



e-Planning Research Methodology

•Knowledge models and representation

2008-2018

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Knowledge Models & Representation

Context for the role of ICT

Theory of Knowledge

ICT and Knowledge Engineering

Knowledge Representation

ICT and “Knowledge Capacity”

Examples of Projects



Context for the role of ICT

ICT in Planning

- Data in Engineering vs. Data in Planning
- New ICT bring access to a new type of data



Context for the role of ICT

ICT in Planning

- A new territory scale
("neighborhood planning")
- A new dimension of planning
("local indicators")
Citizens role enabling local indicators for local planning



Context for the role of ICT

ICT in Planning

- **New sources of data**
e.g. remote sensing, automatic gathering of geo-referenced data, long statistic series
- **New analytical tools**
e.g. GIS - Spatial Analysis, Forecast & Trade-off models



Context for the role of ICT

A new dimension of planning

The new ICT bring with them
change for the rules for economy & planning

- **Vendor ("Smart" Industry) interests vs. City interests =>**

- Centralized/Integrated vs. Distributed
- Vendor standards vs. Open standards
- Who owns the data?
- Citizen empowerment vs. Industry control
- Big Brother vs. accountability



Context for the role of ICT

A new dimension of planning

The new ICT bring with them
participatory science.

New Paradigm:

- Participatory gathering of indicators;
- New models of building policy & monitoring.



