

# Modelling Cultural Dimensions and Social Relationships to Create Cultural Synthetic Characters

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# Abstract

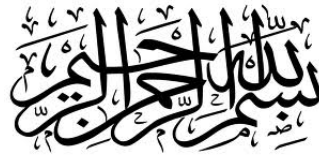
The work presented in this thesis investigates studies and theories of culture, social power and the relationship between culture and emotion studied by psychologists and anthropology. We operationalised a Cultural Dimension model, proposed by Hofstede, and Social Power and integrated them into an already existing architecture for autonomous agents called “FAtiMA”.

The purpose of the adapted system is to generate culturally-specific behaviour in character interaction which is recognisably different to users.

Two different experiments, with human participants, were conducted to investigate the perceived differences between two different groups of characters: with and without cultural parameters.

The main result shows that users do recognise the differences in character behaviour between the two experimental cases, which demonstrates that our model is able to create culturally-specific synthetic characters.

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Finally, and most importantly, I wish to express my deepest gratitude to my Father in Libya, also to my Mother (Allah bless her soul).

# Declaration

I hereby declare that the work presented in this thesis was carried out by myself at Heriot-Watt University, Edinburgh, except where due acknowledgement is made, and has not been submitted for any other degree.

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Ali Mosbah Mohammed Ellafi (Candidate)

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Ruth Aylett (Supervisor)

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Date

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# Chapter 1

## Introduction

### 1.1 Introduction

Our culture plays an important role in our daily life as we can see its reflection and influences on our behaviour, activities, even the way we communicate and interact with others [ERA11, RL12]. It also has an influence on the way we process information [KPQV06].

Some researchers in agent architectures have studied the effects of social interaction and emotional response [AVA<sup>+</sup>09, MDPP10, CBFV14]. On the other hand, some psychologists have studied the relationship between emotions and culture and its effects on emotional expression [MF92]. These studies have mentioned that some types of emotions such as joy, sadness, fear and anger are experienced in a similar way across cultures but they are different in the way they are provoked and also the length of time these emotions stay active.



Moreover, some social factors have been taken into account in agent architecture design. These factors are used to influence the agents' behaviour and the interaction between agents. One of these factors is social power, which is one of the characteristics of group structure and defines the interpersonal relations of group members [CR69].

This work considers the role of emotion, culture, social power and the relationship among them and how they influence behaviour.

It was inspired by several disciplines: theories in emotions, cultures and social relationships developed by psychologists; synthetic character research and computational models of emotion. In this thesis we study these theories with respect to their potential in contributing to the development of synthetic characters and develop a system that has its roots in culture and human behaviour in general. These theories, their links and other relevant work are reviewed in Chapter 2 to provide sufficient knowledge for the design of synthetic characters that behave based on a specific culture.

The initial aim of the research is to model culture and embed it in the “minds” of the synthetic characters by using cultural dimensions and an affective architecture.

## 1.2 Motivation and aim

Culture has several characteristics that can influence and shape human behaviour [EARN13]. Culture may be defined as a set of symbols and behaviour patterns that are learnt and shared by a group of people who live within the same social environment [MDA<sup>+</sup>09]. These cultural aspects (patterns of thinking, feeling, and acting) make the members of one group different from another [HH05]. However, no culture is objectively better or worse, what might be 'good' behaviour to one observer may be 'bad' behaviour to another. Thus, the same situation can be perceived differently by people

from different cultures. People currently tend to move from one culture to another for different reasons, maybe as refugees, students at a university or as financial immigrants and thus have more chance of interacting with each other. Sometimes these interactions can be extremely difficult. If people are not aware of each other's culture, this leads to misunderstanding behaviour, which can be quite critical [AHT<sup>+</sup>14]. Therefore, to avoid cultural misunderstanding we believe that people need to consider intercultural awareness.

One of the aims of researchers working on intelligent virtual agents is to build believable characters [B<sup>+</sup>94, CBFV14]. A factor seen as important for achieving believability in synthetic characters is *“Believability in synthetic characters highly depends on the richness of the characters’ actions and interactions, on their expressions, and more importantly on how well they lead the user to the suspension of disbelief”* [PP05]. Therefore, we can argue that, believable synthetic characters that simulate human behaviour need to include a cultural element as part of their interaction with other characters and human users. These types of characters can play an important role in helping users to get knowledge about other cultures, the way people live, interact and also their beliefs. This means, a synthetic character can play a role in solving misunderstandings amongst cultures. The advantages of this are that users can experience other social situations in a short time in a safe environment [EAHG10, NAL<sup>+</sup>14].

We aim to develop a computational model for synthetic characters that behave intelligently based on a specific culture that can be easily recognised by users. Characters will also have social relationships amongst themselves that can affect their behaviour. By designing and implementing an agent architecture with an explicit model of culture, we aim to contribute to the subject of cultural synthetic characters which could be used by the users to obtain knowledge and to learn about cultural variability.

## 1.3 The Research Objectives

This work argues that models of culture and social power are important when designing an architecture for groups of synthetic characters along with other models such as those for emotion, personality and other social relations. All of these can affect the character's behaviour as they can interact with each other in some way.

Therefore, the main aim of the research is to develop a system that creates synthetic characters whose behaviour is consistent with a specific culture. The research not only involves synthetic characters but also a study of emotion and different cultural and social relation theories.

To achieve that, this research consists of three main objectives:

- To define a parameterised cultural model for synthetic characters which generates behaviour consistent with a specific culture.
- To model the interaction between the cultural parameters and the agent emotional architecture for synthetic characters.
- To create synthetic characters using this architecture and evaluate the response of users, from different cultures, to the cultural parameterisation by comparing synthetic characters with and without cultural parameters.

### *1.3.1 Research Questions*

The three main research questions are:

**Q1:** What is the effect of the cultural dimensions on the synthetic characters' behaviour?

**Q2:** What differences in motivation do observers attribute to synthetic characters, when different cultural parameters and social power are embedded in the “mind” of synthetic characters?

**Q3:** Do users from different cultures perceive the different agent cultures differently?

### *1.3.2 Research Hypotheses*

The research questions of the research are formulated based on the following hypotheses:

**H1:** Social relationships and cultural dimensions are essential elements in the specification of a synthetic character's behaviour. Characters with these parameters will be better recognised and their behaviour will be scored more highly than characters without them.

**H2:** Users that belong to a similar culture as the one simulated by the agents will perceive the agent's behaviour as culturally believable.

## 1.4 Structure of the Thesis

This thesis is divided into eight chapters which are outlined below:

Chapter 1: gives an introduction to the thesis by explaining why we are conducting this research, the idea behind it and how we are going to do it.

Chapter 2: reviews the literature on culture and social power theories. The review pays attention to their relationship with emotions and their influence on human behaviour.

Chapter 3: This chapter reviews some of the most relevant work developed in recent years. It describes the main features and presents some future considerations of the existing systems.

The review focuses on three main areas: firstly, it reviews some existing synthetic characters systems where theories and models of culture are presented; secondly, it explores some relevant agent architectures. The review considers the relevance of the integration of reactive behaviour, emotions and social behaviour.

Finally, it reviews some emotion-based architectures and considers their dynamic emotional process and the role of emotion in the agent architecture and how they apply appraisal and coping mechanisms. This chapter ends with a summary and discussion of the systems reviewed.

Chapter 4: reviews the FAtiMA (**F**ear**N**ot **A**ffective **M**ind **A**rchitecture), affective agent architecture, covering its structure and the interaction between its components, along with its ability to generate emotions and produce believable behaviour. The review focuses on the emotion mechanism and investigates the role of emotions and their effect on agents' behaviours.

Chapter 5: discusses the conceptual model for the development of agents with culturally-specific behaviour and presents the elements that specify a culture and describe their effect on the behaviours of the characters.

Chapter 6: describes the implementation in more technical detail.

Chapter 7: describes two experiments and their design approach to evaluate the cultural agents. It discusses results and illustrates them with appropriate figures and graphs.

Chapter 8: provides the overall conclusion of the work described in this thesis and gives some recommendations for future work.

Appendix A: shows the character personality configuration; Appendix B presents the marriage approval story used in the first scenario; Appendix C presents the second scenario story; Appendix D shows all the active pursuit goals; Appendix E presents the coding of the initial Hope and Fear emotions implemented in this thesis; Appendix F shows events and their effects on characters' relationships; Appendix G gives the refined questionnaires used in the electronic version by the participants in the experiments; Appendix H shows the email sent to participants; Appendix I shows the flow-chart used to decide which statistical test is most appropriate for our data; Appendices J,K,L show the questionnaires used in the pilot test to collect data; Appendix M shows a summary of the pilot test result; Appendix N presents the results obtained for the research questions; and Appendix O shows participants' opinion about both scenarios.

