

A Multi-dimensional Relationship Model

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ABSTRACT

With the course of time and the increasing use of computers in the daily life of everyone highlights the relationships we develop with them as well as the importance of these relationships. This aspects gains special importance when we refer to synthetic characters. Following the previous ideas, we have developed a model of relationships that models the processes involved in these relationships in several dimensions. For this purpose we have based our research in both computational systems that include relationships and in theoretical theories of the psychology and sociology of human relationships. As a way to validate and test our model, we have introduced the intimacy relationship and conducted an experiment with eight users where they interacted with a prototype of a game where they to develop a relationship with one character.

The evaluation of the experiment's results showed that from all the test conditions, the one that included our relationship model presented the higher and better results for all the three variables of measure in the relationship establishment.

Keywords

Interpersonal Relationships, Intimacy, Relationship Model, Computational Agents, Synthetic Characters.

1. INTRODUCTION

1.1 Motivation

Since the invention of computers, that they have been used to help humans in some mechanic, workaday and routine tasks. With the course of time, computers became more present and accessible in the daily life of everyone. We interact with them unconsciously and in some routine tasks like buying train tickets, paying the car parking, in the traffic lights, mp3 players, mobile phones, on the ATM machines, playing electronic games and other ubiquitous interfaces.

This increasing presence of computer and computational systems in our life, highlights an important role needed to take into account and that is increasing its importance, the relationships that we develop with them and the personification of their relationships with us.

According to Nass and Reeves [30] studies, people interact (unconsciously) with computers like they interact with each other by applying the same social rules when provided with the appropriate social cues. The approximation and consequent growth of identification between people and computers lead us towards the creation of believable systems, this means systems that should act like humans but don't need to be necessarily realistic [32]. This aspect enhances the importance of creating human-computer interactions that take into account in social factors. This fact enhances the idea of creating computational systems that provide interfaces that have a social dimension, behave socially and that have the goal to meet the user expectations. This is possible through the use of synthetic

characters, i.e, computational systems that are life-like entities and that will allow the user to interact in a natural way like if they where interaction in a real world with real people. In this way, it's important to create synthetic characters with rich actions and interactions but, it's really necessary to create a suspension of disbelief in the user [31].

According to this, if we provide synthetic characters with the ability to establish and understand relationships, we can improve our relationships with them and, in this way, take advantage of the benefits of the relationships and use them on characters. This problem is addressed by Bickmore and Picard in [1], where they highlight the fact that "it is important to not only understand the nature of this phenomenon and its effects in work and leisure contexts" but it is also important to make these relationships last through time and, for this purpose, it is essential to use strategies to construct and manage and those relationships.

In this way, it is important to apply the theoretical studies in relationships in order to find a generic way to represent them, i. e., find a generic model framework involving the relationship processes and serving as a base to represent relationships in characters. Another aspect that is needed to take into account is the understanding of the essence of relationships and the difference between them. For example, the trust relationship is a simple relationship, i.e., a relationship per se, but when we talk about friendship, we are referring to a more complex relationship that is composed by other simple relationship like trust or intimacy. In this way, it's important to create a generic model, capable to represent simple, complex and multi-relationships at the same time.

1.2 Objectives

Following the ideas exposed in the section 1.1, we propose as the main objective of our work the creation of a relationship model that can serve as a framework to the creation of believable relationships between synthetic characters. When interacting with each other, human tend to behave according to the relationships they share and, consequently, these relationships will in turn influence their future interactions. In this way, we want to create a generic model of relationships by formalizing a concept of relationship taking into account the processes responsible for the relationship establishment, management and revision.

1.3 Outline

In this article we will first present an overview of some computational systems that address the issue of the use of relationships and a theoretical background in Psychology and Sociology of Human Relationships. Then, we will present our Relationship Model and the experiment conducted in order to evaluate it. Finally, we will present our conclusions of the tests and present some ideas of future work.

2. COMPUTATIONAL SYSTEMS

In this section we will present a brief state-of-the-art in our research area, the relationships between agents and the processes inherent to these relationships. We have divided the studied works into two categories: Interactive Agents and Multi-Agent Simulation.

