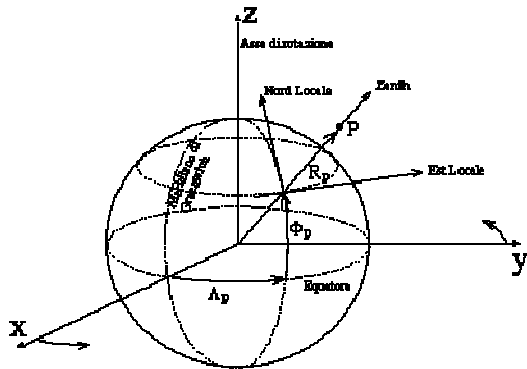


Capitolo 1°  
Richiami di GIS

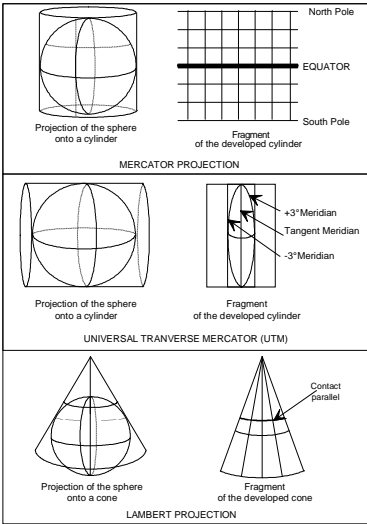
I – Richiami di GIS

- 1.1 – Modellazione degli oggetti a 2D
- 1.2 – Acquisizione dei data geografici
- 1.3 – Query spaziali
- 1.4 – Indicizzazione spaziale
- 1.5 – Richiami di cartografia
- 1.6 – Conclusioni

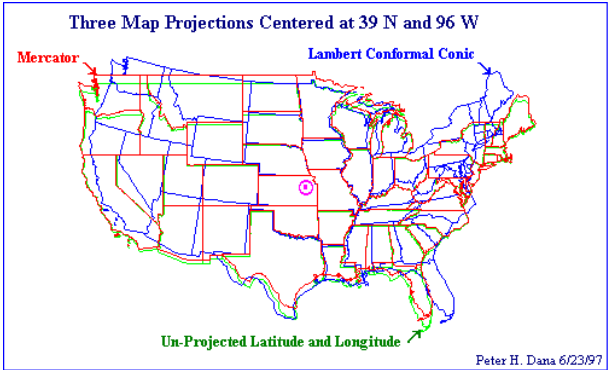
Coordinate



Proiezioni sulla sfera



Proiezioni differenti



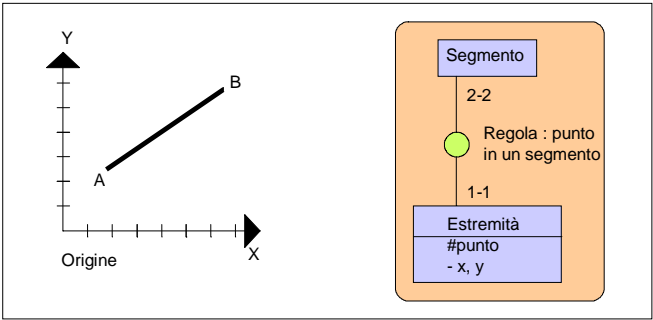
Percorso minimo



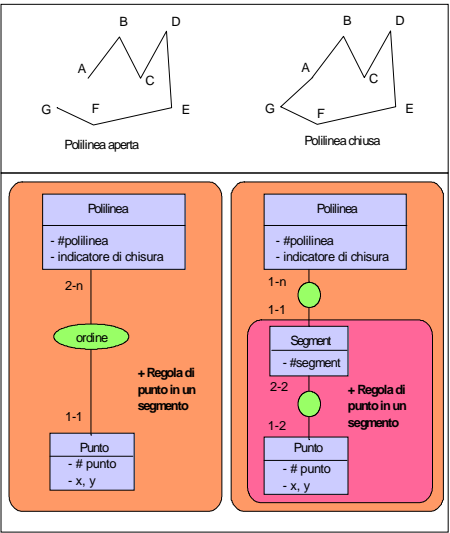
1.1 – Modellazione a 2D

- Linee, polilinee, poligoni, tessellazioni
- Superfici, terreni
- Quadtree
- Reti

Modello di segmento



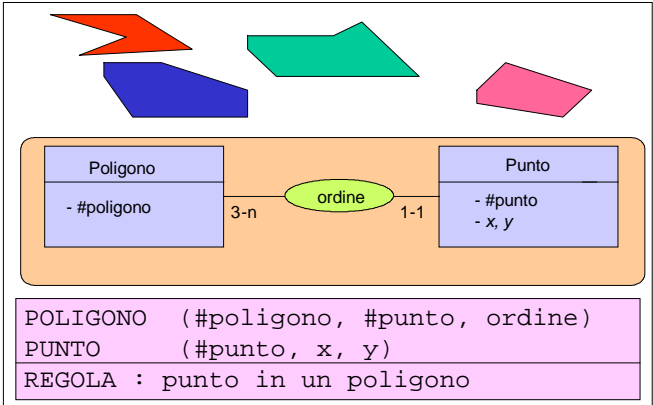
Modelli  
per le  
polilinee



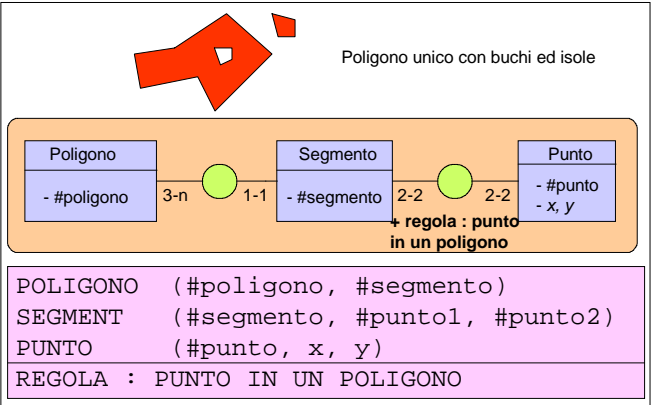
Vari tipi di poligoni

- Poligono semplice isolato
- Poligoni complessi isolati
- Tesselazioni irregolari
- Poligoni con polilinee
- Orientamento dei poligoni in una tessellazione
- Organizzazione gerarchica dei territori

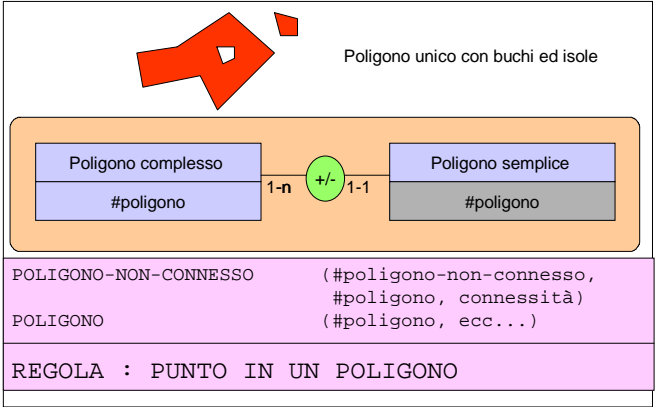
Poligoni isolati



Poligoni isolati complessi  
(non connessi) (segmenti)



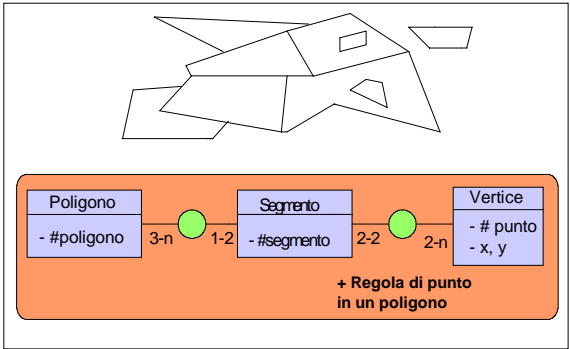
### Poligoni complessi (non connessi) (pezzi)



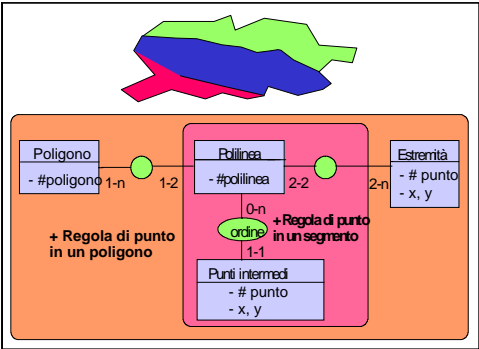
### Orientamento dei poligoni

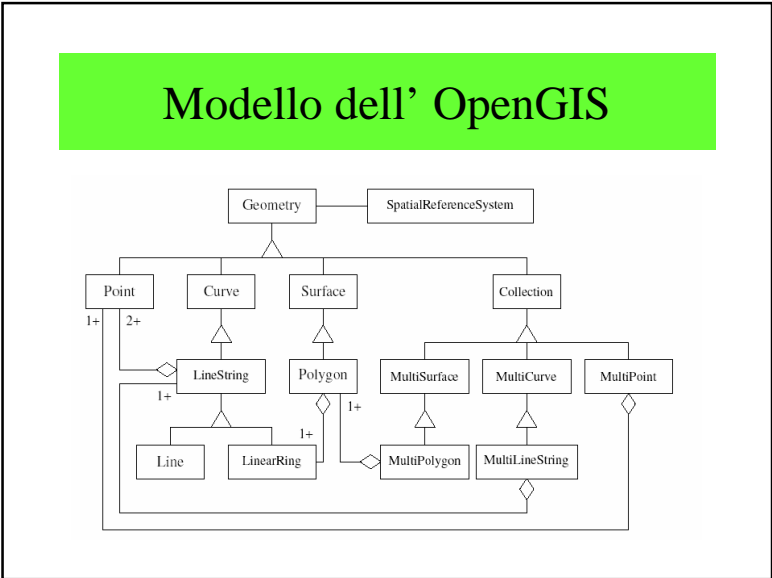
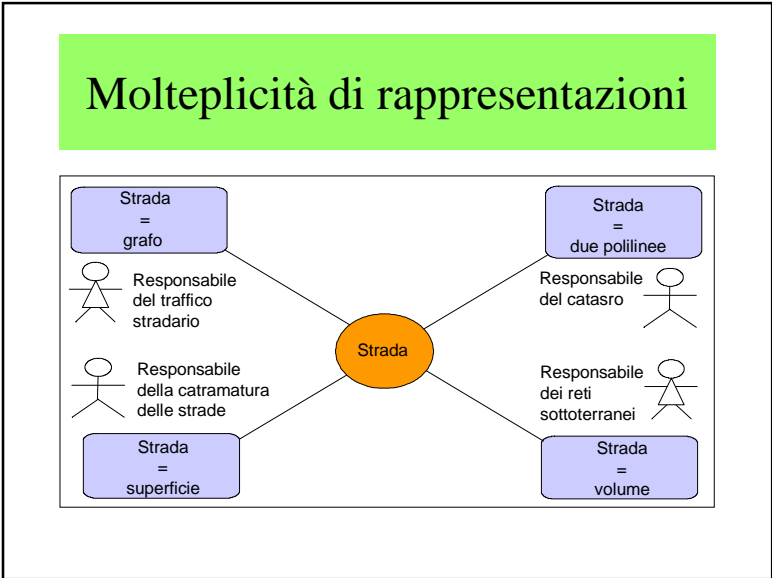
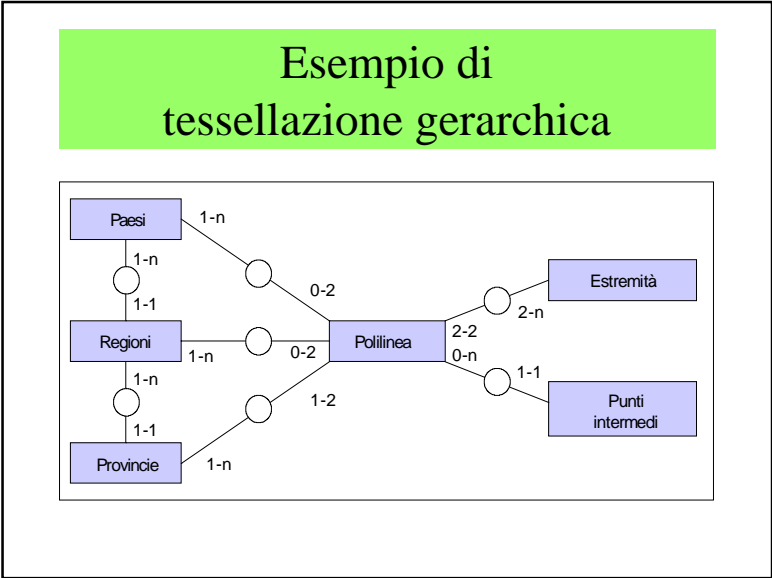
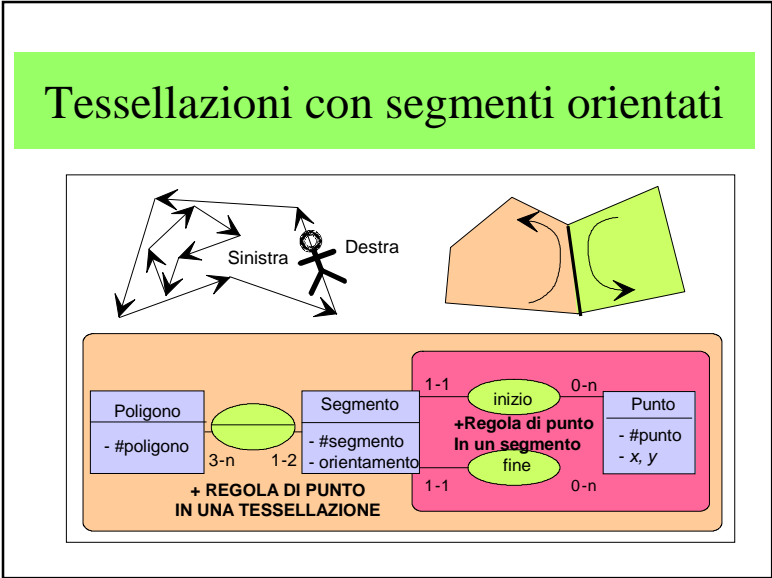
POLIGONO (#poligono, #segmento, #segmento-seguente)  
SEGMENTO (#segmento, #punto1, #punto2)  
PUNTO (#punto, x, y)  
REGOLA : PUNTO IN UN POLIGONO

