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argumentative support system in environmental scenario development

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introduction

Gravics has been designed in order to *support decision-making processes for natural park setting*.

In environmental planning decision making, *knowledge actors and knowledge bases* are under continuous modifications in consequences of changes of actors' involvement, of activated learning mechanisms, of knowledge use and production.

Referring to such continuous modifications, the research activity has been focused on the *introduction of a dynamic representation of environmental future scenarios* which are defined in terms of *process-scenarios*.

The idea of *process-scenarios* is consistent with the belief that visions of the future are not static but change continuously in the course of planning action. Such changes, representing the transactions from one action space to another, need to be made explicit in terms of *cognitive conditions and argumentations* (cognitive causes) that generate the transactions themselves.

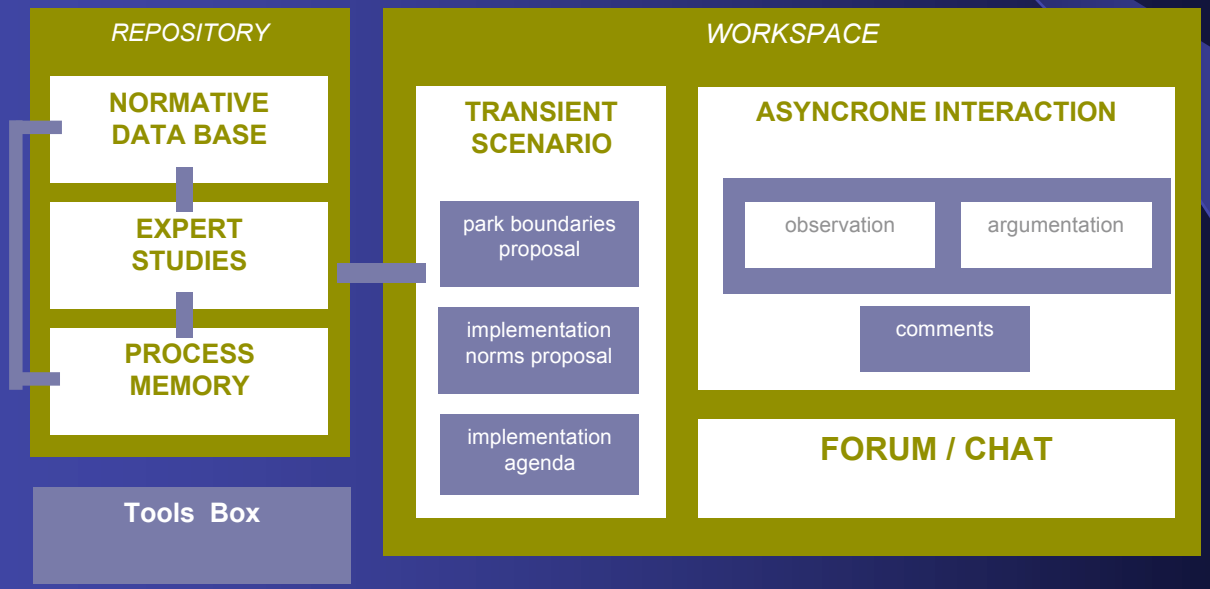
Argumentation can be considered in terms of different cognitive activities: problems identification, possible solution generation and evaluation to these problems.

The proposed paper focuses on the *automatic extraction of part of the argumentative base*; in particular we focus on the automatic extraction of *argumentative maps (argu-maps)* from texts by users who ask and discuss for changes in the future scenario within a text mining approach.

GraviCS: what problems, what perspectives

GraviCS architecture is consisting of three macro-modules:

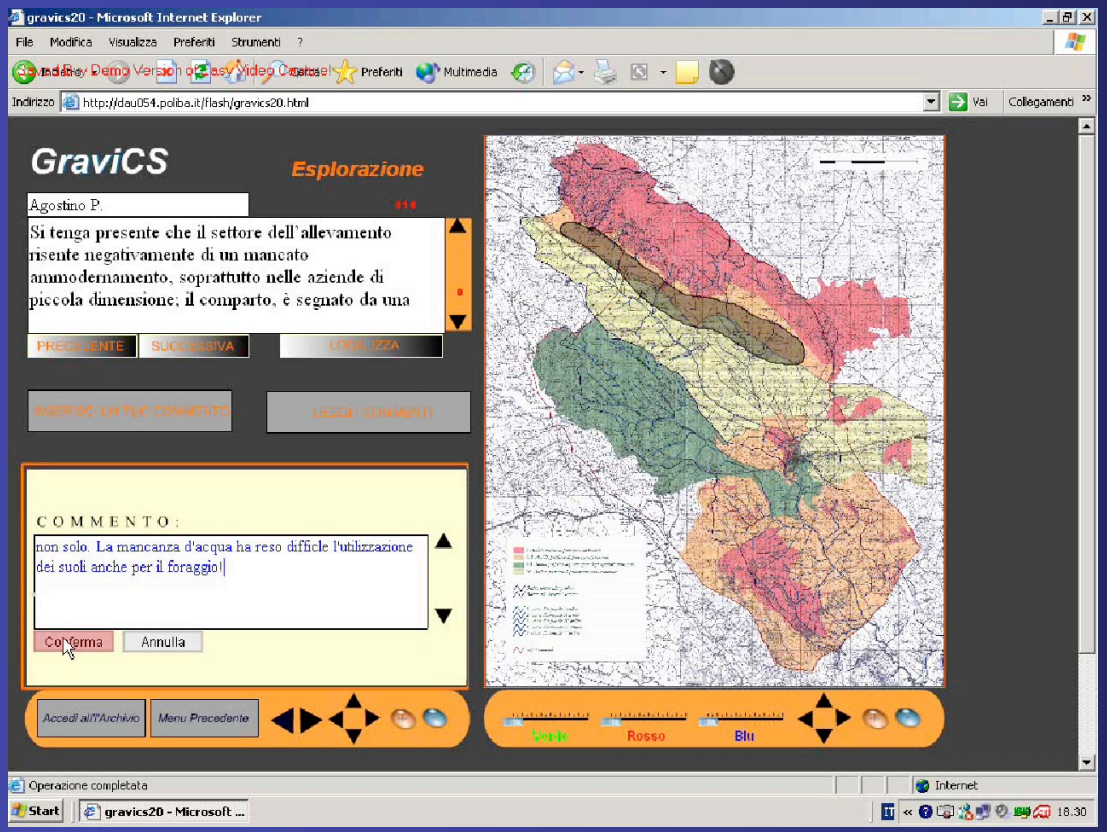
i)Organizational memory module; ii) Virtual space of interaction; iii)Tools box



… the basic goal for the system design has been that of implementing a system that can evolve together with the evolving decision-making process

GraviCS workspace supporting the argumentative dialogues …

… represents the virtual space where knowledge is acquired in two different interactive environments:



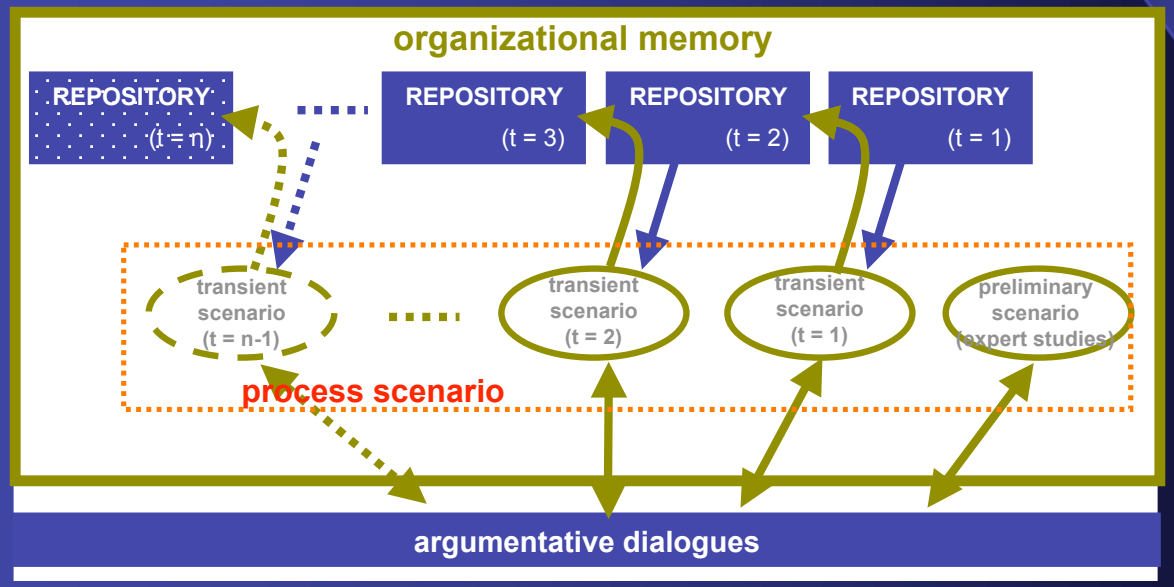
- ✓ an individual, asynchrone interaction environment enabling the introduction of **observations/argumentations** and eventually related **comments**
- ✓ a synchrone environment supplying forum and chat