# Chapter 2

## Theoretical Background

### 2.1 Introduction

In this chapter we review some studies and theories of culture, social power and the relationship between culture and emotion studied by psychology and anthropology. However, we start our review by introducing the concepts of culture, social power and the relationship between culture and emotion as studied by psychologists.

### 2.2 Background on Culture

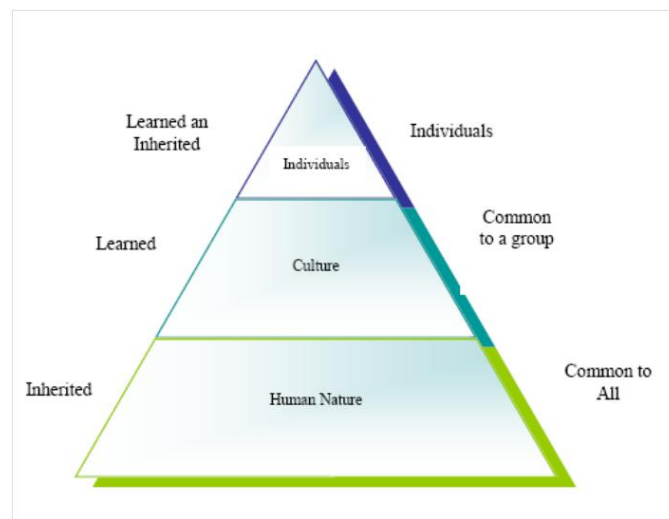
Culture has several characteristics that make it unique as a variable influencing human behavior [Tri95]. It is a social construct and emerges from the interaction of the group of people who share it [HH05]. The main factors that foster different emergent cultures are different languages, different geography, different political arrangements, and different histories [Tri95]. Triandis [Tri95] emphasizes that “*culture shapes a structure of habits; it shapes the behavior and perceptions of its peoples*”.

There are really an 'indefinite' number of ways to form a culture and no culture is objectively better or worse [HPH02]. What is good to one observer may be bad to another or the same situation can be perceived differently by people from different countries. Researchers [KK52] have compiled a list of 164 possible definitions of culture.

Perhaps the most comprehensive and cited study about differences in cultures comes from Hofstede [GJ91]. He introduced a taxonomy of culture based on a wide experimental study that gives the most detailed insight into differences in value orientations and norms. He has addressed culture as a collective programming of the mind: *“Every person carries within him or herself patterns of thinking, feeling and potential acting which were learned by members of the same culture throughout their lifetime”*. He extended the definition of culture to: *“Culture is always a collective phenomenon, because it is at least partly shared with people who live or lived within the same social environment, which is where it is learned. It is the collective programming of the mind which distinguishes the members of one group or category of people from another”*.

According to Hofstede [GJ91], Personality can be seen as one of the personal factors such as gender, age, emotional state or personal relationships that influence human behaviour. On the other hand, Culture as a social phenomenon influences a whole group of people. Hofstede [GJ91] illustrates the relationship between Personality, Culture and Human Nature which is presented graphically in Figure 2.1 and described as follows:





**Figure 2.1:** The mental programming model [GJ91]

- The most basic level is 'Human Nature' or universal level of mental programming which is shared by all or almost all humans. It contains basic physical and psychological functions and is inherited through people's genes. Therefore, every human has the ability to have emotions such as fear, joy, sadness, anger or love. This also relates to observing people's environments and talking to other humans.
- Culture is the middle layer (the collective level) of the mental program which is common to a group, and is learned and not inherited and shared with some but not with all people. This means that, it is common to people belonging to a certain group and environment, but different among people from other groups. Culture plays a crucial role in the perception and selection of behaviours, mainly without this being realized. Hofstede [GJ91] stated that this layer should be distinguished from the other layers.
- Personality is called the individual level which is a unique set of mental programs as it represents the individual personality even within the same collective culture

and is not shared with anybody else. According to Hofstede [GJ91], personality is partly inherited and partly learned. Personality can be learned by personal experience or modified by the influence of other people's culture.

### 2.2.1 Hofstede's Cultural Dimensions

Hofstede's [GJ91] proposed cultural dimension model seeks to measure different cultures on a number of cultural factors or variables. He categorised cultural variability into six dimensions which describe the important characteristics of a culture. These dimensions are widely used and cited [RNA<sup>+</sup>09, NEL<sup>+</sup>09, Mas09, LDAP12], by Artificial Intelligence researchers in the domain of intelligent characters, as they provide a useful basis for defining culture and are easy to implement computationally. Each of these dimensions refers to variability in individual and collective behaviour. Here, we will describe each of these six dimensions:

**Power Distance** (Hierarchy Dimension), this dimension involves the degree to which power, prestige, and wealth are unequally distributed in culture. Members of high power distance cultures see power as a basic fact in society, and stress coercive or deferent power, while members of low power distance cultures believe power should be used only when it is legitimate.

Hofstede [HPH02] also presented some aspects to identify the characteristic of the people in each culture. For instance, the key elements in High Power Distance are, centralization; people with less power are dependent on those who are more powerful; subordinates and children expect direction; they do not speak without being asked [GJ91]. People from this culture are soft-spoken and polite. They internalize stress and express it indirectly.

**Individualism-Collectivism** (Identity Dimension), in Collectivist culture [GJ91] individuals see themselves as integrated into strong and cohesive groups and expect to serve and feel responsible for other people in their society; they have shared interests, stress harmony, tradition and maintaining face. Therefore, relationships are very important in a collectivist culture.

While in Individualist culture people are more concerned with themselves and their immediate family; they also emphasize personal rights and responsibilities; privacy; one's own opinion and self-expression [Tri88, GJ91, Gud97]. Characteristic individuals are self-centered using *I, me*. This dimension like the first one, concerns the relationship among people.

**Masculinity-Femininity** is defined by the ways in which gender plays a role within the society. Some cultures try to reduce the degree of inequality among sex roles [GJ91], categorized as “feminine”. Hofstede [GJ91] demonstrates that: “*people from feminine cultures stress relationships and concern for others*”. Compromise and negotiation are used to solve conflicts.

On the other hand, some cultures have an increased degree of inequality among sex roles, categorized as “masculine”. Masculine characteristics are arguing with others and a tendency to criticize. Moreover, conflicts are settled by arguing or fighting them out. In these groups, people are generally hard to please, tend to be overachievers, and blame others for their mistakes.

**Uncertainty Avoidance**, Hofstede [GJ91] defines this as: “*the way in which people or members of a culture cope with uncertainty and risk, or the degree which people in a culture feel uncomfortable with uncertainty and ambiguity, expressed through nervous stress and a need for predictability*”. People in this cultural dimension are divided into categories, low and high uncertainty avoidance; in a low uncertainty avoidance culture

people are more tolerant of opinions different from what they are used to, generally patient, relaxed, have few taboos and tend to work hard only when it is needed. Finally, emotions and aggression are usually hidden.

**Long-Term Short-Term Orientation**, refers to people's concerns with the past, present and future. Hofstede characterizes Long-Term orientation as persistence, ordering relationships by status and observing this order, thrift and having a sense of shame. People in this culture give more importance to the future than the past and present.

Short-Term characteristics are personal steadiness and stability, protecting your 'face', respect for tradition and reciprocation of greetings, favors, and gifts. In this culture, people are ceremonious, live day by day, and usually talk a lot, particularly about the past.

**Indulgence-Restraint**, this sixth dimension has been added recently based on data analysis of 93 countries and defined by Hofstede as: "*Indulgence stands for a society that allows relatively free gratification of basic and natural human drives related to enjoying life and having fun. Restraint stands for a society that suppresses gratification of needs and regulates it by means of strict social norms*".

Most of the agent architectures discussed in chapter 3 have used Hofstede's work to design and implement computational models of culturally-specific behaviour.

## 2.3 Social Agents

Social behavior refers to the agent's capability to interact with other agents or humans [WJ95]. Agent researchers use terms to define the characteristics of social agents such as: socially intelligent, socially believable, socially motivated, and socially adept

[GVT00]. To be socially motivated the agent has to act based on its identity and role or position in society and has to act believably for an external observer.

