Modelling and Evolution of Social Trends in Virtual Environments

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Abstract: Collective virtual places are growing very quick. These places have appeared as a result of the people living in the nets, who demand more easy and believable ways for interacting within these new sites. We think it is necessary to study which is the order that rules Virtual Societies, which emerge as a result of the arrival and interaction of the Virtual Inhabitants in a Virtual World. Our aim is to define these societies and how people living in the bosom of this ones can interact, express, etc., and at the same time how the society gets feedback from their inhabitants and evolves.

Key Words: *Virtual Society, Social behaviour, Intelligent Society, Virtual Worlds, Agents, Social Trends.*

1. INTRODUCTION

When people started to use computer networks to communicate with others in the distance, it was not expected that this phenomenon could move people to the degree of calling them to *"live"* into the nets.

People like to be connected through environments like CHATS, MUDS, etc.. These are examples of systems where the idea is not interacting with the system through its interface but interacting with people placed in other points of the net through the system's interface. Now there are groups which are joined across the distance with the aim of "interacting", groups formed by people born within different environments, but now joined in another one in which they form a new society called "virtual society", where they can develop a new and different lifestyle.

Human reality is profoundly social, so if virtual reality places are worthwhile places to visit and work in, then the central challenge of VR technology is to support ***social interaction*** in multi-user virtual environments [ROCK95].

Howard Rheingold [RHEI93], in his book *The virtual community,* defined: "***The Net*** is an informal term for the loosely interconnected computer networks that use CMC (Computer-Mediated Communication), technology to link people around the world into public discussions."

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"Virtual communities are social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace."

"Cyberspace, originally a term from William Gibson's science-fiction novel *Neuromancer*, is the name some people use for the conceptual space where words, human relationships, data, wealth, and power are manifested by people using CMC technology."

"Each of the small colonies of microorganisms--the communities on the Net--is a social experiment that nobody planned but that is happening nevertheless." [RHEI93]

We agree with these definitions although we will refer to the Rheingold´s "*Virtual communities*" as "*Virtual Societies*", but the essence is the same. Using computers to simulate naturally occurring societies, is a rapidly growing area of research [GILB94]. The study of aspects such as social behaviour, social simulation and interaction in virtual societies is growing. We emphasise on studying virtual communities or *Virtual Societies* on-line to find out if real-time computer mediated communication (in this case any network-based virtual environment), is able to give birth to, a *Virtual Society*. If this Virtual Society is able to emerge, then we are interest in developing a model which will represent a Virtual Society with its Social Trends, Collective memory, etc.

Today's virtual societies, however, are not just formed by people communicating to each other, but also we find a set of autonomous agents that can help visitors or just move around, to give a feeling of an inhabited world. A lot of work has been done in order to embed some intelligence into these agents, but they are still lacking some attributes to make them social entities.

Our aim is not to contribute to the sociological study of virtual societies but to define a computational model of the social trends and evolution of the Virtual Society, in a way that can be used to populate the society with autonomous intelligent and social agents, that get feedback from real users in order to select and evolve their social behaviour.

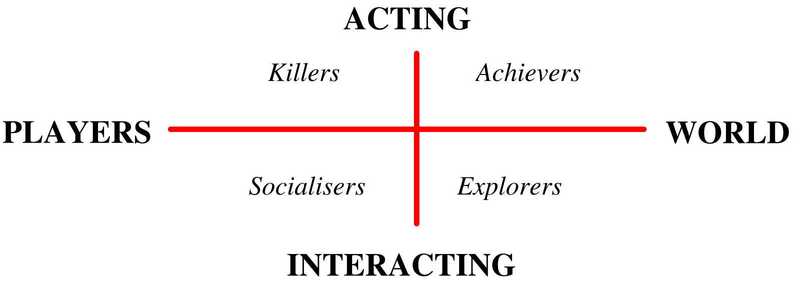
2. RELATED WORK: Brief History

The first MUD (Multi-User Dungeon), originally refereed to a particular game, not an entire class of them, was created and written by *Roy Trubshaw and Richard Bartle,* at Essex University in Britain. Roy's reasons for writing MUD were twofold: to make a Multiplayer adventure game and to write an interpreter for database definition language.

