

## PROTECTED AREAS AS CONSTRUCTED ORGANIZATIONS

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"No political organization effectively exists to give the whole globe visibility, for unlike nation-states the earth has no external enemy. (164)". "The region, [...] is far too large to be known directly [...] (159) [...]" "Regions, to the extent that they lack a solid political base, lack visibility" (163) (Tuan 1975)

### 1. World Features.

About geo-political or administrative entities attached to territories Varzi (2001) points out: "[...] one could argue that if such geo-political entities exist at all, they exist as dependent entities as entities that supervene or depend ontologically on their territories and on the people and ordinary objects that inhabit them, and perhaps on the behavioural settings in which people and ordinary objects interact".

Terrestrial environment components may be considered *bona fide* (natural) extended entities. Humans create or induce *fiat* extended entities: named locations, climate features, seasonal processes, historical dates (Smith and Varzi 1997).

#### 1.1. Bona Fide and Fiat World Entities.

Fiat (geographic) extended entities like **protected areas** (PAs) arise as a transformation of Nature. Because of its quasi stationary status PAs inherit from space many of its attributes/properties (Varzi 2001). *Place* is preceded by *space* in the ontological sense of being: places are constructed spaces are not (Sack 1999). Places arise as a (human) transformation of Nature, through the use of material and speech forces. Places may be [destroyed] created, and world's complexity could be [reduced] increased depending on [in] correctness of procedures (Tuan 1998). Places are considered *fiat entities*.

Nature reserve location results from political human decision-making. A *nature reserve system* becomes as important than the existence of a collection of reserves in order to guarantee interactions and dynamical actions. The primary objective of a natural resource area can change dynamically (Forman 1995). Historical parks, natural monuments, outdoor museums, historical preservation areas, and wilderness areas are named landscapes where space and place are filled with *content* and *meanings* as a way to reduce the *uncertainty* about some terrestrial and marine ecosystems sustainability (IUCN 1994, Sack 1986, 1980).

### 2. Ontological Aspects of World Entities.

Ontological issues arise when a specific view of the world, a specific reality, (re)conceptualizations and/or representations are involved in the process of transforming implicit knowledge into explicit knowledge (Chandra 2004).

The modes of existence in space/time of *world entities*, its endurance or self-identic persistence include different sort of changes in real-time as a way to continue to exist without any significant loss in quality and/or importance (Grenon and Smith 2008).

#### 2.1. Spatial Dynamic Processes.

*Spatial-dynamic processes* arise when regulatory/control policies are required in order to decide reserve site selection, provision of ecosystem services, and management of marine and terrestrial environments (Smith et al. 2007).

Dynamic features of reality may belong to a modular ontology called *dynamic spatial ontology*. The analysis of snapshots of world entities involved in processes and changes include material/regional ontologies which are *specific domain ontologies* (Grenon and Smith 2008). *Tasks* produce partitions [[] of reality: things that are interesting|not interesting for the task at hand. Those parts are studied by domain ontologies. A specific task occurring in a certain domain belongs to the task ontology field. Task ontologies enable knowledge sharing and reuse (Timpf ?).

In (*geographical*) *information science* ontology helps to integrate information to develop new information in *collaborative environments*: databases, applications and interfaces. The same happens in *agent-based systems* where agents *co-operate, coordinate and negotiate* in a dynamic environment (Chandra 2004). Management of spatial databases involves extraction of implicit knowledge using *bottom up* or *top down* approaches (Chaudhry and Mackaness 2006).

## 2.2. Events. Processes. Activities. Occurrents.

In a *mereologically structured world* regions have shapes, sizes and functions (Smith 1995, 1996).

In Nature and human society a *thing* could be an *event*, a *fact* or an *occurrence*. To occur is to happen, to befall or take place (Sack 1980).