The agent needs a mechanism to analyze the situation from its own perspective and to extract the proper information. Therefore, it is important to allow the agent to make decisions based on its social and cultural surroundings and not only on its physical environment. However, there are different types of social relations and one of them is social power.

The following section will describe the term social power and discuss the characterization of different types of social power and the relationship between social power and Hofstede's cultural dimensions.

### 2.3.1 Social Power

Shaw[Sha71] reviewed a number of studies focused on the influence of individual characteristics on group interaction. One factor that influences interaction is the structure of a group which is characterized by the interpersonal relations of the group members [CR69] and one of these structures is social power.

The term “social power” has been used to define the social influence that a social agent may exert on other agents [FR68]. Social influence can be defined as the psychological change that can be exerted on another person's perceptions, emotions and behaviors which leads to influencing the action of the agent. Here, the social agent can be one person or more than one.

French and Raven [FR68] present a theory of Five bases of power. They categorize them based on the social source as well as the relationships between the social agent and another:

1. **Coercive power:** it is based upon the idea of forcing someone to do what they do not want to do and having the ability to use punishment.
2. **Reward power:** this type of power is based on the idea of someone getting a reward when they do a thing well; it is the perceived ability to mediate reward; Its strength depends on the magnitude of the rewards.
3. **Legitimate power:** is based on one's role. A person with legitimate power traditionally gains obedience from others based on their position or title. Examples include parent/child or master/servant relationships.
4. **Referent power:** this type of power is based on perceived associations between the person who has an overall likability and the social agent. Celebrities often have this type of power.
5. **Expert power:** it is based on the ability to mediate knowledge, expertise, and skills

These types of social power are interrelated and are often combined in the process of social influence. Furthermore, the perception of power has an influence on the group process [LPR52, HZH68] and on the way a member with higher social power is perceived by others in a group.

Hofstede [Hof03] reports a high correlation between the power distance and collectivist dimensions on the basis of national culture. For instance, he found that countries that have high collectivism are found to have high power distance with few exceptions. On the other hand, there is less correlation between the Masculinity/Femininity and Uncertainty avoidance dimensions [CB97].

The most important and related type of power to our work is Legitimate power, sometimes referred to as organizational authority, because it is based on the perception that someone has the right to prescribe given behaviours [PP09]. The main basis for legitimate power is the cultural values that one individual has over another and influences one who is obligated to accept this influence [FJR59]. In addition, the interactions of individuals with higher social power in a group are more likely to drive the group's behaviour [Kip72, KCGM76].

## 2.4 Culture and Emotions

Emotion is defined as a result of subjective evaluation of events and a person's interactions with their environment and consequent reactions, which will result in states of excitement, direction of attention, facial expressions, action tendencies, and behavior[Laz91]. According to research [Rat00, Arg88, COC<sup>+</sup>98, E<sup>+</sup>71] conducted to find the relation between culture and emotions, culture has some influence on the emotions that people express and perceive. Most of these studies try to find the differences and similarities in emotions in different cultures. Even within one culture, emotions exhibit considerable individual difference and have a stronger impact on some individuals than others. Argyle [Arg88] carried out a cross-cultural study aimed at recognising the emotional expressions of people from three different cultures: Italian, English, and Japanese. The results show that people from both English and Italian culture were able to recognize the emotional expressions expressed by their own culture and each others' as well. But, English and Italians failed to recognize the emotional expressions of the Japanese. This suggests that some emotional expressions expressed by people from one culture are easily recognized by their own culture whereas in another culture they may not be recognized.

Ekman [Ekm07] states that seven emotions, namely, anger, fear, disgust, surprise, sadness, happiness and contempt, are universally expressed by all cultures. But, these emotions are culturally dependent in terms of their implications and connotations. He also argues that the degrees of showing or perceiving these emotions are tolerated differently socially across cultures. Ekman [Ekm09] indicates that showing emotions varies from culture to culture. For instance, emotions are publicly displayed and acceptable in individualistic cultures such as Germany whereas they are not in collectivistic cultures such as Japan.

According to Hofstede [Hof03], culture has an effect on nonverbal behavior. For instance, the Identity dimension has a strong relationship with emotional expressivity. It could be argued that, the expression of individual anger is more easily generated and accepted in individualist cultures than in collectivist cultures. The expression of fear is easily identified in individualist cultures whereas in collectivist cultures it is not recognized by all observers [HPH02].

In individualistic cultures the individual is considered relatively autonomous [Tri89]. A goal for individuals is to distinguish themselves from others by expressing their internal attributes such as emotions and beliefs and creating an independent identity from others [MK91].

In a collectivist culture, the distinction between self and others is less clear than in an individualist culture. In this culture, where the self is heavily influenced by social factors and strong relationships, the main concern is to maintain harmony with others. The individual is expected to subordinate their personal feelings and needs to their in-group goals such as family and direct their attention internally to what can lead to maintaining or strengthening their relationship [HPH02].

Emotions are essential for synthetic characters to reflect their feelings in order to establish believability. So, emotions should be used in the modelling of synthetic characters,



but how should it be done? The emotion models investigated in the following section can be used to answer this question.

### 2.4.1 Appraisal and Emotion models

It would be difficult to cover emotion modelling in its entirety as it is a large research area and it is not the aim of this thesis to describe all the models. But it is still essential to present a brief overview of this research domain in order to understand the systems discussed in chapter 3 and 4.

The concept of appraisal (cognitive modeling) was first introduced by Arnold [Arn60]; she argued that individuals evaluate the relevance of environmental changes for their own well-being, mentally checking the harm or benefit of a specific situation or event which in turn can result in action tendencies (reactive actions that are triggered by a certain emotion), and will be experienced as emotions. A number of theories were introduced [Fri86, Laz91, Ekm92, SSJ01]. Each of the theorists proposed a specific set of appraisals that would be particularly important in differentiating one emotion from another.

Frijda [Fri86] introduced a different appraisal approach from the one introduced by Arnold. Based on Frijda, an appraisal gives rise solely to attraction and aversion. He defined emotions as changes in readiness for action, changes in cognitive readiness, changes in action tendencies or changes in readiness for specific concern-satisfying activities. Frijda's theory is based on mapping the patterns of action readiness onto a set of emotions that can be the results of those actions.

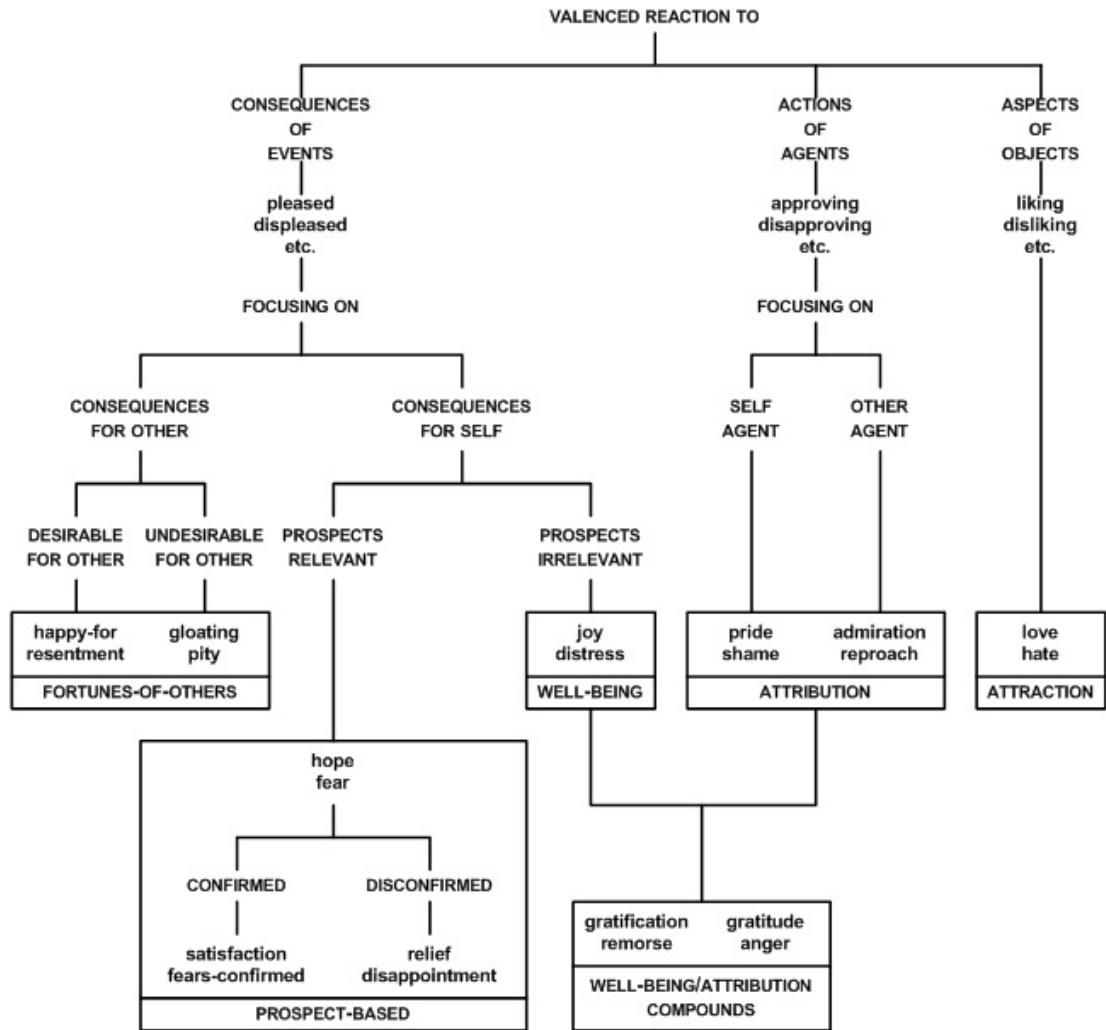
Lazarus [Laz91] extended the general concept introduced by Arnold, distinguishing between primary and secondary appraisals. He defined the primary appraisals as the implications of an event for an individual's well-being whereas secondary appraisals relate to an individual's ability to cope with the generated emotions for the event. He asserts the

