Ubiquitous Mapping in Tokyo

1. Introduction
2. Fundamentals of Ubiquitous Mapping
3. Basic framework of UbiMap
4. Situation in Tokyo
5. Conclusion

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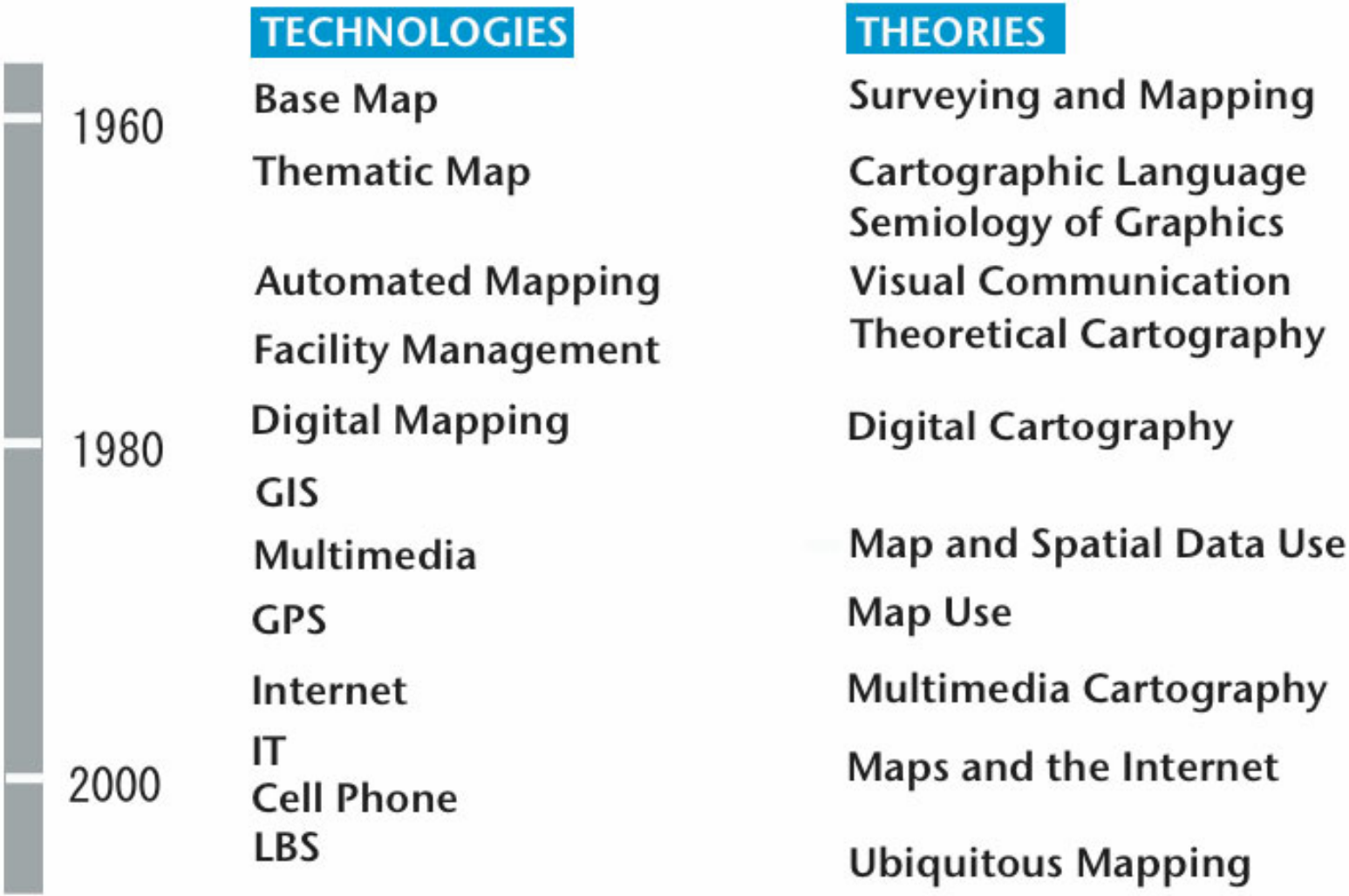
1. Introduction

- Evolution of research by the International Cartographic Association (ICA)
- The role of maps
- Differences between GIS and mapping
- Changes in the information environment