*Events* and *processes* determine the *state of Nature* in spatial and/or temporal locations. A process is related to dynamical performing (Bacon 1998). Once created a process proceeds independent of its creator. A *site* is a place where a particular *event* [process] happen[s]ed. Processes (can) have different rates, can be blocked or suspended, may be foreground and background. They may be cooperating with other ones needing to synchronize with them and/or competing with other processes to acquire some resources (Tannenbaum 1992) running in several ecosystems simultaneously (Forman 1995). Places can be divided in assembled material/temporal parts: objects [processes] are extended in space [time]. While objects may always be entirely present when becoming to its existence, processes may not (Smith and Varzi 1997).

*PAs organization* refers to a material ontology. PAs are extended entities assembled in material/temporal parts. As a cultural-generated geographic process a PA may depend on *world views*. A particular PA is an *enduring fiat organization beginning at some spatial-temporal location* (its material/ temporal boundaries) i.e. a *site*. The basic typology of PAs involves an opposition between bona fide (or physical) ecosystems and fiat (or human-demarkation-induced) landscapes. PAs arise via deliberate choice through the use of perceptual and/or cognitive qualities in virtue of the different sorts of demarcations effected cognitively by human beings (Smith 1995).

When and how often are features that characterize *time events*: a particular event occurs at time *t* (runtime property). When an event occurs as a consequence of a change in relations, properties, states and/or taxonomies it is called a *change event* (Viganò et al. 2006)

In the *real world* processes, events and *activities* existing in a particular place (in space-time) may be called *occurrents*. Occurrents have spatial/temporal parts, and may have *beginnings* and *endings* (Grenon and Smith 2008).

## 2.3. Protected Areas as World Entities.

A *state* is considered an *ecosystem ontological condition* that persists for some period of time. Some system states may no be perceivable at the level of a particular agent. A particular state may be a *precondition* for a *transition* to a *postcondition* or new state of the system.

In PAs there may be sequential/parallel events triggering actions and states as happens in *concurrent systems*. Occurrents determine the state of Nature in a PA. In PAs *actions* arise from multiple geographically dispersed sources in site/time, linked time/change events and processes have properties and relationships that vary over time, and the use of shared resources may be synchronized or delayed often with strict time limits like in communicating sequential processes.

Accepted caring practices, ecosociological and political criteria, and globalized ways of intervention modify PAs states and processes. In *ecosociological systems* processes having a local origin may become regional and global. PAs are subjected to geographical moral concerns (Sack 1999).

### 3. Environments, Systems and Protected Areas.

An *environment* is a *specific habitat*, location or site suitable or adequate for the living of organisms (Smith and Varzi ?).

PAs are embodied in *bona fide*/fiat environments and may *persist* achieving emergent changes over time in pursuit of their *self organized interactions/dependencies* as happens in *dynamic systems*.

A *scalable system* is able to grow and adapt to changing circumstances, managing large workloads, with a high level of performance. Degrading and/or collapsing are undesired/unaccepted properties of a scalable system. Its *robustness* allows for carry over changing circumstances (like disturbances) having a self-adaptive sustaining system operation. *Flexibility* describes the structural and operative ways the system reacts to changes in the environment maintaining *organizational cooperation* (as happens in *strategic networks*). *Efficacy* means to fulfil purposes constantly and efficiently i.e. having an optimal input/ output relation (Paetow et al. 2005, Forman1995).

*System scalability refers to adaptation to quantitative changes in resources and qualitative changes in interactions* (Fischer and Florian 2005).

A *bona fide environment behaves as a scale distributed system*: large-scale refers to large (geographical) area over a long period where global coherence in space/time and mutual dependencies and/or overlappings and unanticipated outcomes persist, and upcoming new information and resources are handled without noticeable loss of performance and/or increase in complexity, determining the appropriate organizational structure for the system in *real-time* (Fley and Florian 2005).

In an environment places are *coupled* when all messages sent from one of them are delivered to every one. If a place becomes *decoupled* (like in a breakdown) it can neither send messages nor to receive messages from any other place. When a sequence coupling - decoupling - recoupling occurs, a place is open respectively for *collaborative - autonomous - collaborative work phases*. In a *network of places* that enables concurrent management in which agents create, evaluate, execute and/or monitor processes coordinating human and socioecological factors (Kappel et al. 1998) places may be [de]coupled when some messages are travelling through the network.

