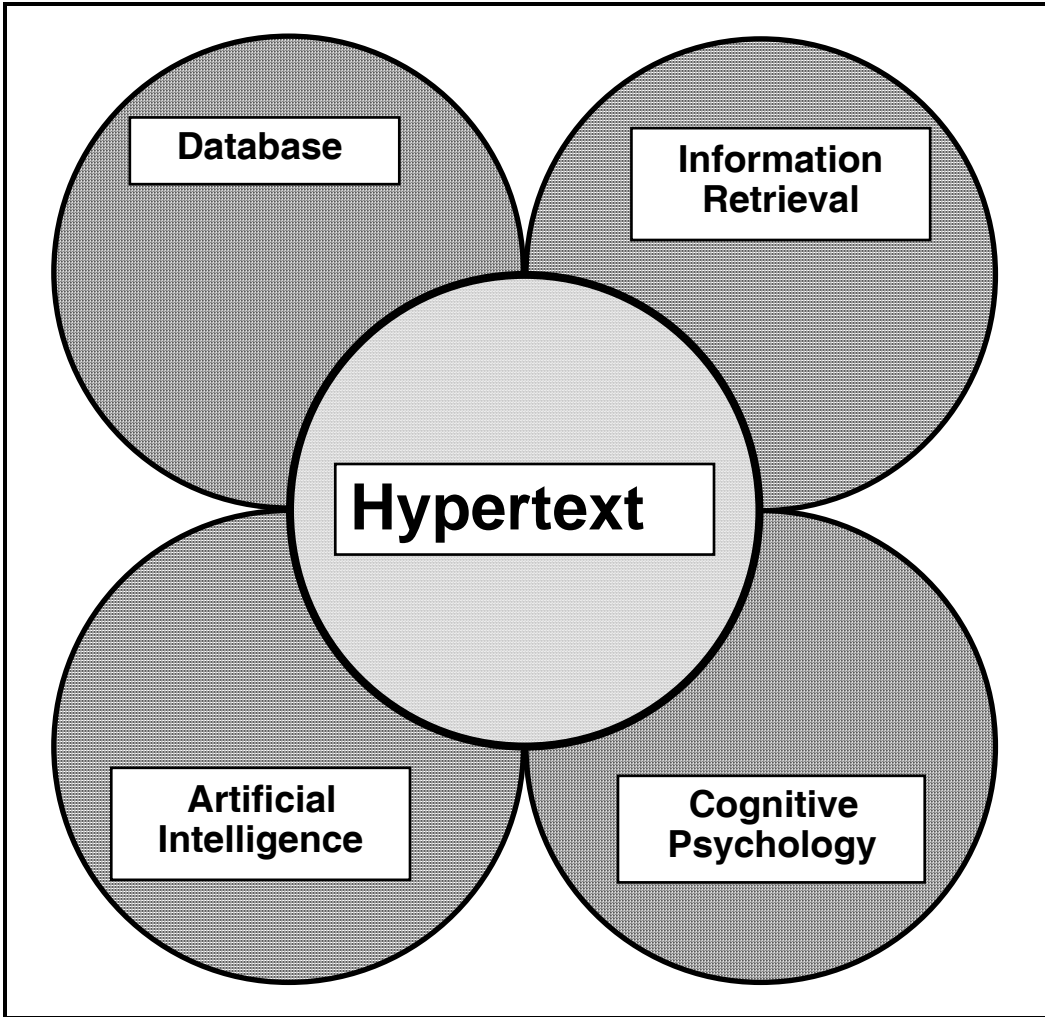
Hypertext: Design Issues

- p Organise the data items
- p Retrieve the relevant information
- p Establish the links
- p “Communicate” with the user



Are user's and designer's models identical?