In 1989 *Jim Aspnes* at CMU began the development of a new MUD system which became TinyMUD. Two features of TinyMUD are particularly interesting historically for us. The first is that Aspnes created a system which could be played over the Internet. The second particularly notable feature was that Aspnes made a conscious effort to discart from his system the whole notion of combat, points and treasure which were at the heart of the earlier systems. Instead, the focus of worlds built with TinyMUD was conversation and creation. TinyMUD itself and is derivative system formed a new branch of MUDs generally referred to as ***"social MUDs"*** [DOUR98]

Until now typological classification of MUDs has primarily been carried out using a single discrimination criterion, which separated MUDs into two groups, **"social-oriented"** and "combat-oriented", these distinction served only to separate TinyMUD and its derivatives from all other MUDs.[KEEG]

In [BART96], Richard Bartle makes an interesting classification of the people who use MUDs, considering the following abstract graph:



Because our work focus on integrating technology and social sciences, we will see only how Bartle defines Socialisers. Socialisers are interested in *INTERACTING with other PLAYERS*, what usually means talking, but it can extend to more exotic behaviours. Finding out about people and getting to know them is far more worthy than treating them as fodder to be bossed around. Socialisers are proud of their friendships, their contact and their influence.

Bartle, uses four kind of players to define the role of people living in MUDs, but does not define the idea of society or community. Players are seen individually and only Socialisers and some times Explorers interact with each other. He does not define semantic frameworks involved in socialising Cyberspace.

As MUDs are typically textual environments and the technology grows, it is needed newer and richer ways for interacting.

At the same time MUDs were evolving, other kind of net environments were evolving too, which were called, generically,*"virtual environments"*. Since 1985, when Lucasfilm created the first networked virtual world called Habitat, dozens of similar Internet-based systems have emerged. Some of them have added 3D visualisation, sound support, building capabilities, avatar creation capability, etc., with the aim of making them more attractive and friendly for users.

WorldChat [DAME98] from World Inc., was the first one which incorporated 3D graphics. **On Live** [DAME98] was the first one which included voice communication and implemented lip-synchronisation, but it does not implement avatar gestures.

Another example is **The CyberCafe** [ROUS97], where the concept of "synthetic actors" is introduced. These actors are able to improvise their behaviour in an interactive environment and they own a repertoire of actions which are automatically planned to achieve each activity. They even reflect aspects of personality traits and mood. **Bodychat** [VILH97], also tries to automate the communicative behaviour in avatars. Here the concept of "Intention" is introduced. Intentions are described as:

> "*Set of control parameters that are sent from the user's Client to all Clients, where they are used to produce the appropriate behaviour in the user's Shadow avatars." [VILH97]*

Improv [PERL96], offers an environment where an avatar can generate motions in real-time, but however, the conversation between avatars is not addressed. **Advanced OZ** [DAME98], implements gestures (called motions), taking advantage of this natural and intuitive communication mode.

The ***SICS Distributed Interactive Virtual Environment (DIVE)***[2] is an experimental platform for the development of virtual environments, user interfaces and applications based on shared 3D synthetic environments. Dive is especially tuned to multi-user applications, where several networked participants interact over Internet. DIVE applications and activities include virtual battlefields, spatial models of interaction, virtual agents, real-world robot control and multi-modal interaction. There are many projects based in DIVE, like the ***WAVE project***, which is known as the Wide Area Virtual Environment, is concentrating on lightweight multicast groups, reliable multicast and flexible consistency mechanisms and not in social sciences.

Systems mentioned above, centre its attention in technology and not in socialising the net. We think there is a gap between technology and social sciences in the networks.

