SSASA08 Meeting presentation
(Debates on Social Simulation: Levels and Types of Models)

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Summary: A classification criterion for multi-agents based social simulation models MABSS is put forward. Then, it is used to present the contributions and main debates in the II SSASA'08 "Meeting on Social Simulation and Artificial Societies Analysis" which took place at the Political Sciences and Sociology Faculty of the Autonomous University of Barcelona on November 2008.

Keywords: Social simulation, Artificial Societies, Socio-physics, Social Norms, Artificial Intelligence, Computational Social Science.

1 Introduction

This volume is one of the results coming out of the II SSASA[1] Meeting which took place at the Autonomous University of Barcelona on November 2008. This is an annual meeting allowing students and researchers to learn and debate issues and methodologies in the domain of social simulation and the analysis of artificial societies (SSASA), particularly in the sub-domain of Multi-Agent Based Social Simulation (MABSS) focusing on studying social phenomena.

In fact, any of the MABSS projects necessarily entails the involvement of researches from diverse disciplines. It is and interdisciplinary effort to reconcile diverse perspectives between Artificial Intelligence, Computer Engineering, Maths, Logics, Sociology, Economy, Social Psychology and the rest of the social sciences. All these perspectives, having social phenomena as a common research domain, provide a context full of coincidences, challenges, possibilities, problems and disagreements. In summary, it is a stimulating academic context in which scientific debate is really intense.

As a presentation to the papers compiled in this number of CEUR-WS, which collects the original work presented at the SSASA'08, this introduction tries to structure the main points which came up in the discussions of this academic meeting. Even though this introduction makes reference to all the participants who sent contributions, some of the papers presented at the meeting have not been introduced here as they have been already published.

1.1 Organisation: MABSS model typology

Researchers have produced an amount of models and simulations on Agent-Based Social Simulation (ABSS) since first trying to strongly unite Distributed Artificial Intelligence (DAI) and social phenomena studies, some early examples being Axelrod (1986) or the Socionics project (Muller, Malsh & Schutz-Scaeffer, 1998).

Nowadays, there are many MABSS models which would seem to be based on very different ontological assumptions obeying in there time to very diverse modelling strategies. This diversity could precisely be due, as authors like Marietto *et al.* (2003) argue, to researcher's interdisciplinarity, that is to say, it would be originated by the fact that researchers come from diverse fields and frequently have different previous scientific backgrounds. Moreover, the apparition of many specific computer tools for the creation and the experimental simulation with artificial societies has made unification particularly difficult. The situation got to the point where there was a public call for standardization in a relevant scientific meeting (ESSA 2005) so that all scientists working with ABSS would be able to understand each other and the public in general could also do it (Saam, 2005; Richiardi, 2006).

A statistical survey was carried out among n=196 ABSS researchers in 2002 (the SimCog project). Its aim was to make progress in a classification of the social simulation models. Results (Marietto *et al.*,

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[1] II SSASA'08 web site in <http://www.uab.es/ssasa>.

2003) gave a solid typology, which has been contrasted, is useful to classify models, and which will be used here to present the contributions to the Meeting.[2] At least three dimensions characterise a MABSS model and can be distinguished in it from their philosophical groundings or the methodological proceedings associated with them.

A) Abstraction level for modelling the object system: the *intention* to represent a real object system (varying from "possible" to "real").

B) Type of evidence required for the validation process:
   1. Structural similarities: Realism, similarities between the theories used and the object system. Varying from "weak" -simply evocative, like the colour clustering in Schelling's (1978) ethnic aggregation model simulations- to "strong" -richly descriptive, like mathematical expressions of social networks and modal ontologies or logics for mental statuses of the agents.
   2. Empirical fitting: Experimentation, measure, trail-and-error and control. Varying from "weak" -negotiated with those implicated, or experts in participative processes- to "strong" -statistically fitted to quantitative data in the real world-.

C) Context in which it is applied, from the "academic" one, in which the natural and social theoretical foundations are used to build ABSS models and to study social phenomena, and the "technical" one, in which ABSS are used as a test-bench for new designs -technological (industrial prototypes) or social (institutional design)-.

By combining these dimensions, the MABSS models can be located into a three-dimensional space which helps establishing the relationship between different models, and allow thinking about the epistemological aspects for families of models (typologies). The assignment of a specific model to a class must be understood within a hierarchical diagram like the following one.