In a PAs network there may be a *scaling* when while the number of PAs may be left unaffected the number of couplings between PAs is raised, requiring a rise in efficiency and an enhancement of robustness and flexibility to *adapt to increasing diversity*.

PAs have *resilience, adaptability and transformability* as attributes of *socioecological systems* (Folke et al.2002) and as *resilient knowledge-based (top down) organizations* PAs may be considered as *embedded socioecological (sub)systems* where people can interact with their environment for their social and economic benefit: in that case *perturbations* cannot shift the system to a different regime and conservation projects may behave as fault tolerant learning processes (Garnett et al. 2007). *PAs components can be dynamically replaced as happens in fault tolerant systems*.

### 4. Governance. Institutions. Organizations.

Governance is characterized by forms, levels and places where to be exerted. *Distributed, triangle wide, meso-innovation and co-governance are forms to achieve co-ordination between agents* (Sutherland and Nichols 2006). Governance requires *institutions* to articulate interests, exercise legal rights, meet obligations and mediate differences (Halachmi ?) allowing for *accountability, transparency and social responsibility*.

In *traditional regulatory governance* co-ordination is almost closed, in *post-regulatory governance open co-ordination* applies a *learning over time* strategy consultation to set and modify wholly or partly voluntary standards and/or *adjustment over time* in response to *feedbacks*, in order to allow for a *convergence* (Mosher ?).

Governance may differ markedly from a PA jurisdiction to another.

An *institution* is a *co-ordination artifact*, an interface between the internal rational decision making capabilities of agents and the social effects of their interactions. *Traditional institutions are (sets of) conventions that a group of agents adhere to in order to accomplish some social agreed*

*objectives*. An *organization* is an entity which is the warrant of those conventions (Noriega 2006).

So called *institutionalization* is a way to shape political, social and economic issues: processes that have a local origin may become regional and global and by *aggregation* many small actions can *destabilize* ecosociological systems (Folke et al. 1998).

Rules are frequently enforced invoking collective, community, customary, aboriginal, [off] inshore, and public rights, lease, license, permit, quota, rights of use, and public good (Sutherland and Nichols 2006).

*Norms* may be considered high-level specifications of acceptable behavior within a given organizational context. *Norms may be considered declarative, while protocols are operative* (Aldewereld, Grossi et al. 2006). Norms may create a new state of affairs and/or may state obligations/permissions in order to perform some actions (Rubino et al. 2006).

*Guarantee accountability, enforce institutional commitments, and contending the wrong doing in order to maintain the permanence and stability of a set of conventions are some main concerns of institutions.*

Institutions may be considered means for regulating agent behavior in *open and dynamic interaction systems*. In decision-making the characteristics of institutional actions to be performed in order to succeed may be considered *preconditions* for an action. In the same way actions to be performed after a successful performance are called *postconditions*.

From an *artificial intelligence* (top down) viewpoint *institutions have an ontology* containing statements about expected actions, conventions and norms that regulate interactions in the institutional context (Viganò et al. 2006). *Statements are about behaviors but not about the way a behavior may be achieved in a possible world* (Aldewereld, Grossi et al. 2006).

## 5. Bona Fide and Fiat Organizational Behaviors.

In *bona fide organizations* the organization determines the way agents collaborate in order to carry on *tasks*. In fiat organizations agents determine the ways they will collaborate in order to achieve organizational goals. In *self-organized entities* agents are involved in dynamic processes in order to manage changes emerging in its environment (Schillo et al. 2002). *Stigmergy* is a process of self-organization where agents through sensing and/or acting modify agents behavior and environment morphogenetic spatial patterns (Small 2003).

(Human) Organizations may be considered *fiat human social entities* and institutions are frameworks where the interaction of organizations occur (Rubino et al. 2006). Roles, relations, interaction patterns, and an informational/technological way of stating/implementing global objectives characterize a fiat organization structure (Dignum et al. 2006, van den Brock et al. 2006).