Evolution of research by the ICA

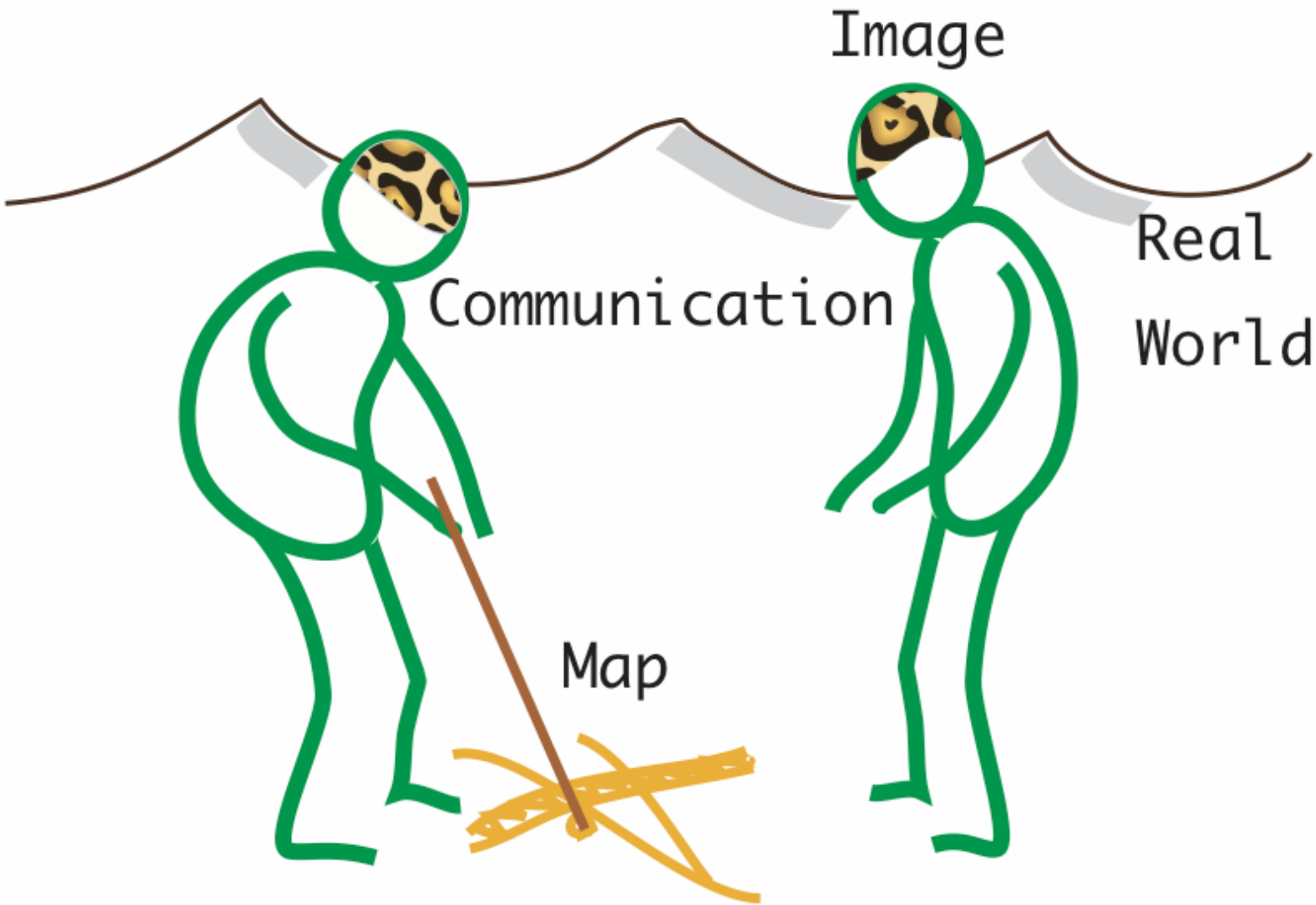
- From base map to thematic map
  - Cartographic language
  - Visual communication
- Digital Cartography (influenced by IT)
  - Integration of map maker and map user
  - From “map” to “mapping”
- The Commission on Ubiquitous Mapping
  - Terms of reference
    - To organize regional workshops including site observation to comprehend the contemporary situation of mobile, car-navigation and location-based mapping
    - To clarify the similarities and differences between systems to establish an evaluation scheme
    - To place the notion of ubiquitous mapping in the domain of Theoretical Cartography