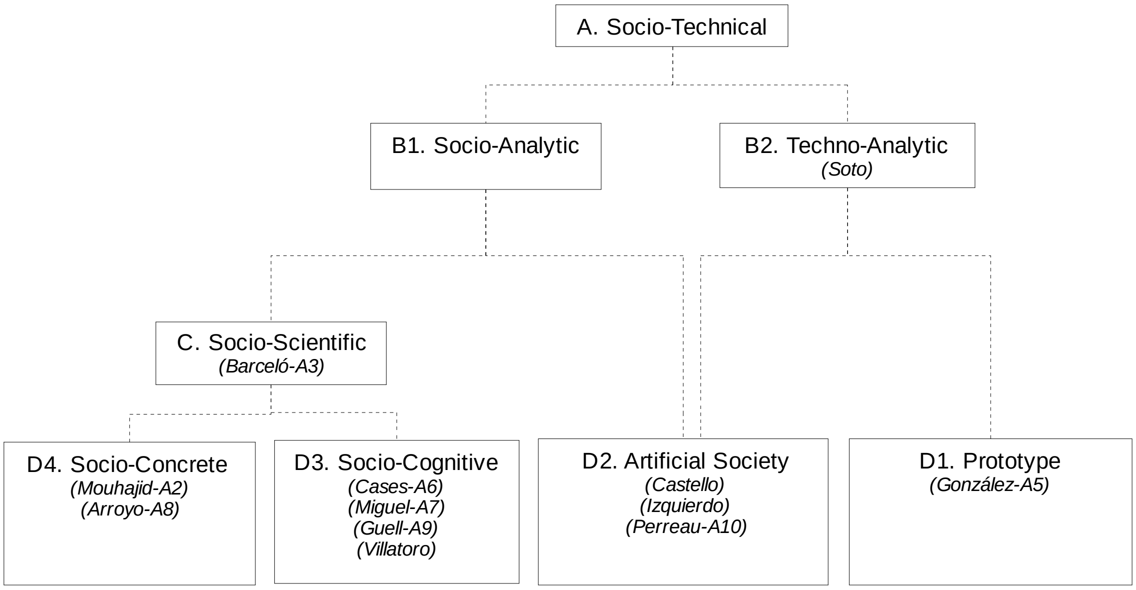

Fig. 1. Hierarchical diagram classifying MASS models (after Marietto *et al.* 2003).

In the following paragraphs we outline a characterisation of the different types of MABSS models and make reference to the authors who made contributions on them in the SSASA'08 Meeting and the papers on the subject published in this volume *(key: Author- ANumber)*.

A. Socio-technical: maximum level of interdisciplinarity between computer and social sciences. Theories on complex social systems are applied to information technologies and then interpretable consequences are inferred back into the social sphere ***(e.g., Socionics)***

B1. Socio-Analytic: A combination of the exploring capacities of D2 and the socio-scientific model (D3+D4).

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[2] The substantial conclusions indicate that: 1) Most researches work with more than one type, 2) the most common are the "socio-cognitive" and the "socio-concrete", and 3) the use of models of "artificial societies" is nothing else than an inspiring or complementary activity for the other models.

B2. Tecno-Analytic: A combination of the exploring capacities of D2 and Prototypes (D1). ***(ref. Soto et al., 2008)***

C1. Socio-Scientific: Linear integration of D3 and D4.

D1. Prototypes: They intend to contrast the way a simulated system works with the requirements given by the technicians or the final users, within a technological context. Therefore, they have a low abstraction level. They are the most "realistic" possible so that human agents, interacting with other agents ("humanware" or "software"), can believe in and accept the *"real"* behaviour of the simulated system (*Turing Test*). Therefore, its validation implies technical criteria (efficiency, response delay...) but particularly some user approval participation processes. Given their adaptative capacity to capture the acceptability criteria of the human beings involved, they would be of a "normative" nature ***(ref. González-A5)***

D2. Artificial Societies: Maximum level of abstraction, having simulation behaviour as the only "empirical" outcome reference. The relationship with the real world is deliberately weak, analogical or non-existent. ***(ref. Castelló, Izquierdo, Perreau-A10)***

D3. Socio-Concrete: They intend to represent direct observations of particular social and institutional processes; therefore they are calibrated in detail from specific situations in the real word. Their context is mainly scientific, so they are dedicated to explore the substantive relationships between the simulation and the object system. Empirical validation of outcomes is basic in this type of models which frequently assume a structural or empirical (*data-driven modelling*) form. This has sometimes created problems which have been tried to be solved by suggesting weak validation forms, like the use of participative methodologies (*companion-driven modelling*) with the intervention of experts or the people involved (CORMAS, 2003) . ***(ref. Mouhajid-A2, Arroyo-A8)***

D4. Socio-Cognitive: They are used to contrast the consistence -or to recursively refine- social theories with cognitive foundations in which the objects are not usually directly observable. Therefore, the validation process is basically qualitative or structural, without reference to empirical procedures. The specification is based in first-order logics and modal logics, with cognitive architectures to explore *"footprints that a multi-agent system leave not only on the behaviour of its component members, but also in their minds"* (Castelfranchi, 1998). In other words, this is what sociological terminology would call the link between the macro and the micro, or determination of the agent by the structure ***(ref. Cases-A6, Miguel-A7, Guell-A9, Villatoro)***

2 Meeting Results

From here on, we present the debates put forth in the diverse sessions of the Meeting, together with the contributions published in this volume or other publications.