role of both appraisals in the process of emotion elicitation. He emphasises that coping is an important part in the emotional process as it connects the relational meaning of a transaction to how an individual acts and feels.

So far, little attention has been paid to the relationship between culture and appraisal. However, appraisal theories [Ell94, Sch97] have stated that culture is likely to have an influence on the relationship between emotions and appraisals of events. People from different cultures can experience the same emotion only if they appraise an event in the same way. But, if they appraise the event differently, they are likely to experience a different emotion. For instance, people feel angry if someone else has harmed them, even if they have different definitions of the types of harm that can be caused by others. According to appraisal theories, goals, tastes and values vary across cultures which can lead to clear differences in the content of emotional experience.

#### **2.4.1.1 The OCC Emotion Model**

The cognitive structure model developed by Ortony, Clore and Collins (OCC) [OCC90] is a hierarchical taxonomic structure where emotion types are defined and categorised; Figure 2.2 illustrates that emotions within each category share similar causes. In this model, each emotion has been characterised by specifying both the eliciting conditions and variables that influence their intensity. Ortony defined emotion as valenced reactions that result from three types of subjective appraisals: the appraisal of the desirability of events with respect to the agent's goal, the appraisal of the praiseworthiness of the actions of the agent or another agent with respect to a set of standards for behaviour and the appraisal of the appealingness of objects with respect to the attitudes of the agent. The model also proposes a compound set of emotions that are caused by combinations of other emotions.



**Figure 2.2:** The OCC model [SDM09]

These emotion models have been considered by Artificial Intelligence (AI) researchers who tried to implement them within a computer-based framework [Eli92, Bat92, DP05, MG06, ALD<sup>+</sup>06, DHV<sup>+</sup>07, LDAP08].

The OCC model [OCC90], and the emotions model proposed by Lazarus [Laz91] are widely used as they are easy to implement and these models represent the basis for most computer-based appraisal systems [Eli92, Bat92, DP05, MG06, ALD<sup>+</sup>06, DHV<sup>+</sup>07, LDAP08].

These two models, the emotions model developed by Lazarus [Laz91] and the cogni-

tive structure proposed by Ortony, Clore and Collins (OCC) [OCC90], are centred on the idea that the way emotions are generated and evaluated is affected by the type of emotion and the environment in which the individual is located (the perceived events). This means that the personality of the individual leads to different reactions and coping strategies. Emotions generated like this will also have an influence on the individual's action selection mechanism and the assessment of immediate future events.

FAtiMA (FearNot Affective Mind Architecture) [DP05], Affective Reasoner [EII92] and EMotion and Adaptation system (EMA) [MG06] have implemented the cognitive appraisal model in their appraisal system. We will describe these systems in detail in the following chapters.

The appraisal mechanism in the OCC model evaluates events according to three things: an individual's goals, attitudes, and standards. Then, the individual's emotions will be generated based on the perceived event depending on whether it is good or bad according to its assessment. Table 2.1 shows the categories of 22 emotion types that can be generated or emerge together to generate a specific emotion.

Emotion category	Emotion		Emotion category	Emotion
Fortunes- Of-Others	Happy-For		Well-Being	Distress
Fortunes- Of-Others	Gloating		Attribution	Pride
Fortunes- Of-Others	Resentment		Attribution	Shame
Fortunes- Of-Others	Pity		Attribution	Admiration
Prospect-based	Hope		Attribution	Reproach
Prospect-based	Fear		Attraction	Love
Prospect-based	Satisfaction		Attraction	Hate
Prospect-based	Fears-confirmed		Well-Being / Attribution - Compounds	Gratification
Prospect-based	Relief		Well-Being / Attribution - Compounds	Remorse
Prospect-based	Disappointment		Well-Being / Attribution - Compounds	Gratitude
Well-Being	Joy		Well-Being / Attribution - Compounds	Anger

**Table 2.1:** The OCC emotions

## 2.5 Summary

In this chapter we have discussed the concept of culture, emotion and social power and argued that the use of synthetic characters that simulate human behaviour in such environments may improve human-computer interaction and support human decision making by our ability to generate a mental representation of other people's states of mind and personalities and make decisions using our beliefs of what their reactions will be.

The review presented in section 2.4, shows the importance of emotions in synthetic characters and also how emotion could be represented and modelled. Therefore, Emotion models and emotion-based systems must be taken into consideration in this work.

# Chapter 3

## Related Work

### 3.1 Introduction

In this chapter we will review some previous research related to synthetic characters focusing on the computational modelling of culture that we found relevant to achieve sufficient knowledge in this area. Since emotion is an essential element in the way people make decisions [[Dam08](#)], we will concentrate our study on agent architectures and their abilities to generate emotions and produce believable behaviour.

We discuss existing work on the creation of synthetic characters that includes models of culture and social relationships. The objective is to identify elements of an architecture for our own synthetic characters implementation. We also present relevant applications developed by computer scientists to create agents with social and cultural behaviour, with applications ranging from computer games to education and training. We divide these systems into two classes: a) Culture in Synthetic Characters b) Agents Architectures for Social/Cultural and Emotion-Based Agents. They have been selected because

of their contributions to agent architecture design, namely appraisal, emotion modelling, planning and action/goal selection mechanisms.

## 3.2 Culture in Synthetic Characters

This section explores computational architectures of synthetic characters related to our research that involve characters' configuration to a particular culture.

The culturally-specific elements in these architectures range from complete models to expressive behaviour.

### 3.2.1 CUBE-G

CUBE-G [RNA<sup>+</sup>09] stands for “CULTure-adaptive BEhavior Generation for interactions with embodied conversational agents”. The project focuses on expressive behaviour; it integrates culture as a computational parameter for modelling interactions with virtual agents. The CUBE-G approach is based on the Hofstede cultural dimensions [GJ91].

The main purpose of the project is to build a system that is able to adapt its behavior according to the user's culture by analysing the user's behavior and defining its cultural background.

To achieve this goal, they took two essential steps: first, setting the system's cultural background by deriving appropriate behavioral parameters for the target culture used to direct the agents; and second, analyzing the user's gestural activity and setting it as evidence for the user's cultural background [RNA<sup>+</sup>09].