2.1 Intelligent Interactive Agents

The Artificial Intelligence systems where the agents are able to interact with other agents, humans and with the environment are widely used in a way of creating agents with the ability to establish social relationships as a way to achieve their goals.

There are many areas where this type of characters is used. We can find them in training (ex.: Fittrack [1]) negotiation/sales (ex.: REA [2]) or Games (ex.: The Sims [3][4][5]). The use of Intelligent Interactive Agents also plays an important role in believable negotiation [29], in the achievement of believability in the engagement of the user as a part of a group [27] or on the study of influence [28].

2.2 Multi-Agent Simulation Systems

One of the main applications of the Multi-Agent Systems is the simulation area. Multi-Agent Simulation Systems (MAS) can be seen as the imitation of a real world process or system over-time [6]. It is widely used to enhance knowledge in biology [7] or in the simulation of evolution of emotions and social relations [8]. In this way, MAS gave us the possibility to make artificial universes or test theories in small laboratories and personal computers.

The use of simulation agents is also important in the simulation of organizational behavior and working environments[9], in the study of influence in groups [10], reputation in computational models [11] and in the study of power and dependence relations in groups of agents.

2.3 Conclusions

With the reading and analysis of these systems, we have identified some characteristics that we believe that are important to take into account when creating our model. These characteristics are:

- relationship representation: explicit representation vs implicit representation (perceive through the interactions and dynamics among the agent);
- the agents have intention and strategies to maintain the relationships;
- agent interaction with users. We want to create a model of relationship where the agents interact with the user, in this way, it is important to analyze what were the systems that provide this interaction with the user;
- if the relationships that agents develop among each other have influence (or not) in the relationships of other agents. We are interested in finding systems that explore the fact that an agent is not a character isolated in a world and, develop social relations with other users, in this way, the establishment (or development) of some relationships among agents can have influence in the relationships that those agents have with other agents. For example, agent A is friend of agent B. If agent C do not like agent B, the relationship between A and B can be negatively influenced.

We have observed that only 3 systems [2][1][10] include processes to maintain the relationships with others overtime, this can mean that in some systems the interactions among the actors occur only one time or that they do not deliberately try to maintain those relationships. Regarding the interaction with the user, none of the systems that were catalogues as Multi-Agent Simulation systems provide user interaction, in this way, this kind of systems only incorporate relationships among computational agents. In terms of relationship influence, the major part of the systems do not take into account this factor, this can happen because in some of them the agents only have the ability to interact with one actor. We can also observe that the major part of the systems do not represent explicitly the relationships that their agents establish among them or with the user.

3. RELATIONSHIPS

3.1 Introduction

The evolution of a relationship is not a static process but a consequence of interactions by someone and the perception and validation of that interaction by the other relationship partner. In order to achieve different levels in relationship, people use different strategies [12]. Although, the relationship evolution do not depend only from who uses those strategies, but their target have the final decision in deciding if they accept them and if they want to maintain a relationship with other person [13].

Taking this, in the next sections we will explore the three main concepts present in relationships: Stages, Strategies and Filters.

3.2 Stages

Intuitively, we all have a tendency to perceive a relationship as an evolution of stages [12] that have an emotional parallel in both deepening and broadening of affection or connection. However, this perception of relationship evolution is a relative one and it is based on different recognitions of the differences between emotions, their labeling and the perception of how all the processes are intertwined and then how it modifies the relationship itself [12]. In other words, with the recognition of the relationship stages we can adapt and change our emotions and interactions in a way that we found to be more adequate to that particular stage.

Following the previous ideas, the concept of stages exist majorly because people recognize them and when two partners identify a change in a relationship status it is because they can manifest the change with full meaning to other people [12]. We can see this, for example, in a ring (change manifest) in an engaged (relationship stage) couple.