2.1 The socio-physical perspective to study social phenomena.

Some of the most relevant contributions studying social phenomena with MABSS methodologies have taken the physical or the mathematical perspective as a starting point. Even though Physics usually works with continuous fields and MABSS works by discretizing time, there is an amount of research in *socio-physics* using simulation to study complex social systems.

What are the contributions of Physics in this domain? It is not a question of importing the concepts, even though some of them, like "energy" "mass" or "field", would have a strong inspiring and analogical potential. In has more to do with taking the spirit and the methodology used in this domain. The aim is not to focus on measuring, but to use a *reductionism* approach favouring abstract-but-comprehensive approximations. In this sense, during the Meeting, the issue of the existence of what we call "the ockham minimum set" to which the researcher can not renounce when studding social phenomena, only produced A) an agreement on the essential *heterogeneity* of social agents, and B) an open debate on whether the *topology* -the structure of relationships of a social network- should be considered as a (fixed) datum which is set-up at the beginning, or as a final result in the simulation (co-evolutive).

One of the main discussions on the former issue was the significant fact that social agents have internal mental states, the specific contents of which are particularly relevant because they have qualitative causal influence. MABSS confronts the challenge of modelling these internal states, and even though the physical perspective seems to give many useful "reactive" models (systems producing actions), it would be desirable to advance towards "deliberative" models (systems producing procedures to produce actions). Transforming these meta-systems into models is not trivial in terms of effective simulation of human social systems. Also the issue which J. Brands raised at SSASA'08 can not be ignored: Should agents with conscience of their future actions be modelled? As social agents are self conscious, a social system is therefore intrinsically recursive and the issue on complex systems would widen up with the topic of how to model systems in which the explanations about the system have an effect into the future actions of the agents.

On the later topic put forth -the status of the social network-, the Meeting gave an interesting panorama on the diverse ways in which physical-mathematical concepts can be considered: particularly, *structure* and *graph*.

As the presentation of Moujahid, Cases & Olasagasti (Computational Intelligence Group, UPV/EHU) confirms, both the *graph* and the *phase sincronisation* physical concepts can be used for modelling the key concepts of *social network* and of *consensus opinion formation* -or *public opinion*-. Its study on the dynamics in the opinion groups clustering for individuals with a previous communitarian structure uses the physical perspective of particles phase-syncronicity, and relys itself on initial data corresponding to empirically available registers of observed populations, like a New Zealand group of dolphins or a karate club **(paper 2. "Consensus Dynamics in a Dolphin Social Network")** [3]

Considering people/agents as **oscillators,** a concept in physics implying a particle with two possible states, has sense in the simulation of certain systems where there are coincidence -or consensus- phenomena among the "elemental particles" towards one of the only two opinion states. This ontological assumption can be weakly assimilated to the existence of the social phenomenon of "sympathy", in which case, it must be assumed 1) that public opinion has an intrinsically oscillating nature (between two clearly defined extremes) plus, 2) an aggregation mechanism in opinion. While the simulation work presented allows validating the second assumption in a satisfactory way, the first one can be questioned as being a simplification with respect the qualitative contents of opinion.

The advantage with this type of simulations is that they allow generating the micro-history of the process by which many individuals end up configuring two "opinions" through different transitional intermediate regimes or states. Moreover, they also permit to show the existence of a limit from which two oscillators can not coincide in the phase. Their conclusions typically are that the evolution of opinion groupings greatly depends on the structure or the initial network typology. When this communitarian structure is incorporated as a *datum,* the model is identifiable as "socio-concrete" (D4), as there is no reference to qualitative contents.

As regards to the use of **graphs** for modelling systems with social consensus dynamics, X. Castelló (IFISC-CSIC, UIB) presents a study on the evolution of linguistic domains in a system with two socially equivalent languages (Castelló *et al.*, 2006, 2008).