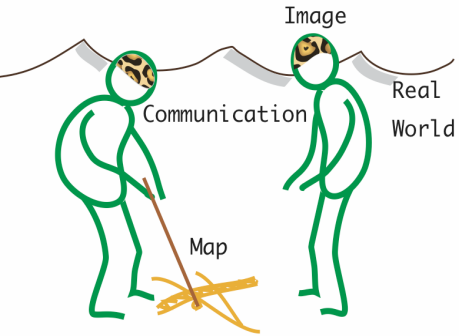
Evolution of research by the ICA

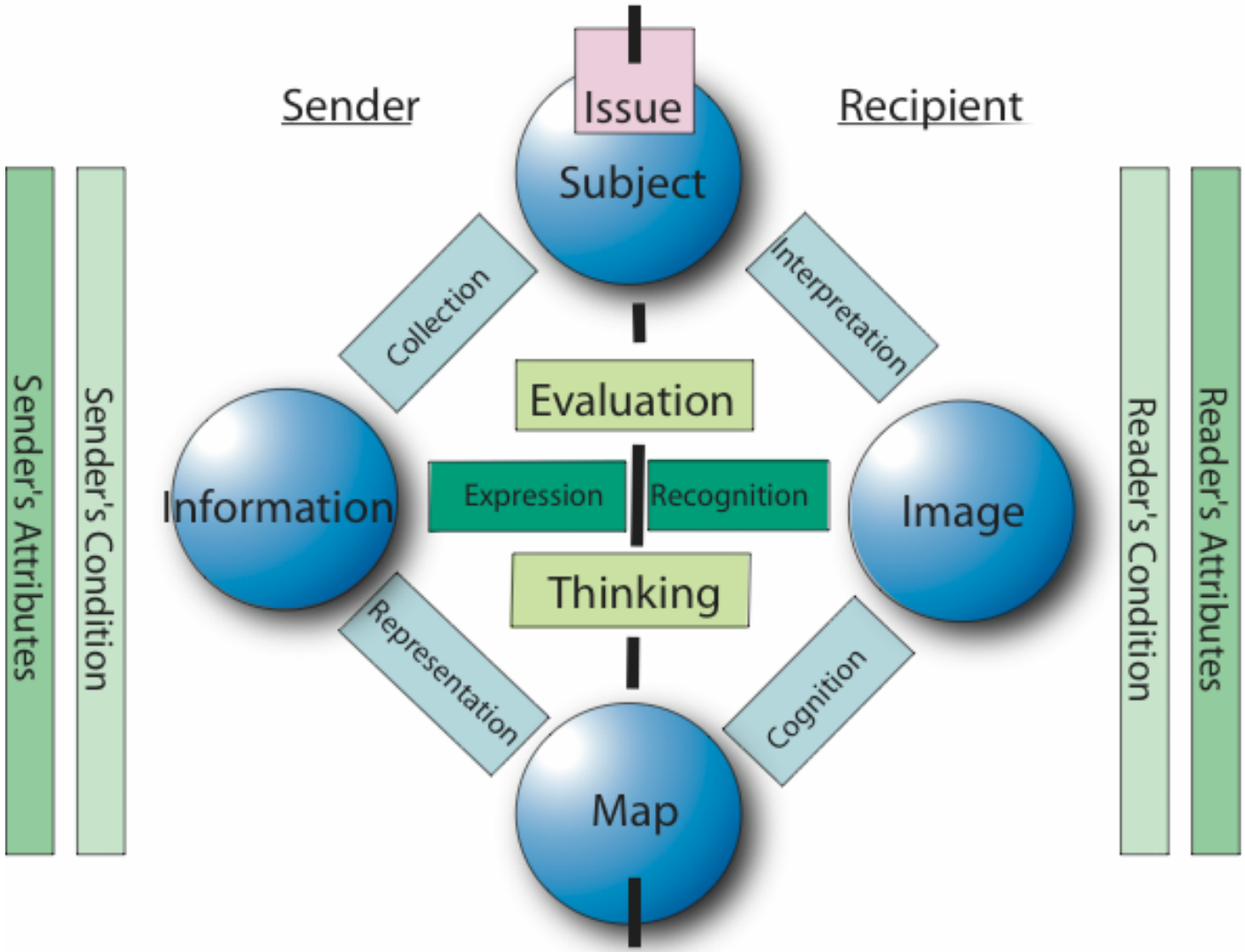
The role of maps

- To provide the framework of location
  - Relative location (relationship with landmarks)
  - Absolute location (coordinate system)
- Visual representation (primary role)
  - Pattern image
  - Rapid recognition
  - “Good” and “bad” representations
- Human–Map–Space Interaction
  - Recognized early in human history
  - Accelerated, facilitated, and stimulated by developments in IT