3.3 Filters

Filters or the filtering process is a sequence or series of decisions through which we make choices about the stage of relationship we want to maintain with others. When a person passes one filter they go on to the next. According to Duck[13], its creator, there are four filters in the process of relationship evolution:

- Sociological Cues: The physical proximity plays a very important role in determining if we establish relationships. This filter represents the restriction on who we meet, based on where we physically go (where

we live, work, etc.). The author argues that we choose where we want to be so, we can (in some way) control who (or the type of people) we want to meet with;

- **Pre-Interaction Cues:** After we meet people, there are some filters that we use in order to choose who we want to continue seeing. At this stage, non-verbal cues play a very important role, we focus in physical appearance, physical attractiveness, how someone dress, the style, what s/he is reading, listening i.e., this filter accepts who gives us a good first impression based in what we are, like and want . At this stage, this type of information about what we see or hear about the other person is the only information that we have about the other;
- **Interaction Cues:** It is in this filter that we make the choice to include or exclude someone from possible relationships. As people start to talk, the content of the conversation starts to matter, people start to know more about the other person and both have elements to decide if what they had judged about one another is positive or negative;
- **Cognitive Cues:** This is where the deepest decisions are made. We look for people with similar attitudes, beliefs and values as us. In this stage we make the difficult decision/statement if the other personality match our own and proceed to a deeper level of the relationship.

3.4 Strategies

The evolution of a relationship is not a static process where we sit and wait for it. We create and use different strategies to change the state of a relationship or to model it in way to achieve our goals within a relationship. In this way, we can see these strategies as the “key” to access different relationship levels.

The first contact we have with someone is mainly visual or non-verbal. We see people everywhere we go and, having this free will to choose our sociological location, we predispose ourselves to be with other people. As the relationship evolves people start to know more about each other and the depth and breadth of the mutual knowledge increases. This evolution will also reflect an increase in the complexity and intensity of the interactions we have with others.

Considering this, we will present some general strategies that can be applied through different stages in a relationship.

- **Attitude validation:** According to Byrne [14], human beings have a natural predisposition to feel good when someone validate their attitudes, which can be conditioned by the association of the occurrence of the attitude validation with the “validator”. This validation will be perceived as “liking” and consequently will report that they like who provides this attitude reinforcement;
- **Self-disclosure:** One of the beliefs people feel about the development of the relationships is that they have to reveal information about themselves as appropriate to the stage of the relationship. These constant revelations serve as a sign of growing intimacy and trust in our partner. This process can be both verbally and non-verbally.

- **Shared Meanings:** the process of knowing someone is the process of framing and understanding the other person in as many levels as we can until we reach a sense of shared meaning. Duck as divided this process into four layers: (1) Commonality of experience; (2) Mutuality ; (3) Equivalence of evaluation ; (4) Sharing of meaning.

This is a process that continues indefinitely and proceeds right through our lives and the life of the relationship [12]. Each new day and in every interaction or meeting with the partner new information comes and could change our understanding. Therefore, we are continually exploring our partner in different circumstances of life and continually reevaluating the meanings that we share and the extent to which we do so.

- **Organizational talk:** Talk not only servers instrumental purposes, such as the apportionment of time and arrangement of the demands of work relative to home/social life, but it also is used in social settings. This social settings can be the conduction of arguments, divide work, plan holidays or to create an imaged future [15]
- **Organizational conflicts:** Conflicts arise in terms of good and bad kinds of conflicts. In this way, we can say that the “organizational” conflicts (good) are actually more useful than the purely “emotional” (bad) one, in the way that kind of conflict seems to help the relationship to become organized [16]. In this way, we can state that some conflicts (and their resolution) are useful for the relationship as they target roles and routines and involve negotiation of tasks, activities or duties in the relationship.

4. MODEL ARCHITECTURE

As previously mentioned, the development and maintenance of relationships is not static and involves several and complex processes. When interacting with each other, human tend to behave according to the relationships or the state of the relationship they share and, consequently, these relationships will in turn influence their future interactions. In order to put all this complex processes and their influence in the future together, we have developed a relationship model. The definition of this model was inspired by the psychology theories and definitions discussed in the previous section and its mainly sustained by the theoretical background exposed by Duck [12] and is supported by the relationship definition proposed in the previous chapter.