The ***Virtual Society (VS)*** project [LEA96], is a long research initiative that is investigating how future electronic society will evolve. Their goal is to explore the capabilities of existing technology to support social spaces. The Virtual Society project is designed to realise the dreamlike vision through the latest digital and networking technology. The goal is a seamless community between real society and electronic society, another kind of community, a virtual society that's fun, fast and free. They have a system called *CommunityPlace (CP)* which has elements of CSCW (Computer Supported Co-operative Work). They focus on the development of a simplistic architecture which enables share 3D worlds but not focus on social sciences.

This system differs from the DIVE based work in that Community Place has been designed from the outset to work in a wide area, low bandwidth environment. The Community Place architecture is a hybrid

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[2] available at: ***http://www.sics.se/dive/dive.html***

peer-to-peer and client-server architecture. The Community Place browser is designed to use low cost PC machines and uses the VRML graphics standard. This project focus on the development of Client Protocols for Interaction.

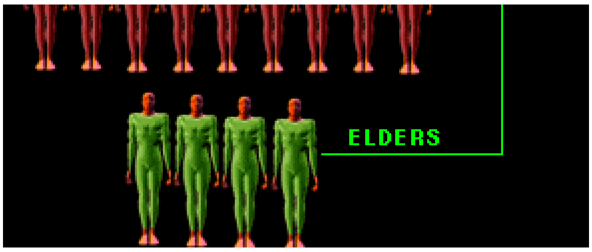
MASSIVE (version 1) [3] is always and only a teleconferencing system and an example implementation of the spatial model of interaction - its not a general-purpose VR application development environment. There are several projects in which MASSIVE has been used. Some examples are:

Comic project: is a three year basic research action (1992 -> 1995) to investigate techniques and develop tools for real-world large scale CSCW application developers. It draws together both Computer Science and Social Science fields in order to try and understand the process of group communication more fully. It aims to examine and overcome the practical and theoretical problems limiting effective CSCW product development at that moment.

The Inhabit project: will examine a VR conferencing system (MASSIVE). Meetings will be held within MASSIVE between the different sites involved in the project, and we aim to evaluate both the networking and usability requirements through a series of experiments.

All these projects study interaction, not based in social sciences but in physical mechanisms for interacting.

In ***"ColonyCity"[4],*** they have defined a society with its own structure both social and political. All people living in this society have their own task to reach.



a) NEOPHYTES - non-residents who are new to ColonyCity, looking around, getting used to what's there. They are given a limited choice of basic generic avatars and can explore and chat but cannot earn credits or build anything.

b) RESIDENTS - registered members of the community who have the right to build their own houses and earn credits. They are given a richer selection of avatars to choose from and can earn credits and thus buy goods and services in the mall and around the community.

c) CITIZENS - residents who are actively participating in the community by taking a job or function (see Political section below). They can earn even more credits and they can have their own custom avatar.

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[3] available at: ***http://www.crg.cs.nott.ac.uk/research/systems/MASSIVE/***

[4] available at: ***http://www.colonycity.com/info/about/details/social.html***

d) ELDERS - citizens who have been members of the community for more than a year and who have proven themselves valuable to the community.

This status is awarded and automatically includes a higher rate of credits for the same activities.

In this product, we can see there is a social structure but their sociological model seems to be based in antique of their inhabitants and their political model.

The "*Project for the Simulation of Social Behaviour (PSCS for Progetto per la Simulazione del Comportamento Sociale)"* [PSCS], started in the 80s at IP-CNR as a stimulating research experience gathering people with different background: the main aim of the program has been to promote the scientific interface between AI-based computational methodology, cognitive modelling, and the social sciences.

As in Morningstar's paper said [MORN90], the essential lessons abstracted from the experience with Habitat, the first virtual world, is that a cyberspace is defined more by the interactions among the actors within it than by the technology with which it is implemented. At the core of our vision is the idea that cyberspace is necessarily a *multiple-participant environment.* It seems to us that the things that are important to the inhabitants of such an environment are the capabilities available to them, the characteristics if the other people they encounter there, and the ways these various participants can affect one another.

When we are looking at a virtual mountain, the most significant thing is the beauty of the landscape. Nowadays the technology has solved this challenge, so we think the next step is to make the user of a virtual world feel that his/her avatar can **interact** in the virtual world as he/she can do it in real life. This implies the need of studying sociological and psychological theories and the use of artificial intelligence to help achieve this goal.