### Modello di tessellazione poligonale



### Altro modello di tessellazione

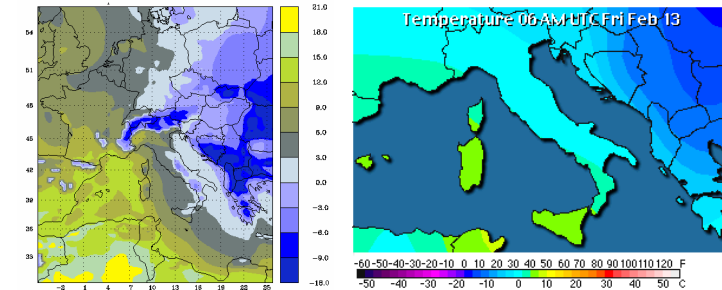




## Fenomeni continui

- Teoria dei campi continui
  - Campi scalari
  - Campi vettoriali
- Applicazioni
  - Meteorologia
  - Studio del mare
  - Terreni, suoli
  - Ecc.

## Esempi

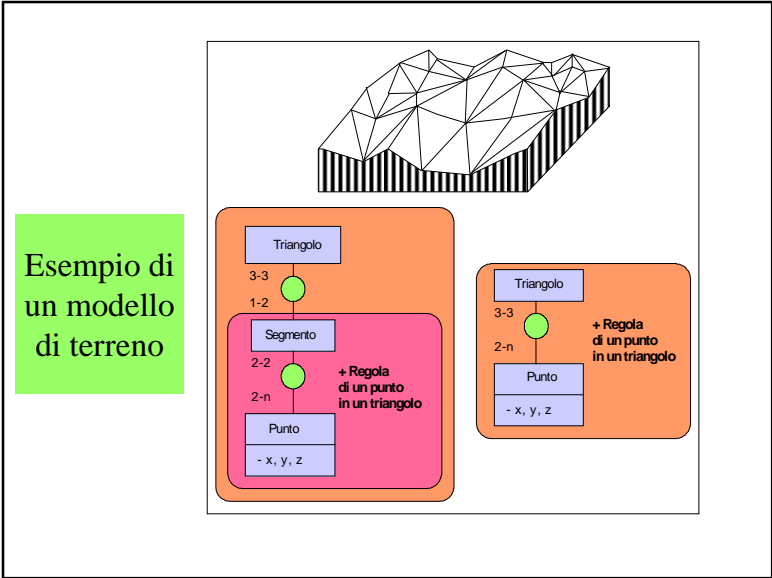


## Modellazione dei campi continui

- Impossibile di conoscere la funzione in tutti i punti
- Necessità di campioni
- Necessità di funzioni d'interpolazione
- Due livelli di modellazione
  - Campo come un oggetto (es. Temperatura in una regione)
  - Campo come un abstract data type (es. Valore della temperatura in un punto)

## Superfici, terreni

- TIN
- Griglie



**a/ Rappresentazione diretta**

```
TRIANGOLO (#triangolo, #vertice1, #vertice2, #vertice3)
VERTICE (#vertice, x, y, z)
E
```

REGOLA : Punti in un triangolo

**b/ Rappresentazione orientata segmento**

```
TRIANGOLO (#triangolo, #segmento1, #segmento2, #segmento3)
SEGMENTO (#segmento, #vertice1, #vertice2)
VERTICE (#vertice, x, y, z)
E
```

REGOLA : Punti in un triangolo  
Includendo più topologia:

```
SEGMENTO (#segmento, #punto1, #punto2, #triangolo-destro, #triangolo-sinistro)
```

**Interpolazione pianaria per stimare  $z$**

- Ogni triangolo è localizzato in un piano la cui equazione è:
$$z = Ax + By + C$$
- Come conoscere i parametri  $A$ ,  $B$  e  $C$  ?
- Abbiamo 3 vertici, dunque
  - 3 equazioni a 3 incognite

**c/ Rappresentazione con parametri**

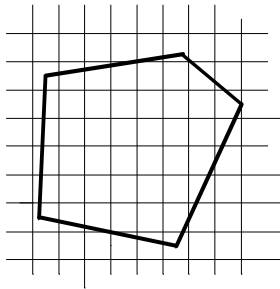
```
TRIANGOLO(#triangolo, #vertice1, #vertice2, #vertice3, A, B, C)
VERTICE (#vertice, x, y, z)
```

**b/ Rappresentazione orientata segmento con parametri**

```
TRIANGOLO (#triangolo, #segmento1, #segmento2, #segmento3, A, B, C)
SEGMENTO (#segmento, #vertice1, #vertice2)
VERTICE (#vertice, x, y, z)
```

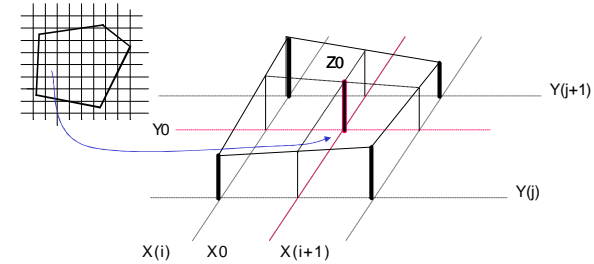
**c/ Ecc.**

## Maglia semplice



Ad esempio, passo di 100 metri

## Interpolazione in una griglia



Formula d'interpolazione bilineare :  $z = Axy + Bx + Cy + D$

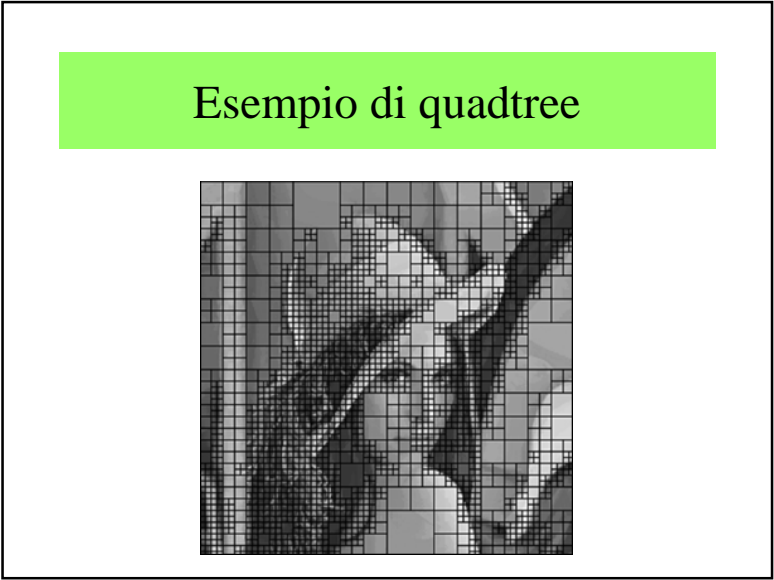
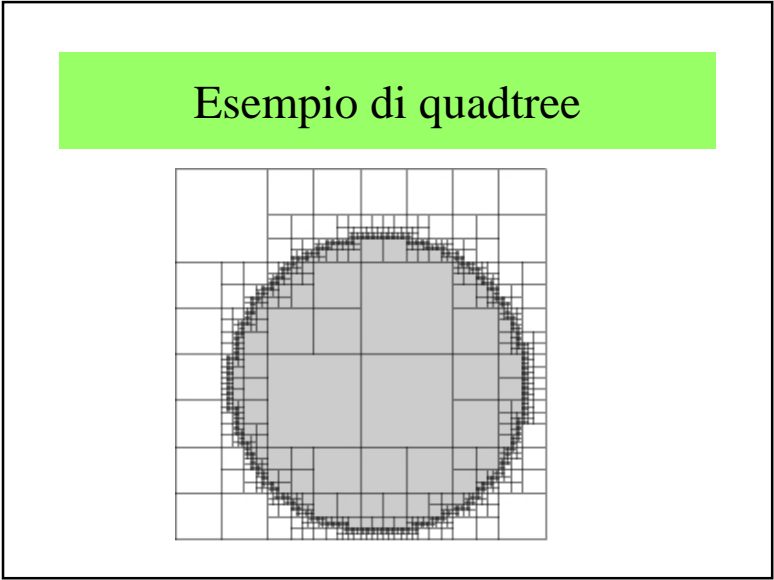
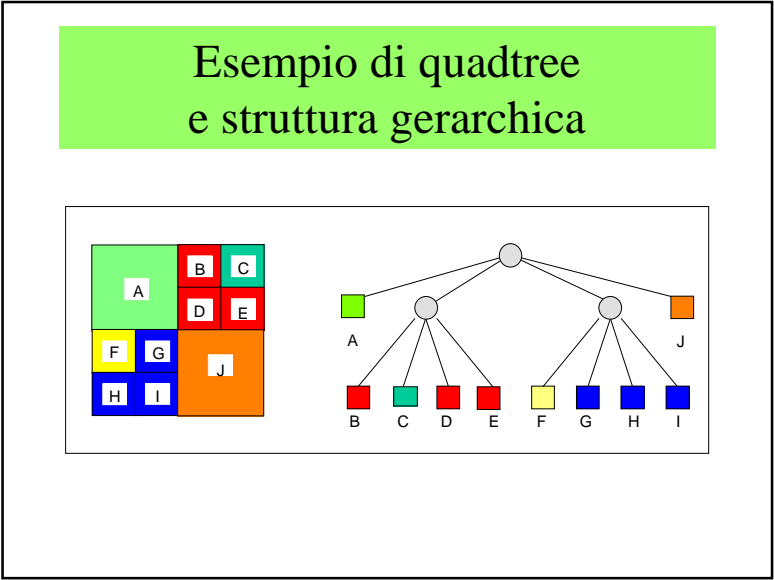
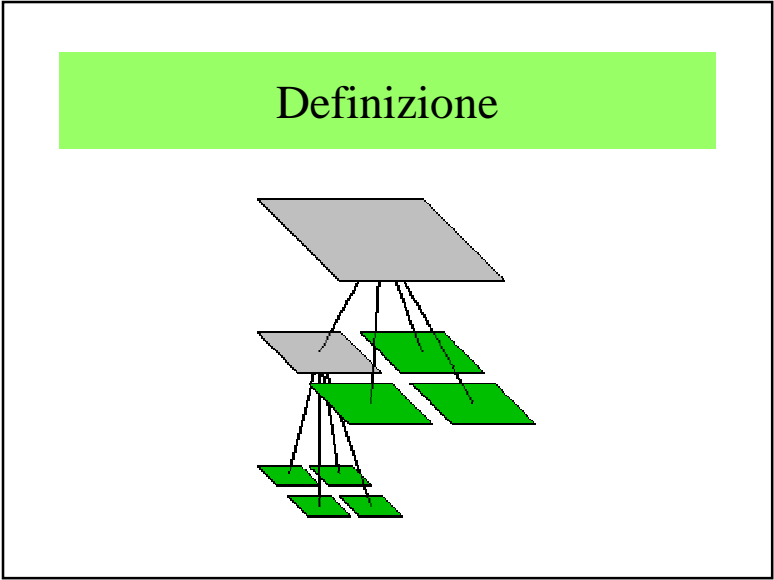
## Quadtree, Octree