Process-scenario: dynamic environmental future scenario

a *process-scenario:* represents the "story" of transactions from an action space to another one and are composed by two basic elements:

✓*transient scenario*, momentary images of the process-scenario

✓*argumentative maps*, explaining the transition between two subsequent transient scenarios.



the *transient scenarios*

✓is consisting both of a textual part and a cartographic image of the Natural Park setting area together with the wide set of observations, comments, micro-decisions and suggestions produced throughout the interaction and not yet deliberated

✓It *captures the context of specific ideas, decisions, and actions* created by the participants through the recording of issues, observations, and comments

✓*promote shared understanding at a particular time* about the context situation but does not have long-term value

✓provides a sort of representation of (some but significant) aspects of organizational and interpersonal communication, and makes the representation of those aspects available for subsequent use in the context of ongoing activities.

Argu-Maps: functions and objectives …

…if we imagine the process-scenario as a sequence of transient-scenarios, argumentative-maps represent the logic link between one transient-scenario and the subsequent and are asked to explain and take memory of the scenario evolution.

Argumentative-maps have to be structured and deduced according to two objectives:

- ✓ to explain the transition between subsequent transient-scenarios;
- ✓ to support agents in monitoring and evaluating their own and the collective cognitive traces (i.e. argu-maps constitutes a possible answer to the problem of design rationale recording, being a learning support supplied to the process actors).

Text mining for argumentative map extraction

Argumentative maps, in GraviCS, are produced by the use of textual-analysis of interaction documentation (debates, observations, comments and discussion)

The analysis of the text has been carried out within a standard Text Mining framework.

The introduction in GraviCS of a module for automatic Text Mining oriented to argumentative-maps generation derives from two main needs in the scenario building process:

- ✓ to allow the automatic and rapid organization and structuring of knowledge contained in textual documents growing quickly and continuously. Trying to minimize the risk of a subjective interpretation in map development;
- ✓ to capture main argumentative contents believing that these are mostly contained in the text of discussion collected during the scenario building process.

The software used for the test is TextAnalyst

(Megaputer Intelligence, Inc. 1999-2000).

The software processes text by the use of neural network and generates semantic structures as end products.

The analysis process is consisting of three phases:

✓pre-processing: software identifies words stems and separates these stems from their prefixes, suffixes and endings

✓statistical analysis: establishes statistical weights for the words of the text and statistical weight for their reciprocal relationship.