Origin of Map Communication

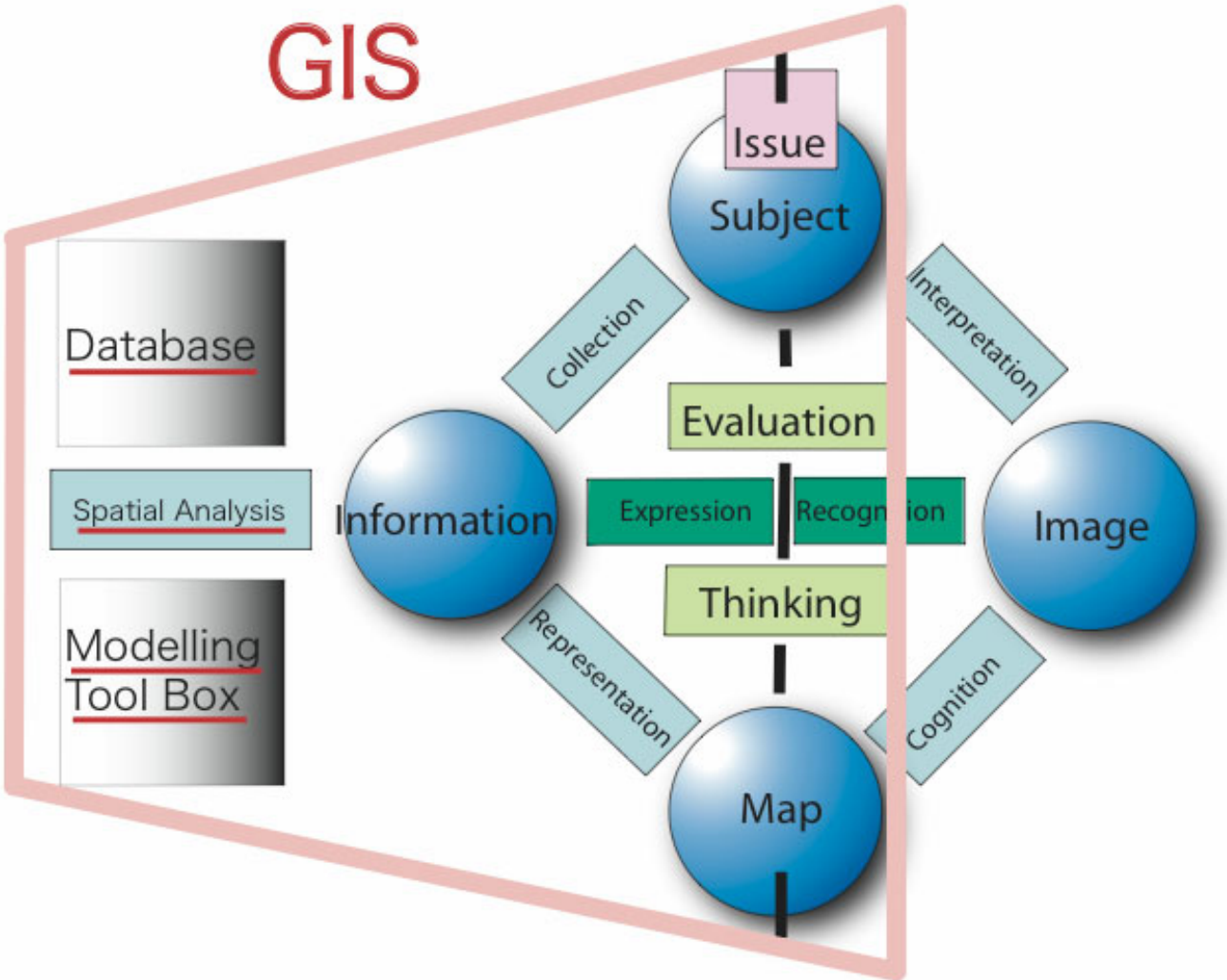




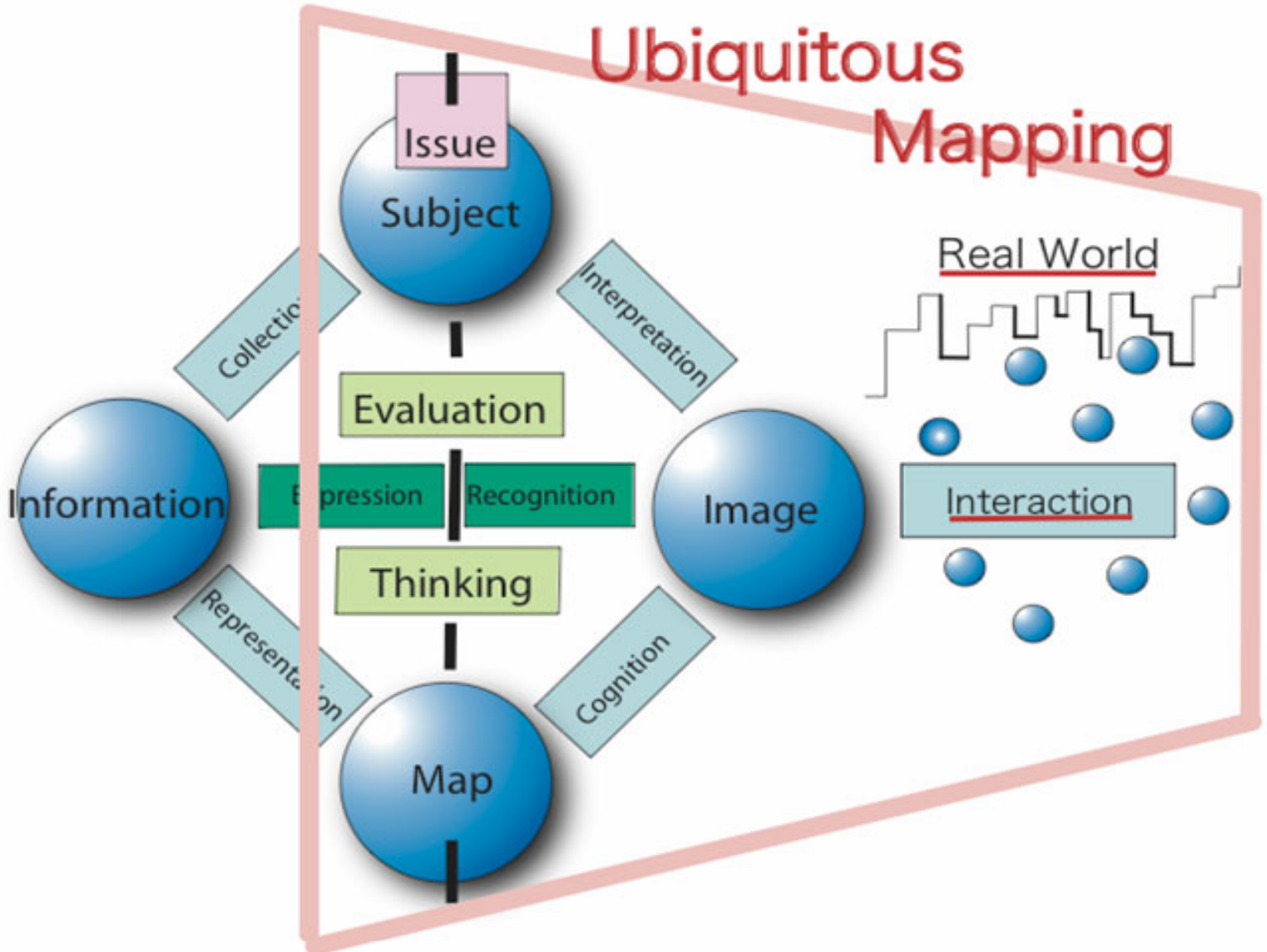
Map Communication

Difference between GIS and mapping

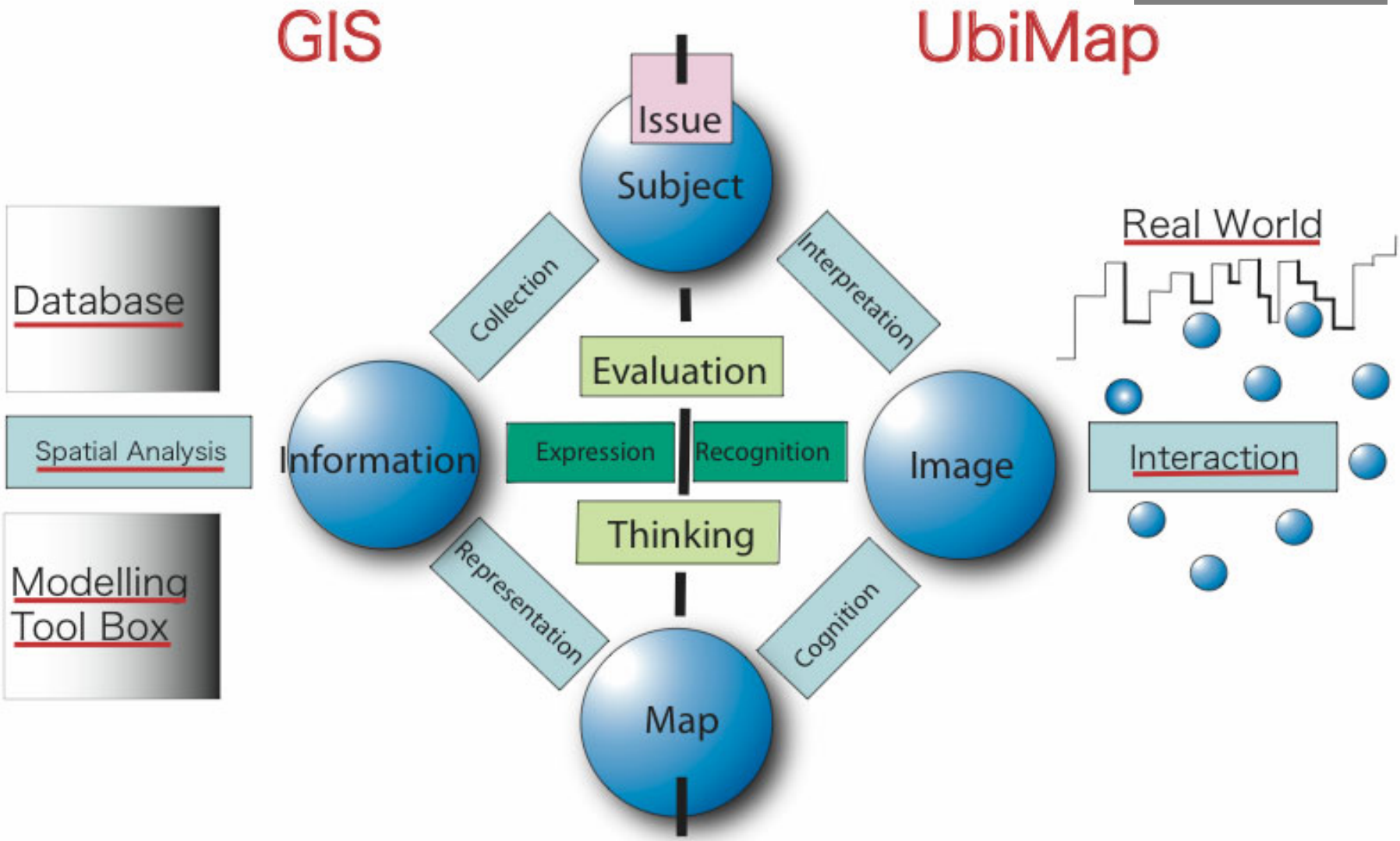
- GIS
  - Data input, database building, data analysis, data output on spatial information
- Map (Ubiquitous Mapping)
  - Includes not only map making but also map use and map communication considering the interaction between the map, the spatial image, and the real word
- GIS is system function oriented, whereas maps are human-oriented and include spatial cognition, decision making and communication factors



GIS in the Mapping Process



Ubiquitous Mapping in the Mapping Process



GIS and Ubiquitous Mapping

Changes in the information environment

- Visualization of information
  - From radio to TV, and now the internet
  - Visualization of printed media
  - Visualization of information using terminal devices
- Ubiquitous computing
  - Computers are now everywhere (ubiquitous)
  - Mobile equipment common
  - e-Japan (broadband), u-Japan (wireless)
  - Person-to-person, person-to-machine, machine-to-machine (machine communication: network, human communication: understanding)