Context for the role of ICT

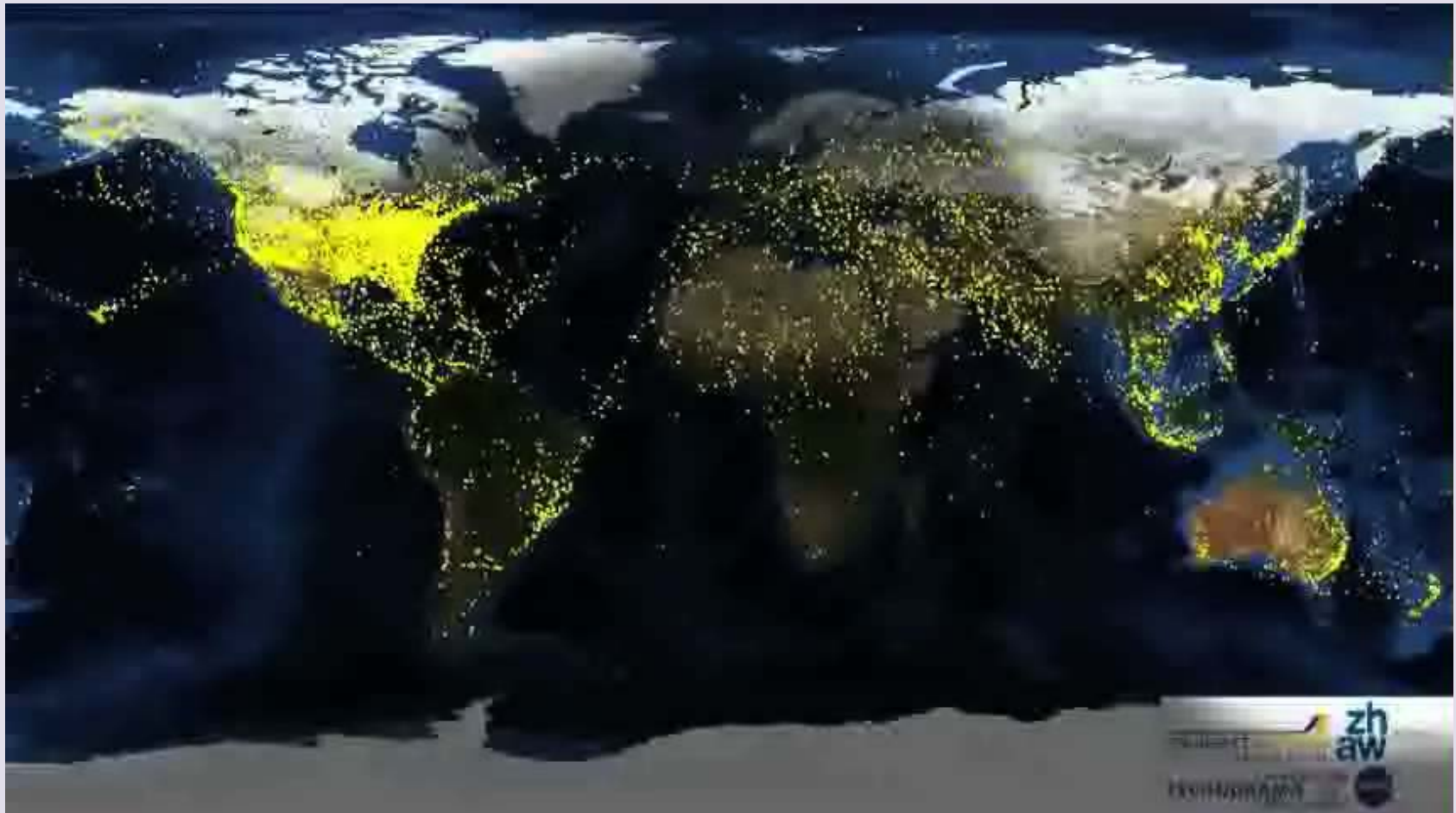
A new dimension of planning





Context for the role of ICT

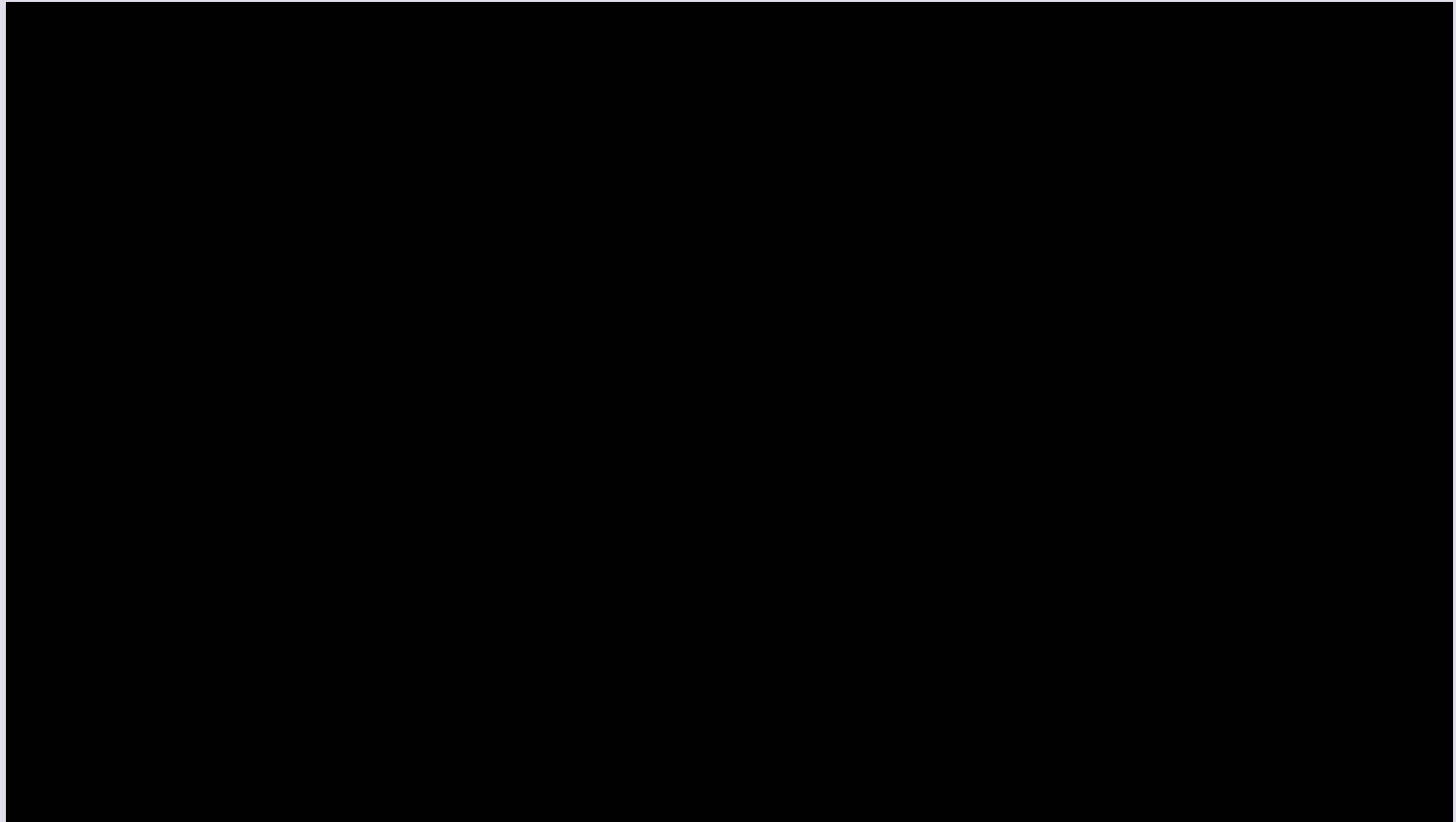
A new dimension of planning





Context for the role of ICT

... new professions



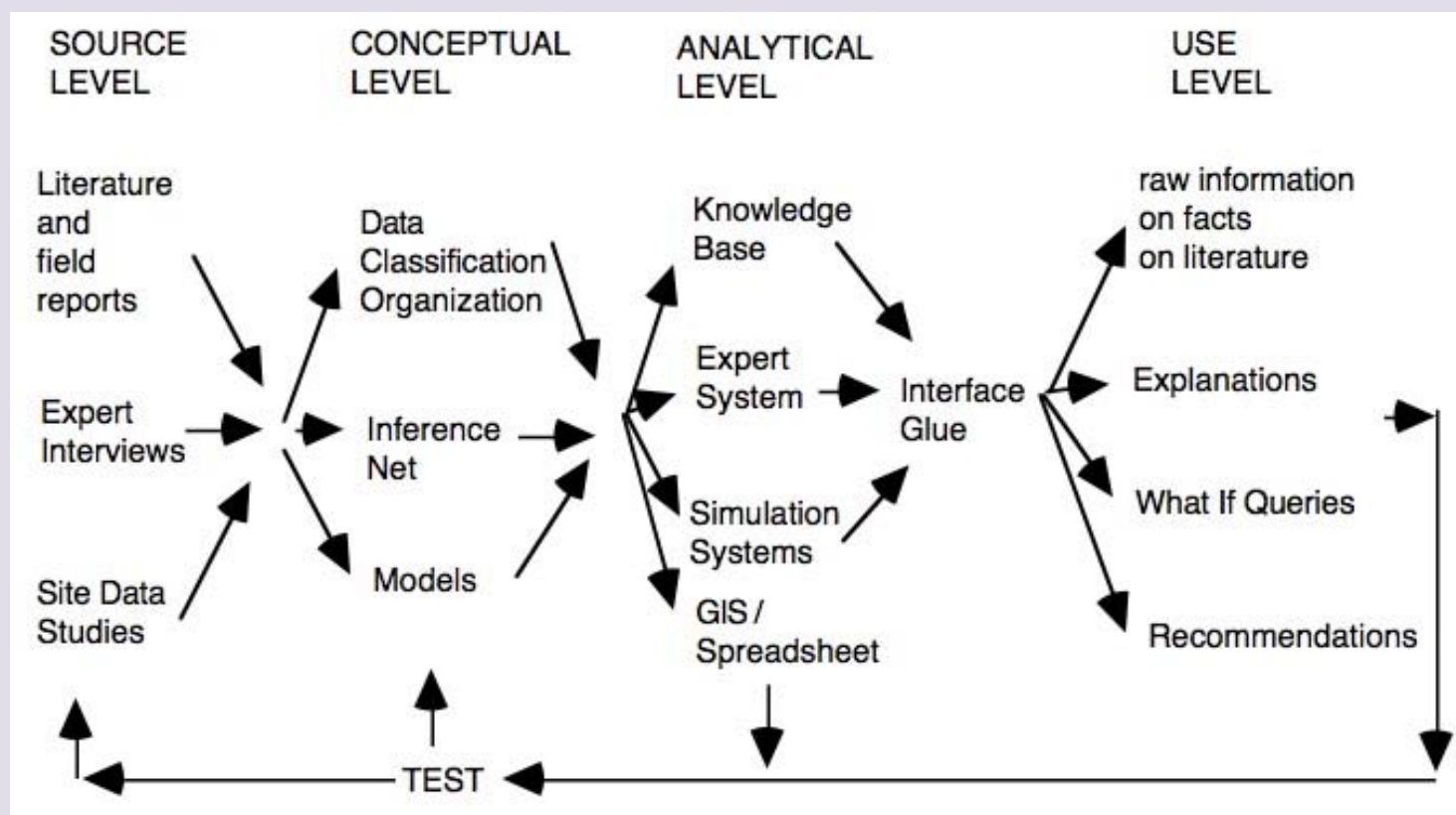


Context for the role of ICT

Different system levels

(Ferraz de Abreu, P. 2002).

"New Information Technologies in Public Participation: A Challenge to Old Decision-making Institutional Frameworks"





Theory of Knowledge

The key concept is **Knowledge**

*How to develop it, capture it, represent it,
store it, transmit it, process it.*



Theory of Knowledge

The key concept is **Knowledge**

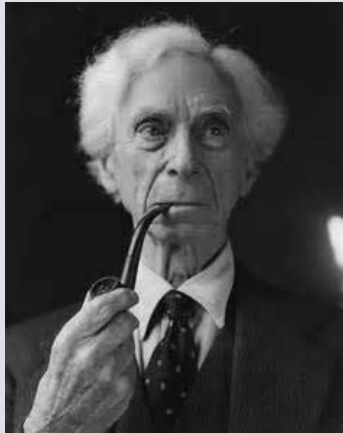
- **Gnoseology** (gnosis + logos)
- **Epistemology** (episteme + logos)
- **Schools of Knowledge Theory**
(ex. empiricism, rationalism, skepticism)

Flea Paradigm & Cogito ergo sum



Theory of Knowledge

The key concept is **Knowledge**



- Bertrand Russell (1926)
Theory of Knowledge

- Logic, Induction, Deduction

- Inference Engines

- Marvin Minsky (1980) (Frames)