We think that the most important thing to have in mind of all seen above is that social MUDs, Virtual Environments, etc., have in essence the way in which people interact, so the idea is to see how integrate HCI (Human Computer Interaction), CVE (Collaborative Virtual Environments) and CSCW (Computer Supported Co-operative Work) with Social Sciences, and see how Virtual Societies are able to evolve since the Net Chaos or Anarchy to the Social Order.

The aim of our work, is to explore these societies and how people living in them can interact, express themselves, etc., and at the same time how the society gets feedback from its inhabitants and evolves.

3. AN INTELLIGENT "VIRTUAL SOCIETY"

We can talk about a "Society", from the moment when there are, at least, two living creatures that are together and start interacting. The idea of modelling a virtual society is the same as presented by Giuseppe Mantovani [MANT96], and it is that cognitive processes such as categorisation, stereotype construction, and social identification can make electronic environments even more strongly sensible to social norms than face-to-face communication.

A "Virtual Society" (VS) is a virtual world inhabited by avatars, guided by humans, and by some automated agents (but acting as humans too), both called in general "virtual inhabitants" (VI). These "virtual inhabitants" are placed into the "Virtual Society" and are able to interact.

Similar social situations and problems to those that occur in real life can be expected in a "Virtual Society". Difficulties in establishing a relationship, communication problems, xenophobia, sexual harassment, etc., are aggravated by the fact that the "virtual inhabitants" may come from different real societies and speak different languages.

Given an isolated individual, he/she acts guided by his/her necessities, intentions and goals. The way these actions are carried out is influenced by the personality of the individual, his/her moods, his/her believes, facts, all of them, that emerge from his/her internal state model.

Moreover, an individual immersed in a community, a society, must add to the actuation motivations aforementioned the necessities, intentions and goals of the other individuals. His/her behaviour with regard to the outer world increases its importance, since it can have some influence on the actuation of the rest of the environment inhabitants.

Here is where it is necessary to introduce a new factor, which can determine, or at least have some influence in, the behaviour of an individual within a society. It includes all the trends, human values, fashion tendencies, racist ideas, ways to interact, that are generally accepted, and lies in the society “memory”. This has been called *Social Trends.*

In real life, when someone arrives to a new country, he/she is empty of knowledge about the tendencies, likes, etc., which are in fashion. Gradually, he/she starts understanding which are these tendencies, fashions, etc., are, and he/she can agree with them or not.

In real life, when you are in a new country, you are only able to see the portion of the society in which you are submerged. Something similar occurs in a VS, where you will only see a portion of it, which here is called "Sub Virtual Society" (Sub-VS). This would be like the partial view we could have of a very big data base. At the same time, as you travel through the virtual world, your view of the VS will change, different views will be the Sub- VS, as is show in the Figure 1.

As VS are divided into Sub-VS, there will be particular *Social Trends* for each Sub-VS.

4. VIRTUAL SOCIETY MODEL

We agree with Mantovani's [MANT96] model, in the sense that actors, VI in our model, carry out tasks with the aim to achieve projects and goals. The challenge is develop a model which will represent the way in which VI reach their goals being influenced by social patterns and immersed in a VS.

4.1 Collective memory

This concept could correspond to Mantovani´s model Level 1, with the difference that Mantovani do not distinguish between kinds of inhabitants, and we think for example that the Past History of the society is only necessary for agents.

In real life it is not needed to explicitly define a scheme or a physical representation of the society because this scheme is implicit in the own composition of the society, but in a virtual world, due to the nature of its VI, we will need to represent this VS in some way.

As we said above, there are two kinds of VI. Avatars guided by humans do not need this representation of the VS because, as they are guided by humans, they are able to perceive the *Social Trends* just by looking at the virtual world.

On the other hand, agents, which are not guided by humans, do not have eyes, so it is necessary not to have *Social Trends* not implicitly in the VS but explicitly written somewhere. This is what we will call collective memory.