His model can be classified as an "artificial society" (D2) given there is an initial abstract social network, with concrete typologies but without direct empirical links with real data. The agents in this system are homogeneous and, in this case, have three possible states of linguistic use. The analysis is enriched by the existence of bilingual agents which are located in the interfaces or frontiers. In the case presented -to be improved with future extensions-, the issue studied is competing processes within the social networks generated depending on experimental needs, in which the relational structure does not co-evolve with time. It is shown that, in this situation, the time taken to reach "linguistic consensus" basically depends on the initial network typology.

Reductionism to a sufficient mechanism in model specifications (at meso-escalar level) is claimed as a strategy from the Physics approach. For instance, in the mentioned case, certain cliques -between the individual node and the total system- would be reduced to meta-nodes.

Another interesting physical concept that can be applied to the analysis of social phenomena and which has been presented by S. Izquierdo, from *INSISOC-UVA* group (Izquierdo & Izquierdo, 2008; Izquierdo *et al.,* 2007, 2008) is the **field.**

This strategy for modelling social phenomena -linked to the use of Markovian processes with discrete time-, implies building "worlds" containing some field lines allowing generating "social landscapes" with "movement towards" tendencies. As Izquierdo shows, the way a field acts produces the movement which their lines follow, particularly if the span of "jumps" is small. The main interest of this perspective is that the parameter jump *does not necessarily have to be* understood only as a geographical position: with this methodology any other escalar variable of interest to interpret social phenomena can be introduced in the model. Some suggestions in this sense can be, for example, any parameter controlling agent behaviour changing slowly (socialization, learning), or the percentage of people adopting different possible behaviours or opinions within a social interaction situation with simultaneous change.

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[3] E N.: All the references to numbered articles refer to other contributions published in this same volume

A sound approximation to the *habitus* sociological theory (Bourdieu, 1988: 170-171) is the implementation of an adaptive strategy learning system, with *individual predispositions* modelled over a "social landscape" of field lines. The model that was presented during the Meeting assumes that all agents have *perfect* information and a single pay-off matrix -just one game, one typified situation- to evaluate results. Therefore, it can be considered as an "artificial society" (D2), useful for theoretical ascertainment, and where suppositions can always be added to integrate other more realistic assumptions, like *strictly local* information and *diverse* pay-off matrixes linked to heterogeneous situational contexts.

2.2 A.I. perspective to study social phenomena.

The second perspective related with social sciences in MABSS studies which had representation in the Meeting was Artificial Intelligence (A.I.). The debates opened from this perspective were not particularly technical, but were orientated -in a very fructiferous way- towards epistemological issues. The A.I. position about the existence of a minimum set of necessary elements for any social simulation (the "ockhamian minimum") was unanimous: this set does not exist, on the contrary, its extension depends on the issue being researched, that is to say, the specific domain within social phenomena studies in which the simulation is used.

The engineering point of view put forward to social sciences that research questions were systematically deficiently posed in this domain, but this request was positively complemented with three A.I. tool use proposals. One of the general agreements, coinciding with the present research line called "analytical sociology" (PAPERS, 2006: nº80), was that modelling and simulation contributed to formulate better questions, as it needed detailed specifications of the elements composing the system to be studied and replicated.

The debate on the need to measure the performance of a MABSS model is equally worth to be underlined. In this case, despite the presently opened debates on the problematic assumption of the "explanation- prediction symmetry theory" (Thompson, 2009; Troitzsch, 2009), those present agreed on the prevalence of empirical criteria.

Part of the debates worth pointing out was the request, made by MABSS users coming from the A.I. domain, that the terms "complex" and "complicated" should not be confused. Even if it is true that the complexity source for a social system is the existence of a vast number of interactions between multiple agents, there is no need for complicated models in the system or in the constitution of the agents in particular. To the eyes of a macroscopic level observer, a system with many simple agents and non-complicated interaction norms can generate, with time and as an aggregate result of numerous interactions, a very complex behaviour, or even a chaotic one.

The engineering perspective, as the physics one, can also give social studies -though the use of MABSS- this clarity in separating and specifying basic and emerging elements. The social simulation methodologies promote the recognition of patterns as emergencies arising from agent individual social actions and the validation of these results with empirical data, with the ultimate aim to reach something more than just the mere description of the phenomenon and to contrast hypothetical propositions on the underlying mechanisms. This aspiration is no different from that associated with general scientific knowledge, and, in this sense, the use of A.I. tools would probe to be useful.