✓ re-normalization: the neural network of Text Analyst adjusts the weights

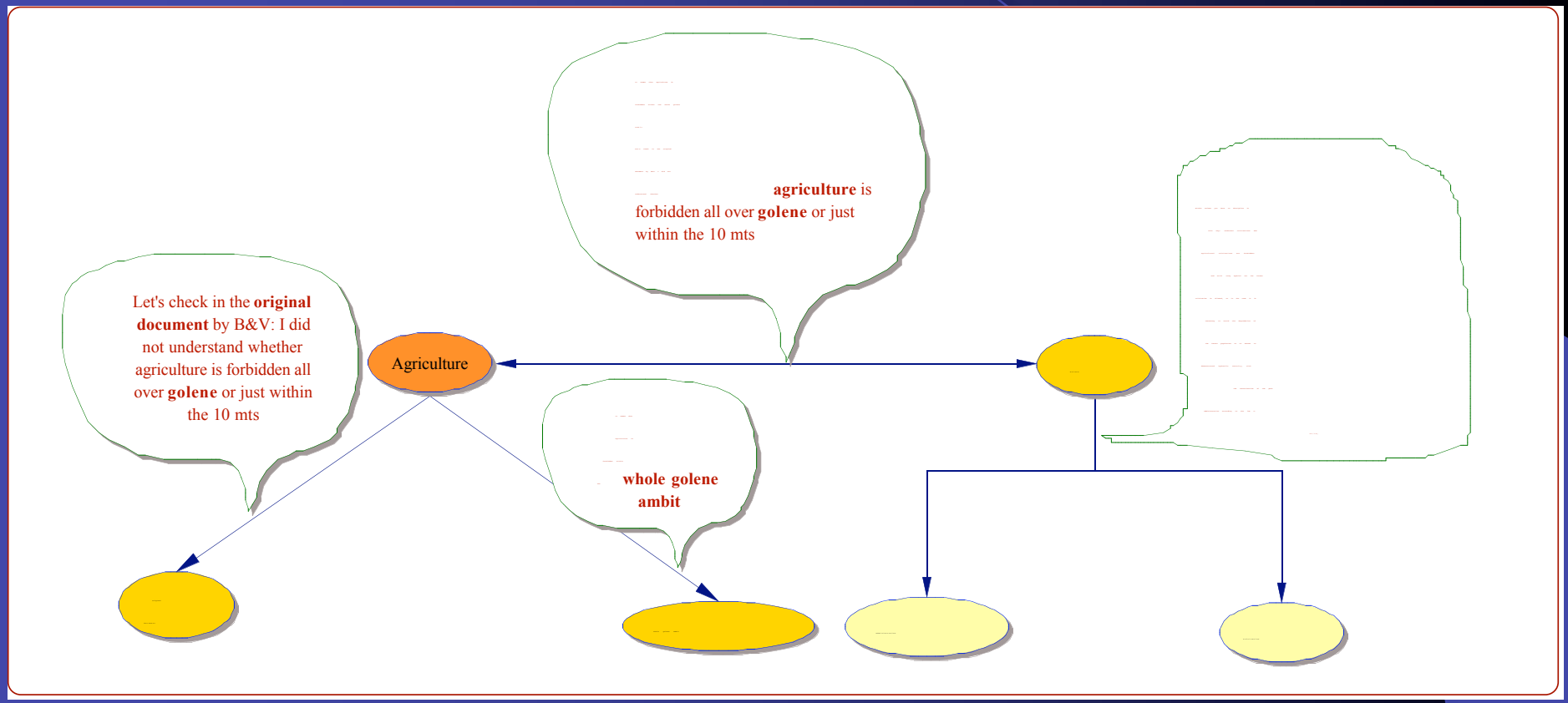
Text Analyst outputs are graph-like structures called semantic networks.

These networks provide the most important words and word combinations (named “semantic concepts”) contained in the analyzed text and the relationships between them.

the argumentative-map has been obtained by superimposing two different frameworks of the software results

- ✓ the hierarchy of semantic concepts (hierarchy reveals the different importance of words),
- ✓ links between words , each link underlines relation between different concepts.

….such superimposition has been represented with a graph-like map in which concepts are nodes and hierarchic connections father/sons are links.



(Golene are called the dry-soils between bank and embankment of the Po river)

Experimentation in order to test text mining for argu-maps creationin GraviCS.

the experimentation refers to the work carried out for reviewing the regulations of the Po river Natural Park (Veneto region, Italy):

the scenario simplification consisted of considering only the regulative component of a scenario and, more relevant, only the textual mode of agent cognitive contribution.

the definition of norms about activities allowed in the park area have been taken into account. We focused our attention on the evolution followed by a specific rule introducing restrictive practices about agricultural activities (article n.20 of the regulations).

The testing analysis included two main phases:

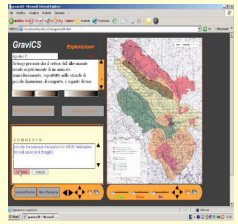
- ✓texts analysis and argumentative-map structuring;
- ✓results assessment.

The chosen test-text answers to the following requirements:

- ✓ plurality of authors with different cognitive domains
- ✓ different moments of interaction (non-synchronic interactions)
- ✓ open contents of observation
- ✓ use of mixed language (informal and technical language)

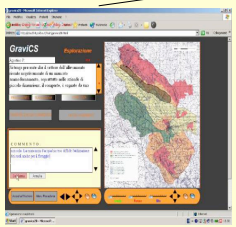
…in order to test the procedure with fragmented and inhomogeneus texts like the ones processed in GraviCS