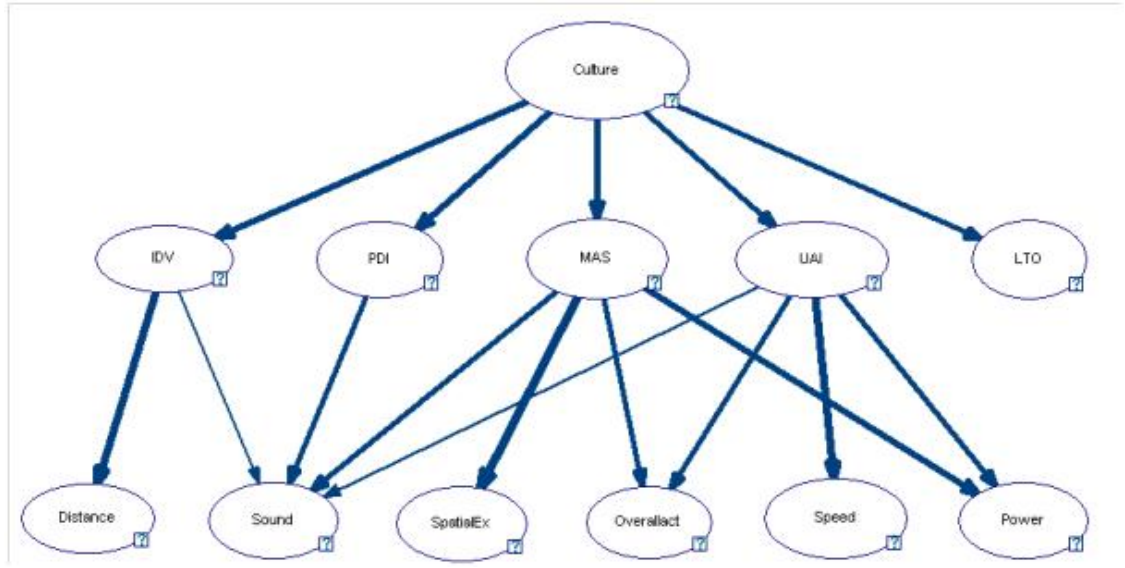
For the first task, correlations between extreme positions on the cultural dimensions of Hofstede and six variables of expressive gestures were defined. These variables are:

- Distance: the distance between agents while they interact.
- Sound: how loudly the agents speak.
- Spatial extent: how much space is used for a gesture.
- Overall activation: how many gestures in a specific time.
- Speed: speed of movements.
- Power: the strength of gestures.

However, they only integrated four of these variables in their cultural model: spatial extent, overall activation, speed, and power of the user are analysed due to the functionality of the sensor used (Nintendo's Wii remote controller). The other two expressive gestures "gaze and speech" are left out of the analysis.

To obtain the selected expressivity features from their user's gestures and to deal with unreliable and incomplete information, given a user may deviate from his cultural prototypical behaviour, they use Bayesian networks described in [JN07]. Figure 3.1 shows the Bayesian network used to model culturally specific nonverbal behavior.





**Figure 3.1:** Bayesian network to model culture specific nonverbal behaviour [RNA<sup>+</sup>09]

The first level of the Bayesian network presents the culture node which is connected to Hofstede’s dimensions. The output level consists of different behavioral parameters that are correlated with the specific Hofstede dimensions.

For classifying the eight cultures, Arabia, China, Germany, Israel, Japan, Sweden, Thailand and US, they used a first level with five variables, Hofstede’s features with values “low, high”. Thus, to connect the cultural dimensions and the nonverbal behavior, they used ten synthetic cultures [HPH02] two for each cultural dimension representing the end points of each dimension (Low/High). These were mentioned above in section 2.2.1 when we talked about Hofstede’s cultural dimensions, and showed how specific behavior differs depending on culture.

Table 3.1: Shows an example of the relationship between cultural dimensions, the corresponding behaviors and their correlation.

Cultural dimensions		Nonverbal behavior distance and sound	Connection between them
Identity	Indivs (extremely high on the Individualism dimension)	Verbal and likely to stand out visually, when in groups	Physical distance and loudness increase. "moving from Collects to Indivs"
	Collects (the other extreme on this dimension)	In contrast, can be very silent and are physically very close within in-groups	

**Table 3.1:** Connections between cultural dimensions and the corresponding behaviors

An example of how the model works was presented in [RBE<sup>+</sup>07]: Let us assume that the user's gestures are slow, not powerful, not extended in space. With these clues, the Bayesian network is updated to allow for inferring the user's cultural background.

By applying specific probabilities, the system estimates the user's culture as an Indivs and the agent's behaviour is set based on that: therefore, the agents stand far away from each other, speak in a mid-level voice, and use fewer and slow gestures with small spatial extent. On the other hand, if the user's gesture was slow and wide, the system estimates the user's culture as Collects. Therefore, agents move closer, and use more wide and powerful gestures.

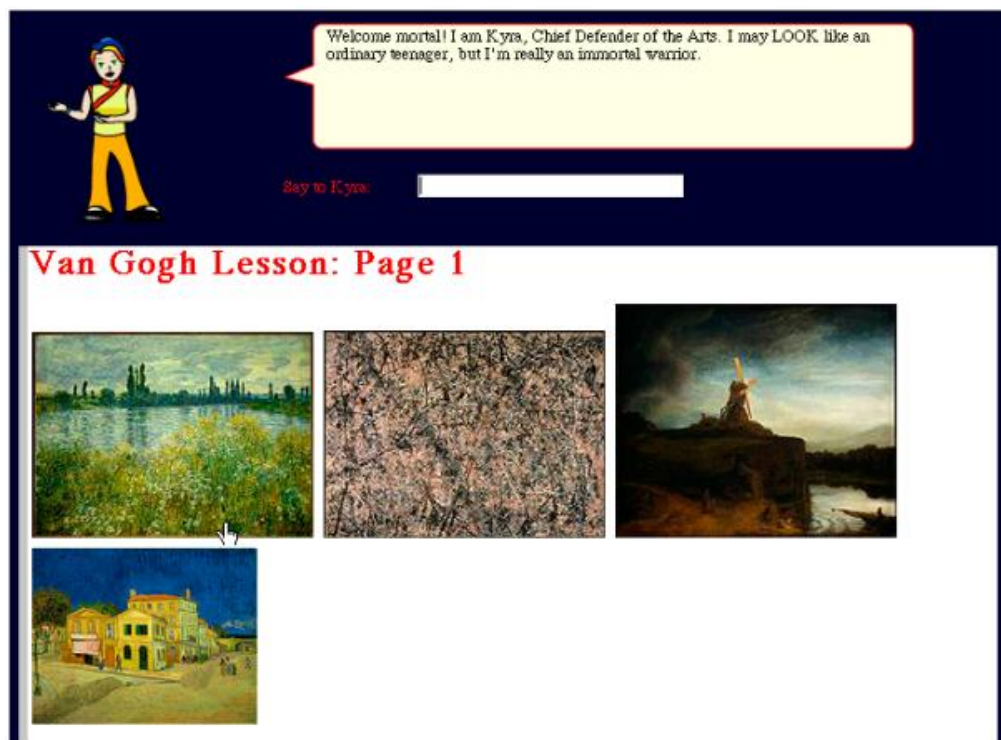
The cultural dimensions parameterisation approach used in CUBE-G to adapt agent behaviour to the user's cultural background gives us quite helpful insights into our goals. It shows how to correlate Hofstede's cultural dimensions to specific behaviour.

### 3.2.2 Kyra

Kyra [MHR04] is a synthetic character with autonomous behaviour and personality traits developed at Stanford University's School of Education and Computer Science

Department and Extempo Systems Inc. Kyra is an adolescent guide girl designed to motivate and educate preteens on artistic expression values and art history tendencies. Kyra was designed by expanding its individual variability to deal with three different cultures: the United States, Brazil, and Venezuela. They based their idea on studies [OMP97, NIL00, MKD<sup>+</sup>01, Ewe03] in which the interactions between characters from the same culture are seen as more socially attractive and trustworthy than between those from different cultures.

Kyra interacts through the Extempo website and has capabilities to communicate through gestures, textual, and spoken utterances. Visitors, on the other side, interact with Kyra by typing in textual utterances and Kyra responds through graphical actions and text bubbles. Figure 3.2 shows the screenshot of the interface for interacting with Kyra.