Hypertext: the underlying areas



Database technology - *Data Modelling*

Information Retrieval - *Indexing*

Artificial Intelligence - *Connecting data items*

Cognitive Psychology - *User Interface*

Some considerations

p **No purely sequential visit**

p **No obliged connections**

p **Interaction paradigms:**

- *multiple*
- *interchangeable*

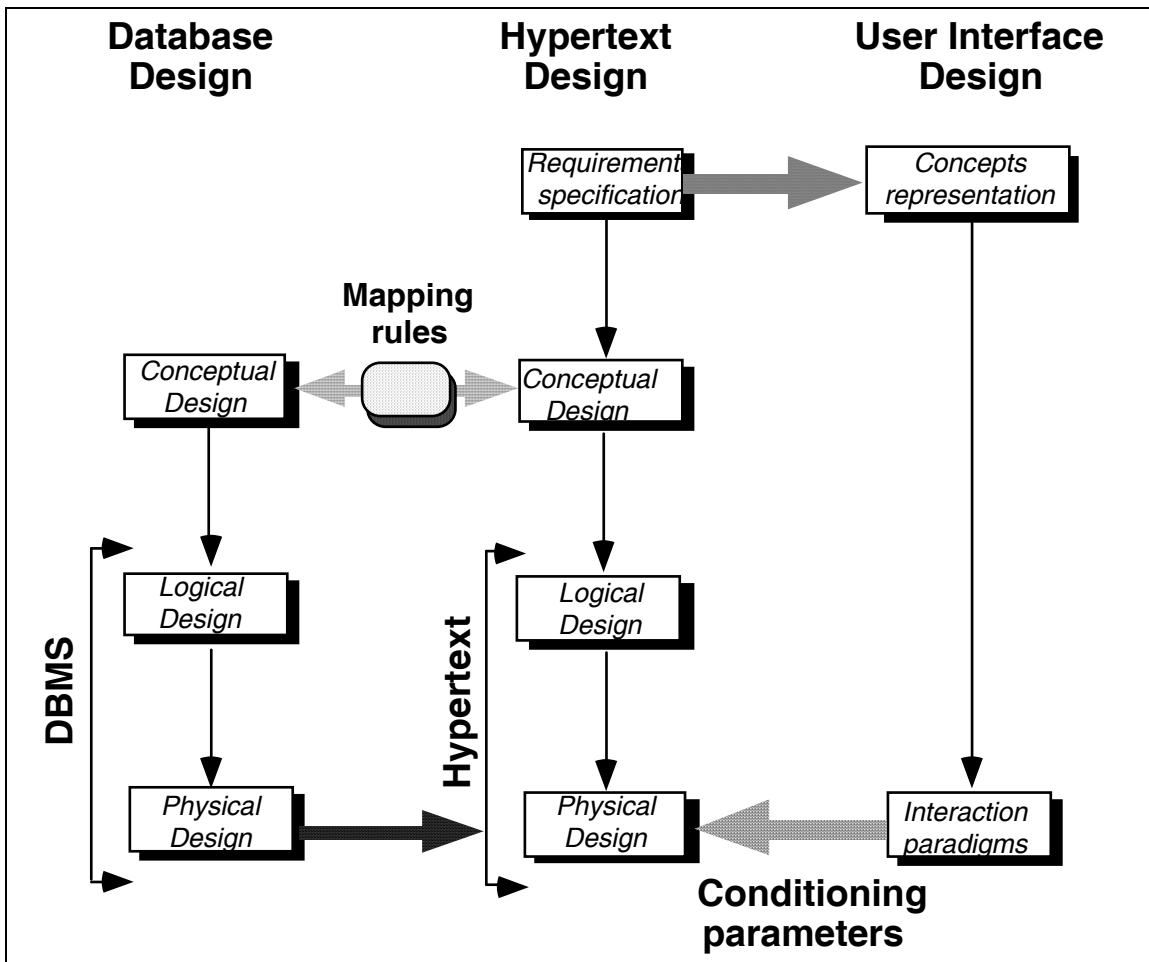
p **Links:**

- *different types*
- *visualisation*
- *dynamic*

Hypertext Design Methodology: the architecture

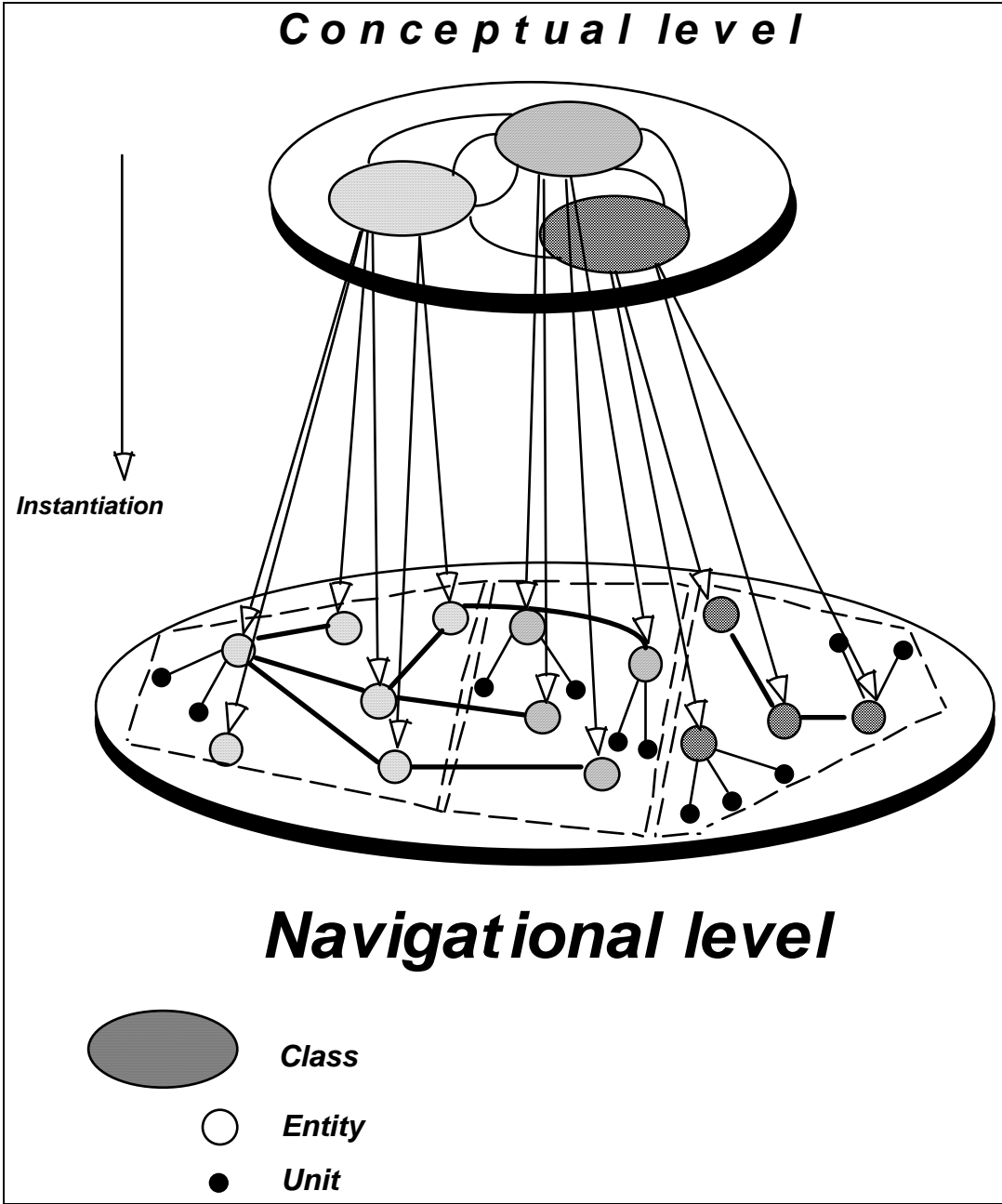
p An integrated methodological approach to the design of:

- hypertext (nodes and links)
- database
- user interface



The model

- p **Two levels in the model:**
- Navigational level** - Data & extensional links
 - Conceptual level** - Intensional links

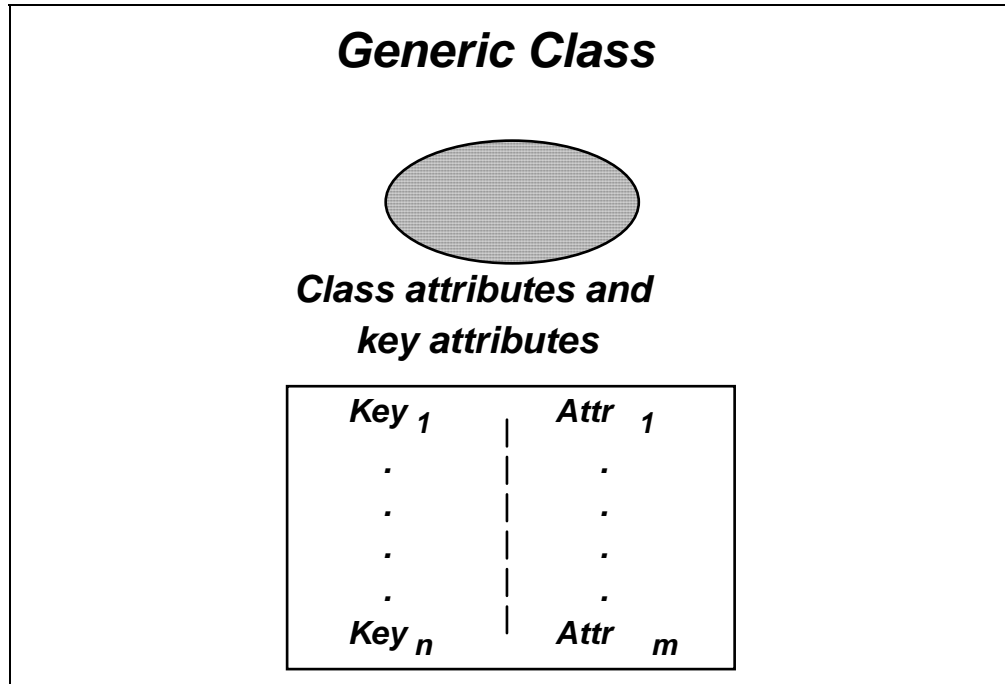


p **The user navigates at both level and from one to another**

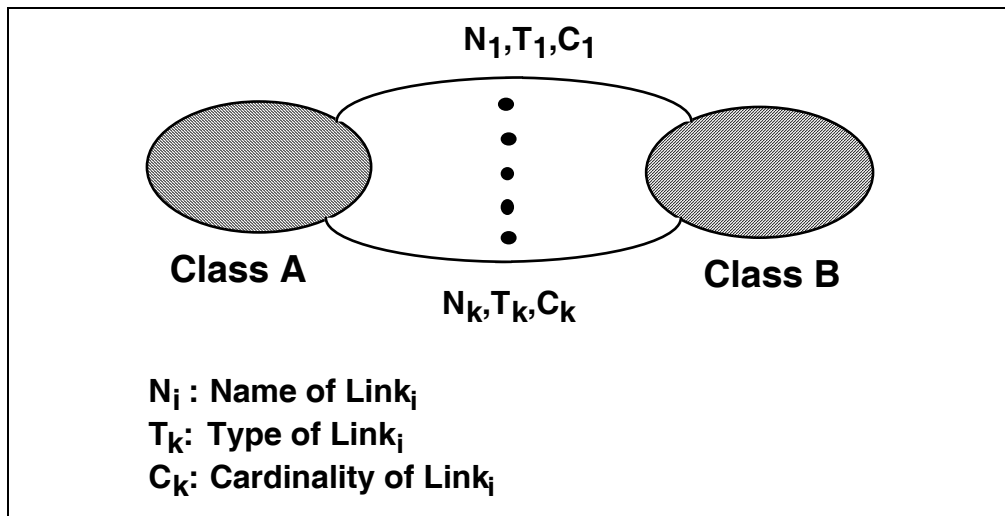
HT Design: the Conceptual level

p **Schema definition:**

- class and its attributes



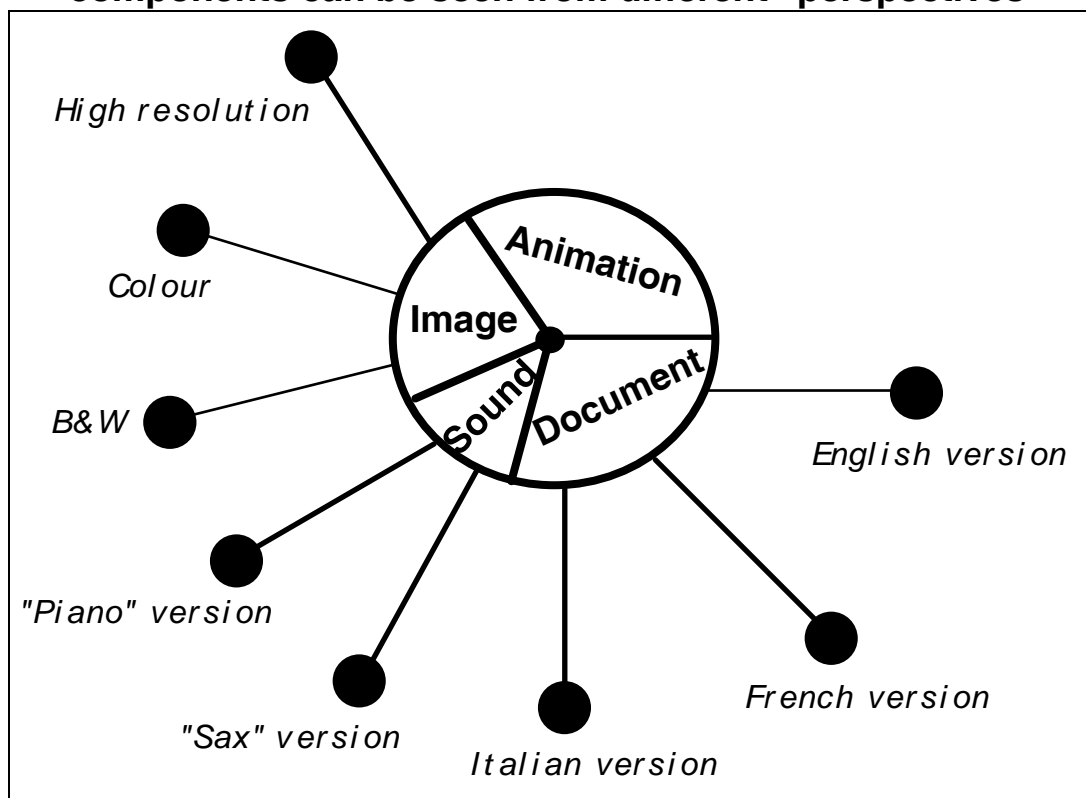
- links



HT Design: the Navigation Level

p Definition of instances

- every entity has several “components”
- components can be seen from different “perspectives”