Agents can be humans, families, organizations, nation-states, they are *stable social entities* with a certain *degree of autonomy* in their behavior (Albrecht et al. 2005).

A *disruptive event* is an almost unpredictable one and will affect the performance of agents and/or the achieving of goals in an organization. A normal course of action may not yield expected results when applied to a disruptive event (Wijngaards et al. 2006).

## 6. Co-operation. Co-ordination. Collaboration.

The *co-ordination of tasks* in socioecological organizations may be *fault-tolerant to agent failures and may institutionalize anticipated co-ordination as a way to ensure efficient performance*. In high level social interaction *co-ordination, co-operation and negotiation* require dynamic organizational structures (Schillo et al. 2002).

In *dynamic interaction systems* heterogeneous and autonomous agents enter and leave dynamically the system creating expectations about their behavior (Viganò et al. 2006). A scalable system will manage the participation of new agents entering the system without significative additional organizational effort while keeping a stable performance of large projects in cooperation (Paetow et al. 2005)

*Knowledge-based (top down) activities* are requiring *strategic co-operation* and networks as means that allow an organization's capability to create new knowledge by combining new and existing knowledge.

When an individual *cognitive agent* conceptualizes a PA as belonging to a specific IUCN class, it is also involved in perception. *Agent fiats* are much more ephemeral than *social fiats* because they are individually dependent. In contrast, social fiats like national park borders are only generically dependent, and can be sustained in being by successive generations (Smith and Varzi 1997).

In *collaborative decision-making* agents belonging to several communities coordinate their mental models and share a set of common beliefs in order to achieve a common goal for a time period (Rana et al. 2005). A *team* may be an organizational agent community (two or more agents) which collaborate in order to perform a task and/or support a shared process. Team members must be co-operative, reliable and having non-conflicting behaviors about norms, being able to update their knowledge-bases and to acquire additional functionality in order to increase their effectiveness quickly. Behaving as a distributed system a team may be prepared to manage unforeseen events like crises and unpredictable events. In a particular environment crises include: Nature, involved territories, locations, resources, humans, culture and social relations. Crises are subjected to time-criticality, de-escalation, restoration, human performance fluctuation, fatigue, resource depletion, (un)availabilities, communication failures. Crises management depends on incomplete situation awareness, defective information, defective fault tolerance, partial knowledge, real time course of action. Facing a crisis members of a team may desert, disband, re-align, re-compose in operational/real time (Wijngaards et al. 2006).

*Dependencies arise from shared use of resources by multiple tasks* (Crowston 2004). In dynamic systems processes are interdependent and activities are interactive requiring co-ordination. *Co-ordination* is managing dependencies between activities. Identifying existing generic dependencies and the sort of involved processes is a requisite in order to design a co-ordination model, in a co-ordination medium *information and processes drive the behaviour of the entities being co-ordinated* (Schumacher 2001), dependencies arise between tasks rather than individuals or units and to find a cause for a need to co-ordinate is more important than the outcome of co-ordination. Co-ordination involves discovery/ matching/ joining and negotiation/ co-location/ message exchange/ goal achieving and convergence in a particular objective. When some PAs have similar goals to achieve using similar activities managing the same dependencies, managers may choose different co-ordination mechanisms, thus resulting in different processes (Rana et al. 2005, Crowston 2004).

*Co-operative activities* are mediated by *co-ordination artifacts* that embed and enact co-ordination policies via creating/composing and/or ruling/governing social activities (Rubino et al. 2006). *Adjustable autonomy* refers to entities that show a dynamic change in their own autonomy, transferring decision-making control to other entities in key situations (Scerri et al. 2002).

Multi-disciplinary communities are *co-operative agents* having several kinds of static/dynamic expertise, membership may be static or dynamic, interaction between agents is not pre-defined as happens in *virtual communities*: agents require a network co-ordination strategy (Rana et al. 2005).