**Figure 3.2:** Screenshot of Kyra's interface [MHR04]

In adapting a character to a different culture, this work applies a framework for ten key characteristic qualities: identity, backstory, appearance, content of speech, manner

of speaking, manner of gesturing, emotional dynamics, social interaction patterns, role, and role dynamics. These qualities “*both define and are defined by each character’s unique idiosyncratic behaviors and signature personality traits, as well as by the character’s cultural grounding*” [MHR04]. These ten qualities need to be changed in order to maintain the character’s believability in its cultural adaptation. Therefore, specific tendencies for the culture need to be defined in each of these key qualities for animated characters. An example of how each of the qualities was described and highlighted within the framework of cultural specificity was presented in [MHR04]

The one we found at most relevance more to our work is: *Emotional Dynamics*. Emotions in Kyra are expressed differently depending on the character’s emotional state at a specific time using a text-based description or graphic. Also, emotion in Kyra has been described by type, how the character expresses it, and how long it lasts.

Emotional dynamics are grounded on the basis that a character’s emotional model should impact their behaviour, and in turn be affected by the user’s or other character’s actions.

The emotion theory in Kyra is based on the idea that the emotions expressed by people from one culture are shared and easily identified by other people [Ewe03]. On the other hand, other categories such as: emotion frequency, degree of emotion, emotion threshold and emotion decay vary across cultures.

Kyra shares three main mood dimensions: an emotional one ranging from happy to sad, a physiological dimension ranging from peppy to tired and a social dimension ranging from friendly to shy. The three Kyras differ drastically over time until every mood regresses to a neutral state.

Moreover, Kyra is integrated with a complex natural language understanding engine, mood system, and a learner model that allows her to respond in an appropriate manner to the visitor’s sentences.

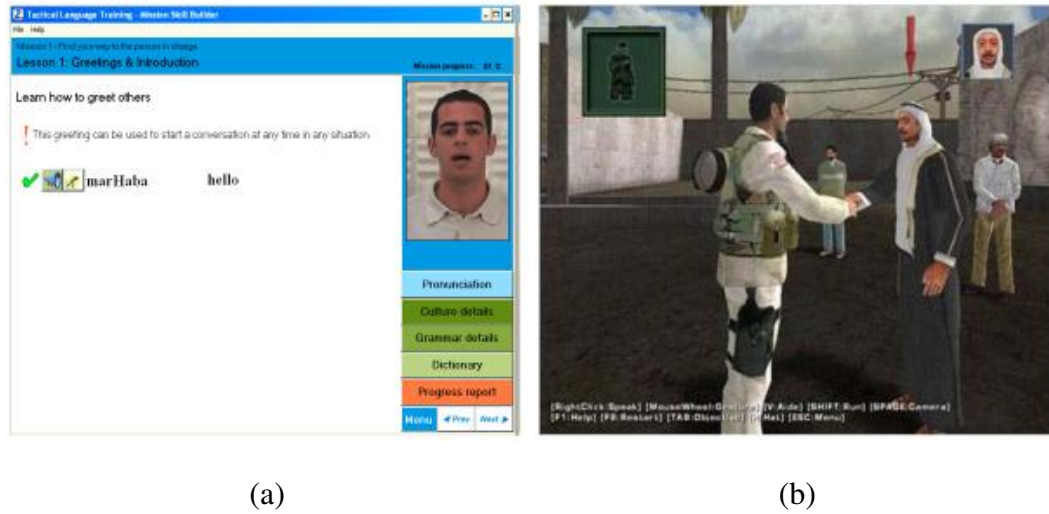
As we mentioned we especially focus on the use of Emotional Dynamics to adapt a character to different cultures. It illustrates how to use the character's emotional state, and what and how it is affected.

### 3.2.3 *Tactical Language and Cultural Training System (TLCTS)*

The Tactical Language and Culture Training System (TLCTS) [JBFW<sup>+</sup>04, JVM05] developed at the University of Southern California, USA, aimed in its first version to teach users Arabic along with some Arabic cultural skills. It was used to help learners gain communicative skills in foreign languages that are less commonly taught.

The TLCTS uses a task-based approach, where the learners practice their communication skills with local people in a simulated village.

The TLCTS uses a multimodal interface to let learners communicate through chosen gestures and speak on behalf of their synthetic characters in simulated social situations. Figure 3.3. shows the two main TLCTS components. One is The Mission Skill Builder, where learners prepare themselves before starting a mission by practicing their communication skills and learning some cultural norms needed for their mission “contact with local official in charge”; the other is The Mission Practice Environment, where learners test out their communicative skills by assuming the role of an Army Special Forces unit character and exploring a virtual village.



**Figure 3.3:** (a) The Mission Skill Builder. (b) The Mission Practice Environment [JVM05]

TLCTS uses the Thespian architecture [SMP05, SMP06], which is a multi-agent system for controlling virtual characters in an interactive drama. Thespian architecture uses Partially Observable Markov Decision Process (POMDP) [SS73] to control each character in the story. Thespian agents are built for modelling virtual humans and social groups. Each agent is composed of state, dynamics, goals, beliefs (theory of mind), policy and social relationships.

Thespian focuses on social relationships such as trust and liking. It was used for PsychSim [PM05], an agent framework to generate social and goal-oriented behaviour, for more details see [PM05].

An evaluation conducted on TLCTS has shown promising results in learning aspects of specific cultural differences [JVM05].

The TLCTS is useful and relevant; one of the system's features we need to explore is the way it controls the behaviour of the synthetic characters and the way it embeds cultural norms in the character's behaviour.

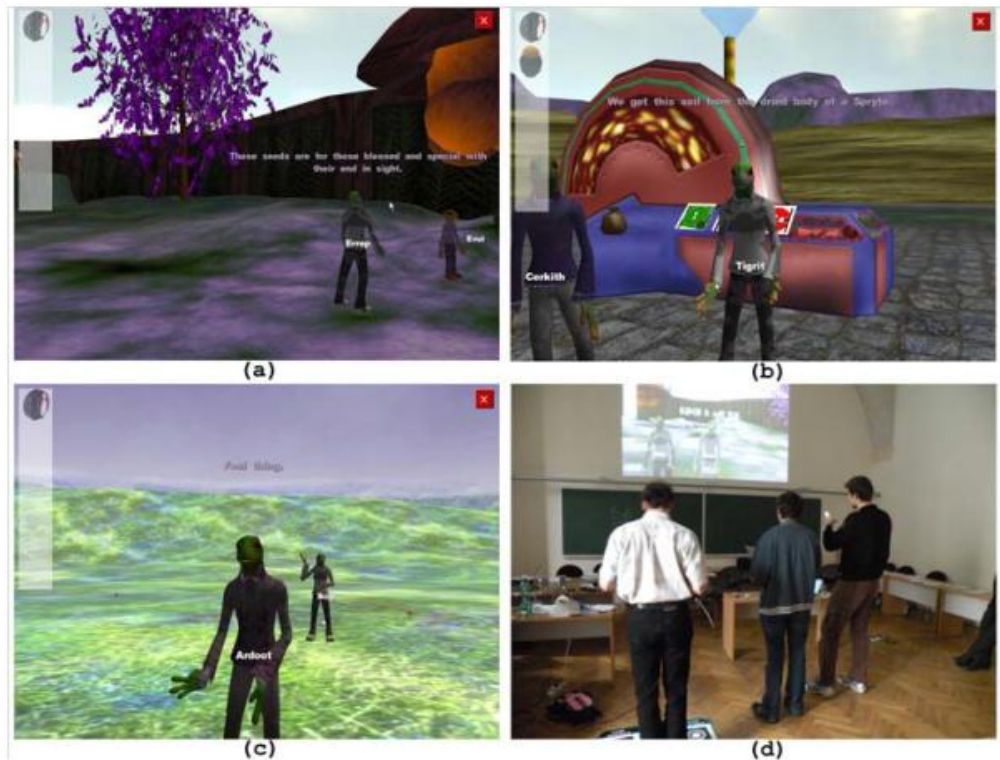


### 3.2.4 ORIENT

ORIENT [LDAP12] stands for (Overcoming Refugee Integration with Empathic Novel Technology) and is an intelligent graphical- character based system designed as a cultural application. More details can be found in [AVA<sup>+</sup>09, LDAP12].

The application was focused on education in intercultural empathy [AVA<sup>+</sup>09], aimed to increase adolescents' intercultural sensitivity and competence. The system integrated two models: the cognitive appraisal-based FAtiMA architecture, and the drive-based PSI model.

Characters in ORIENT were developed as aliens called Sprytes on a planet called Orient as shown in Figure 3.4 (a,b and c). The application lets a group of three users (teenage) cooperate, as can be observed in Figure 3.4(d), to deal with a specific situation.