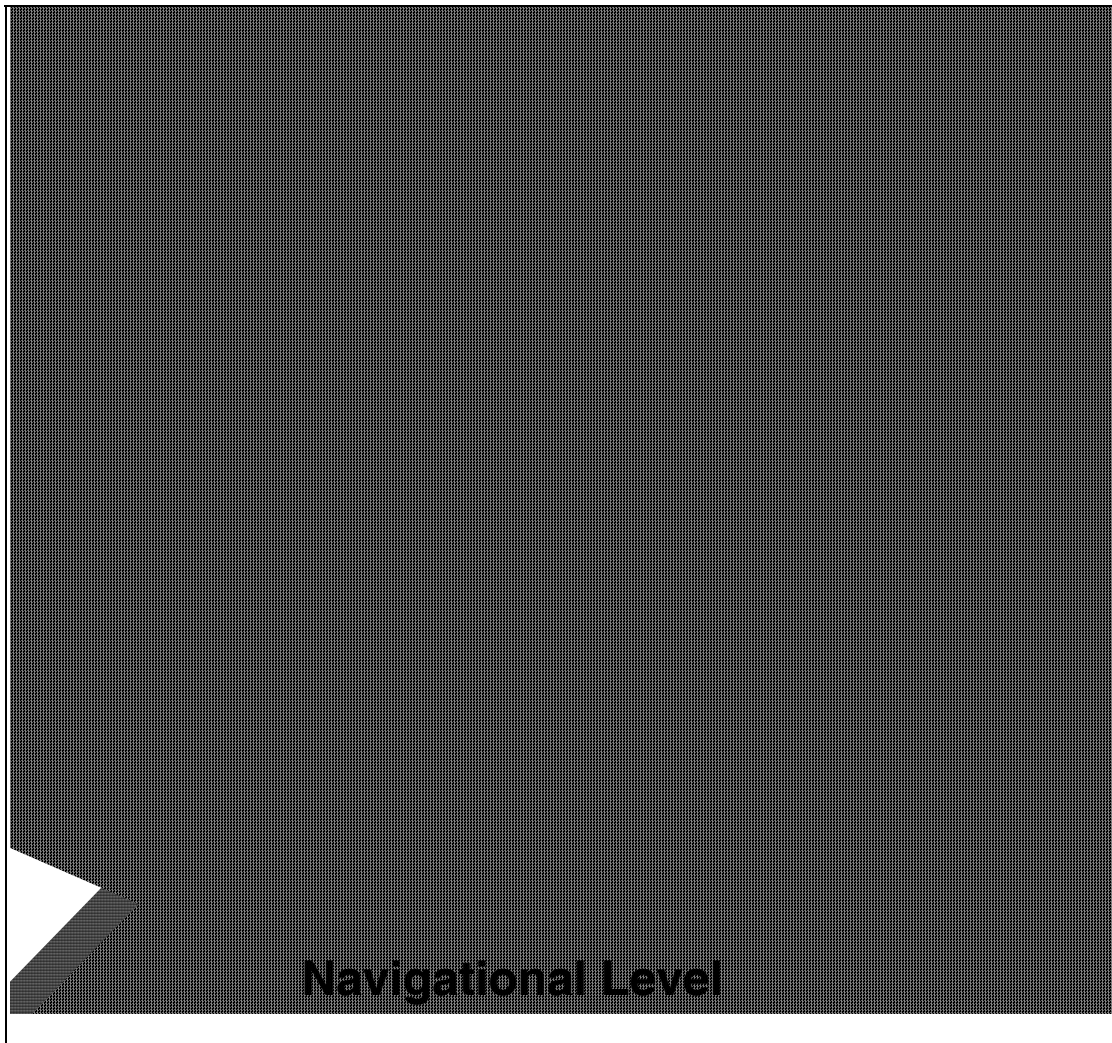


- links towards other nodes

HT Design: a Refinement of the Conceptual Level

p Indexing of free text information

p Representing concepts relationships



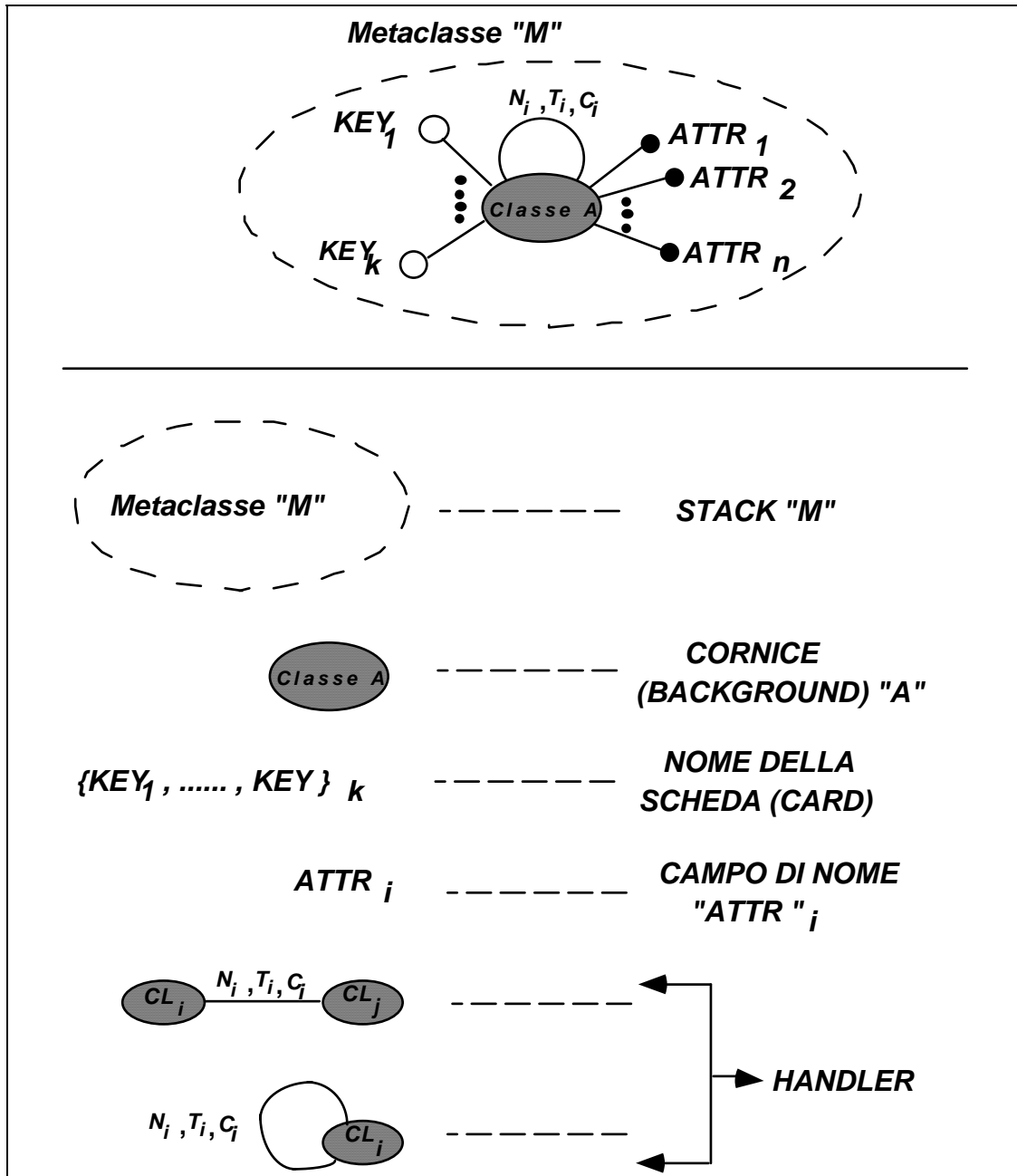
R: set of the representations of the documents of every class