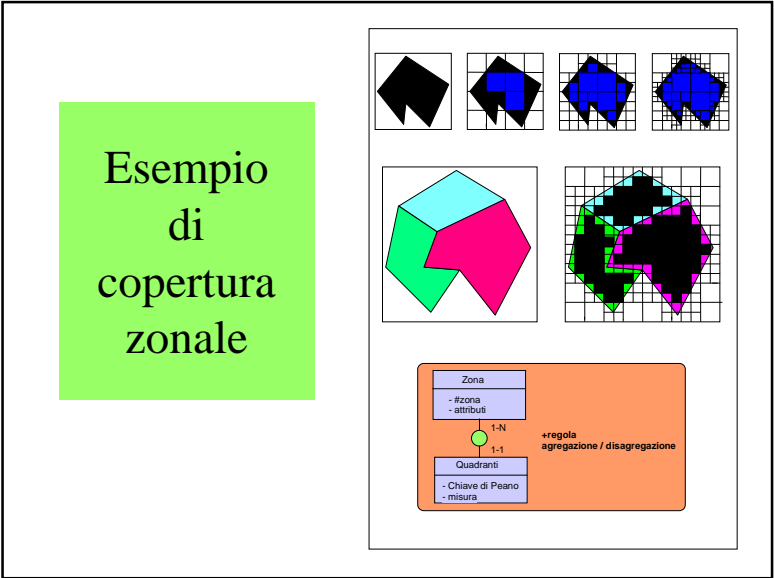
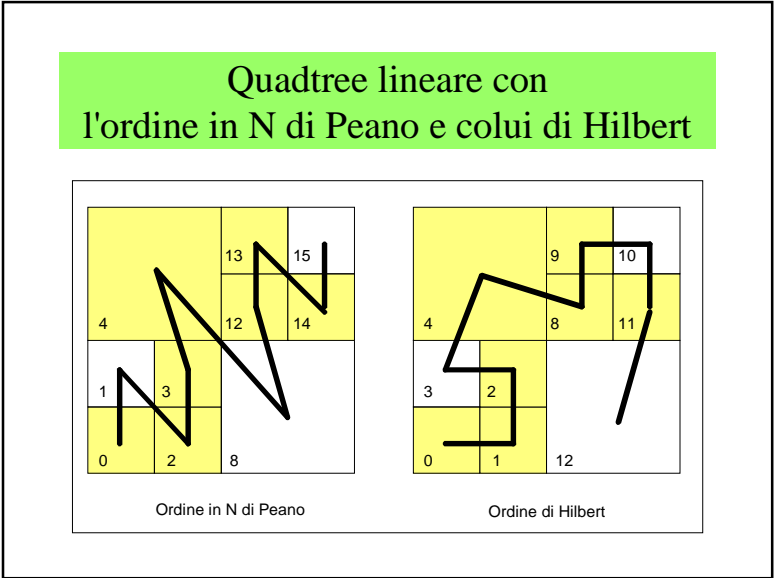
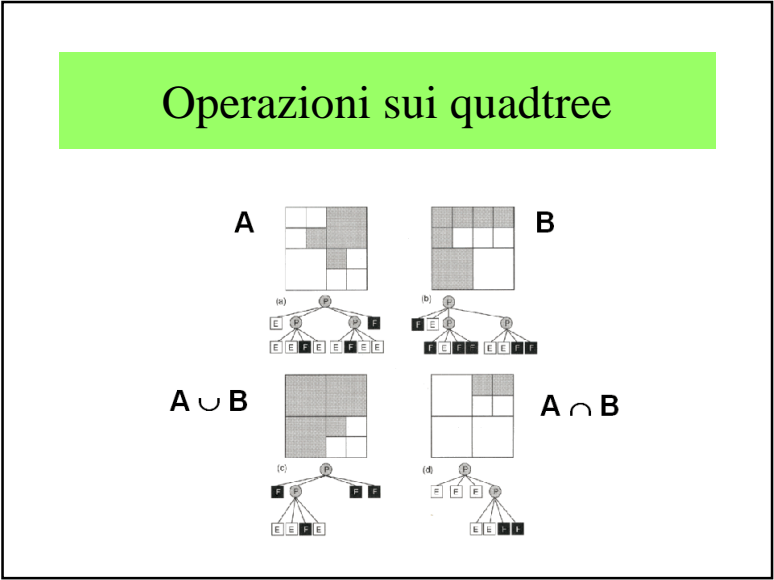
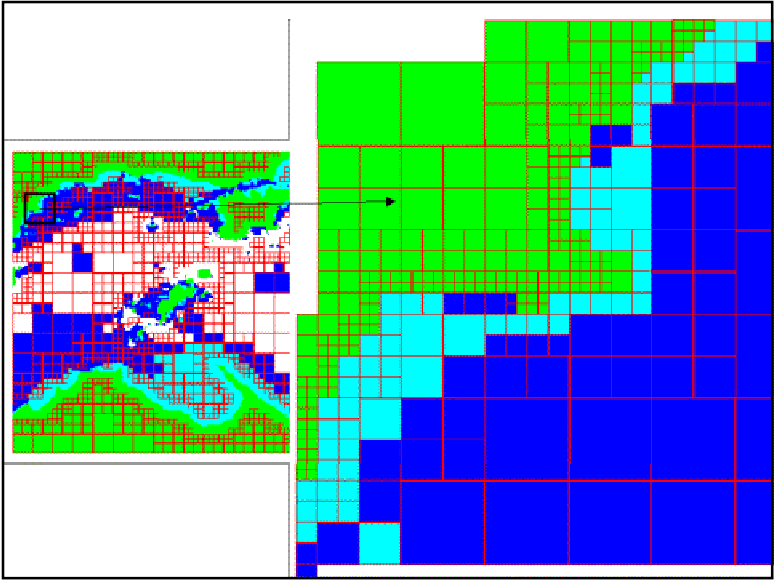
- Visione peaniana dello spazio
- Soddivisioni ricorsive
- Esempio

## Quadtree

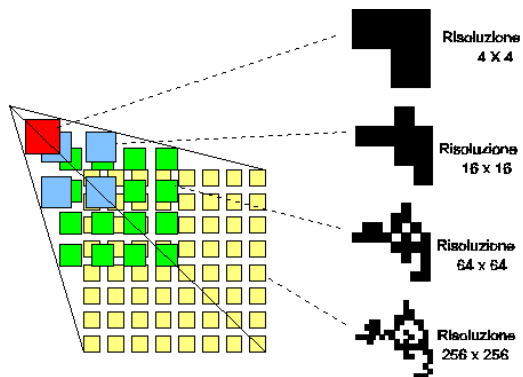
- Soddivisioni ricorsive di un quadrato in quadrati più piccoli
- Criterio di ferma
  - quadrato omogeneo
  - limite di risoluzione







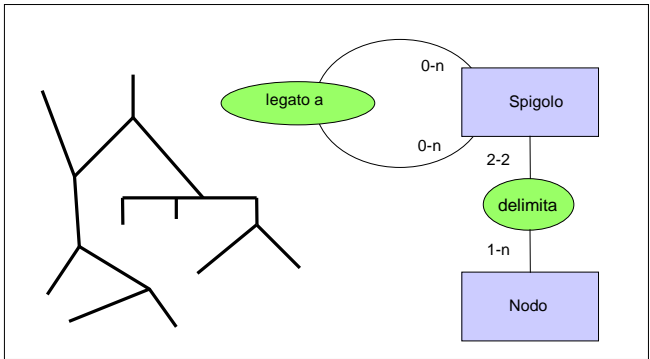
Esempio di piramide



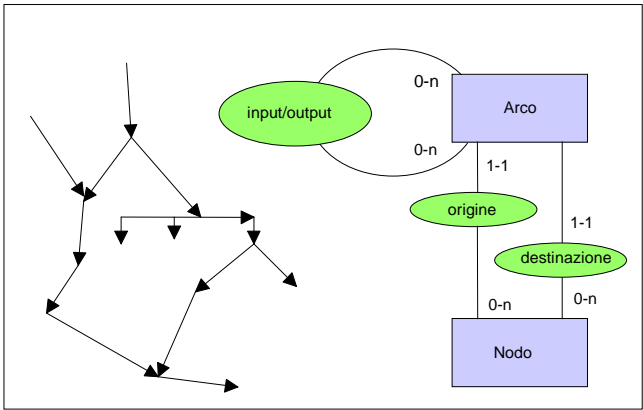
Reti

- Reti
  - Trasporto
  - Tubi
  - Ecc.
- Grafo
  - Orientato
  - Non orientato

Grafo



Grafo orientato



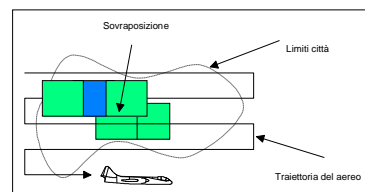
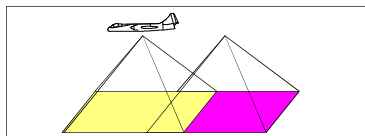
## 1.2 – Acquisizione dei dati

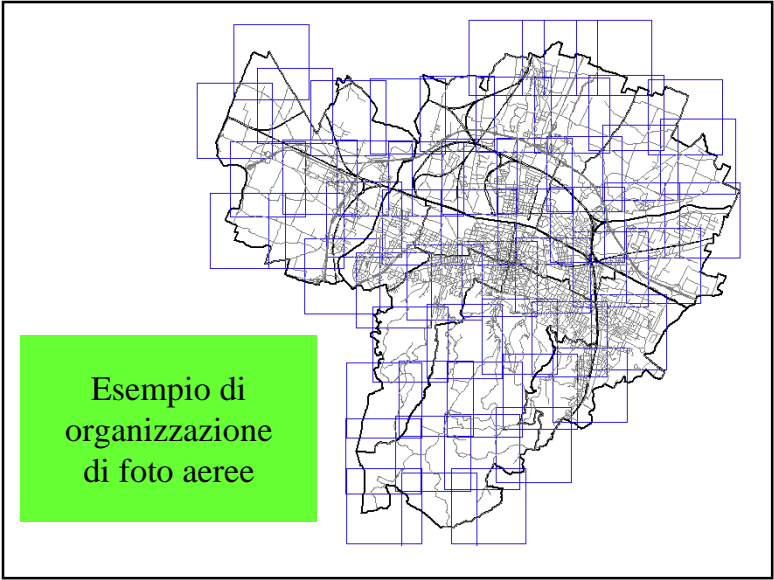
- Misure
- Digitalizzazione
- Foto aeree
- Immagini da satellite
- Laser
- GPS
- Sensori