**Figure 3.4:** a) Educating a child Spryte for picking seedpod from the tree which is against the Spryte's culture; (b) A Spryte explaining their life cycle; (c) Angry gesture to the user for stepping on a little tree; (d) Users interacting with ORIENT. [AEH<sup>+</sup>11]

ORIENT uses a contact theory approach [AVA<sup>+</sup>09], based on the idea that inter-group prejudice can be reduced through contact between the groups under specific conditions [AI154]. Contact theory states that four conditions must be met for contact to reduce prejudice: (1) an equal status between the groups in the situation, (2) common goals, (3) intergroup cooperation, (4) and the support of authorities, law, or custom.

The basic idea of ORIENT is to ask a group of three (13-14 years old) to convince the Sprytes (from an unfamiliar culture) to cooperate with them in saving the planet by destroying the meteor with a special device they have to find on the surface. In order to reinforce the believability of agents, they tried to make agents close-to-life-size by using a large screen projection and making the users interact with agents through movement in physical space. Each user was assigned a role with a specific interaction device (two mobile phones, Dance Mat and WiiMote) which were necessary to accomplish the overall goal of the application.

The system is based on the cultural dimensions derived by Hofstede, which were used to design an artificial culture for Sprytes on ORIENT by linking cultural parameters to cultural behaviours. Figure 3.5 shows an example of the cultural settings with some Hofstede values and symbol definitions for two cultures. This example of the content of the cultural settings file shows the symbol translation used by the agent to translate the action, before the action is performed, to its symbol meaning.



Hofstede variable defined in XML
<pre>&lt;CulturalDimensions&gt;   &lt;PowerDistance&gt; 100 &lt;/PowerDistance&gt;   &lt;Collectivism&gt; 30 &lt;/Collectivism&gt;   &lt;Masculinity&gt; 70 &lt;/Masculinity&gt;   &lt;UncertaintyAvoidance&gt; 60 &lt;/UncertaintyAvoidance&gt;   &lt;LongTermOrientation&gt; 50 &lt;/LongTermOrientation&gt; &lt;/CulturalDimensions&gt;</pre>
Symbol definitions: Culture 1
<pre>&lt;Symbols&gt;   &lt;Symbol name="bow" meaning="respect-gesture"/&gt;   &lt;Symbol name="wave-hand" meaning="greeting-gesture"/&gt;   &lt;Symbol name="give-object" meaning="offer-gift"/&gt; &lt;/Symbols&gt;</pre>
Symbol definitions: Culture 2
<pre>&lt;Symbols&gt;   &lt;Symbol name="bow" meaning="greeting-gesture"/&gt;   &lt;Symbol name="wave-hand" meaning="disagree-gesture"/&gt;   ..... &lt;/Symbols&gt;</pre>

**Figure 3.5:** Cultural settings and symbol definitions for two cultures [AVA<sup>+</sup>09]

The Sprytes' culture is a tribal one with a hierarchy (high power distance), and a collectivistic culture where they live in groups.

The hierarchy in Spryte culture has three layers: Elder, members of its council and the Spryte population.

Since the agents were modelled to look like tree frogs, were chosen to be unfamiliar to any specific human culture, were ungendered and had no facial expression changes, users found it hard to recognise the personality of individual Sprytes.

We especially focus on the way they integrate the cultural model into FAtiMA to design cultural synthetic characters.

### 3.2.5 Traveller

**TR**Aining for **V**irtually **E**very **L**ocation for **L**earning **E**mpathic **R**elationships (Traveller) [MSP<sup>+</sup>13] is an agent based application for intercultural training that was developed in the eCute project <sup>1</sup>. The main purpose of the application is to teach young adults (aged 18 to 25) cultural differences at a more general level.

Unlike most agent-based applications for intercultural training, Traveller does not focus on specific cultural aspects of a particular country. Instead, it tries to focus on teaching cultural differences that can distinguish a broad set of cultures.

They use an interactive-storytelling approach to train the user. The user plays an active role in a narrative where the user must go through a series of practical problems (Critical Incidents), interacting with agents capable of simulating different synthetic cultures in their behaviour in order to progress in the story.

To achieve that, the user learns by playing the role of a character called Travis that decides to go on an adventure across different countries to find a great treasure that his grandfather left him. In each country Travis interacts with groups of characters and deals with a number of critical incidents in each of the countries in order to proceed to the next country. The characters have distinct cultural profiles and their behaviour emerges from their cultural parametrisation.

Traveller allows the user to interact with the application through the Kinect which allows the user to make his choice by gesture through facing a large screen rather than typing using a keyboard.

The story of Traveller is divided into five interactive episodes (The Beach Bar, The Museum, The Train, The Café and The Volcano Island) in which critical incidents take place. Figure 3.6 shows an example of a cultural difference in the beach bar scene. The image on the left shows a highly individualistic culture and the image on the right shows

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<sup>1</sup><http://ecute.eu/>

a highly collectivistic culture.



**Figure 3.6:** Example of a cultural difference in the beach bar scene [MSP<sup>+</sup>13]

To represent cultural differences Traveller uses a computational model of social motives, named the Social Importance Dynamics (SID) Model which is based on the theory proposed by Kemper (status-power theory) [Kem11]. Kemper defined status as our ability to act in the interests of another social entity and this is represented in the SID model as Social Importance (SI). On the other hand, Power refers to our ability to coerce others to act in our favour.

The main idea in the SID model is to establish a link between the two dimensions, Individualism vs. Collectivism and Power Distance, and the cognitive processes of the agent through the notion of cultural influences. The Social Importance (SI) in the model is divided into SI Attribution Rules, SI Conferrals, and SI Claims.

Traveller uses culture to influence social factors that agents attribute to others. For instance in the SI attribution rules they use the Individualist and Collectivist dimensions to affect the relation between in-group members and out-group members. The higher the value of Collectivism specified for the agent's culture, the less SI will agents attribute to the members of an out-group and the more they will attribute to members of the in-group.

Traveller also uses the Power Distance dimension to influence another social factor (how people treat elders): the higher the score for this particular dimension, the more people

treat them in a privileged manner and the more elders expect to be respected and have special rights. They represent these notions in their model as rules in the SI attribution. Claims and Conferrals, in the model, are also culturally influenced by a particular dimension. Table 3.2 and Table 3.3 show some of the claims and conferrals. These claims and conferrals are associated with specific actions in a concrete scenario.

Where:

*A*: is an action that is perceived as a claim.

*V*: is the amount of Social Importance the action is claiming.

*D*: is the name of a cultural dimension (e.g. Individualism).

*M*: is a multiplier that is applied to modify the value *V*.

SI Claim		Cultural Influence	
A	V	D	M
casual-greeting	v3	IDV	-m3
ask-personal-information	v4	IDV	-m4
join-group	v5	IDV	-m5
blame-older-person	v6	PD	m6
prioritize-younger-person	v7	PD	m7
take-group-initiative-elder-present	v8	PD	m8
prioritize-older-person	v9	PD	-m9

**Table 3.2:** General SI Claims that are culturally influenced

SI Conferral		Cultural Influence	
A	V	D	M
casual-greeting	v10	IDV	-m10
ask-personal-information	v11	IDV	-m11
accept-blame-if-older	v12	PD	m12

**Table 3.3:** General SI Conferrals with cultural influences

The first three claims are influenced by the Individualism dimension (IDV). The amount of SI claimed (V) is lowered by how much IDV is specified for the agent's culture (M). This means that these actions are more acceptable by others that have a low SI in such cultures. The other four claims are influenced by the Power Distance (PD) dimension. These claims are that older people are more privileged in cultures that have a large power distance.

Similar to claims, conferrals are associated with specific actions in a concrete scenario. The third conferral corresponds to an older person, defined with a large PD dimension, accepting an accusation from a younger one that has not yet earned enough SI.

The cultural dimensions are used to influence the SI value (V) by the following equation, in which the Score (D) corresponds to the score associated with the dimension D and M is a multiplier, either positive or negative, which is applied to modify the value V of the associated SI component, namely the attribution rules, the claims and the conferrals.

$$V_{modified} = V_{initial} + |V_{initial}| * M * (Score(D))/100 \quad (3.1)$$

The SID model is integrated into FAtiMA-Modular version [DMP14]. In this architecture there is a Theory of Mind Component, which is not in the FAtiMA-Baseline

architecture, used to create a model of the internal states of other agents.

Traveller does not use the Emotional Reaction Rules and Action Tendencies, which are associated with the agent, in their scenarios.