As we can see in the Figure 1, our model is divided in the 3 main concepts, the states, filters and strategies.

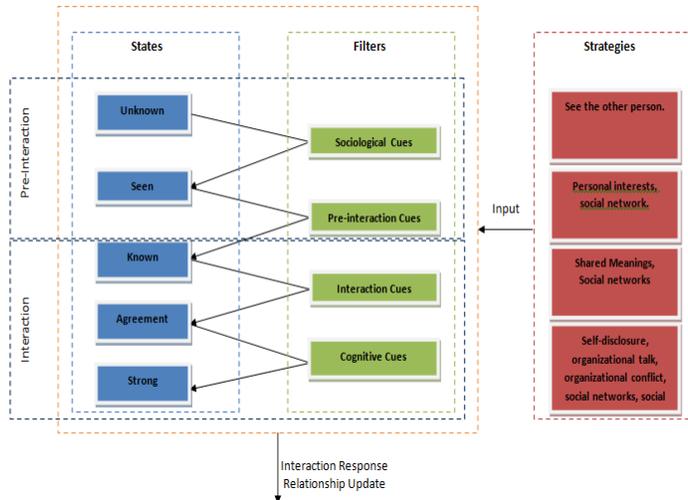


Figure 1 - Model Architecture

4.1 Stages

The relationship evolution is a non-static process in which, through the course of time and well succeed interactions, we can perceive different stages accompanied by an evolution of the possible and acceptable interactions. We can describe these states as a fixed set of stages that different relationships go through, defining the level of the relationship between two people at each moment.

These stages appear as a consequence of a passage through the Duck's filters explained in the previous chapter. When someone achieves the requisites of someone to pass through is filter, we consider that that person is moving from one relationship level to another. Duck's filtering model [13] defines four important decision moments, which means that we will divide in relationship into five stages.

Following the topics discussed in the previous chapter, the relationship evolution have an important moment from which we can really start to know the other person and to continue (or not) the relationship to deeper levels, the first interaction between the relationship intervenients. Considering this, we have established an important division in the relationship evolution, the division between what happens before and after this first interaction.item

- **Pre-Interaction States:** define the level of the relationship before the direct interaction between the intervenients has started. All people are different, have different interests, motivations, go to different places and met and stay in touch with different people.
 - Unknown: there are people that we have never seen or do not even know that they exist. These people are considered as 'unknowns' for us and represent the lowest stage of a relationship.
 - Seen: Before we directly interact with someone, we have to first see him/her and know that that person really exists.
- **Interaction States:** in this state we assume that the intervenient have been introduced. It is also the state of the relationship that starts after the first direct

interaction between the actors has started and continues through the subsequent progressions (or regressions) of the relationship. When passing from the previous to this state, we assume that is impossible to recede. Like the previous state, the interaction state is composed by other states:

- **Known:** we consider that someone is in this stage of the relationship right after the first direct interaction. From this moment, we are allowed to start discovering more about the interests of the other person. In this stage people talk about some superficial topics like personal interests and the physical contact is very low.
- **Relationship agreement:** at a certain point in the relationship, people decide that the relationship is something important to them. The physical contact can increase and we have less problem in hugging the other person, at a verbal level, people start to reveal more about what they like, their interests and also can address some conversations about feelings, concerns and opinions.
- **Strong Relationship:** at a certain point, the relationship with someone start to be not only important but in some aspects essential, strong and can last forever. In this stage people share their deepest feelings, concerns show their strongest opinions and emotional support and help.

4.2 Filters

As said before, Duck have defined four filters [13] or four major choices in the process of the relationship evolution that allow us to 'put' someone in a different relationship state and filter who we thing that do not deserve it. Following the same reasons exposed in the previous section, the relationship filters were also divided in two high-level filters that highlight the important moment of a relationship that is the moment of the first interaction.