### Teodoliti



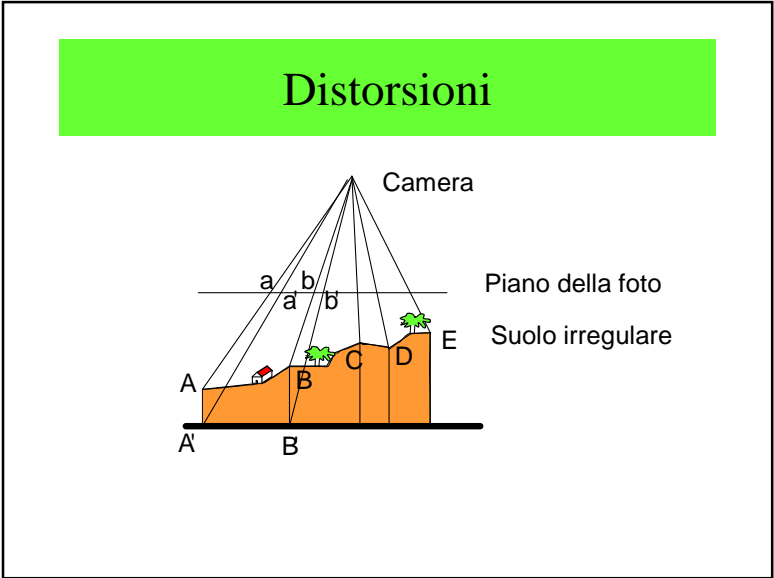
### Foto aeree





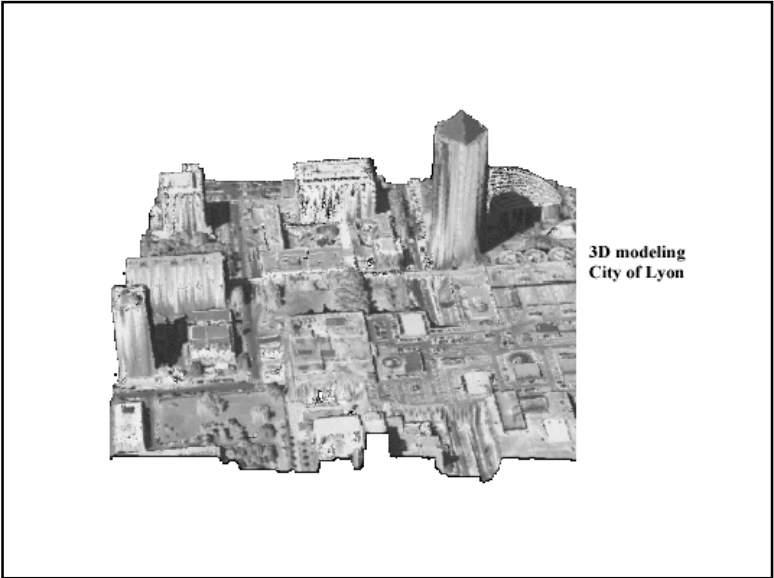
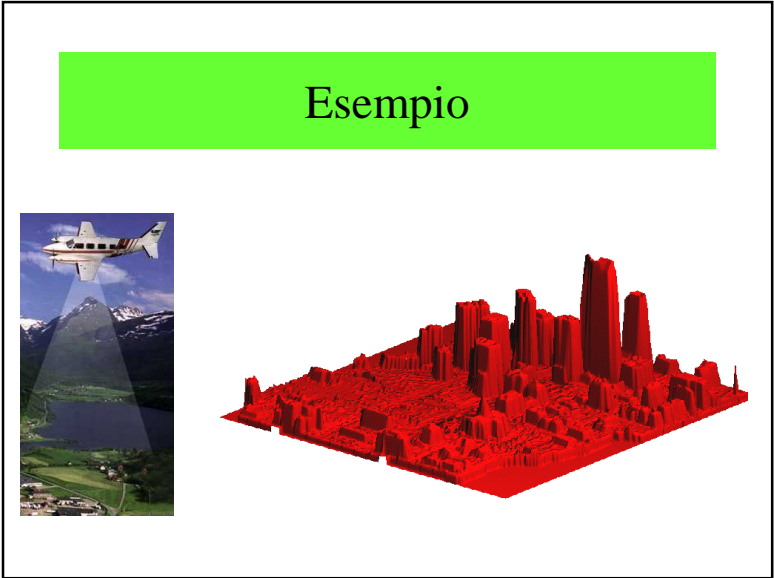
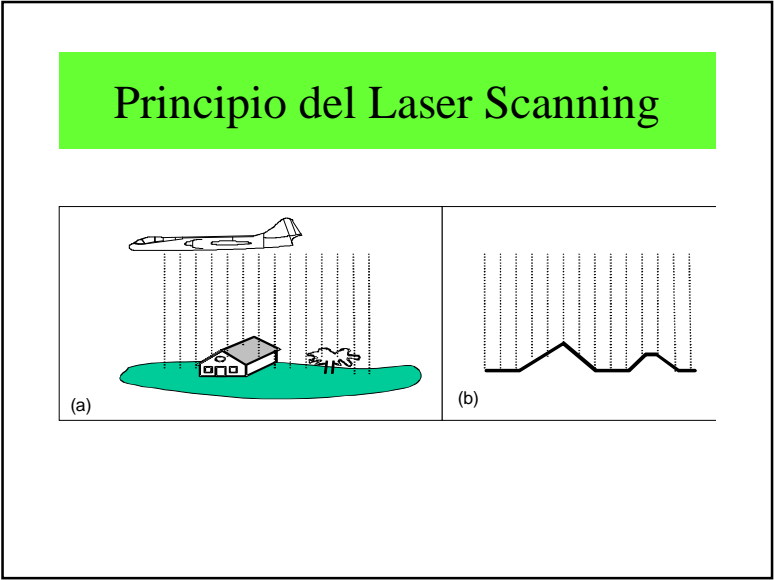
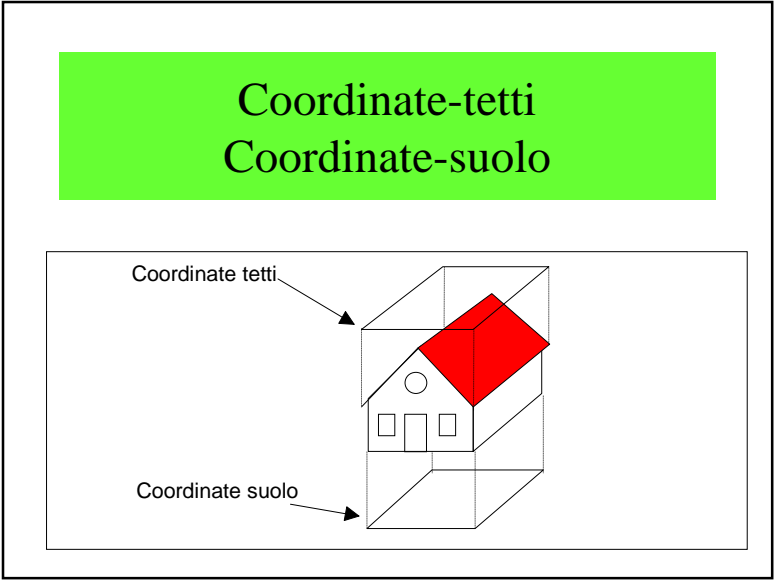
### Caratteristiche delle foto aeree

- Altitudine: da 500 a 3000 metri
- Formato: 23 cm × 23 cm
- Scala da 1:3000 a 1:25000
- Paio di foto → rilievo
- Parallassi → determinazione di altitudini
- Foto-interpretazione
- Ortofoto (mosaicatura)

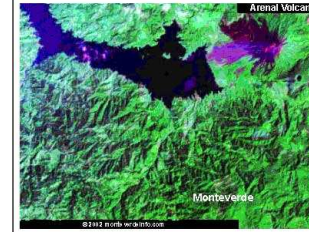


### Distorsioni

The diagram illustrates scale distortion. The top part shows a 3D perspective view of a camera taking a photo of a landscape with 'Casa A', 'Casa B', and an 'Albero' (tree). An arrow points down to a 2D 'FOTO AEREA' (aerial photo) showing the same scene. In the photo, 'Casa B' is larger than 'Casa A' due to its closer proximity. A 'Road' is also shown. Below the photo, a diagram shows four square photo swaths arranged around a central point labeled 'Nadir'.



Versailles  
 Le Bourget Airport  
 L'Orly  
 Le Bourget Airport  
 L'Orly  
 Le Bourget Airport



Il diagramma illustra lo spettro elettromagnetico con le seguenti regioni e valori:

- Iperfrequenze:** 30 cm (1 GHz) a 0,3 cm (100 GHz).
- Infrarosso:** 300 μm (10<sup>12</sup> Hz) a 3 μm (10<sup>14</sup> Hz).
  - Termico: 300 μm a 3 μm.
  - Lontano: 300 μm a 3 μm.
  - Vicino: 3 μm a 0,3 μm.
- Visibile:** 0,3 μm a 0,4 μm.
  - Rosso: 0,4 μm a 0,7 μm.
  - Arancione: 0,7 μm a 0,8 μm.
  - Giallo: 0,8 μm a 0,9 μm.
  - Verde: 0,9 μm a 1,0 μm.
  - Azzurro: 1,0 μm a 1,1 μm.
  - Violetto: 1,1 μm a 1,2 μm.
- Ultravioletti:** 0,3 μm a 300 Å (10<sup>16</sup> Hz).
- Raggi X:** 300 Å (10<sup>16</sup> Hz) a 3 Å (10<sup>18</sup> Hz).
- Raggi gamma:** 3 Å (10<sup>18</sup> Hz) a 0,003 Å (10<sup>20</sup> Hz).

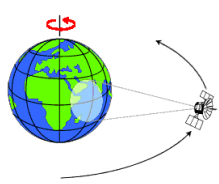
Radiazioni solari

Radiazioni solari con riflessioni

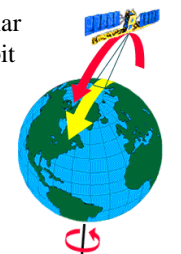
Filtraggio

Emissioni proprie

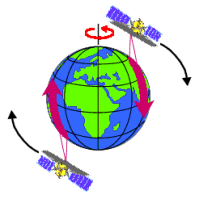




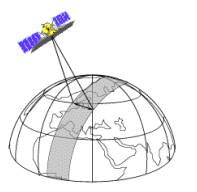
Geostationary orbit



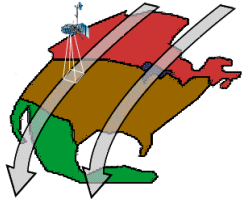
Polar orbit



Phases



Tracking



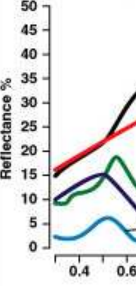


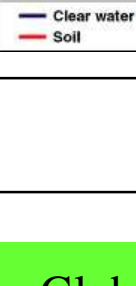
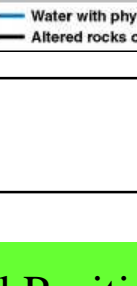
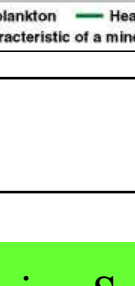
Subsequent passages

<http://www.ccrs.nrcan.gc.ca/ccrs/eduref/tutorial/chap2/c2p2e.html>

Firme spettrali

[http://www.rsac1.co.uk/remote\\_sensing/main.htm](http://www.rsac1.co.uk/remote_sensing/main.htm)

Generalised reflectance spectra of some earth surface materials

Visible	NIR	SWIR
		
		