KW: set of Keywords that refer a specific concept that can be attached to a document in "R"

Thesaurus: representation of semantic relationships among the concepts

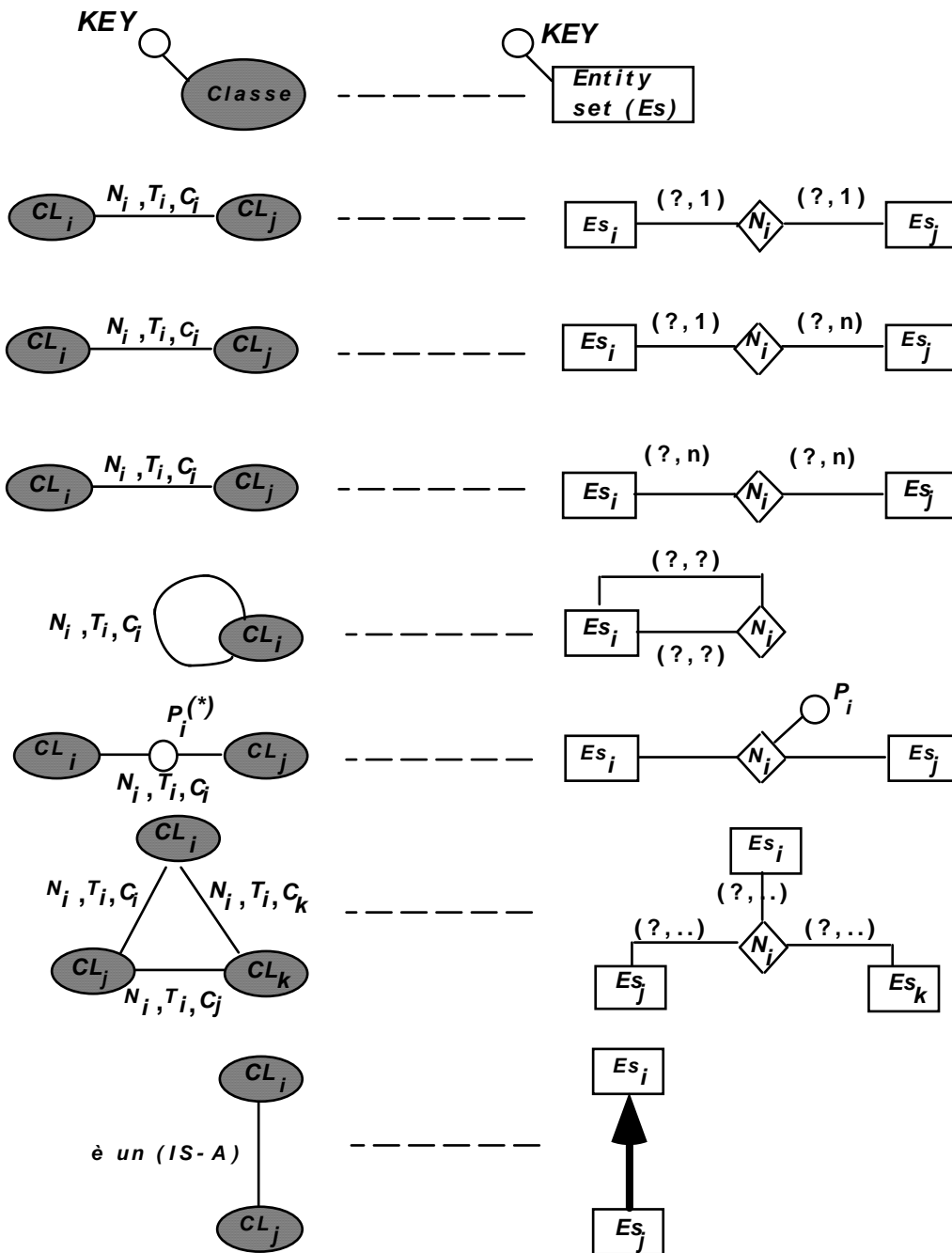
HT logical Design

- p Mapping rules guide the translation from the conceptual schema to the logical HT schema
- p An example using "HyperCard":



ER vs HT

REGOLE DI TRASFORMAZIONE



(*) P_i : Proprietà del legame tra due classi

Demètra (Demeter)