As Sub-VS evolves (this will be explained in point 5), it is needed to store up the out of fashion tendencies in which we call *"Collective Memory"*, is like a pass history of the VS, is not interpreted, it is just like a statistic in real life. Avatars or agents could access the Collective Memory, to see for instance what were fashion tendencies twenty years ago. As [MACY93] says: *“Look ahead by holding a mirror to the past”*.

4.2 Social Trends

We propose to incorporate a specific set of elements into the definition of our Sub-VS: list of human values, fashion tendencies, racist ideas, ways of interacting. For a Sub-VS, the values contained in each social trend represent what is in fashion in this Sub-VS. With all these traits each Sub-VS will be able to evolve.

We will briefly describe each of these items.

Values scale: it is a list with the priorities of the VI in the Sub-VS, for instance (in order of priority): enjoyment, work, family; could be the values of this list in a Sub-VS.

Fashion tendencies: which are the last tendencies in clothing and adornments used by the avatars to get a better appearance.

Racists and class-consciousness: in a Sub-VS it could be improper that a VI talks to another one who has a reptile appearance, for instance.

Ways of interacting: in the Sub-VS there are ways of interacting that are socially accepted. These ways to interact are not different in its goals but in its procedures.

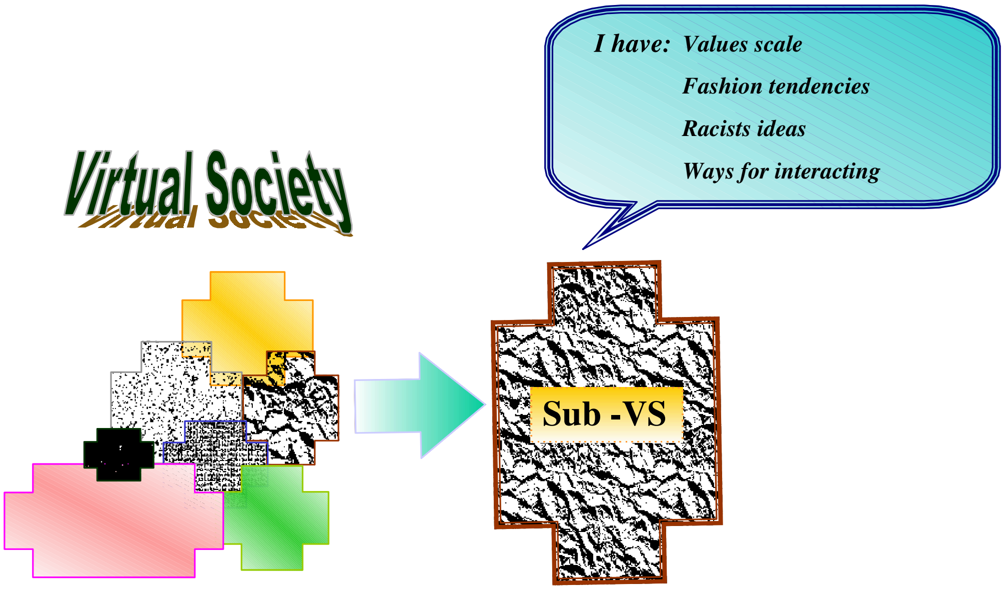

Figure 1. Structure of a Virtual Society

Mantovani introduces all these concepts Level 1 into the concept “structure”. Social trends will define different sub-societies, as section of the society.

4.3 Individual social traits

Each "Virtual Inhabitant" (VI), will have a particular set of values for the above mentioned *Social Trends* and it will be possible that a VI is not affected by some social trait as it occurs in real societies. We will define another element which joins the above *Social Trends* to define *"Individual Social Trends",* it is the "*Internal status".* This could be the same as in Mantovani's model, “User” at Level 3.

Internal status: this represents the VI as a single element of the society. Additional information on this model can be found in [IMBE98]. These trends will define different kinds of VI as isolated individual as it would be if it was not immerse in a Sub-VS.