Reflectance %

Wavelength in micrometres

Clear water    Water with phytoplankton    Healthy vegetation



Soil    Altered rocks characteristic of a mineralised zone

Ikonos



2

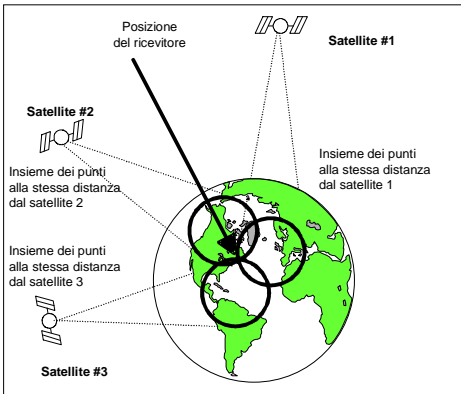
Global Positioning System



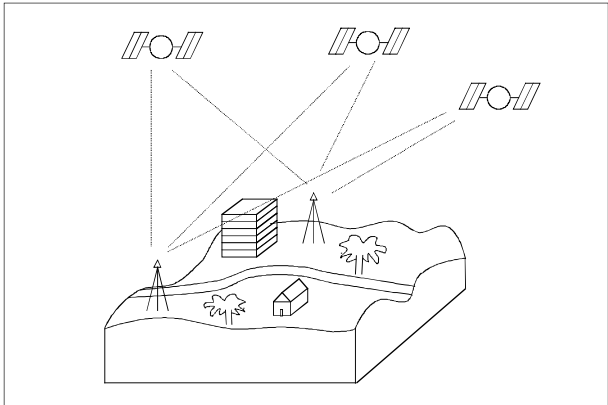
PIONEER



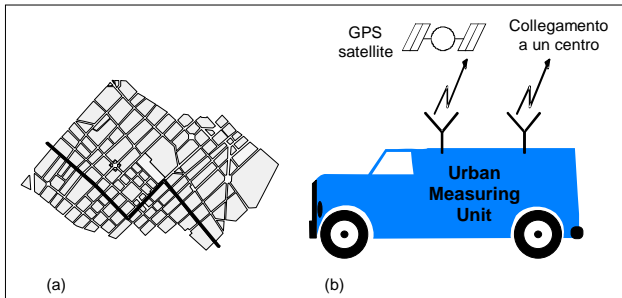
Principi di GPS



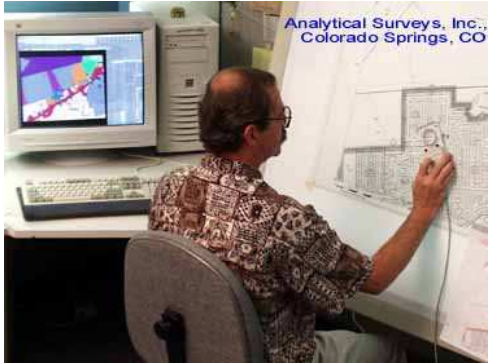
GPS differenziale



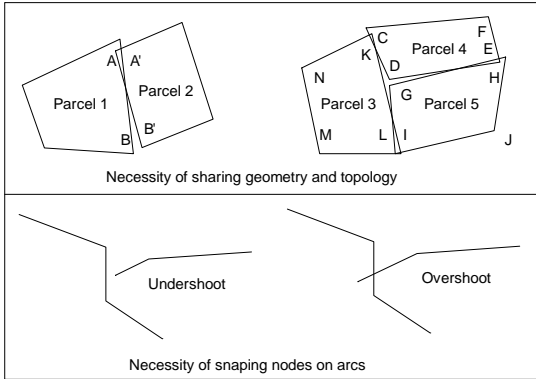
Acquisizione con un veicolo



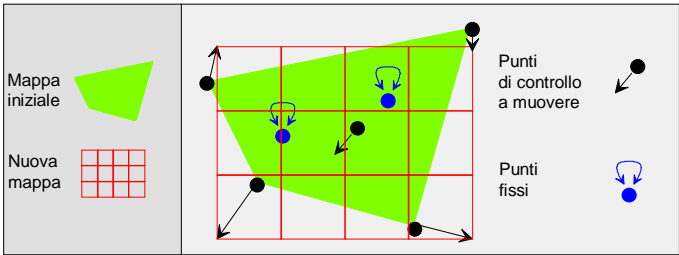
Digitalizzazione



Errori comuni nella digitalizzazione

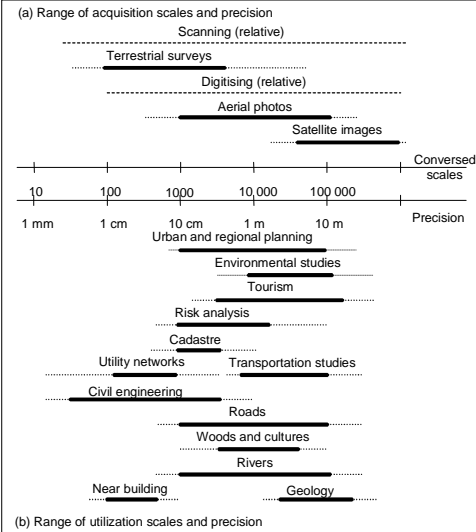


Rubber-sheeting



Trasformazioni elastiche bilineari

Scale



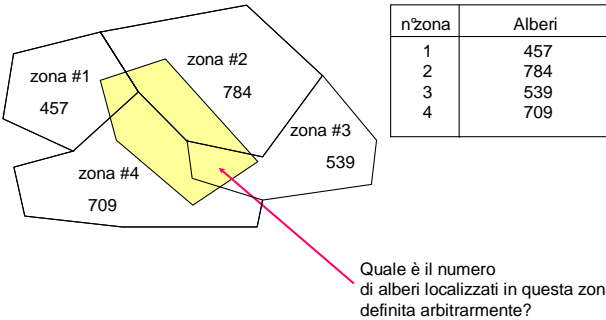
1.3 – Query spaziali

- Che cosa c'è in questo punto?
- Che cosa c'è in questa zona?
- Quale è il cammino migliore per andare da Lisbona a Varsavia?
- Quali sono i paesi vicini all'Austria?
- Quali sono le provincie varcate dal fiume Pò?
- Quale è il luogo il più inquinato?
- Quanti sono i fabbricati a meno di un Km dal confine tra Italia e Svizzera?

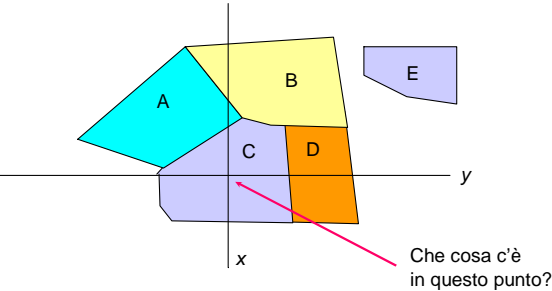
### Tipologia delle query spaziali

- Query di punto
- Query di regione
- Query di distanza (buffer zones)
- Ricerca di un sito ottimale, di un cammino ottimale
- Query topologiche

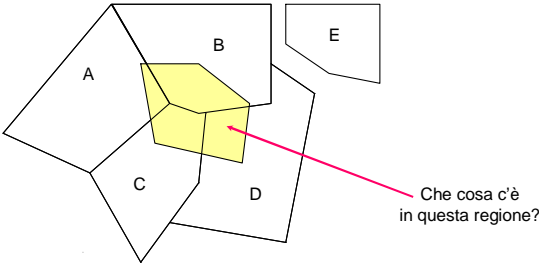
### Esempio di query spaziale



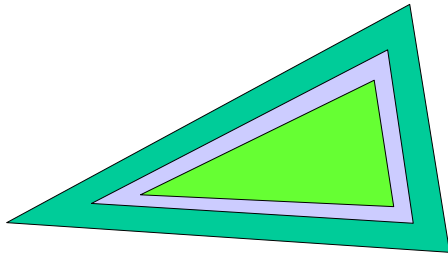
### Query di punto



### Query di regione



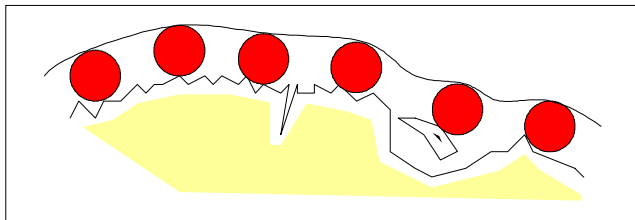
### Query di distanza (buffer zones)



### Buffer zone



### Definizione di una buffer zone con un poligono frastagliato

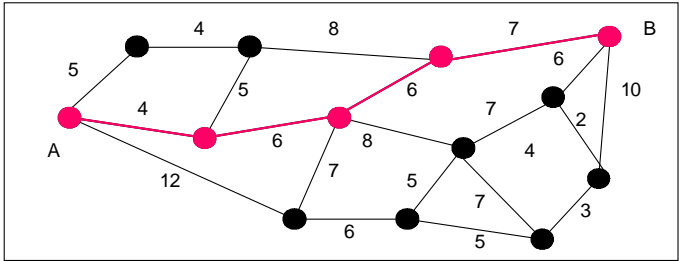


Esempio: delimitazione delle acque territoriali

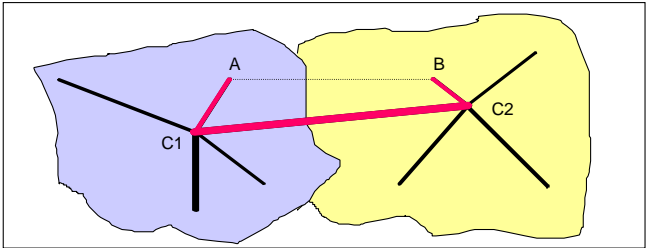
### Ricerca di un sito ottimale, di un cammino ottimale

- In un grafo
- In un grafo gerarchico
- In un poligono
- In un terreno
- Circuito del commesso
- Circuito turistico

Ricerca del cammino minimo  
in un grafo

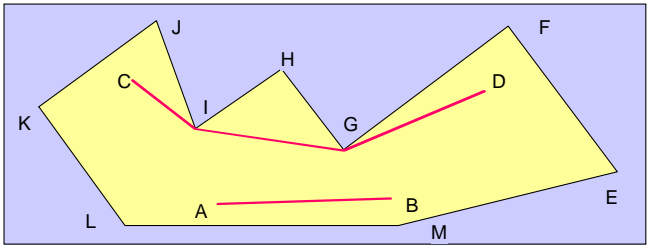


Cammino in un grafo gerarchico



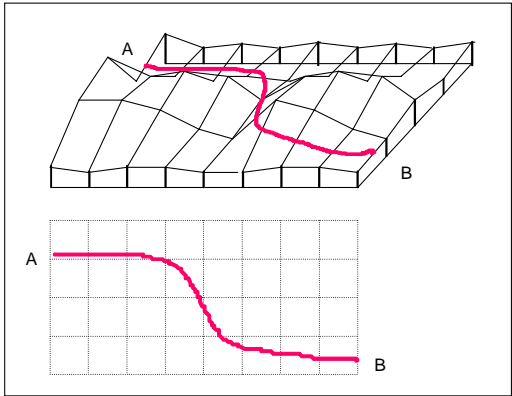
Come andare da A a B?

Cammini minimi in un poligono



Come andare da A a B?  
Come andare da C a D?

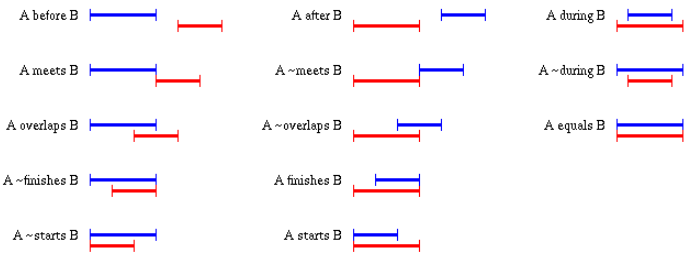
Cammino in un terreno



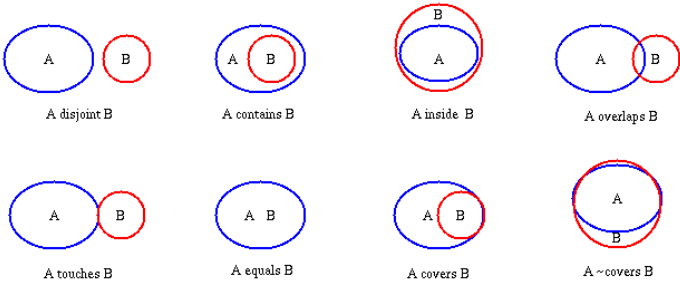
Query topologiche

- Query sulla posizione e la vicinanza degli oggetti
- Relazioni di Allen, di Egenhofer
- « tocca », « intersetta » ecc.

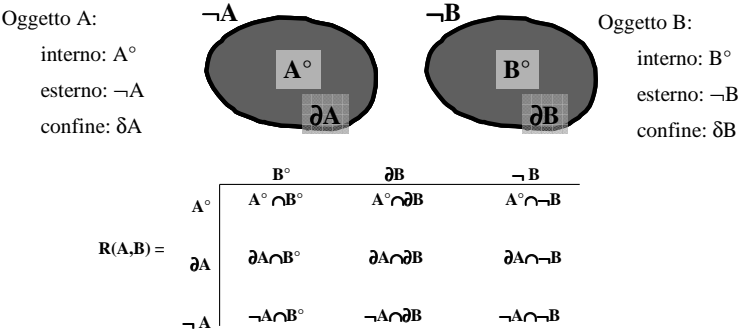
Relazioni di ALLEN



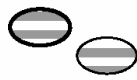
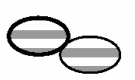






Relazioni di Egenhofer

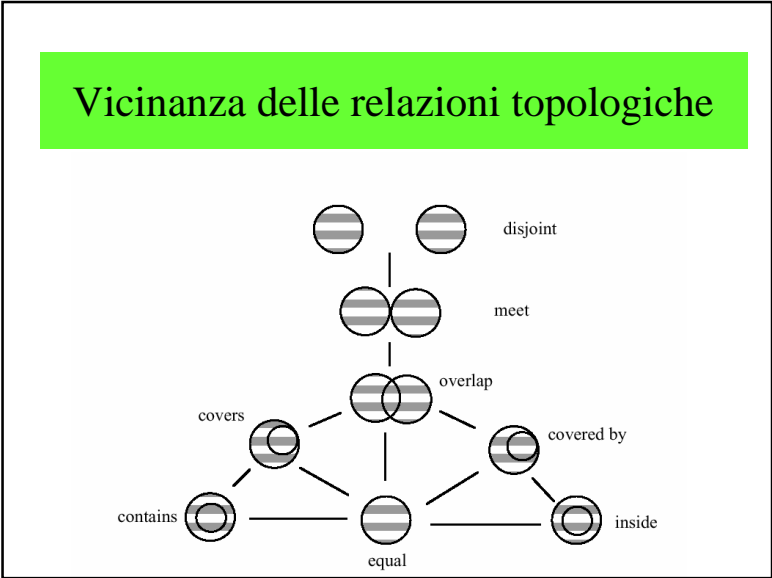


Modello delle 9 intersezioni di Egenhofer



$$R(A, B) = \begin{pmatrix} A^{\circ} \cap B^{\circ} & A^{\circ} \cap \partial B & A^{\circ} \cap B^{-} \\ \partial A \cap B^{\circ} & \partial A \cap \partial B & \partial A \cap B^{-} \\ A^{-} \cap B^{\circ} & A^{-} \cap \partial B & A^{-} \cap B^{-} \end{pmatrix}$$