2. Fundamentals of ubiquitous mapping (UbiMap)

- Ubiquitous nature of maps
- From “map” to “mapping”
- General aim

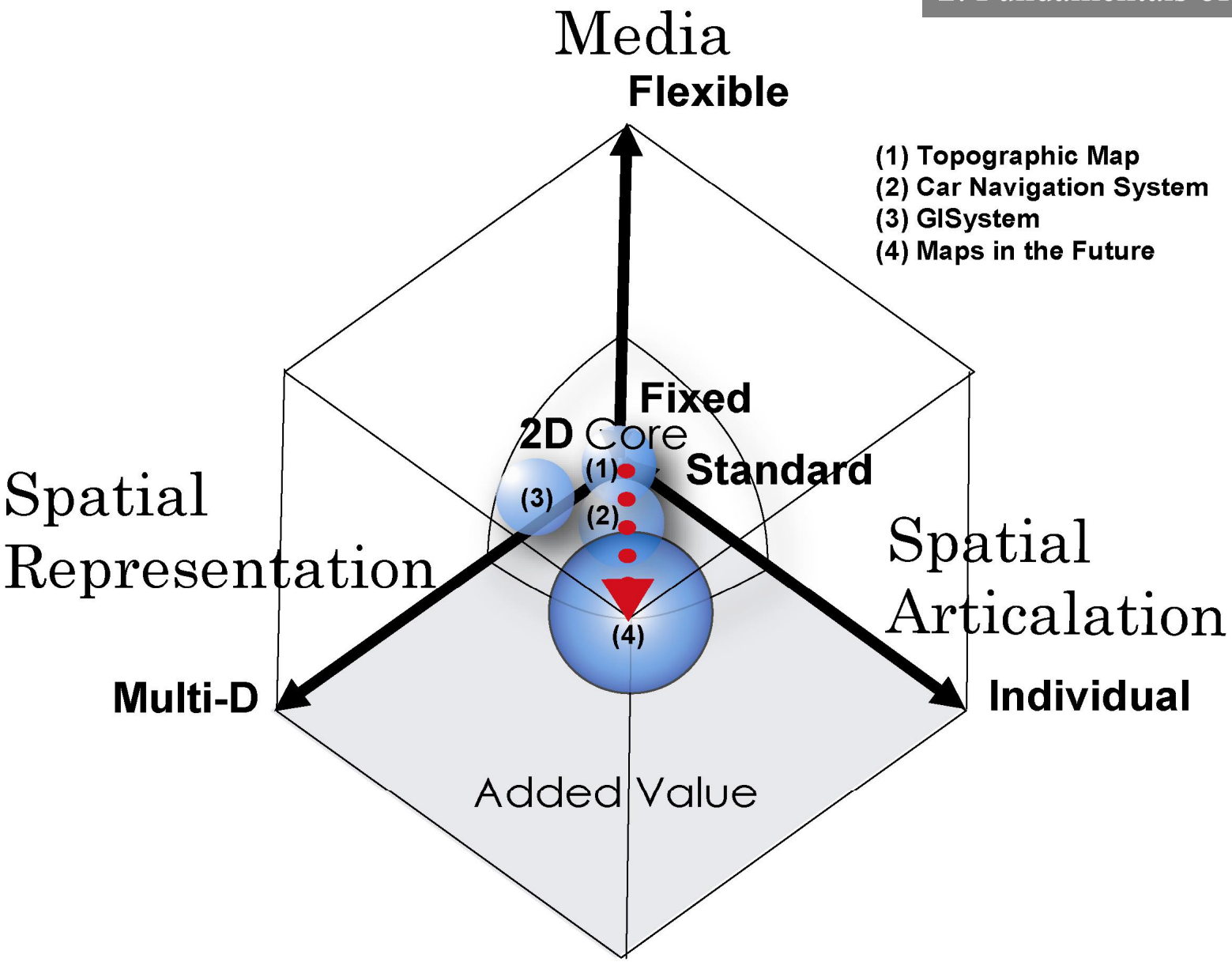
Ubiquitous nature of maps

- Visual perception (see any part of the image)
  - Recognition of entire image (pattern recognition)
  - Thematic image and background (figure and background)
  - Representing alternative solutions in the same image