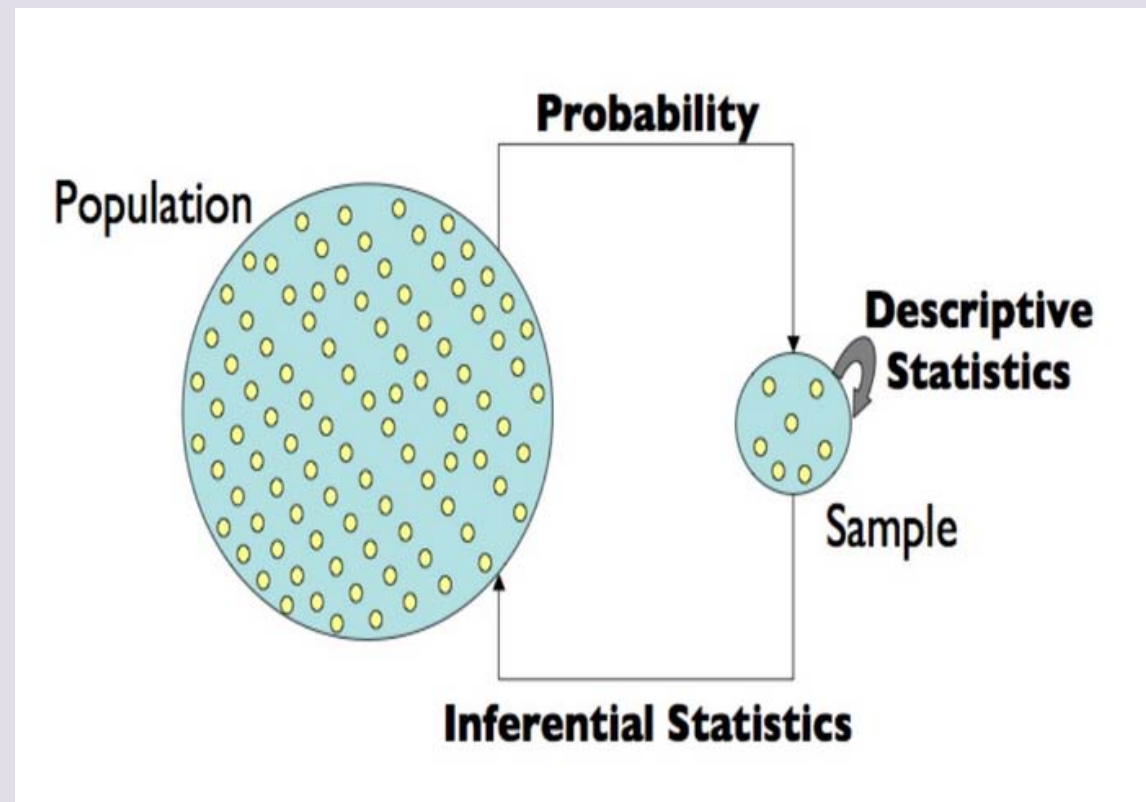




Theory of Knowledge

The key concept is **Knowledge**

Induction, Deduction, Inferencing... Reasoning

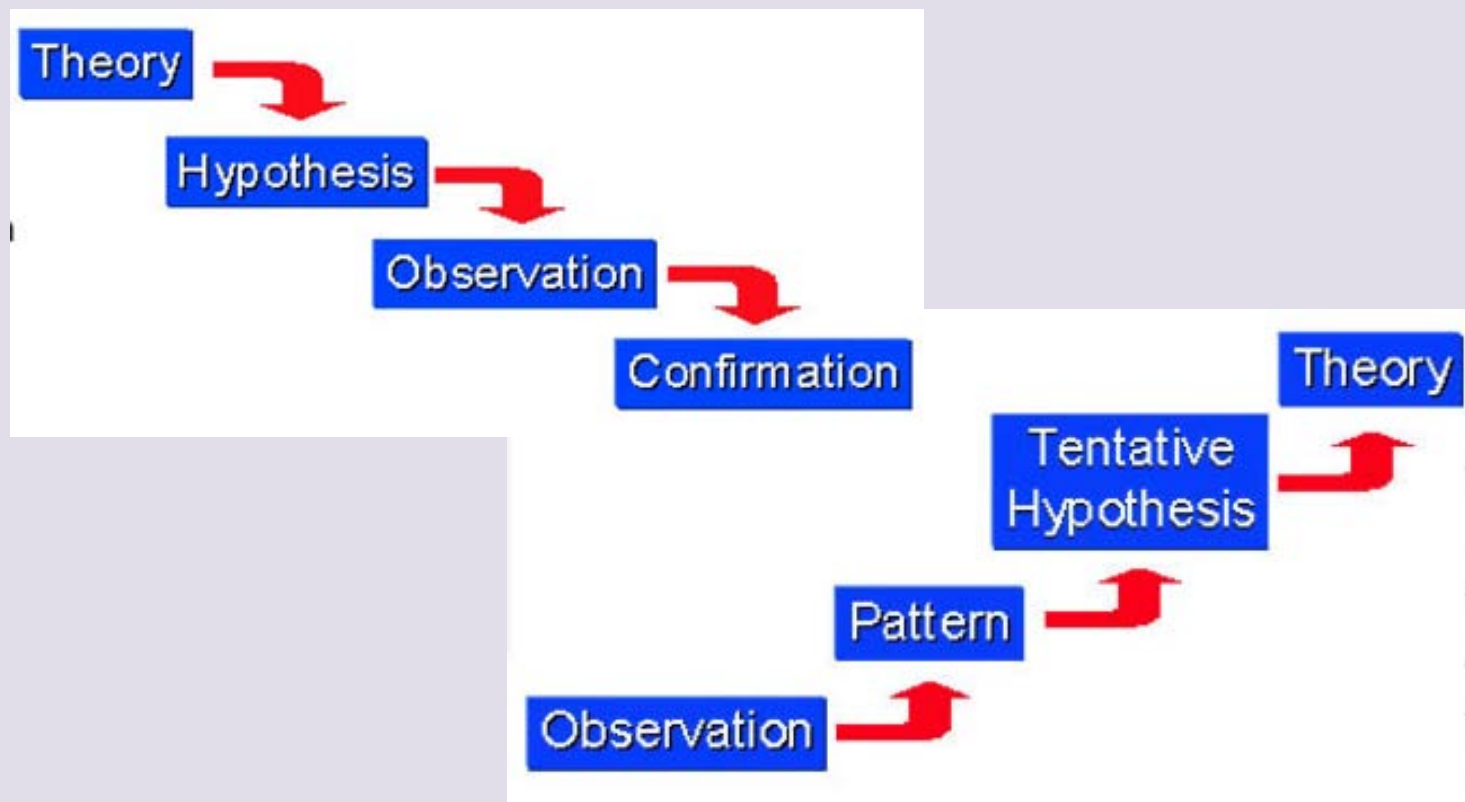




Theory of Knowledge

The key concept is **Knowledge**

Induction, Deduction, Inferencing... Reasoning





Theory of Knowledge

The key concept is **Knowledge**

Knowledge Representation

Knowledge Classes - Canonical Representation

- Term
- Concept
- Definition
- Model
- Rule
- Norm
- Procedure
- Methodology
- Description

(Pedro Ferraz de Abreu
1996)



ICT and Knowledge Engineering

REVISION

The key concept is **Knowledge**

*How to develop it, capture it, represent it,
store it, transmit it, process it.*

But for that we need as well:

To select the Media most adequate
to specific knowledge and communication...