As in real life, avatars will be bombarded by the tendencies stored in the *Social Trends* of the Sub-VS. Both of the VI types will be able to decide whether to take into account the values of the Sub-VS *Social Trends* in which they are living, or not.

Some VI will be influenced by these tendencies, and as a result of this influence the VI will need elements like shops to buy things for symbolising its status in the Sub-VS. For example, if you are playing the role of a businessman you might need a Rolex and a sport car, but only if you are influenced by the Sub-VS.

With all these trends defined in the Sub-VS and instantiated in each VI, when we arrive to one of these Sub-VS we will be under the illusion that this Sub-VS is alive and people who inhabit there are alive too. You will be able to say which is the last fashion and who are old-fashioned in this Sub-VS.

The first time you arrive to a Sub-VS, you will see the differences between yourself and the rest, and also between the natives of the Sub-VS, you will feel lonely because you has not defined your social trends. As you perceive what are the Sub-VS trends you will be able to integrate yourself in the Sub-VS, defining your own *Social Trends*, deciding the social group in which you want to be integrated. Then you could be one more and go unnoticed, or try to intentionally differentiate yourself.

5. EVOLUTION OF THE VIRTUAL SOCIETIES

5.1 Individual Social Traits Evolution

As we have commented above, the degree of user control over the avatar’s behaviour can be very diverse. In one extreme, the user can take the whole control (an avatar is something like a puppet). In the other extreme, the avatar behaviour has been completely automated (the avatar is then usually ruled by an intelligent agent). Of course, between these two poles there is an extensive range of intermediate control possibilities [IMBE98].

As it occurs in real life, the *Individual Social Traits* will evolve over time depending on several circumstances. The evolution in agent-ruled avatars differs few from the evolution in user-ruled avatars, given that both employ the same evolution mechanisms, although there are some small differences that must be taken into account. These mechanisms are, basically, the following ones:

- Learning: This mechanism is based upon the avatar is personal experience. Every avatar's behaviour producing good results is assimilated, while all pernicious conducts are avoided.

- Imitation: An avatar tries to imitate the more successful conducts of the avatars in its surrounding, and tries to evolve against the less beneficial ones. The imitation is easily understood in the case of user-ruled avatars: the user is the one who imitates the other avatars' trends, and imposing them over his/her avatar. The influential source is always another avatar (or other avatars), as it is shown in the Figure 2.

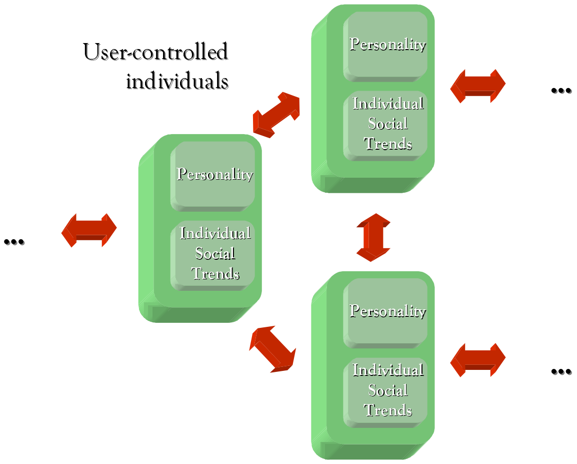

Figure 2. Evolution of the *Individual Social Trends* in user-ruled avatars

On the other hand, the imitation becomes more complex when it is an agent the one who controls the avatar. The agent makes then use of the *Social Trends* as an aid for making a decision, as it is shown in Figure 3.