In defence of Artificial Intelligence tools Juan A. Barceló (Prehistory Dept., UAB) argues that A.I. does not only provide efficient tools to classify empirical material, but allows building expert systems -a kind of *grey* or *transparent boxes*- in which social domain theories -like those in History or even Prehistory- can be compared (**paper 3: The Computer Simulation of Social Dynamics and Historical Evolution: The case of "Prehistoric" Patagonia**). Tough some tools, like the use of descriptive neuronal networks or the fuzzy automated classification, can be considered as not very explanatory, other ones can solve some of the problems in the classical statistical analysis applicability conditions.

To face some of these problems, particularly those related with agent heterogeneity, the A.I. perspective allows opening alternative paths looking for explanatory mechanisms as a solution. The proposal to generate artificial systems to describe groups of data obtained from empirical archaeological fieldwork, without referring to the existent old theoretical types but to behaviour models of heterogeneous agents interacting among themselves and with the environment would be considered as an example of "socio-scientific" models (C1).

The use of common languages is particularly important in the MABSS domain, as normally many researchers from diverse disciplines coincide in it. For P. Fonseca (Statistics and Operative Research, UPC) one of the most interesting contributions of A.I. can precisely be the promotion of scientific communication through the use of graphic formalisms allowing describing complex social systems, their institutional structure, the cognitive equipment their agents have, and the social dynamics involved **(paper 4: SDL, A Graphical Language Useful to Describe Social Simulation Models)**.

If it is necessary to have a formalism which is independent from the programming platform which being used and has modularity -enclosed and individually confirmable-, then the SDL‘s proposal complies all the requirements and it is also a standard specification which is compatible with other standards (like UML). It moreover allows describing in graphic terms any complex system which needs to be simulated, including MABSS simulations designed by social scientists without needing to know programming languages. SDL permits to make a hierarchical decomposition of any system in four levels facilitating the development of each part by any of the experts involved. System, Blocks, Processes and Procedures, could approximately correspond to Society, Social Agents, Social Phenomena, and Social Mechanisms.

As C. González (People&Videogames) suggests the role of A.I. tools can be much more linked to empirical validation instruments. One of the possible applications is the construction of a behavioural expert system (**paper 5: Social Behavior Simulator: Estudio de la interacción social con un ser simulado)**. It is shown in the Meeting as an example classifiable as “prototyping for resolution” (D1) and is used to study the social interaction between simulated and real beings.

Once the system, which simulates the behaviour of an adaptive agent expressing three degrees of emotion (positive, neutral, negative), has been initiated and by means of many interactions with a heterogeneous sample of real individuals, the system’s behaviour converges towards recognising action-reaction patterns as a result of social interaction.

The aim of the process, in this case, is to compile information on the opinions and the subjective experience of those involved in the experiment. In this way, a MABSS consisting of a virtual agent and diverse human beings helps to obtain real data on behavioural responses. This will afterwards allow constructing MABSS systems empirically calibrated with these basic behaviour norms.

2.3 Artificial society analysis.

On a biological based analogy, the Cases *et al.* contribution (Computational Intelligence Group, UPV/EHU) simulates an artificial society corresponding to the collective intelligence perspective **(paper 6: Swarm Intelligence: una aplicación a la toma de decisiones colectivas)**.

This model, which can be classified among the “socio-cognitive” ones, experimentally implements a society with reactive agents who homogeneously follow diverse resolution mechanisms to solve “opinion” conflicts directing them towards one of the two possible actions. Disinformation status (*does not know*) and over-information one (*does not reply, doubts, indecision)* are modelled and added -in contrast with what was done in **paper 2-** to the group of agent action preferences, binary and excluding (eg Invest/ Save, Cooperate/Deceive). The three implemented deliberative algorithms are tossing a coin, following fashion and excluding one’s own opinion, resulting in any case, in the diffusion of a unanimous option among the population.

A relevant characteristic of this simulation model is the importance of agents’ location within space, as well as the scope of its perception of the social environment, given that the deliberative mechanism is based on the interaction with the close neighbourhood. Results reinforce the general idea that *social distance* is very important, in terms of relationship network and information contents. This would be compatible with Castells (2002) thesis and with the idea expressed by Bourdieu (1988) and his notion of *habitus* which suggests mimetic amplification and separation mechanisms which end up resulting in social distinction.

Deepening in cognitive issues, J. P. Soto (ALARCOS Group, UCLM) presents a model classifiable as “techno-analytic” (B2) the main objective of which is the final development of an efficient on-line cooperative working system. In this context, the quality of each individual contribution is “socially” evaluated by the rest of agents. A virtual society with two levels or operational layers is designed as a prototype (Soto *et al.*, 2008).