p **A Hypertext for visiting and managing the “Orto Botanico” in Pisa**

- Design
- User interface
- The visiting
- Implementation
- Navigation tools

p **Design**

p **User requirements analysis**

p **The conceptual schema**

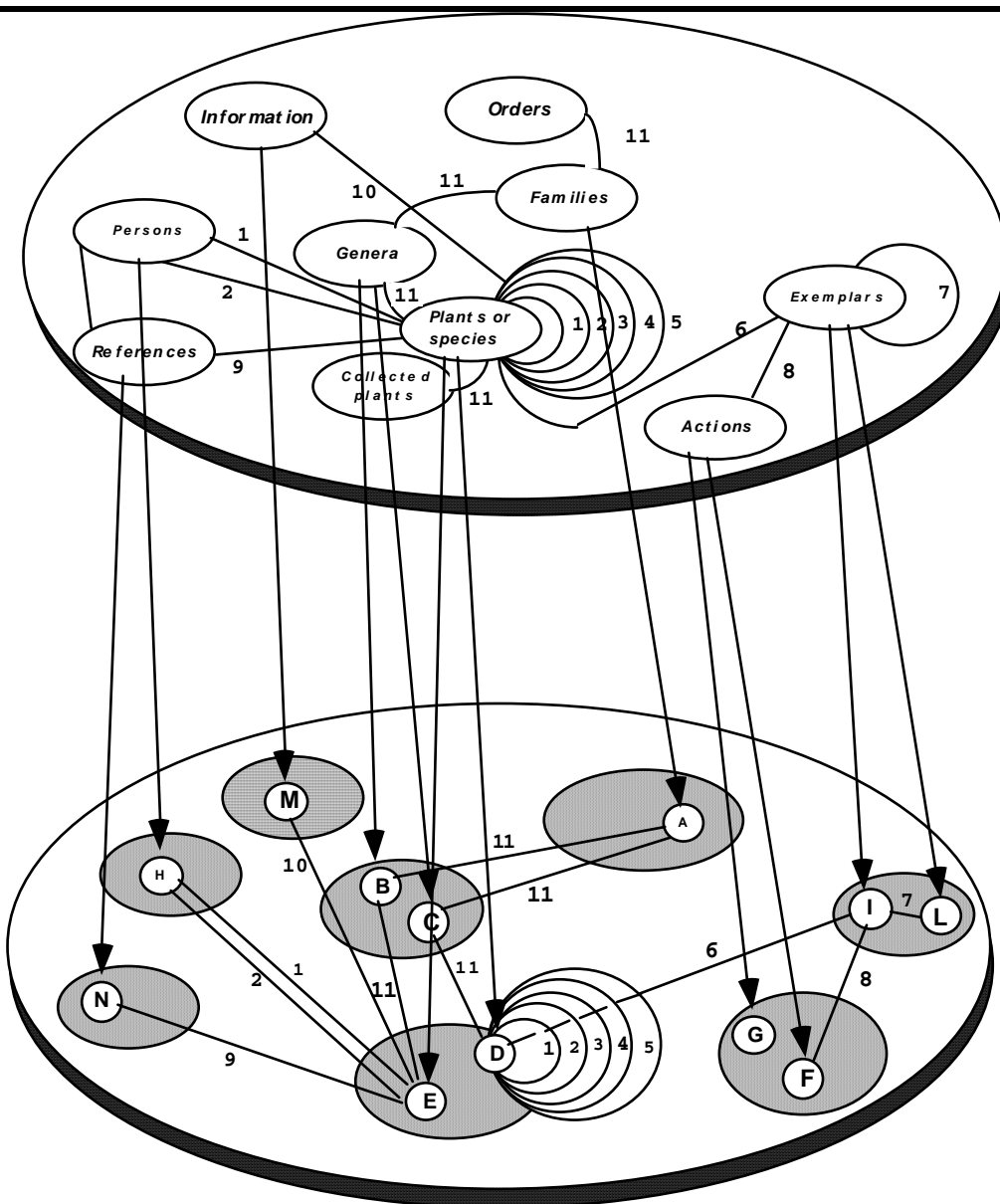
p **The database**

p **The hypertext**

p **The environment**

- **HyperCard**
 - *user interface and hypertext typical features*
- **Butler**
 - *DAL (Database Access Language) multi-user database server*