ICT and Knowledge Engineering

REVISION

The "C" of ICT - what is communication

- theory of communication
- Shannon's equations (*signal / noise*)
- neguentropy

$$(I = \log_2 1/P ; S = K \log_e P \quad K \rightarrow \text{Ct. Boltzman})$$





ICT and Knowledge Engineering

REVISION

what is communication

the universe as audience

The paradigm of boot straps / shoe laces



ICT and Knowledge Engineering

REVISION

what is communication

the universe as audience

The paradigm of boot straps / shoe laces

- interaction out of phase in space
 - cultural context
 - conceptual context
- interaction out of phase in time
 - embedded help
 - interface consistency



ICT and Knowledge Engineering

REVISION

what is communication

the universe as audience

The paradigm of boot straps / shoe laces

- chose de most adequate:

@ representation model

@ media support



ICT and Knowledge Engineering

REVISION

what is communication

Theory of Communication revisited

- measuring information *transfer*
- the 3 core parts (*emission, reception, media*)
- the tools of communication
- the technology of communication

Why do we communicate?



ICT and Knowledge Engineering

REVISION

The key concept is **Knowledge**

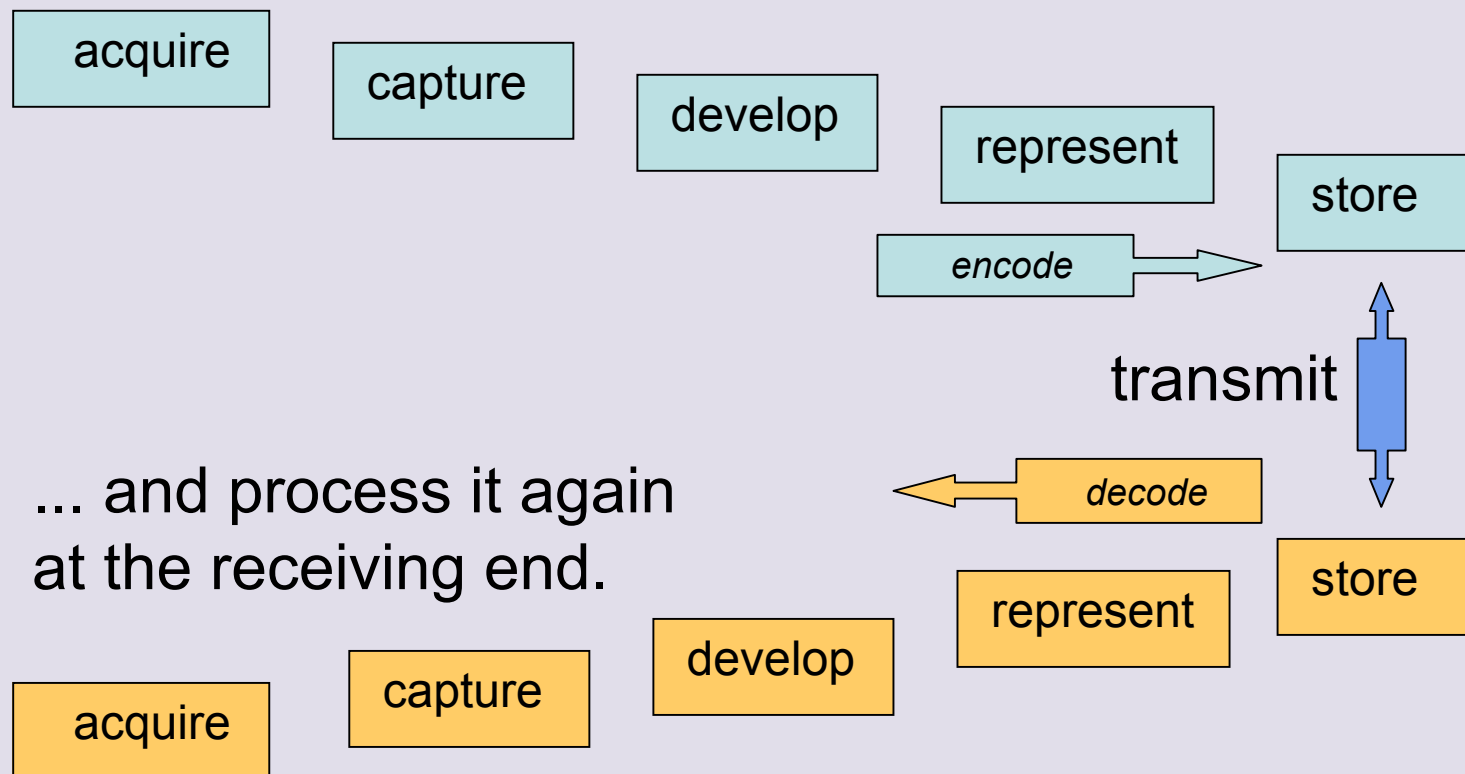
*How to develop it, capture it, represent it,
store it, transmit it, process it.*



ICT and Knowledge Engineering

what is communication

Information --> *knowledge*:





ICT and Knowledge Engineering

The key concept is **Knowledge**

How to develop it, capture it, represent it, store it, transmit it, process it.

But for that we need as well:

To select the Media most adequate to specific knowledge and communication...