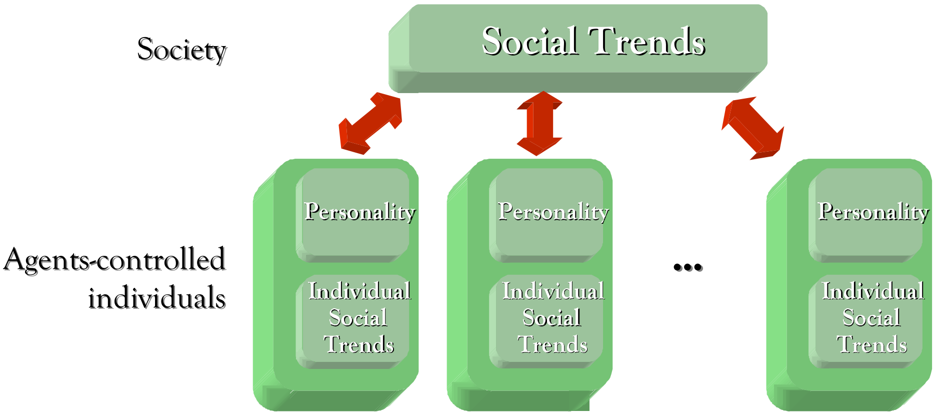

Figure 3. Evolution of the *Individual Social Trends* in user-ruled avatars

- Innovation: This is the main way of evolving by generating new trends, proposing new alternatives to the existing ones. If the new behaviours succeed, they will be imitated by other avatars, and they may even become a social trend.

  Here, an interesting reflection arises: which should be the limit for an agent-ruled avatar to take the initiative for setting the new trends? And, which would then be the reaction of human-ruled avatars?

5.2 Social Trends Evolution and Collective Memory Updating

The fact that the avatars *Individual Social Trends* evolve over time - no matter which is their control source, human or agent - involves the evolution of *Social Trends* too.

Whenever a significant majority (or, at least, a majority minority) of *Individual Social Traits* have evolved, the *Social Trends* will evolve towards the new conducts, as if is shown in Figure 4.

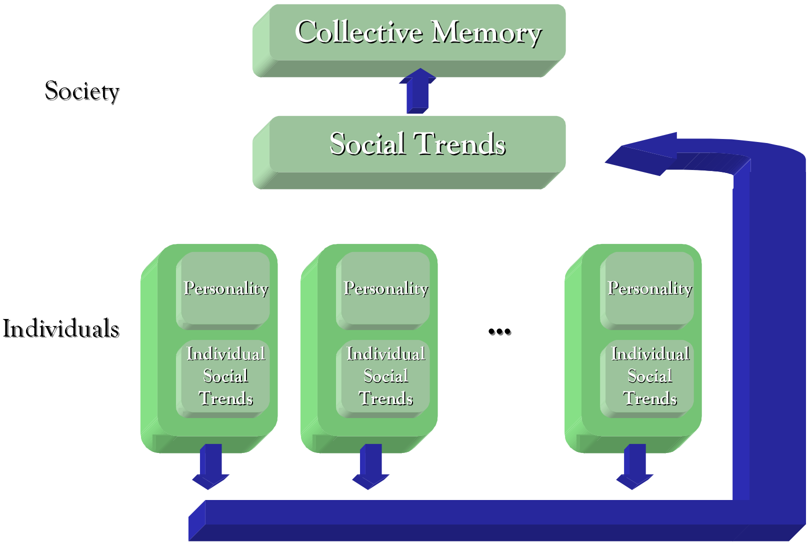

Figure 4. Evolution of the *Individual Social Traits* and updating of the *Collective Memory*

Moreover, every change in the *Social Trends* implies an updating of the *Collective Memory*, recording the new trends and, therefore, maintaining the historical social memory.

6. CONCLUSIONS

People living in the nets make places where a new kind of life emerge. As a result we can see that nets are sites full of inhabitants, so it is needed to develop systems where the interface helps to reach the needs of people who live this way.

There are places where people can interact, but it is also needed that in these places grows an order able to define the tendencies and the way of acting of the VI. This is the reason why we have defined the concept of "Social Trends", "Individual Social Trends" and "Collective memory".

We think the best way to study how a VS evolves is to create a Virtual World where people can arrive through his/her avatar, and interact with each others. The society and VI will evolve, thus it is needed a methodology to represent how the VS evolves and this one will be the simulation engine through we will be able to see the behaviour and evolution of our VS.

Our aim is to implement a social virtual model and pilot it into a game-based intelligent virtual environment, placed under the Amusement Project development, where there will be the two kind of inhabitants mentioned above.

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