- image of the process-scenario

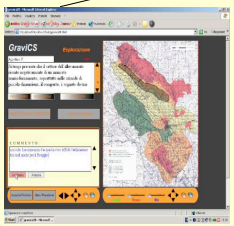


preliminary scenario t=0

Transient Scenarios

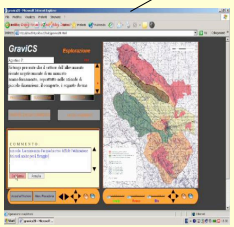


Nelle golene e nelle zone prospicienti l'alveo senile del Po ricadenti in zona B e C **non è consentito l'impianto selvicolturale produttivo** o coltivo agricolo a distanza inferiore di 10 m dal ciglio della riva dell'alveo. Le coltivazioni arboree e le coltivazioni agricole esistenti a distanza inferiore ai 10 metri dal ciglio della sponda **devanno essere riconvertite** al fine di assicurare una fascia continua di vegetazione spontanea avente funzione di prima barriera al moto ondoso, di stabilizzazione delle sponde e di depurazione delle acque. Le coltivazioni produttive esistenti in suddetta fascia alla data di approvazione del presente Piano possono essere continuate fino al completamento del turno produttivo ovvero fino alla scadenza delle concessioni in corso. Negli stessi ambiti è altresì vietato l'impiego di diserbanti chimici e l'aratura e il taglio a raso **degli ambiti golenali.**

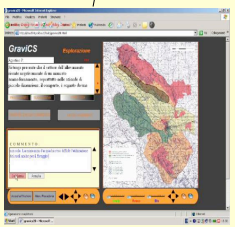


nelle zone prospicienti l'alveo

senile del Po (B8) non è consentito *** l'impianto coltivo agricolo. Nelle golene in zona B (B7) le coltivazioni arboree e le coltivazioni agricole esistenti a distanza inferiore ai 10 metri dal ciglio della sponda devono essere riconvertite al fine di assicurare una fascia continua di vegetazione spontanea avente funzione di prima barriera al moto ondoso, di stabilizzazione delle sponde e di depurazione delle acque. Le coltivazioni produttive esistenti in suddetta fascia alla data di approvazione del presente Piano possono essere continuate fino al completamento del turno produttivo ovvero fino alla scadenza delle concessioni in corso. Negli stessi ambiti è altresì vietato l'impiego di diserbanti chimici e l'aratura e il taglio a raso degli ambiti golenali



***le **coltivazioni arboree** e le coltivazioni agricole esistenti a **distanza inferiore ai 10 metri dal ciglio della sponda** devono essere riconvertite al fine di assicurare una fascia continua di vegetazione spontanea avente funzione di prima barriera al moto ondoso, di stabilizzazione delle sponde e di depurazione delle acque. Le coltivazioni produttive esistenti in suddetta fascia alla data di approvazione del presente Piano possono essere continuate fino al completamento del turno produttivo ovvero fino alla scadenza delle **concessioni in corso**. Negli stessi ambiti è altresì vietato l'impiego di diserbanti chimici e l'aratura e il taglio a raso degli ambiti golenali.



*** Nelle zone A, B e D del Parco non è consentito l'esercizio di attività agricole.
*** Nelle zone C dell'area del Parco l'attività agricola è consentita solo negli ambiti delle Golene (C1) e delle aree boscate e agricole marginali all'interno di aree paesistico-ambientali (C5) secondo i criteri di coltivazione biologica e/o integrata le coltivazioni agricole devono essere tenute a distanza non inferiore di 10 metri dal ciglio della riva dell'alveo.
Per le coltivazioni agricole *** esistenti nelle golene (C1) si dovrà procedere a riconversione, per una distanza pari a 10 metri dal ciglio della sponda, al fine di assicurare una fascia continua di vegetazione spontanea avente funzione di prima barriera al moto ondoso, di stabilizzazione delle sponde e di depurazione delle acque. Le coltivazioni produttive esistenti in suddetta fascia alla data di approvazione del presente Piano possono essere continuate fino al completamento del turno produttivo.

A1

t=1

t=4

time

First modification

Third modification

A1+ A2

Result assesment: the text mining procedure for developing the argumentative maps :

limits

- ✓not able to manage a complex ontology
- ✓strong limit for the immediate communicative effectiveness of the maps

positive aspects

- ✓greater objectivity in the textual analysis reducing, as much as possible, external interpretations and
- ✓providing an easy and real time tools supporting content exploration into the process-scenario. This last feature is important, especially in order to process a large amount of texts.

Conclusions

i. argumentative maps result particularly effective in describing the micro-decisional contexts but they fail in explaining, synthetically, the logical reason of modification between two following transient scenario

ii. At the same time argumentative maps can be considered valuable tools of exploration; in this sense, they provides to the user the structure of discussed contents leaving them free in contents exploration and interpretation. Therefore, the maps are a sort of self-reflection tools helping users to reach a better awareness about his own and group's cognitive path.

Thanks for your kind attention.

Any questions?

Anna De Liddo