Given the virtual nature of the communities like the one we are considering -and many others, like any social network in the Web 2.0- we should underline as one of their specificities that there is a problem of *trust* in front of other agents, particularly derived from the fact that actual presence is not necessary. However, at the same time, efficiency is boosted with cooperation. Therefore, it is important to study the mechanisms through which cooperation can be reached and maintained, overcoming the trust problem.

The system presented at SSASA'08 implements a reactive level -or layer- (typical of most MABSS models) on top of a social-deliberative one. The unification of these two last aspects, previously separated, comes from ascertaining that *"all deliberative goals implied social behaviour"* (Soto *et al.*, 2008: 40). The reactive layer provides behavioural answers from environment perceptions and mental relevant states -personal history, trust, intuitions- while the social-deliberative layer generates plans for future action, aims, social interests, social beliefs and includes a trust generator.

The implementation of the multilayer system has been done with the meta-modelling tool INGENIAS **(see paper 8)**, which allows graphically modelling MABSS and has tools to be able to generate codes afterwards in diverse languages to execute the simulation.

Another example of the most usual tools for building artificial societies (Netlogo) is employed by F. J. Miguel (SSASA Group, UAB) to test, in terms of explanatory relevance, the "generic need" of a specifically sociological theoretical proposal (**paper 7: ABSS Methodology for Testing Complexity-Levels: Case of Elementary Forms of Sociality**). The strategy employed is nearer to the concept of "theoretical validity" than to that of "empirical validity", because what is done is a *mental experiment* comparing two societies, with and without the implementation of the feature analysed and the model used is not calibrated with empirical data of any real case. This model can be classified as "socio-cognitive" (D4) and uses a previously existent model to *refine it* and then studying the effect of step by step variations. It shows how to implement different *sociality* forms -in the sense Allan Fiske (1991) understands them- and analyse if they have an impact on, and in which way they influence, the aggregate system outcomes, considering both quantitative aspects (behaviour "efficiency" measure) and qualitative ones (emerging relationship reticular structure).

The implementation of a variety of *sociality* forms requires modifying the cognitive structure of agents from the original "control" model, being relevantly necessary to widen the mental representation capacities of its *social map*, and to be able to store and use information on other agents. It should be also underlined that, there is also the need to implement a *social labelling* mechanism allowing identifying and classifying other agents from externally observable characteristics.

In this simulation, the network of relationships is not an original *datum* nor follows typical formats (small-world, ego-centered, free-scale...), but is precisely one of the results of the model evolution dynamics. Its analysis allows completing, in a significant and relevant way, the results obtained from the mere standard statistical analysis of the system's global "efficiency" indicators.

On their part, M. Arroyo and S. Hassan (GRASIA Group, UCM) present a model classifiable as "socio-concrete". Their model takes the Spanish society between 1980 and 2000 as the object system (**paper 8: Marco teórico-sociológico y operativización para modelar un Sistema Multi-Agente sobre la evolución de la religiosidad española)**.

A both complex and complicated modelling system is presented with the explicit aim to make the mechanisms of social change understandable, although not to predict future scenarios. It is both things because it calibrates both public opinion empirical data (European Value Survey, 1981) and extended demographic reproduction (National Censuses and Local Registers, INE). This empiric "fixation" reduces the space of the initial parameters, and ensures greater realism, understood by the authors as "*distributive analogy*".

The models called "micro-simulation" (Nigel & Troitzsch, 2006), like that presented by Arroyo & Hassan, offer the advantage to generate as a result micro-biographies for all the agents, and this allows using qualitative analysis techniques, event sequence analysis or social network analysis, together with quantitative statistical techniques for aggregate results.

2.4 Formalizing and studying "social norms".

Finally, with respect such an specific issue as "social norms", some of the meeting's contributions allow to put forward a first relevant discussion on the *locus* of norms. It is not only a philosophical debate, as within the context of MABSS research there is the need to specify in detail the system to be studied. This necessarily implies taking decisions about the model design and therefore the detailed formalization of "social norms".

The theoretical and philosophical debates in the MABSS domain become meaningful when they become technical and methodological ones, and at this level it is necessary to establish if norms are an *internal* state of the agents or an *aggregated* result of social dynamics, or even both, by virtue of a *feedback* mechanism which systematically determines the evolution of the agents' mental states from the results of their interactions (adaptive learning). Therefore, the focus of the discussion moves to the existence and the coordination of different levels within social reality, that is to say, variety of simulation levels or layers *(see also papers 4 and 7)*.

On the other hand, from the contributions that were presented -which imply diverse conceptions (and formalizations) of what a "social norm" is- it should be underlined that a positively validated simulation result does not logically imply explanatory efficiency in the model's implementation. Moreover, in the particular case of "socio-concrete" models, one must not forget that different specifications of the model can generate the same result.