- Creation process (create anywhere)
  - Generation
  - Creation
- Use process (use anywhere)
  - Mobile maps
  - Receive existing maps
  - Create and use

From “map” to “mapping”

- Bi-direction
- Real time
- Context awareness

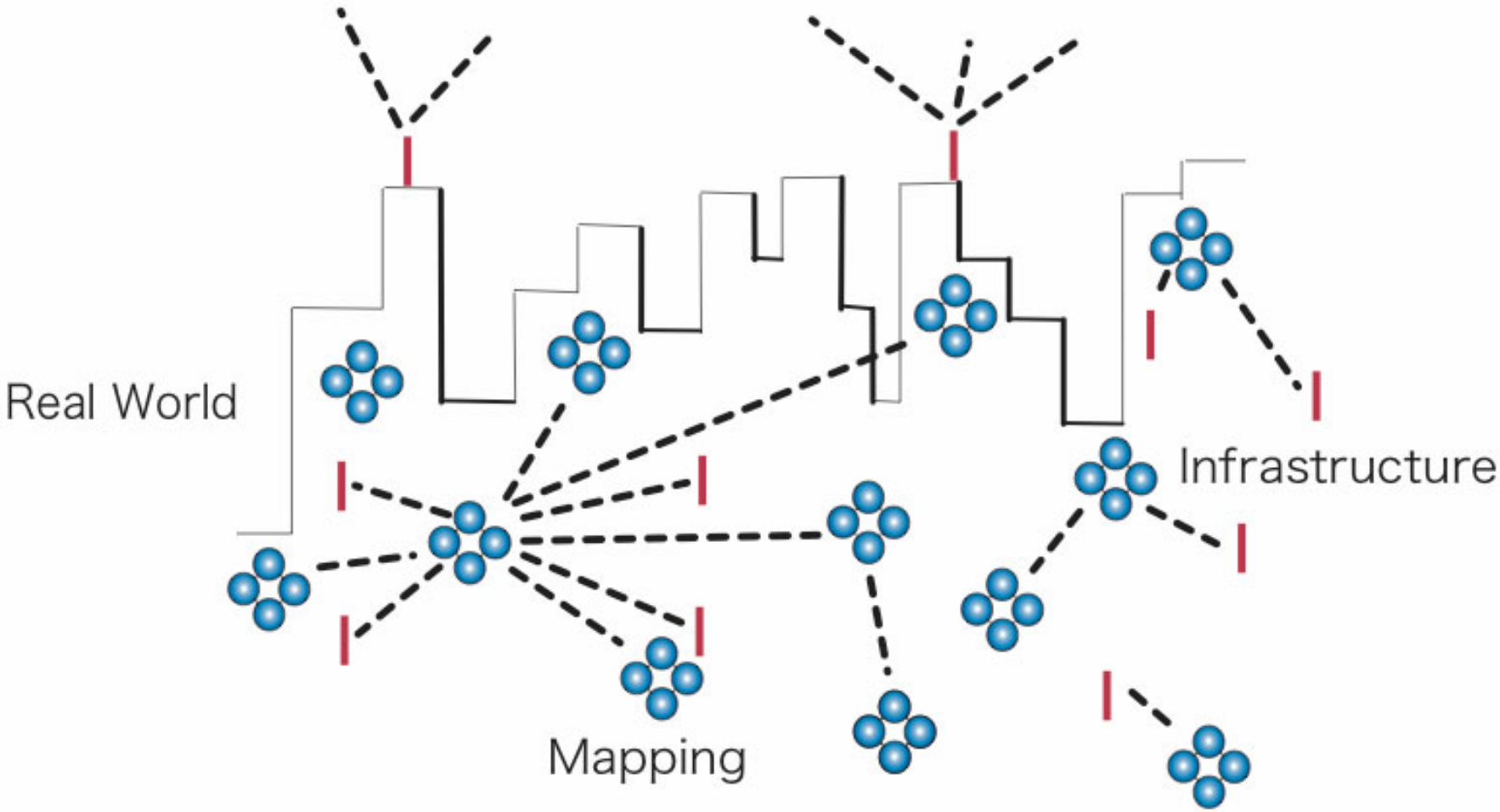
- Support spatial problem solving
- Egocentric (personalize)
  - Actual position
  - Easy to understand
  - Image stimulation
  - Stimulate spatial context awareness