<div>disjoint</div>  <div><math>\begin{pmatrix} \emptyset &amp; \emptyset &amp; -\emptyset \\ \emptyset &amp; \emptyset &amp; -\emptyset \\ -\emptyset &amp; -\emptyset &amp; -\emptyset \end{pmatrix}</math></div>	<div>meet</div>  <div><math>\begin{pmatrix} \emptyset &amp; \emptyset &amp; -\emptyset \\ \emptyset &amp; -\emptyset &amp; -\emptyset \\ -\emptyset &amp; -\emptyset &amp; -\emptyset \end{pmatrix}</math></div>	<div>overlap</div>  <div><math>\begin{pmatrix} -\emptyset &amp; -\emptyset &amp; -\emptyset \\ -\emptyset &amp; -\emptyset &amp; -\emptyset \\ -\emptyset &amp; -\emptyset &amp; -\emptyset \end{pmatrix}</math></div>	<div>contains</div>  <div><math>\begin{pmatrix} -\emptyset &amp; -\emptyset &amp; -\emptyset \\ \emptyset &amp; \emptyset &amp; -\emptyset \\ \emptyset &amp; \emptyset &amp; -\emptyset \end{pmatrix}</math></div>
<div>equal</div>  <div><math>\begin{pmatrix} -\emptyset &amp; \emptyset &amp; \emptyset \\ \emptyset &amp; -\emptyset &amp; \emptyset \\ \emptyset &amp; \emptyset &amp; -\emptyset \end{pmatrix}</math></div>	<div>coveredBy</div>  <div><math>\begin{pmatrix} -\emptyset &amp; \emptyset &amp; \emptyset \\ -\emptyset &amp; -\emptyset &amp; \emptyset \\ -\emptyset &amp; -\emptyset &amp; -\emptyset \end{pmatrix}</math></div>	<div>inside</div>  <div><math>\begin{pmatrix} -\emptyset &amp; \emptyset &amp; \emptyset \\ -\emptyset &amp; \emptyset &amp; \emptyset \\ -\emptyset &amp; -\emptyset &amp; \emptyset \end{pmatrix}</math></div>	<div>covers</div>  <div><math>\begin{pmatrix} -\emptyset &amp; -\emptyset &amp; -\emptyset \\ \emptyset &amp; -\emptyset &amp; -\emptyset \\ \emptyset &amp; \emptyset &amp; -\emptyset \end{pmatrix}</math></div>



- 1.5 – Indicizzazione spaziale
- Importanza dell'indicizzazione spaziale
  - Uso dei quadtree
  - Uso delle curve di Peano
  - Uso dei R-tree
  - Indicizzazione in Oracle SDI
  - Conclusioni



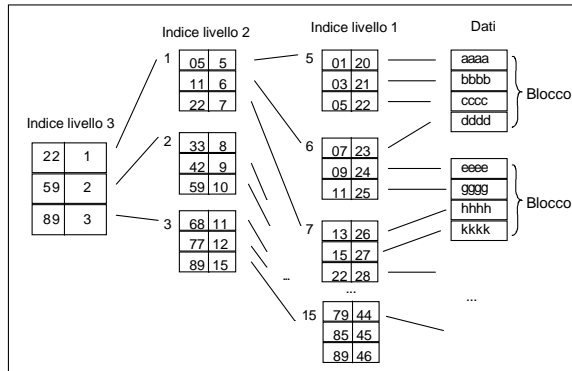
## Importanza dell'indicizzazione spaziale

- Acceleratore d'accesso
- Senza indice :
  - scansione totale del DB
  - costoso in termine di tempo
- Necessità di strutture dati e di procedure di accesso adeguate

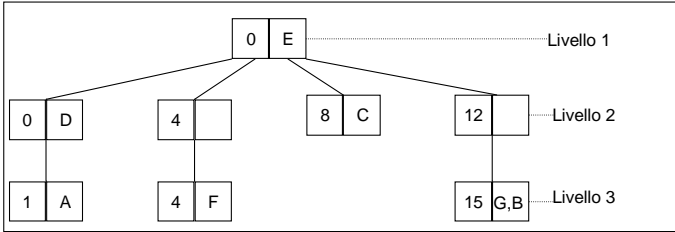
## Indicizzazione nei DB relazionali



## Gerarchia di indici



## Uso dei quadtree





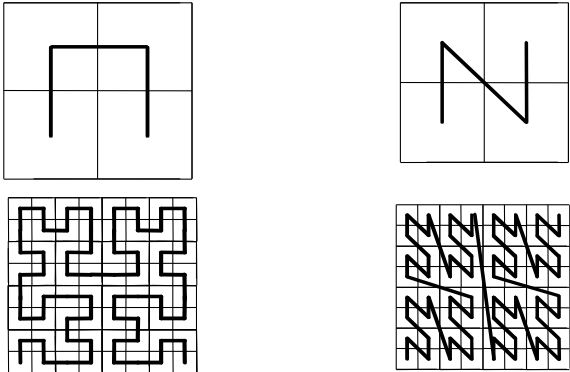
Uso delle curve di Peano

- Curva che empie lo spazio, che passa ad ogni punto nello spazio
- Copertura totale
- Impossibile con la geometria euclidea
- Possibile con la visione peaniana

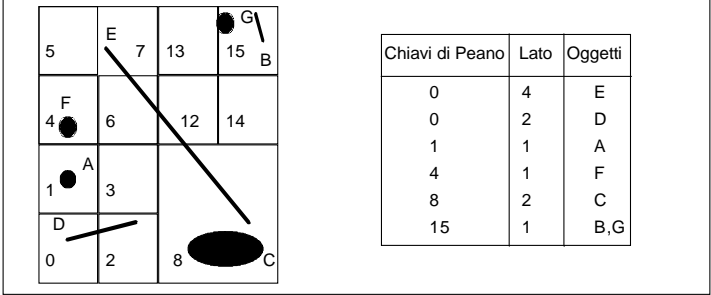
Curve di Peano

- Impossibile con la geometria euclidea
  - Punto 0D
  - Linea 1D
  - Spazio 2D
- Possibile con la visione peaniana
  - Punto 2D
  - Linea 2D
  - Spazio 2D
- Curve di Hilbert, in N di Peano

Curve di Hilbert e di Peano



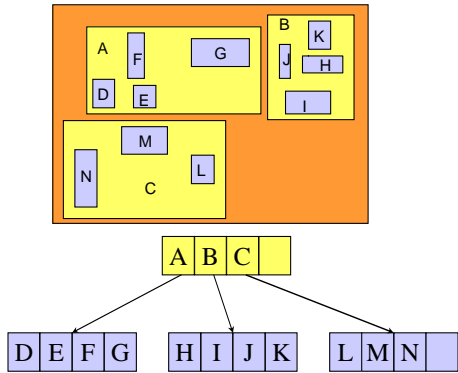
Indicizzazione di un piccolo territorio



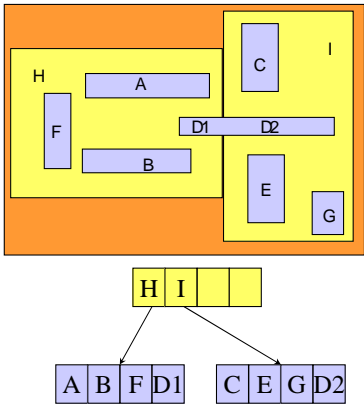
Uso dei R-tree

- Alberi di rettangoli (r-tree)
- Alberi ammgliorati (r\*-tree)

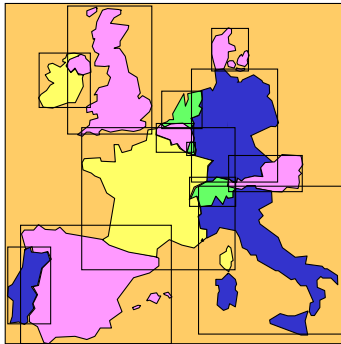
Esempio di R-tree



Esempio di R\*-tree



Indicizzazione della mappa di Europa con rettangoli

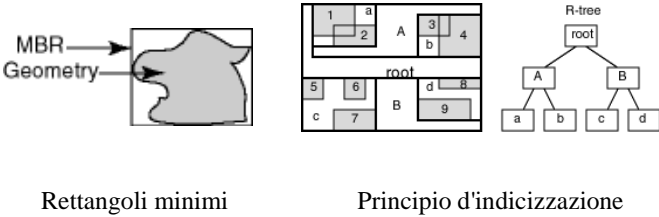


## Indicizzazione (Oracle)

- Quadtree / R-tree

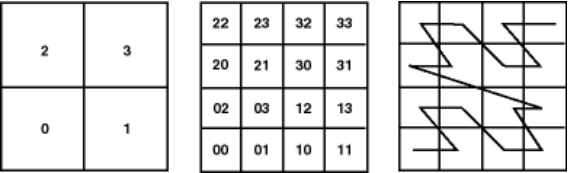
```
SQL> create table <layername>_SDOINDEX
2  (
3    SDO_GID integer,
4    SDO_CODE raw(255)
5  );
```

## R-tree



Rettangoli minimi      Principio d'indicizzazione

## Quadtree



Quadtree con chiavi di Peano (codice di Morton)

## HH codes

- HHCODEs (Helical Hyperspatial Codes)
- Chiavi di Peano
- Longitudine/latitudine/altitudine/tempo

### Creazione d'indice

```
-----  
-- CREATE THE SPATIAL INDEX --  
-----  
CREATE INDEX cola_spatial_idx  
ON cola_markets(shape)  
INDEXTYPE IS MDSYS.SPATIAL_INDEX;  
-- Preceding created an R-tree index.  
-- Following line was for an earlier quadtree index:  
-- PARAMETERS('SDO_LEVEL' = 8');
```

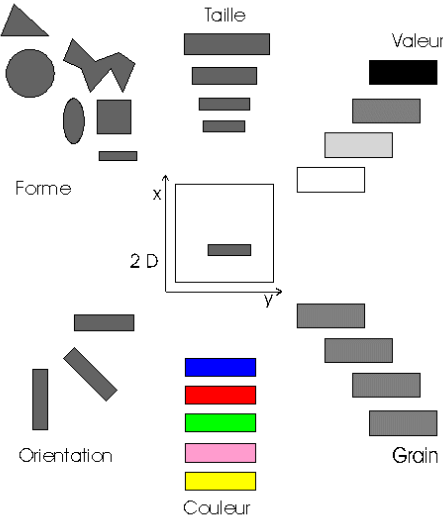
### Selezione d'indice

R-tree Indexing	Quadtree Indexing
The approximation of geometries cannot be fine-tuned. (Spatial uses the minimum bounding rectangles. Index creation and tuning are easier.	The approximation of geometries can be fine-tuned by setting the tiling level and number of tiles. Tuning is more complex, and setting the appropriate tuning parameter values can affect performance significantly.
Less storage is required.	More storage is required.
If your application workload includes nearest-neighbor queries (SDO_NN operator), R-tree indexes are faster.	If your application workload includes nearest-neighbor queries (SDO_NN operator), quadtree indexes are slower.
If there is heavy update activity to the spatial column, an R-tree index may not be a good choice.	Heavy update activity does not affect the performance of a quadtree index.
You can index up to four dimensions.	You can index only two dimensions.
An R-tree index is recommended for indexing geodetic data if SDO_WITHIN_DISTANCE queries will be used on it.	
An R-tree index is required for a whole-earth index.	