Anyway, the experimental strategy of introducing step by step "fine grain elements" and the comparison with control models allows isolating and identifying the performance of significant mechanisms. Given that a very complicated model does not facilitate nor ensure validation, this *incremental experimentalism* proposal, together with the claim to patiently follow what is most simple, acquires a special value.

For Güell & Tena (GSADI-UAB) a "social norm" should be understood as a *motivation to act* (**paper 9: Hacia un concepto de norma social integrable en modelos de simulación social multiagente**). This conceptualization locates norms at the micro-individual level, forming part of the agent's mental contents or resources. Therefore, any model designed in these terms is classifiable as "socio-cognitive" (D3).

After reviewing three alternative definitions of social norms -the Standard Rational Choice Theory, C. Bicchieri and J. Elster-, the authors conclude by establishing the definition which, according to their criterion, most adjusts to the nature of the concept and offers the greatest explanatory possibilities for its use in MABSS models.

It is also worth underlining the defence of a wide range of heterogeneity in norms, depending on diverse sources of internal motivation, on external institutional recognition (and sanction) and even the emotions involved. This can result in models with a great inter-agent heterogeneity (groups depending on motivation), but at the same time also a great intra-agent heterogeneity, as for a single agent the same externally observed action can imply different internal normative motivations.

Alternatively, Perreau de Pinninck (IIIA, CSIC) propose understanding the concept of norms as a *restriction of the actions which can be done*. This restriction can be modelled through a wide range of mechanisms, for example, the existence of a public registry of trusted agents **(paper 10: A Reputation-based Routing Mechanism to Increase Personal Norm Compliance)** which is used to allow activating social ostracism mechanisms (Perreau *et al.*, 2008).

Such a kind of models, classifiable as "artificial societies" (D2), give access to a simulated virtual environment, useful as experimental scenarios to check the performance of different strengthening behaviour rules. The analytic methodology used is inspired in evolutionary theories, implementing different groups of initial conditions for artificial societies (diverse topologies, different norms, different mechanisms of strengthening norms) and using the resulting dynamics of the random agents' interaction to obtain information on the comparatively best mechanisms. So, the object of study is not the qualitative contents of norms, but the underlining mechanisms which rule diffusion and the way certain norms are maintained along time.

This approach, corresponding to an extensively contrasted methodology in the MABSS community, allows using the results as guidance in virtual interaction environments (P2P, MySpace).

Finally, Villatoro & Sabater-Mir (IIIA, CSIC) propose an alternative conception of social norm, *as an observable behaviour pattern,* which emerges as a decentralised control mechanism coming from the evolution of the social system itself (Villatoro & Sabater-Mir, 2008). This notion -aligned with Axelrod's (1986) classical one, or Bicchieri's (2006) contemporary one- allows building MABSS models in which the "normativity" is not a *datum* but the result of the system's evolution. The case presented, inspired in the life of the historical community of the yaghans in Patagonia, but classifiable as a "socio-cognitive" (D4) model, allows studying two types of effects of the interaction: the external ones -on the environment- and, particularly the internal ones -changes in mental states-. The simulation allows analysing group formation by coincident social norms for a virtual society of a *"simplifiedly realistic"* nature. The implementation of two necessary elements probes to be necessary: a) individual cognitive capacities for recognition, "classification" and memory of other agents, and b) social mechanism (*computational algorithms*) of social group labelling of any agent by another *(see also **paper 7**).*

From an initial set of possible norms dealing about how the resources should be shared between members of the society, the evolution of the system results in the dominance of a sub-group -or just one specific norm-, depending on the available environmental resources for each time. In a similar way, the social configuration associated with the dynamic formation of groups equally depends on the access to economic resources. Experimentally, the arrival of a whale stranded in the beach generates a reconfiguration of both individual mental norms and social groups.

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References

Axelrod, Robert (1986) “An evolutionary approach to norms”, *The American Political Science Review*, 80 (4), 1095–1111.

Bicchieri, Cristina (2006) *The Grammar of Society: The nature and Dynamics of Social Norms*. Cambridge University Press, 2006.

Bourdieu, Pierre (1988) *La distinción*. Taurus: Madrid.

Castelfranchi C., Conte R. and Paolucci M. (1998) “Normative Reputation and the Cost of Compliance”, *Journal of Artificial Societies and Social Simulation*, 1(3), http://www.soc.survey.ac.uk/JASSS/1/3/3.html, 1998.