- **Pre-interaction Filters:** corresponds to the filter through which a person needs to pass in order achieve interaction stages. This filter include two Duck filters that define the choices made before the partners interaction and can be seen as pre-conditions to achieve an interaction level in a relationship. This group is composed by two filters used in the evolution within pre-interaction states: sociological cues and pre-interaction cues.
- **Interaction Filters:** after an interaction starts, we start to talk with the other person and discover really how the other person is. This knowledge is not only based on their appearance and non-verbal aspects but also in deeper aspects of the other person. In this way, we have more precise and deep elements to accept or reject the relationship or more specifically to choose the level of the relationship we want to have with someone. This is composed by: interaction cues and cognitive cues.

4.3 Strategies

In the course of the relationship evolution, the strategies that we use to change the level or the course of the relationship will depend on where we see that the relationship is and have to be changed during the different stages.

In an initial state we can see these strategies as predispositions that are highly connected to our personal interests or where we want to be. We notice people that attract us, who is close to people we already met and we consider interesting or who respect our social rules. For example, it is hard to imagine an environmental activist attracted to someone that s/he saw acting disrespectfully to the environment.

After we start to interact with someone, we start to know more about that person through some superficial topics and very low non-verbal interactions and if the relationship evolves in a positive way, we start to reveal more (and hear more) and all the interactions start to be more deep, not only based in suppositions or superficial conclusions but in deep knowledge about each other.

5. IMPLEMENTATION

After the definition of our relationship model, we have decided to prove the validation of the model, to evaluate its effects and ensure that it reaches the goals of our work.

As a way to achieve this, we have created a prototype of a game (that includes our model) (see Figure 2) and engaged the user in interactions with a non-player character (npc) as a way to explore the creation of a relationship of intimacy between the npc and the user.



Figure 2 -Game general view

5.1 Prototype

In order to present to the user a believable scenario we have decided to use a 3D representation of our characters and decided to use a game named NeverWinter Nights 2 [17]. NeverWinter Nights is a RPG (role-playing game) that comes with an editor (NeverWinter Nights Toolset) that allowed us to create the interaction scenario, give our characters a 3d representation and that supported all the character interactions (physical animations and dialogues).

Thus, only the use of the NeverWinter Nights Toolset was very limitative to our work, because all the code had to be scripted using the specific scripting language of the editor. In order to surpass this difficulty, we used searched for a solution to provide us a more flexible development and we found the NeverWinter Nights Extender (NWNX) [18]. NWNX it is a middleware that adds extra functionality to NWN, such as SQL database support or additional scripting functions using a trick called instrumentation. With instrumentation NWNX attaches itself (creating a hook) to certain scripting functions and in this way is able to manipulate their results.

Another tool that we have decided to use was the NwnLink, a C# module developed in GAIPS that provide us a C# development by creating a database connection in order to send game requests and listen to new events in the game.

When a change in the game occurs (e.g. an character starts a conversation), an event is triggered and an instruction describing this event is written to the database. The scripts that handle these events and perform this database change are attached to the events of the game itself. In order to handle these events, NwnLink has a database listener that perceives and read every change in the database, allowing the treatment of this information.

In the reverse order, when we want to change something in the game (e.g. an answer to a dialogue question, an animation), we do what we called 'requests'. A request is when we call a C# instruction that writes what we want to change in the game in the database. This database change will be noticed by the NWNX that will read it and make the requested changes in the game world.

5.2 Intimacy

In order to create the scenario of interaction and use our model in the game, we had to choose a relationship to include in our model. The relationship we have choose was the intimacy. The Figure 3 shows the integration of this relationship in our model.