A *self-organizing network* restructures in *real time* on the basis of its interactions. The *architecture* of a self-organizing network at a time  $t$  contains an *expectation of its future operation* (Leydesdorff 2000). *Petri* and *reference nets*, state transition diagrams and abstraction and composition techniques (Köhler et al. 2005, Crowston 2004) may contribute to *design a network of PAs resistant to the emergence of unexpected events* as happens in self-organized and dynamic systems (Decker 1998).

PAs may have adjustable autonomy requiring co-operation, co-ordination and flexibility as happens when linking multidisciplinary communities like scientific boards, authorities in charge, representatives of local communities and NGOs (UNESCO 2000). *PAs management requires co-operative agents*.

In *collaborative environments* agents belong to *collaboration networks* requiring multiple skill/ interdisciplinary/ complementary resources and resistance to failures to facilitate interaction and adaptation of agents. *Messages in a collaboration network* may reach non local community members when the local level of resolution of conflicts is not sufficient to resolve problems (Rana et al. 2005). *Co-operative agreements* provide opportunities for knowledge acquisition and learning. *Network's strategy process* will support the building of trust between the network members (Valkokari and Helander 2007).

Collaboration, co-operative management, multi-level co-ordination and some degree of co-operation is proposed as a way to exercise authority, shared decision-making and coordinated inter-governmental strategy in PAs (Ministry of Labour and Citizens' Services 1998, Osborne 2005) and to foster co-operation between residents, World Heritage site directors and personnel, tourism operators, co-ordinating site managers, local, regional and national authorities (UNESCO ?).

*In Pas conflicting goals will difficult the co-ordination of tasks, co-operation and collaboration could contribute to design a strategic self-organizing collaboration network of PAs that may behave as a fault tolerant organization having standard management decision levels: strategical, tactical, operational and real time.*

## **Conclusion.**

PAs are fiat entities belonging to the real world. PAs organization refers to a material ontology (Smith 1996). Knowledge about modular/specific domain ontologies has been strongly improved in the past fourty years. *Ontological issues matter in the PAs management.*

Having a starting space/time coordinate sustainability in PAs involves *endurance*, requires naming, support persistence mechanisms, schedule implementation, event handling and visibility improve.

PAs are not just [parts of] ecosystems. PAs also are places which people know, operate in and make decisions about, and are essential to projects because they [dis]allow or displace some things to take place. *PAs are requiring an improvement in governance.*

*A virtual organization* is an aggregation of autonomous and/or heterogeneous entities/individuals in order to achieve a common goal (Rubino et al. 2006). *A network of PAs may become a virtual organization able to adapt to emerging scenarios.*

In PAs agents must share specialized knowledge and information becoming members of *cooperating expert systems*. It is expected an improving of understanding about the way co ordination is achieved in human societies at micro/meso/macro levels of aggregation (Fischer et al. 2005). *Socionics* may contribute to the development of intelligent computer technologies in order to develop/validate knowledge based (top down) and behavioral (bottom up) ecosociological models of PAs dynamic adaptation to changing requirements as a way to resist disruptive events/conflicts and acquire scalability (Fischer and Florian 2005).

## **ABSTRACT**

Protected areas (PAs) arise as a transformation of Nature as a way to reduce the uncertainty about some terrestrial and marine ecosystems sustainability.

PAs organization refers to a material ontology. PAs are fiat extended entities assembled in material/temporal parts.

PAs are embodied in bona fide/fiat environments and may persist achieving emergent changes over time in pursuit of their self-organized interactions/dependencies. As embedded ecosociological (sub)systems PAs have resilience, adaptability and transformability: their components may be dynamically replaced as happens in fault tolerant systems.

Governance may differ markedly from a PA jurisdiction to another, processes having a local origin may become regional and/or global, and by aggregation many small actions may destabilize the state of a PA.

Carrying out and performing organizational activities in a PA involves human, biological and ecosociological co-ordination. Decentralized control strategies, objective and subjective co-ordination will contribute to design a network of PAs being capable to resist the emergence of unexpected events and/or quantitative/qualitative changing requirements as happens in self-organized entities and dynamic systems.

**KEYWORDS:** *protected areas - sustainability - ecosociological systems - governance - coordination*

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