### 1.5 – Cartografia

- Teoria dei colori di Itten
- Variabili visuali di Bertin
- Cartografia statica, dinamica, interattiva
- Generalizzazione
- Come mentire con una mappa
- Coremi

### Variabili di Bertin



Variabili visuali di Bertin

Variables visuelles

Forme	Grandeur	Orientation
Motif (texture)	Teinte (couleur)	Valeur de teinte

LE VARIABILI DELL'IMMAGINE

XY 2 DIMENSIONI DEL PIANO	PUNTI	LINEE	ZONE	12	14
Z	GRANDEZZA				
VALORE					

LE VARIABILI DI SEPARAZIONE DELL'IMMAGINE

GRANA					
COLORE					
ORIENTAMENTO					
FORMA					

Legenda di una mappa

DEVONIAN OR OLDER

Da Amphibolite, schist, metasedimentary rocks, mylonite

MORDOVICIAN

OM MACADAMS BROOK FORMATION: quartz-rich siltstone and sandstone

CAMBRIAN

CMN MACNEIL FORMATION: dark grey shale, siltstone, and limestone

CMML MACLEAN BROOK FORMATION: quartz sandstone, siltstone, and shale

CT TROUT BROOK FORMATION: shale, siltstone, and minor sandstone

CC CANCE BROOK FORMATION: mudstone, siltstone, and minor limestone

CMC MACCORMACK FORMATION: siltstone and shale

CS SGADAN LAKE FORMATION: quartz arenite and quartz pebble conglomerate

LATE HADRYNYAN-CAMBRIAN

HCB BENGAL ROAD FORMATION: maroon to red conglomerate, sandstone, siltstone, minor grey siltstone

KELVIN GLEN GROUP

HCK Orange litho, arkose, pebble to cobble conglomerate, purple subarkose, red siltstone

LATE HADRYNYAN

Hbl Monzonite (East Bay Hills belt)

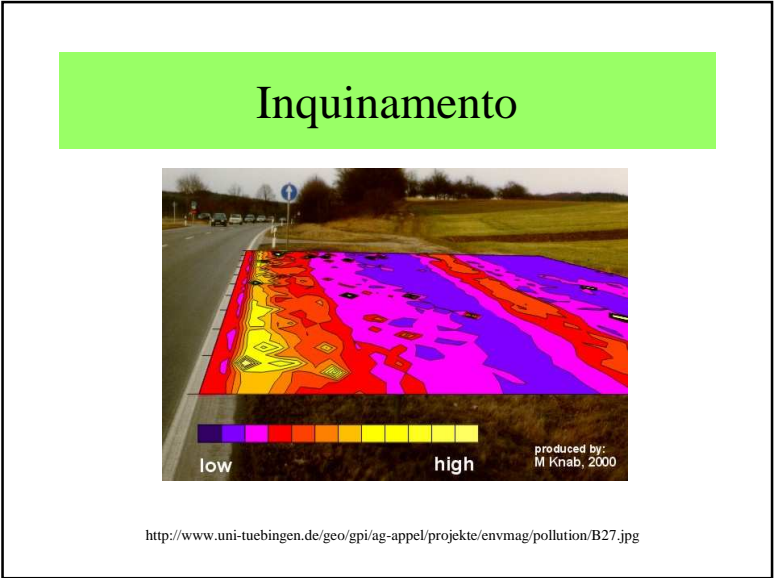
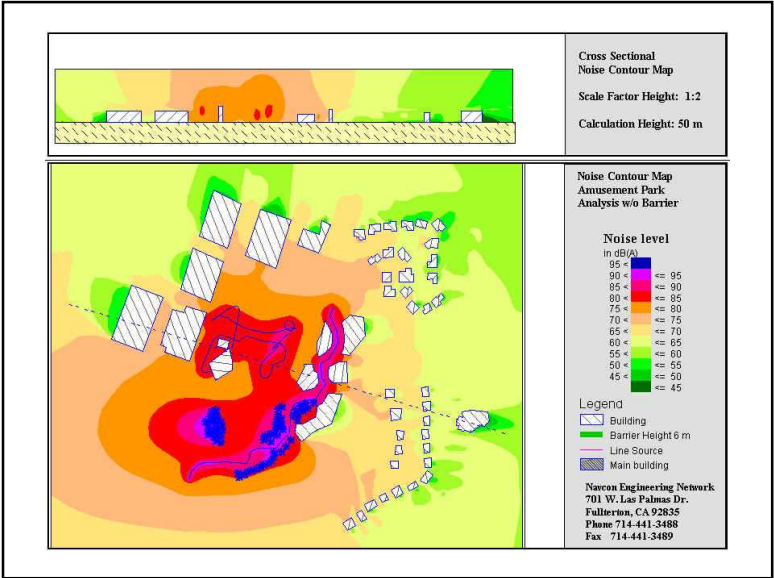
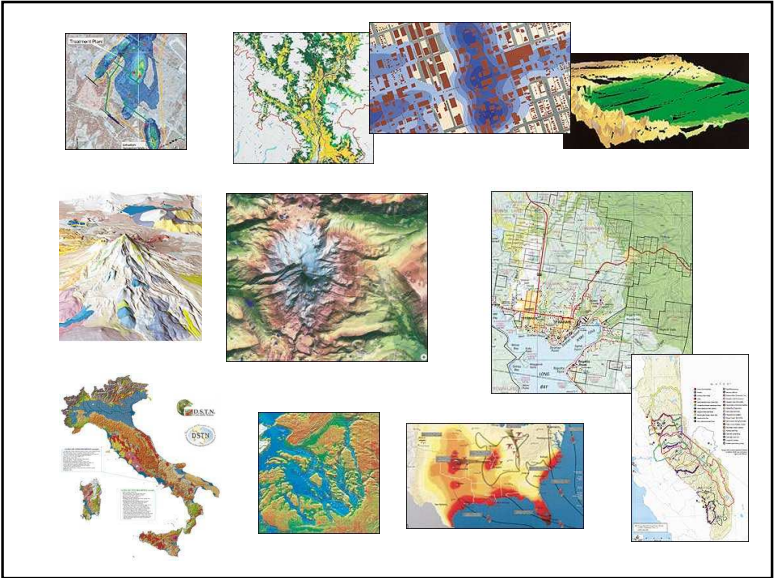
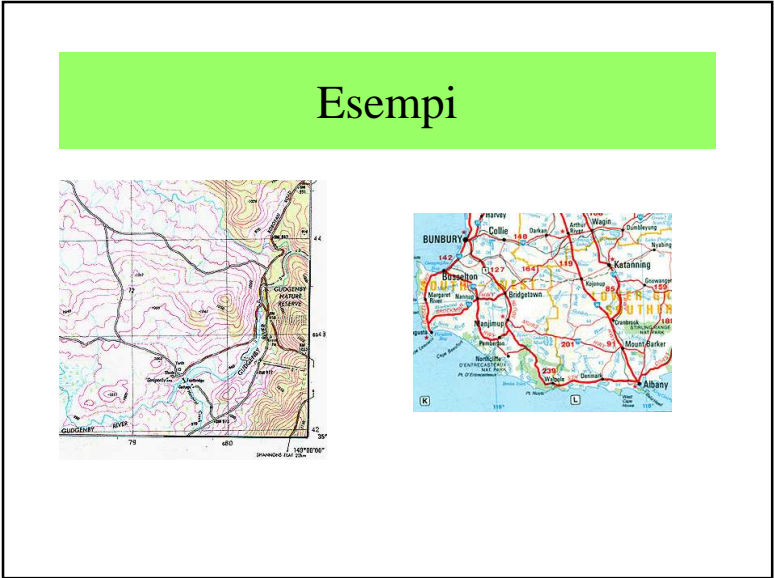
Hgp Granitic porphyry (East Bay Hills belt)

Hgb, Hgb Basaltic gabbro (Coastal belt) Hgb: other gabbroic intrusions (coastal belt)

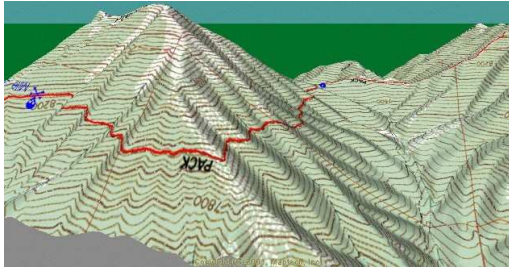
<http://www.nrcan.gc.ca/ess/pubs/guide/images/legend.gif>

Cartografia statica

- Un pezzo del mondo
- Rappresentare qualcosa
- Legende
- Esistenze de "sotto-culture"

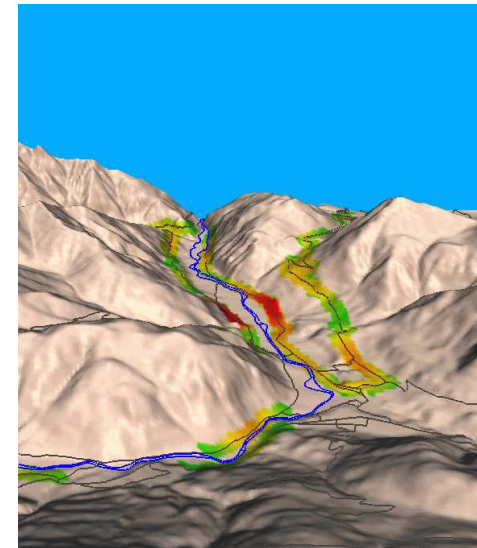


## Cartografia tridimensionale



## Mappa dei rischi 3D

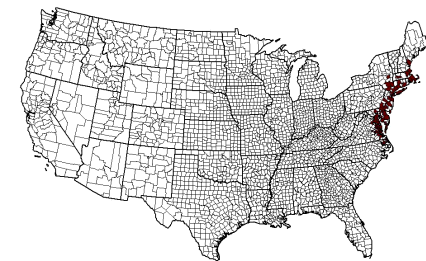
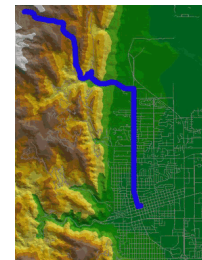
[mpa.itc.it/  
corso.html](http://mpa.itc.it/corso.html)



## Cartografia animata

- Con animazione
  - modifica delle forme
  - modifica dei colori
- Semiologia grafica?

## Exempi di mappe animate





## Altri esempi

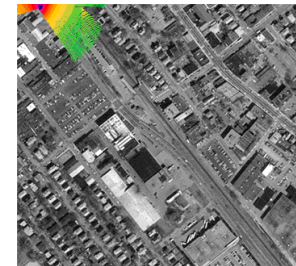


Monte Santa Elena



Mappa

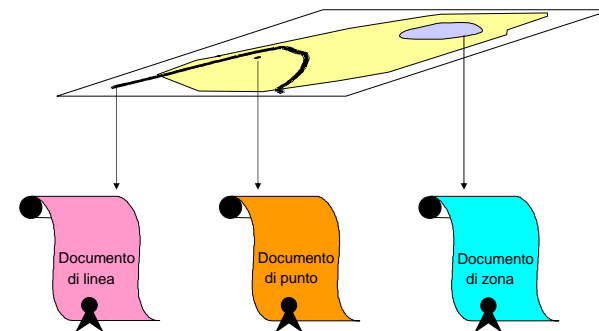
## Rumore di una motocicletta



## Cartografia interattiva

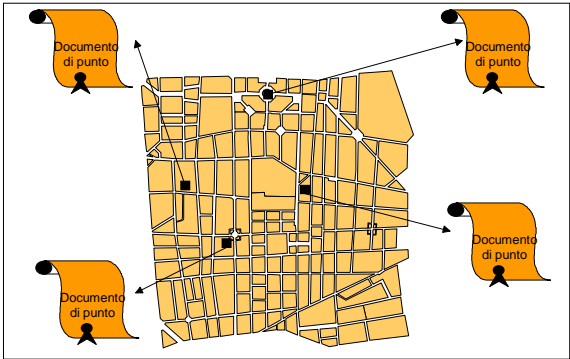
- Interazioni con l'utente
- Mappe clicabili
- Ipermappe

## Principi delle ipermappe

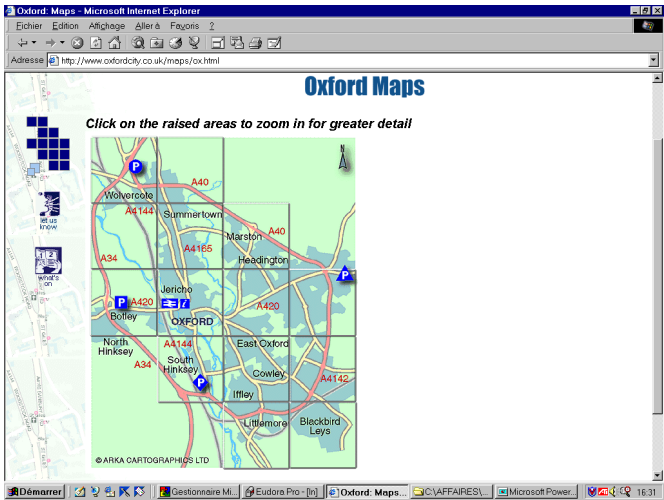
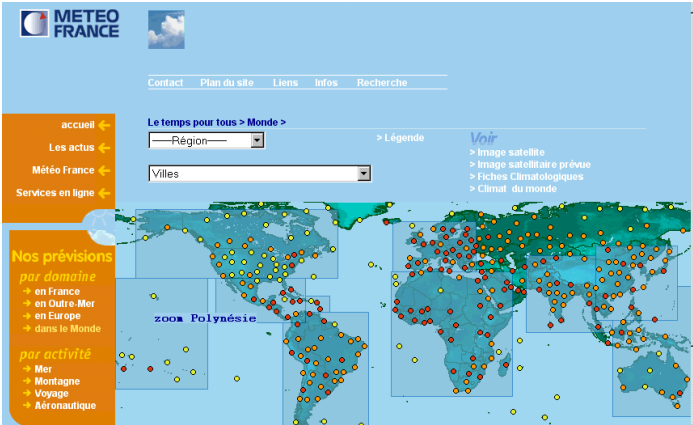