The conceptual model

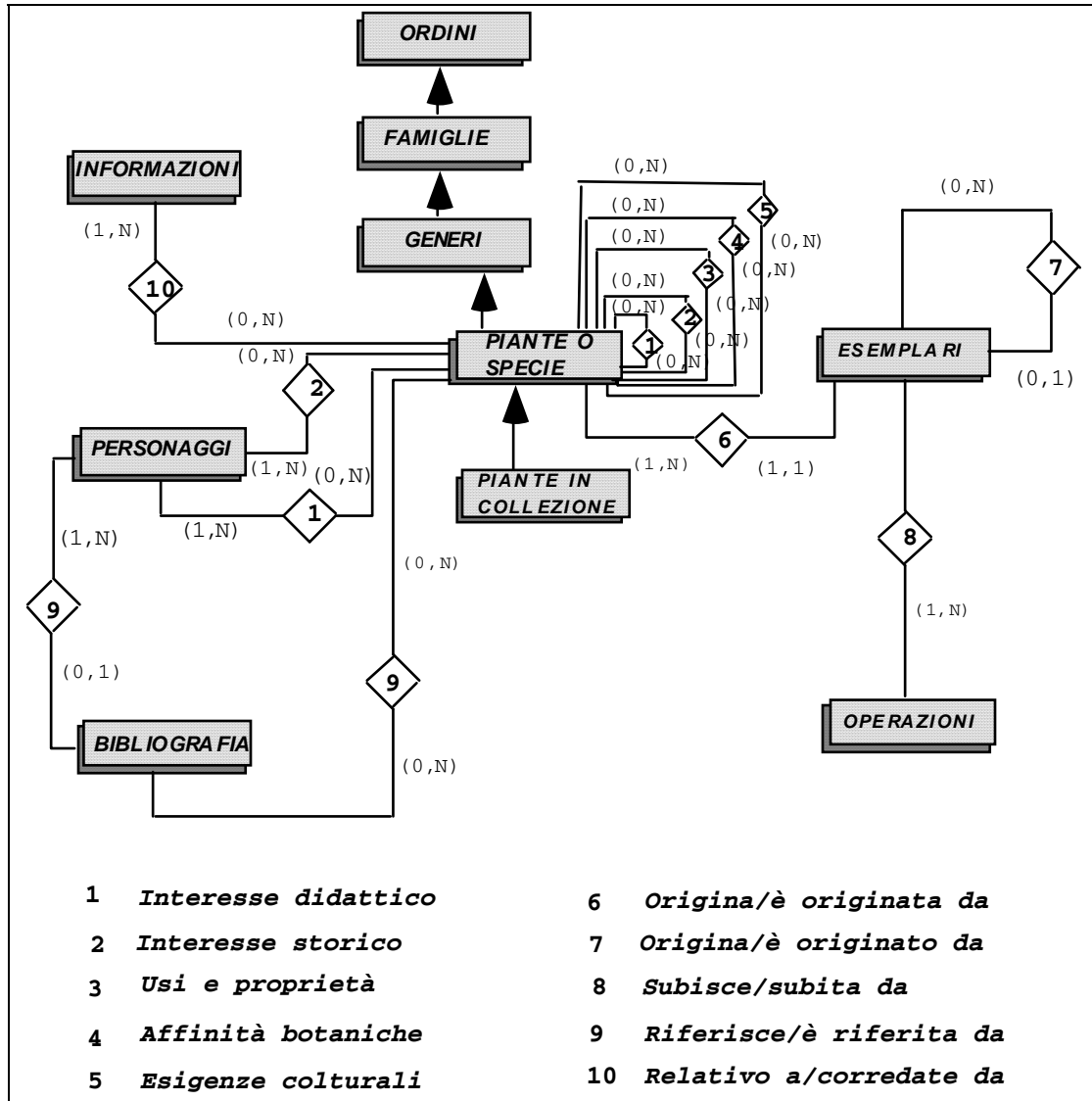


A ROSACEAE	E PYRASTER	I C226/ 90
B PYRUS	F SEEDING	L C115/ 90
C MALUS	G RIPICCHETTATURA	M INF. "i"
D BACCATA	H LINNEO	N [BIBL. "j"]

- | | |
|------------------------------|-----------------------------------|
| 1 <i>Interesse didattico</i> | 6 <i>Produce/è prodotto da</i> |
| 2 <i>Interesse storico</i> | 7 <i>Origina/è originato da</i> |
| 3 <i>Usi e proprietà</i> | 8 <i>Subisce/subita da</i> |
| 4 <i>Affinità botaniche</i> | 9 <i>Riferisce/è riferita da</i> |
| 5 <i>Esigenze culturali</i> | 10 <i>Relativo a/corredate da</i> |
| | 11 <i>È un (Is-A)</i> |

DB & HT Logical Design

p **The Entity-Relationship schema**



- p **HT logical design:**
- application of the mapping rules towards Hypercard

The User Interface: Design Issues

p **Several interaction paradigms**

- **Map**
- **Classification**

p **Colour**

p **Supporting multilingual info**

p **Interactive aspects**

Visiting Demeter

p **Choosing the language**

p **The user profile**

p **The access points:**

- **Choosing the itinerary**
- **Formulating queries**
- **Topographic Browser**
- **Botanic Garden guided tours**

p **Different card types**

p **Navigation tools**

- **Multiple links browser**
- **Classification browser**
- **The map of the links**

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Link Map

p **Local representation of navigation proximity**

p **The distance varies according to the affinity a_{ij} between the node i and the node j :**

$$a_{ij} = \frac{\sum_{h=1..k} Up_h \cdot \sum_{l=1..n_h} w^{hl}_{ij}}{\max_{j=1..d} \left\{ \sum_{h=1..k} Up_h \cdot \sum_{l=1..n_h} w^{hl}_{ij} \right\}}$$

$$d_{ij} = \frac{\alpha}{a_{ij}} + \beta \quad \text{with } \alpha, \beta \text{ constants, and } a_{ij} > 0.$$

p **The map reconfigures itself according to the path followed during the visit and the “user profile”:**

- let (Nv_1, \dots, Nv_k) be the tuple whose components correspond to the number of times a specific link has been followed by the user
- let (Up_1, \dots, Up_k) be the current user profile
- the new updated user profile (Up'_1, \dots, Up'_k) is given by:

$$Up'_i = \frac{\left(Up_i + \frac{Nv_i}{\max_{j=1..k} \{Nv_j\}} \right)}{2}$$

p **Circular topology with two levels**

Conclusion

- p **Very often in the HT implementation:**
 - emphasis on technological aspects (various media)
 - limits on the communication of the information
 - constrained navigation
 - no model for design and implementation

- p **We proposed a methodology that integrates Hypertext, Data Base and User Interface issues**

- p **The distances among the nodes can be dynamically modified according to their affinity value:**
 - the affinity is not statically defined; the user can modify his/her profile based on statistical evaluation of the followed paths

- p ***Demètra* has been taken as a case study for the methodology.**

- p **Many interaction paradigms:**
 - map
 - classification

- **space**
- *the link map for the navigation proximity*