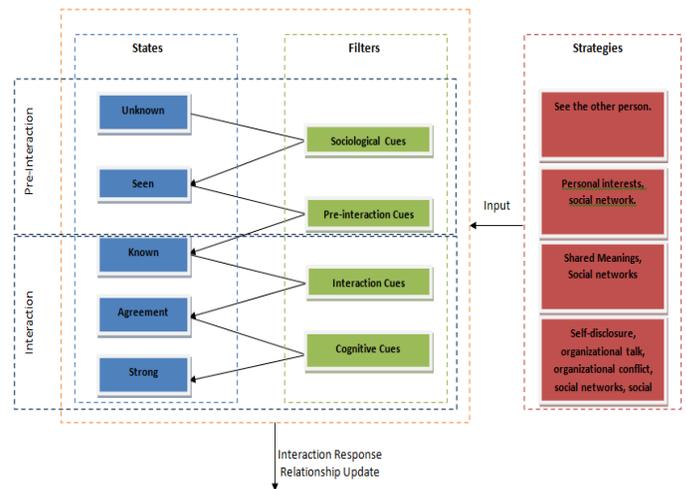


Figure 3 - Intimacy and Relationship Model

The formalization of a universal concept of intimacy has been a dilemma for the scholars. Nevertheless, the conceptions of intimacy usually describe at least one of three phenomena:

- intimate interactions: are described as communicative exchanges between people by sharing the personal (innermost, private) aspects of their selves. This sharing

process can be: verbal (involving self-disclosure of personal facts, beliefs and opinions and the verbalization of feelings and emotions); non-verbal (by sharing a meaningful glance, affectionate touching or even share expressions of emotion such as tears);

- intimate relationships: are described by Hinde [19] as an implication of “a series of interactions between two individuals known to each other...” i.e., those in which partners that know each other well maintain positive feelings towards one another;
- intimate experiences: are the feelings and thoughts people have during their intimate interactions.

5.2.1 Stages

According to Altman and Taylor [26], the degrees of personal knowledge shared between friends can vary from “narrow and superficial” to “broad and highly intimate”. The content of areas of exchange as well as the intimacy level of this exchange is directly related with the level or state of the relationship. For our experiment, we decided to not use the Pre-Interaction States (and consequently the strategies and filter for those states) because we are interested in the process of relationship evolution and not properly with the modulation of its creation and all the factors that contribute to it. According to this, the stages identified and used were: Non-Intimate; Intimate; Highly-Intimate.

5.2.2 Strategies

In order to change the level within an intimate relationship, there are a set of strategies that allow us to achieve our goals. They can be characterized in the basis of behaviors, feelings and thoughts that people have during and following their interactions. The components that define an intimate behavior are:

- Openness and self-disclosure: self-disclosure is seen as a vital component of intimacy, facilitating the development of new relationships [26] and the maintenance of ongoing ones [20]. According to Prager and Buhrmester [21], this process is related to a greater emotional involvement and fulfillment of needs and relationship satisfaction. When the participants intimate interaction reveal more (personal and emotional) aspects of themselves the interaction is perceived by them as more intimate;
- Partner Responsiveness: partner responsiveness can be defined as the active attend [22], understanding [23] and empathy for other partner's perspective. According to Reis and Shaver an interaction is considered intimate if a discloser perceives that the listener manifest understanding, acceptance, validation and caring towards the discloser's communication;
- Communication of Positive Regard: Like the disclosure and the response to disclosure behaviors, the expression of positive feelings towards someone is an important aspect of intimate communication [24]. The perception of a positive view by a partner towards oneself, helps in the maintenance of a high self-esteem [25] and the communication of positive regard will put the partners in a better position to sustain the intimacy in their relationship;

- Reassurance and emotional support: the provision of emotional support is very important for a relationship and also for the partners. This kind of support may appear in different situations such as when one partner shares difficulty and the other offers comfort, reassurance and different perspectives for thinking about one problem;

5.2.3 Filters

As defined in the previous sections, are choices made by people in order to continue, reject or maintain in the same level an relationship with someone. In order to incorporate the intimacy relationship in our model, we have defined two important moments of decision:

- Interaction Cues: in this filter, an important choice is made. People talk about each other but their verbal and physical interaction show a distance between them, in this filter, the choice of starting to talk more about themselves and showing more intimate interactions.
- Cognitive Cues: in this filter, an important choice is made to the relationship. When we decide that people pass through this filter we are willing to achieve a deep intimate level where the four strategies presented play a very important role.

