Automated Selection of Base Map Information from the Global Map

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Development of expert systems for map design

- Why
- Who for
- How

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Development of Cartographic Design Expert Systems

- Why
  - systems are capable of producing good maps, but offer little assistance to user in cartographic design

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Development of CES

- Who?
  - Decision makers using digital map data & GIS

They have:

- knowledge about topic information, not of cartography

But:

- don't want to spend time on map design (not their primary task)

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Development of CES

- How?
  - Develop a model of cartographic design
  - codify rules for each stage
  - build knowledge into expert system

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Question

- *What topographic base information should be included in a particular map?*
  - Part of map composition
  - Much neglected aspect of map design
  - Topographic features function as locational referents or “landmarks”
  - Some topographic information may be necessary to understand the topic information
  - Other information irrelevant / adds clutter

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Selecting base information

- Need to know:
  - Map topic
  - Map scale
  - Level of detail required (purpose of use)
    - Map for overview or analysis?
    - User experienced or inexperienced
  - Probability of including different types of base info in that type of map (i.e. the knowledge base)

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Previous work

- Cartographic Design Expert System modelled on the range of maps in a national educational atlas
  - Base scale 1:2 million
  - Target map scale 1:2M – 1:15M
  - Generally successful in producing sensible maps on a range of topics at various scales & levels of detail

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The Global Map

- Can the principles be applied using the Global Map as a source?
- Widespread availability of free data makes this an obvious target
- Previous data was structured specifically for the problem
  - Is the Global map appropriately structured?

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Global Map feature classes

- Coastline
- Major rivers; other rivers; Inland water
- International boundary; Primary boundary; Secondary boundary
- Major towns (cities?); other settlements; Urban areas
- Primary route; Secondary route; other route; Trail
- Railroad; Ferry route
- Relief (not included here)

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Core Map Topics

- Base map
  - Outline
  - Topographic
- Cultural
  - Political
  - Population
  - Economic
  - Communications
- Physical
  - Relief
  - Land cover
  - Climate

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Building the knowledge base

- Various possible approaches
  - Introspection used for initial attempt
- Identify key map topics
- Score each feature class for importance to that topic
  - 10 = essential; 0 = not relevant
  - Build matrix / table of certainty values

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Selection table

	basic	outline	cultural	physical	topographic	political	population	economic	communicatio	relief	land cover	climate
Coastline	10	10	10	10	10	10	10	10	10	10	10	10
Major river	0	6	6	10	10	6	6	6	6	10	10	10
Other river	0	1	0	7	6	0	0	0	0	7	7	7
Lake	8	8	8	10	10	9	9	8	10	10	10	10
Internat bnd	10	10	10	10	10	10	10	10	10	10	10	10
Primary bnd	0	6	8	6	8	9	9	8	8	6	6	6
Secondary bnd	0	1	6	1	6	6	7	6	6	1	1	1
City	0	5	10	5	10	10	10	10	10	5	5	5
Settlement	0	2	9	1	8	8	9	9	9	1	3	1
Urban area	0	2	6	2	6	6	6	6	6	2	2	2
Primary road	0	4	9	4	10	8	9	9	9	4	4	4
Secondary road	0	2	7	2	8	7	7	7	7	2	2	2
Other road	0	0	5	0	4	5	5	5	5	0	0	0
Trail	0	0	3	0	4	3	3	4	5	0	0	0
Ferry route	0	0	5	0	4	3	3	5	6	0	0	0
Railway	0	2	6	2	8	6	6	6	6	2	2	2

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MAP 1

- Map_topic Topographic
- Map_user general
- Map_purpose overview
- Scale 1:3 million

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MAP 2

- Map_topic Topographic
- Map_user specialist
- Map_purpose analysis
- Scale 1:3 million

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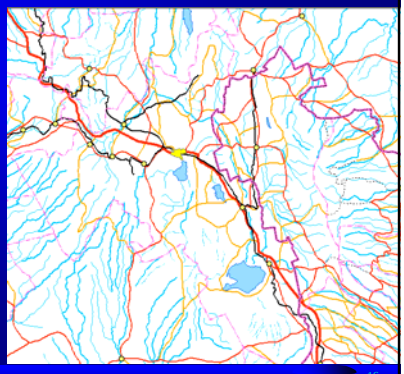
MAP 3

- Map_topic Topographic
- Map_user specialist
- Map_purpose analysis
- Scale 1:1 million



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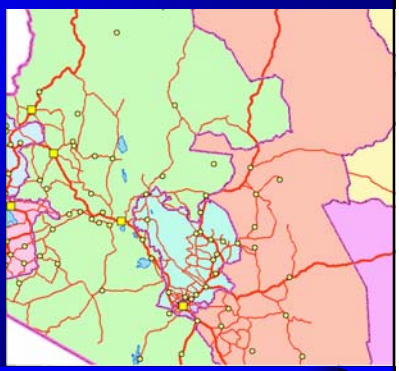
MAP 4

- Map_topic Political
- Map_user general
- Map_purpose overview
- Scale 1:3 million



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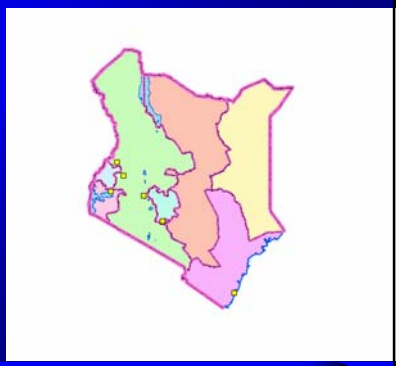
MAP 5

- Map_topic Political
- Map_user general
- Map_purpose overview
- Scale 1:10 million



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Global Map Specification

- Global map has basic feature classes required
- Data dictionary not easy to use
  - How are field names and Value type/codes made easily useable?
  - Problem with value = 'unknown'
  - Often only distinction between features is name field

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Data coding improvements

- OK for some themes (e.g. roads) not others
  - Need to process data first making assumptions
    - E.g. Named rivers = major, un-named = minor
  - No administrative rank for settlements - problem
- To ease selection, themes should be hierarchically coded where appropriate
  - Major rivers, minor rivers;
  - National capitol, state capital, county town, …
  - This would also help automate assignment of type style & name placement

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Conclusion

- Responds to user's requirements
  - Default values depend on the situation
- Still needs to be implemented within a GIS
  - GIS don't support typical ES mechanisms
- It will:
  - make software (& data) easier to use
  - (help) stop people breaking the rules
  - reduce the number of bad map-like objects

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- BSc Geographic Information & Mapping Sciences
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