Castelló, X.; Eguíluz, V. M.; San Miguel, M. (2006). “Ordering dynamics with two non-excluding options: Bilingualism in language competition”. *New Journal of Physics*, 8, 308–322.

Castelló, X.; Toivonen, R.; Eguíluz, V.M.; Loureiro-Porto, L.; Saramäki, J.; Kaski, K; San Miguel, M. (2008) “The evolution of language”, in Smith; Smith; Ferrer-Cancho (eds.). Proceedings of the 7th International Conference (EVOLANG7), Barcelona 2008, World Scientific Publishing Co. 59-66.

Castells, M. (2002) *La Era de la Información. Vol. I: La Sociedad Red*. México, Distrito Federal: Siglo XXI, Editores. 2002.

CORMAS: Common-Pool Resources and Multi-Agent System, <http://cormas.cirad.fr>.

Fiske, A. P. (1991) *Structures of Social Life: The four elementary forms of human relations*. New York: The Free Press, 1991.

Gilbert, N. & Troitzsch, K. G. (2005) *Simulación para las ciencias sociales (2ª ed.)*, Madrid: McGraw-Hill, 2007.

Izquierdo, L.R. & Izquierdo, S.S. (2008) “Dynamics of the Bush-Mosteller Learning Algorithm in 2x2 Games “, in Weber, Elshaw & Mayer (eds.) *Reinforcement Learning. Theory and Applications*, Vienna: I-Tech Education and Publishing, Chapter 11.

Izquierdo, L.R.; Izquierdo, S.S.; Gotts, N.M.; Polhill, J.G. (2007) “Transient and asymptotic dynamics of reinforcement learning in games”, *Games and Economic Behavior*, 61(2), 259-276.

Izquierdo, S.S.; Izquierdo, L.R.; Gotts, N.M. (2008). “Reinforcement Learning Dynamics in Social Dilemmas”, *Journal of Artificial Societies and Social Simulation* 11(2)1.

Marietto, M. B.; David, N.; Sichman, J. S. & Coelho, H. (2003) “A Classification of Paradigmatic Models for Agent-Based Social Simulation”, in Hales *et al.* (eds.) *MABS 2003 Proceedings*, Springer-Verlag, Berlin, Heidelberg, 2003, LNAI 2927, 193–208.

Muller H.J, Malsch T. and Schulz-Schaeffer I. (1998), “SOCIONICS: Introduction and Potential”, en JASSS, 1(3), http://www.soc.survey.ac.uk/JASSS/1/3/5.html, 1998.

PAPERS (2006) *Analytical Sociological Theory*, monográfico de PAPERS. Revista de Sociologia, 80.

Perreau de Pinninck, A.; Sierra, C. & Schorlemmer, M. (2008) “Distributed Norm Enforcement: Ostracism in Multi-Agent Systems”, in *Computable Models of the Law*, Springer-Verlag, 2008, 4884, 275-290.

Richiardi, M.; Leombruni, R.; Saam, N. J. & Sonnessa, M. A (2006) *Journal of Artificial Societies and Social Simulation* 9(1), 15 <http://jasss.soc.surrey.ac.uk/9/1/15.html>.

Saam, N. J.; Leombruni, R.; Richiardi, M. & Sonnessa, M. (2005) “A Common Protocol for Agent-Based Social Simulation”, in *Representing Social Reality: Procedings of the 3th Conference of ESSA*, 2005.

Schelling, T. C. (1978) *Micromotives and Macrobehavior*, New York: W.W. Norton, 1978.

Soto, J.P.; Vizcaíno, A.; Portillo-Rodriguez, J.; Piattini, M. (2008) “A Two Layer Multi-agent Architecture to Support Communities of Practice: a Knowledge Management Perspective”, in *IBERAGENTS: 7th Ibero-American Workshop in Multi-Agent Systems*, 31-41.

Thompson, Nicholas S. & Derr, Patrick (2009) “Contra Epstein, Good Explanations Predict”, JASSS 12(1), 9 <http://jasss.soc.surrey.ac.uk/12/1/9.html>.

Troitzsch, Klaus G. (2009) “Not All Explanations Predict Satisfactorily, and Not All Good Predictions Explain”. JASSS 12(1), 10 <http://jasss.soc.surrey.ac.uk/12/1/10.html>.

Villatoro, D. & Sabater-Mir, J. (2008) “Towards the Group Formation through Social Norms”, in *Proceedings of the Sixth European Workshop on Multi-Agent Systems (EUMAS08)*, <http://www2.iiia.csic.es/~dvillatoro/Publications/2008EUMAS-Villatoro.pdf>.