6. EVALUATION

As a way to evaluate our Relationship Model and test the validity of the objective of this thesis we have used the prototype described in the previous chapter and engaged a group of users in a sequence of interactions with the game character.

6.1 Method

With our experiments we wanted to test the validity and quality of our model and more precisely the quality and validity of all its components. To assess this, we have identified three variables in which the manipulation of the factors described previously (independent variables) will have some effects: (1) Development of the relationship through different levels; (2) Development of the interaction between the relationship intervariant; (3) Adequacy of the interactions to the actual level of the relationship. The test experiment was conducted with a group of 8 people, six of them male and two female with a range of ages from 20 to 30. This experiment was run in individual sessions, where the test subjects tested the game (45 minutes), filled the questionnaires and had a brief conversation about their experience (15 minutes).

With this experiment we wanted to test different aspects in our model and, for this purpose, we have created three different game conditions corresponding to the independent variables:

- The game with our relationship model: in order to test the model “in action” and to understand which are his complete ;
- The game with only one relationship level}: in this condition we fixed the relationship in only one level (to create a more believable scenario, we chose the first relationship level) and only with interaction for this level. With this we wanted to suspend the relationship evolution and to see if the users understand this;

The game with random interactions: for this experiment our goal was to suspend the notion of relationship level. For this purpose interactions from different relationship levels were selected randomly and all have the same behavior, i.e., all the interactions could be accepted positively by the npc because there was no definition of a level.

6.2 Results

From the experiment conducted we obtained 8 questionnaires concerning the three experiment conditions tested by the users. Each of these questionnaires was composed by 8 questions that analyzed the three conditions that evaluated the different dependent variables defined in the section 6.3 and were measured according to the Likert Scale.

With the observation and analyses of this first variable, we concluded that the use of our relationship model favors the understanding and observation of an evolution of a relationship during a scenario of interaction with another character. Besides this, we also observed that with our model, the identification of how many relationship levels the user experiences during his/her interaction is more precise and mirrors what really happens in his/her experiment.

We can also conclude that for the interactions' evolution, the experiment with the inclusion of our model was the one that showed better results in terms of the evolution of both physical and verbal interactions.

Concerning the results obtained, we can also conclude that both the first and second conditions revealed identical results to the adequacy between interactions and the relationship level that they belong to. Though, because the second condition is fixed in only one level of relationship the results to the evolution of interactions and relationship were the opposite of the obtained with the first condition. This helped us to conclude that for both relationship and interactions parallel evolution as well as the adequacy of the interactions to the relationship levels they belong to, our relationship model showed better results comparing with the other conditions.

Another important conclusion we obtained was that the verbal interactions showed better results comparing to the physical interactions. An explanation to these results can be the same exposed in the previous section.

7. FUTURE WORK

According with the results obtained through the evaluation tests to our relationship model, it achieves the goals proposed in the beginning of this document, i.e., we can affirm that our model represents the concept of the relationship proposed and includes the main processes for the creation, development and management of relationships in different dimensions. Although, there are some issues about relationships that were not presented and not studied.

The following points describe some ideas that we found to be interesting to explore in future work:

- **Complex Relationships**): in this work we have tested the relationship our model with a simple relationship, the relationship of intimacy. It is also interesting to

study the model with complex relationship, i.e., relationships composed by other relationships (e.g. friendship);

- **Agent-Agent Relationships**: in the experiment addressed in this work, we have focused on the interaction of one human with one computational character. Although, for scenarios of simulation could be also interesting the use of the model in order to explore the relationships between two computational agents;
- **Group Relationships**: one issue that was not addressed in our work was the influence of thirds in a relationship. As we live in a world full of people, we do not have relationships with only one person at a time, in this way, it is also interesting to explore the creation multiple relationships and see how those relationships have influence in each other;
- **Pre-Interaction States**: following the previous ideas and the work developed, one interesting point of research in future works is the exploration of the Pre-Interaction States proposed in the model. For our work we have assumed that those states were fulfilled, although it is interesting to provide the characters with interests and personal characteristics that will influence their decision in with who they want to start a relationship with.

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