...Plus the **Representation Model**

Table 3.3.5.1.-1 - Knowledge Representation Models

Representation	Inference / Reasoning	System Dynamic
Expressions (equations)	Algebra	attribute driven
Rule-Based	Production Rules (forward/backward chaining)	event or attribute driven
Regular Grammars (Automata)	Production Rules (expansion)	event or attribute driven
Semantic Networks	Relational Rules	relationship driven
Object-Oriented	Inheritance (Z,N)	attribute driven
Script/Procedural	Dispatcher	event driven
Frames	Daemons	event driven
Intelligent agents	Blackboard	event driven
Case-Based descriptors	Pattern-Matching	attribute driven

In (Ferraz de Abreu) , 2002"New Information Technologies in Public Participation: A Challenge to Old Decision-making Institutional Frameworks"



Knowledge Representation

Induction, Deduction, Inferencing... Reasoning

In order to *generalize*,

- Change constants to variables,
- Drop conditions ("AND" clauses,
from IF part of rules),
- Add options ("OR" clauses),
- Climb in an IS-A hierarchy.

In order to *specialize*,

- Restrict the range of variables,
- Add conditions,
- Drop options,
- Descend in an IS-A hierarchy.



Knowledge Representation

Rule-based model (Inference engine)

Inferencing - Paradigm of the week swimmer

System Rules:

```
IF      you have a boat
        you need to cross the river
THEN    method to cross the river <- use the boat

IF      you need to cross the river
        you know how to swim
        you are a good swimmer
THEN    method to cross the river <- swim
```

World Facts:

```
you need to cross the river
you know how to swim
you are a poor swimmer
there is no boat
```

System generalizes:

```
IF      you need to cross the river
        you know how to swim
THEN    method to cross the river <- swim
```



Knowledge Representation

Rule-based model (Expert systems)

- | | |
|---|---|
| 1) IF household IS low-income
THEN house-infrastructure IS low-standard
ventilation IS poor | 2) IF house-infrastructure IS low-standard
AND heating-fuel IS-NOT available
THEN house-heating IS wood-stove |
| 3) IF house-heating IS wood-stove AND
ventilation IS poor
THEN indoor-pollution IS high | 4) IF indoor-pollution IS high
THEN rate-of-children-lung-disorder IS high |
| 5) IF rate-of-children-lung-disorder IS high
THEN mothers-productivity IS low
public-health-costs IS high | |

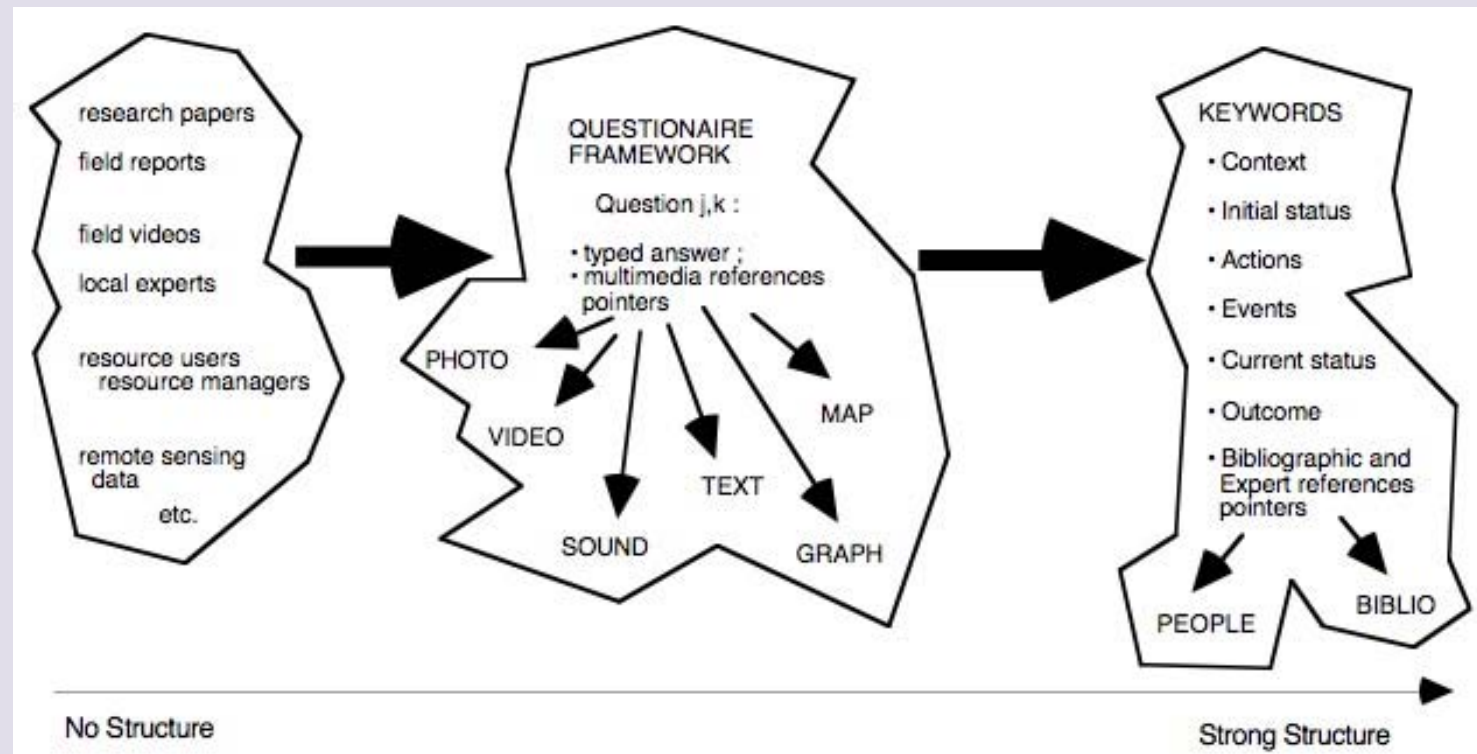


Knowledge Representation

Case-based knowledge model

(Ferraz de Abreu, P. 2002).