Punti o zone attive

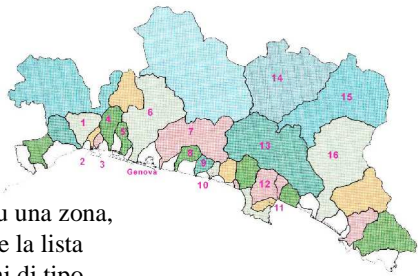


<http://www.meteo.fr>



Ipermappa dei rischi a Genova

<http://www.provincia.genova.it/pdb/pdb03.htm>




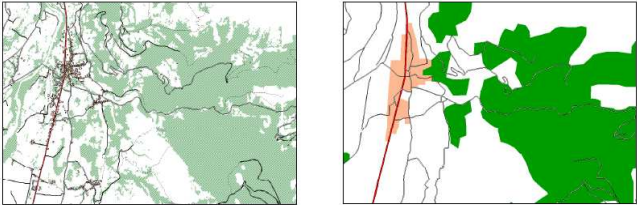
Cliccando su una zona,  
si ottiene la lista  
dei rischi di tipo  
slittamenti di terreno  
ed inondazioni

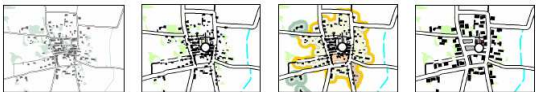



Argumaps  
con smileys

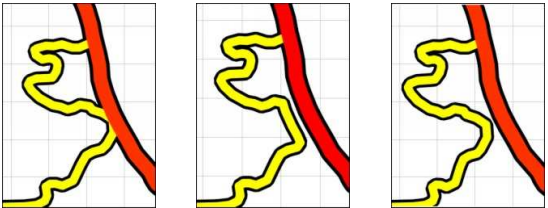
Generalizzazione delle forme











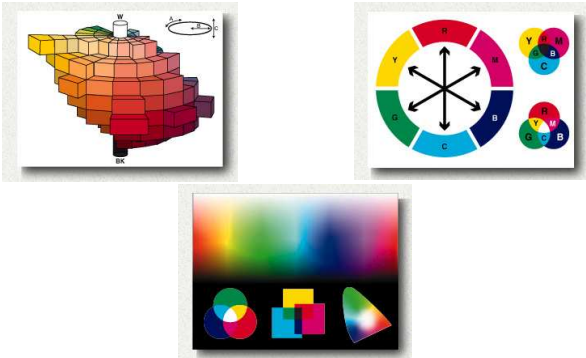


Teoria di Itten





Linking colors



[http://www2.epson.fr/technologies/colorguide/COL\\_G/MAINMENU.HTM](http://www2.epson.fr/technologies/colorguide/COL_G/MAINMENU.HTM)

Stelle e cerchi



Armonia dei colori



Esempi di graduazione

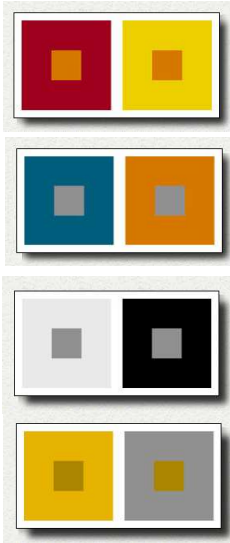


Hue Contrast

Complementary color contrast

Luminous Contrast

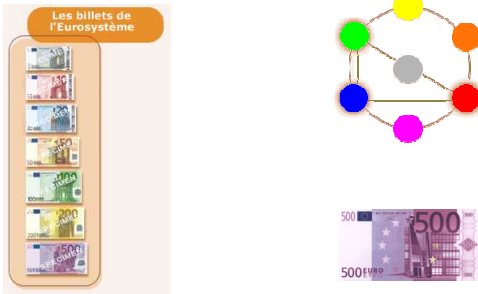
Chroma Contrast



Selezione di colori



Gli euro



Esempi di siti web

<http://www.worqx.com/color/learning2.htm>



Web Site: [www.gravis.com](http://www.gravis.com)  
Split-complementary relationship



primary field of analogous violet hues, contrasting accents of green & orange

Itten's contrast of hue  
medium value / moderate contrast\*

\*Note that the use of the neutral field of gray dilutes the overall contrast of the page, whereas in the following example, the use of full values increases the contrast of the visual plane.




Web Site: [www.treeologic.com](http://www.treeologic.com)  
Complementary relationship




primary field of cyan, contrasting accent of red orange


Itten's contrast of hue or contrast of complements medium value / high contrast




Web Site: [www.ingenta.com](http://www.ingenta.com)  
Split-complementary relationship




primary field of yellow, subordinate color of blue-green, accent of orange  
Itten's contrast of hue or contrast of complements light-medium value/ moderate contrast




Web Site: [www.neumedia.com](http://www.neumedia.com)  
Split-complementary relationship




primary field of purple, contrasting accents of red orange and cyan  
Itten's contrast of hue or contrast of complements medium value/ moderate-high contrast




Web Site: [www.smithandhawken.com](http://www.smithandhawken.com)  
Analogous relationship



primary field of desaturated yellow, contrasting accents of desaturated orange and green  
Itten's contrast of hue medium value/ moderate contrast


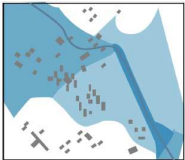



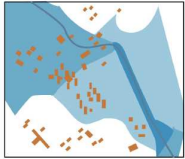
Web Site: [www.compendiumdesign.com](http://www.compendiumdesign.com) (html version)  
Triad relationship



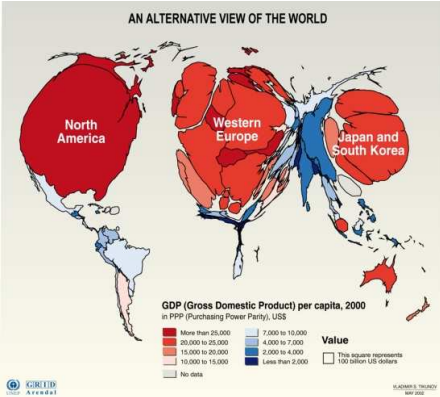
primary field of orange, subordinate contrast of blue-violet, and contrasting accent of green  
Itten's contrast of hue medium value/ moderate contrast

Ameliorazione di mappa





Esempio di cartogramma



AN ALTERNATIVE VIEW OF THE WORLD

GDP (Gross Domestic Product) per capita, 2000  
in PPP (Purchasing Power Parity), US\$

Value

More than 25,000  
20,000 to 25,000  
15,000 to 20,000  
10,000 to 15,000  
7,000 to 10,000  
4,000 to 7,000  
2,000 to 4,000  
Less than 2,000

The square represents  
100 billion US dollars

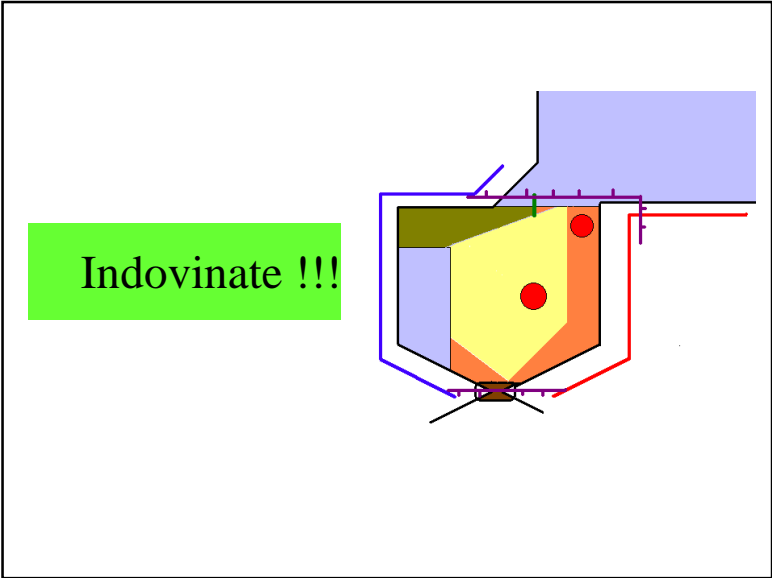
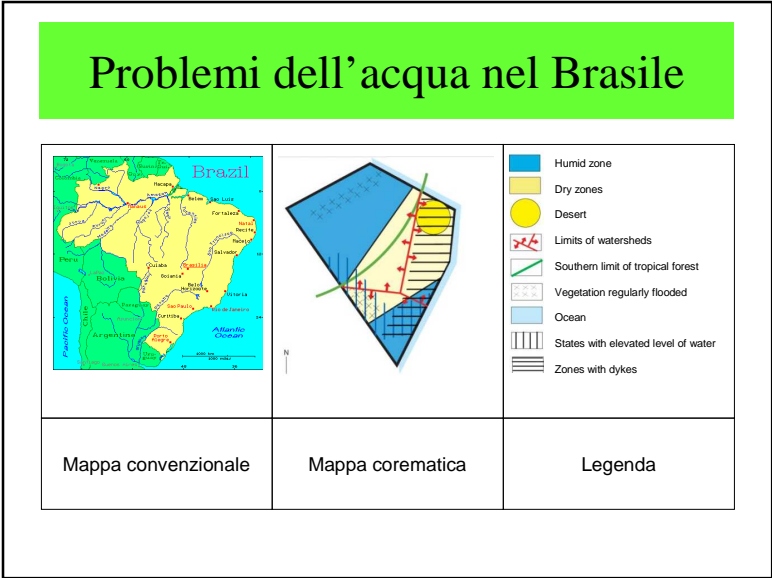
No data

Source: World Bank  
Map 2000

Coremi

- Rappresentazione schematizzata di un territorio
- Rappresentazione visuale di una conoscenza geografica
- Rappresentazione globale visuale
- Riassunto visuale di un database spaziale
- Coremi di Brunet





Come mentire con una mappa!

- Una legenda cattivamente scelta può indurre errori
- Volontariamente o non volontariamente
- Libro "*How to Lie with Maps!*"

How To Lie With Maps

Esempi

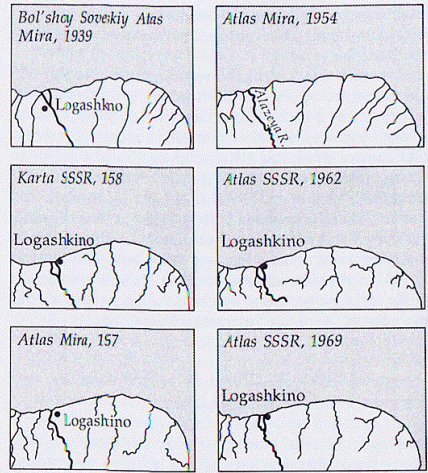


FIGURE 1.1. Representation of Logashkino and vicinity, on the East Siberian Sea, on various Soviet maps published between 1939 and 1969.

Una strana linea di autobus

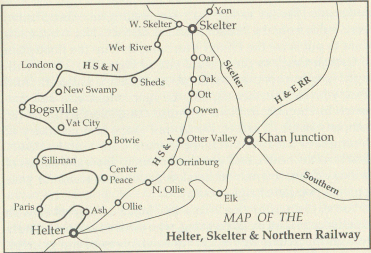


FIGURE 5.1. Engineering department's map of the Helter, Skelter and Northern Railway.

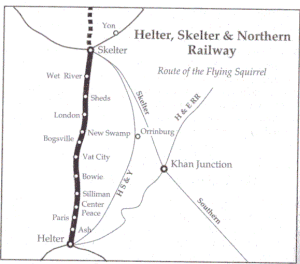
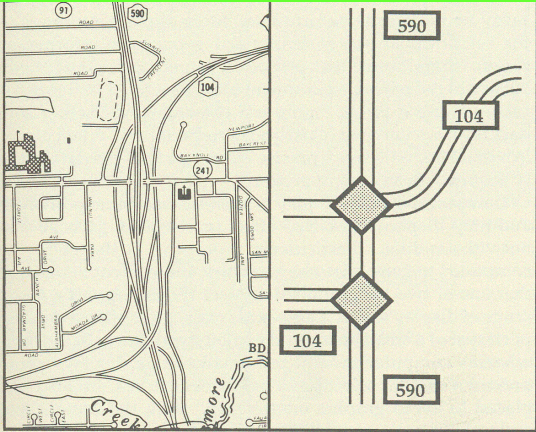


FIGURE 5.2. Advertising and timetable map of the Helter, Skelter and Northern Railway.

Caricature



Conclusione sulla cartografia

- Importanza del messaggio a trasmettere
- Importanza della semiologia grafica
- Cartografia
  - statica
  - dinamica
  - interattiva
- How to Lie?

## 1.6 – Conclusioni

- Fornire le basi dei GIS
- La terra è rotonda
- Modellazione 2D, 3D
- Acquisizione dei dati – incertezza
- Query ed analisi spaziali
- Indicizzazione
- Semiologia grafica