Mapping World

General aim

Ability for users to create and use maps in any place and at any time to resolve spatial problems



Ubiquitous Mapping World

3. Basic framework of UbiMap

- Basic elements
- Framework for description of different cases
- Related areas

Basic elements

- The real world
- The map
- The user

❑ Interactions between elements

Framework for description of different cases

1. Situation or context, background
   - Description of the situation and the background
2. Problem
   - Definition of the problem
3. Strategic planning
   - How to solve the problem
4. Solution process
   - How the solution was derived
5. Results and evaluation
   - Success or otherwise

Related research areas (collaboration)

- Information technology
- Information design (visual communication)
- Spatial cognition
- Urban spatial design

4. Situation in Tokyo

- In-car navigation systems
- Cellular phones
- UbiMap applications

In-car navigation systems

- Development process
  - Commercial system (1981)
  - Use of GPS (1990)
  - Infrastructure development
    - Beacon system, RACS (1986)
    - Tele-terminal, AMTICS (1987)
    - Digital road network data, DRMA (1988)
    - VICS, RACS+AMTICS (1991)
  - ITS (1994)
  - 15 million units (2004)
- Functions
  - Display actual position (2D, 3D, landmarks), congestion/construction, route guidance (map, diagram, voice), query and display (parking etc.)

Cellular phones

- "All-in-one" type high-functionality cellular phones are more popular than PDAs (Palm and Pocket PC) in Japan
  - 90 million units, diffusion rate: 70%
- Example of current cellular phone spec:
  - Full-color, high-resolution Display (240x320 pixels, 167dpi), 3D graphics engine, Java/flash/SVG compatibility, camera (3 Mpx), removable memory, mail, Web, internet, voice recorder, Diary, 2D Bar (QR) Code Reader, GPS, Compass, infra-red reader, Bluetooth, IC Card for electronic currency, hi-fi speaker, Digital FM radio, TV Receiver, dictionary, MS Office compliant

UbiMap applications

- Directions
  - Address system, sign system
  - Use of landmarks
  - Use of augmented reality
- Public transport
  - Transfer map
  - Display panel in trains

UbiMap applications

- Security
  - Personal, car
  - Emergency car
- Improvement of atlas usability
  - 2D barcode
  - Map distribution

5. Conclusion

- Research agenda
- Remarks

Research agenda

- Generation of personalized maps according to the objective and spatial context
- Mapping system development considering participation, collaboration, and partnership of users
- Cross-cultural comparative studies to clarify similarities and differences between UbiMap implementations
- Consider information security and privacy

Remarks

- Ubiquitous mapping aims to realize technical solutions for map creation and use, and to predict the effect on society
- Ubiquitous mapping accelerates, facilitates, and stimulates the universal nature of map creation and using through the application of advanced information technologies