"New Information Technologies in Public Participation: A Challenge to Old Decision-making Institutional Frameworks"





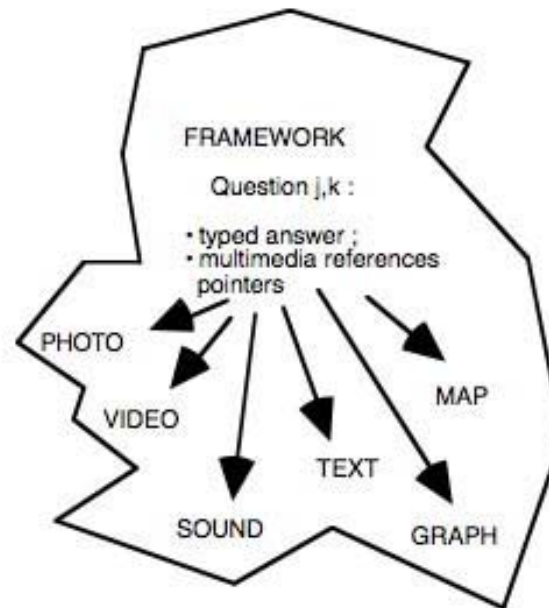
ICT and Knowledge Engineering

Handling Different Media Formats

jpeg
png
gif

mpeg
mov

...



mp3
wma
wav

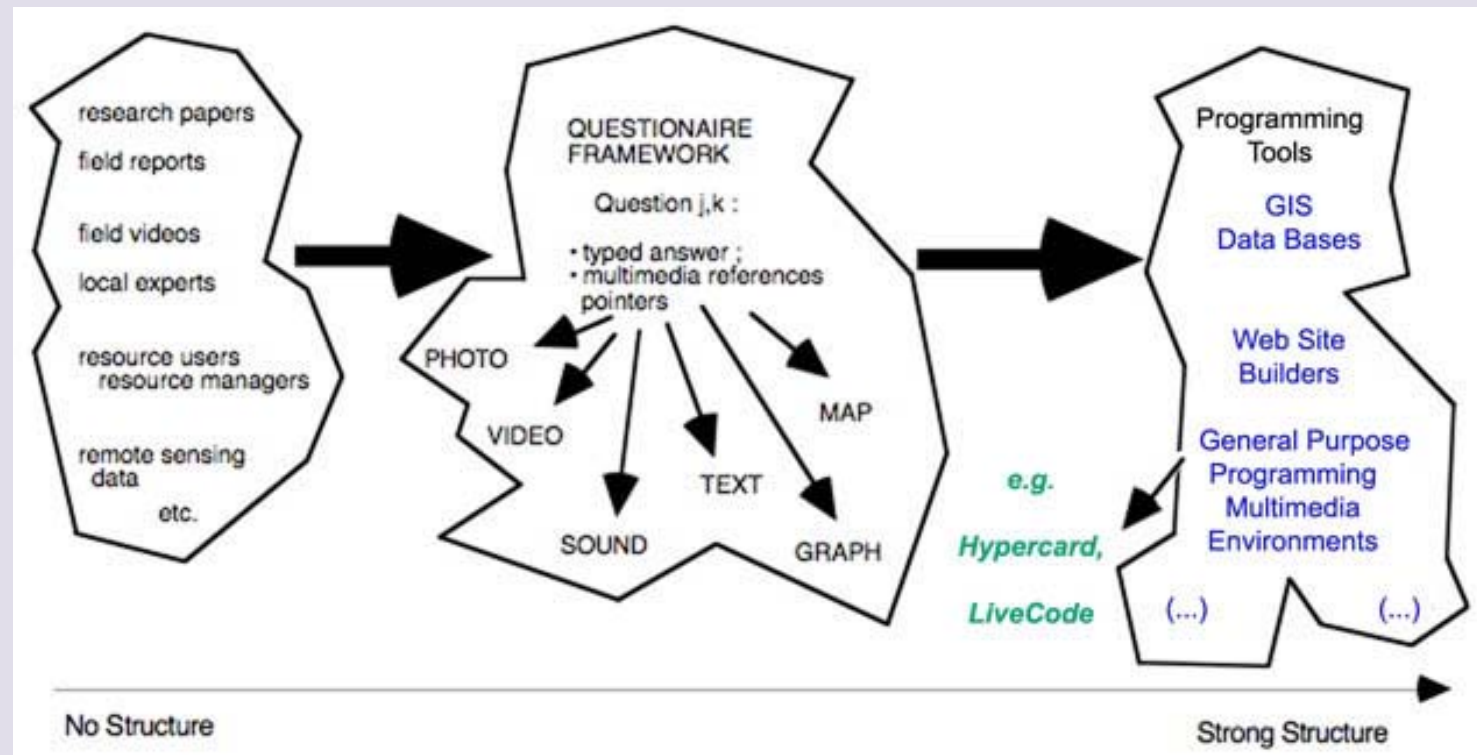
aac
aiff

...



ICT and Knowledge Engineering

Different Programming Tools



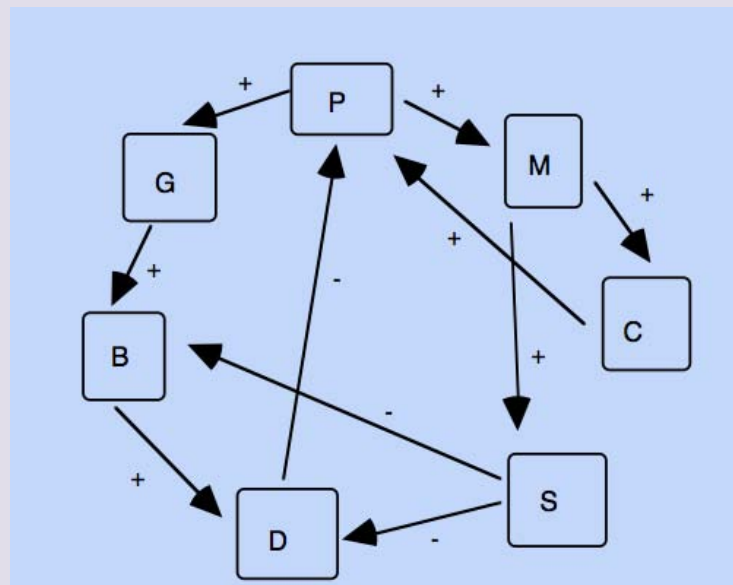


Knowledge Representation

Inference Net Graph Model

Qualitative Analysis Research:

Adapted from Myuryana



- (B) - bacteria present in the area
- (G) - accumulation of garbage in the area
- (D) - number of diseases
- (P) - people in the city
- (C) - migration into the city
- (M) - modernization of the city
- (S) - sanitary improvements

Graph representation of a inference net
of causal relationships - graph tool set.



Knowledge Representation

Case-based Research

Adapted from Omar Razzaz

- **Case identifier** (usually a name). Serves as index key;
- **Context** (resource type, geographic location, etc.);
- **Initial status** (conditions at a date defined as the beginning of the research period);
- **Actions** (deliberate, controlled human intervention impacting on the resource and its users);
- **Events** (non-deliberate, non-controlled natural or social changes impacting on the resource and its users);
- **Final status** (conditions at a date defined as the end of the research period, if past, or the current date);
- **Outcome** (degree of success or failure, which may be user defined);
- **Experts** (persons contributing with information).



ICT and “Knowledge Capacity”

Multidisciplinarity - culture shock



- Conservation vs. development (Olmstead)
- Corner - blessing or curse



ICT and “Knowledge Capacity”

Participatory Science as a KCB tool

The 3 models of participatory science:

- *GLOBE (NASA)*
- *SETI ; BOINC (Berkeley)*
- *PEOPLE (JRC-UE) ; EuroLifeNet (CITIDEP)*



ICT and “Knowledge Capacity”

- Examples of Projects

NEXT



ICT and “Knowledge Capacity”

CITIDEP + MIT Projects

(Examples)

- **IMS** - Sistema Multimedia Inteligente para Apoio à consulta publica (actualização) www.citidep.pt/ims/
- **PEOPLE-Cidadania** www.citidep.pt/act/peoplecitidep.html
- **EuroLifeNet** (em curso) www.eurolifenet.eu
- **Kit Cidadania** (standby) www.citidep.pt/act/citikit.html
- **Sabor/Coa** (standby) www.citidep.pt/act/sabor.html



www.citidep.pt



Participatory Science

CITIDEP PROGRAMS

Citizenship & ICT

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- ICT & participatory science
- ICT & participatory democracy
- ICT, inclusion & cooperation
- ICT, policy & strategy



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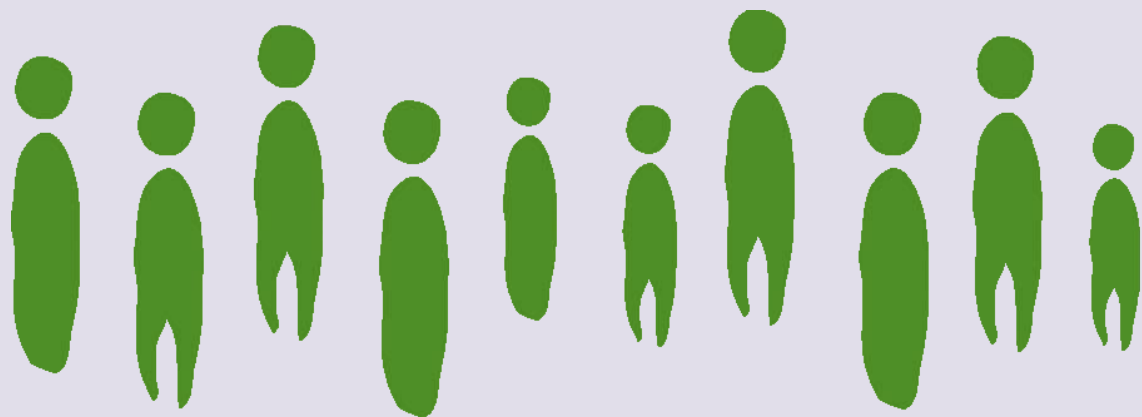
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(em fase de proposta)



www.e-planning.org

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