A cross-cultural study was conducted to determine how users from different countries perceived and acted towards agents with different cultural configurations. The study focused on a single episode of Traveller that takes place in a beach bar which is designed to highlight cultural differences related to the Individualism vs Collectivism dimension. The results show significant differences in users' perception of the agents behaviour.

Traveller allows for implementing cultural dimensions and representing cultural differences. The Traveller implementation seems to focus on using a dimensional model that directly influences the way agents choose goals. It would be preferable to see their impact on the planning process in order to control intentions generated to achieve the goal. But, we still consider that this model has important aspects that will be included in our approach.

The focus of our work is more on the use of cultural dimensions to control the behaviour of the characters through using characters' dominant emotions to drive character selection between competing intentions. We will discuss it in more detail in [chapter 5](#).

### 3.3 Agent Architectures for Social/Cultural and Emotion-Based Agents

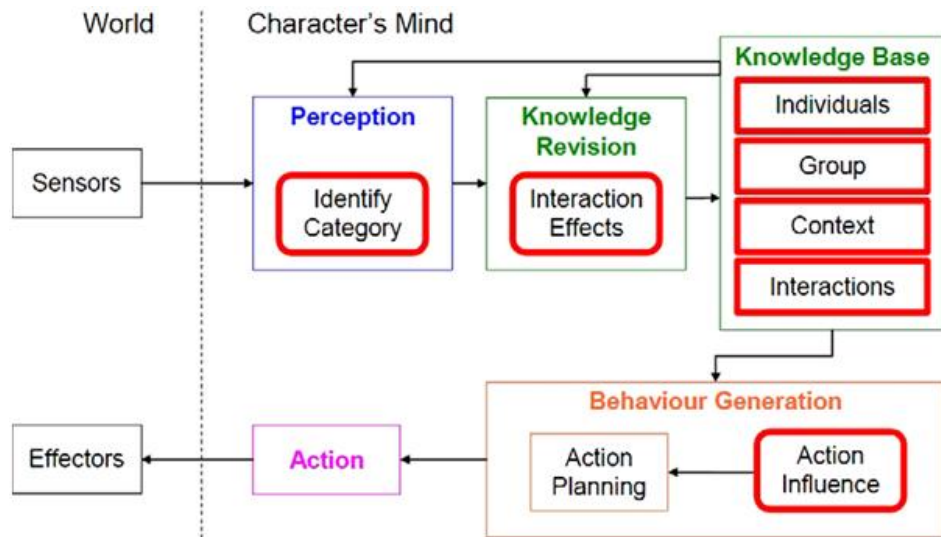
There is little research on social and cultural agent architectures that integrate agents' internal knowledge and reasoning in their architectures [[DHMB<sup>+</sup>12](#)].

This section reviews a selection of synthetic character architectures so as to identify elements of architecture for character implementation. We review the SGD Model in [section 3.3.1](#), CAB Model in [section 3.3.2](#) and EMA Model in [section 3.3.3](#). They have

been selected because of their contributions to the essential areas of synthetic character architectures design, especially appraisal, emotions and social behaviour, planning and action/goal selection mechanisms.

### 3.3.1 SGD Model: A model for group believability

The SGD model [PP05, PP09] is a Synthetic Group Dynamics Model that is aimed to model a dynamic group and allows each individual agent to reason about other agents and the group and to engage the user as an active member of the group. Figure 3.7 shows a diagram of the agent's architecture.



**Figure 3.7:** The SGD model Architecture [PP05]

The SGD model was inspired by human social psychological theory called Theories of Group Dynamics developed by Cartwright and Zander [Car60], McGrath [McG84] and Bales [Bal50].

This model takes into account the different types of interactions that may occur in the group, socio-emotional interactions, and task-related interactions.

The model is implemented in a collaborative game that uses autonomous synthetic characters to collaborate with the user in the resolution of tasks within a virtual environment. The model is focused on small groups which solve collaborative tasks without a strong organisational structure.

Each agent has knowledge of “social relations of power and interpersonal attraction” for the other agents, and for the group itself “the group’s social structure”, which will be used to drive its interactions and behaviour.

These interactions will both affect the group’s state and at the same time be influenced by that state. This means that, once the interaction occurs, the social structure of the group will change, creating the dynamics of the system.

The SGD Model is characterised by four distinct levels: the *individual level* that defines the member’s abilities and personality; the *group level* that defines the knowledge that the agent builds about the group, and its underlying structure, as well as its attitudes towards the group; the *interactions level*, responsible for creating the dynamics in the group. The frequency of interactions depends on the agent’s motivation, group position and personality; the *context level* defines the knowledge that the agent builds about the environment and the tasks that the agents can perform.

However, the most relevant aspects of the SGD Model for our work are the two dimensions used to define group structure called the *structure of power* and the *structure of interpersonal attraction*. The first dimension is the structure of power that emerges from members’ social influence relations which determine the power an agent has to influence the behaviour of another agent within the group. The structure of interpersonal dimension “likes/dislikes” comes from the social relationships that exist between agents within the group.

Implementing these types of relationships will establish a group of agents and drive agents’ interactions and behaviour.



### 3.3.2 CAB Model: Culturally Affected Behavior

The Culturally Affected Behavior (CAB) model was developed at the University of Southern California [vLCS<sup>+</sup>07] to create synthetic characters to teach military personal cultural awareness by allowing them to sound, look, and act differently based on the currently loaded culture. They aimed to model culture by making a distinction between culture and personality with the same aspects but specific to an individual and by which that individual defines his or her identity within the group. They achieved that through using two different types of knowledge: cultural knowledge and task or domain knowledge. Thus an agent's culture can be changed without changing the rest of the agent's knowledge base.

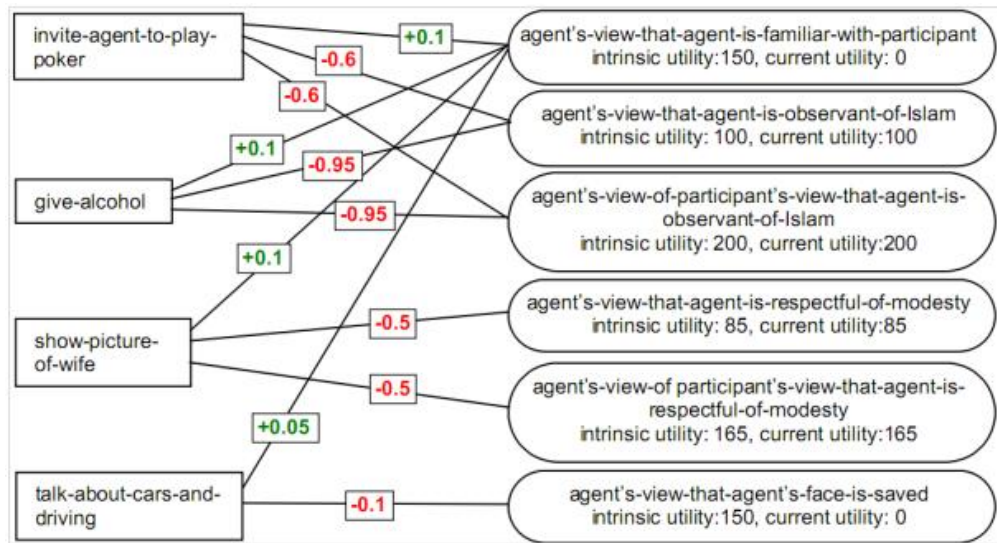
The CAB approach combines social theories, namely: a Theory of Mind [Whi91, NS03], the Schema Theory [DS92], and shared symbol theory [d'A84] with computational methods from Artificial Intelligence (AI), to develop cultural models and representations that are easy to author and modify without requiring re-authoring of the agent's entire behaviour repertoire [vLCS<sup>+</sup>07].

The Theory of Mind (ToM) suggests that human decision making is influenced by our predictions of others' reactions to our actions. In order to model explicit cultural stereotypes and biases a Theory of Mind was used in CAB to create agents that can model and reason about each other, while Schema Theory was used for modelling culturally specific behavior.

The CAB model uses a schema concept to represent culture as a shared collection of schemas [D92], which are an abstract behavior or concept associated with a collection of knowledge around it, which can be triggered by symbols or images. For example, the "writing" schema is associated with someone using an object that leaves a trace across

a surface. Both object and surface are left unspecified. For instance, the object could be a pencil, a pen or a piece of chalk; while, the surface can be paper or a black-board.

The culture model in CAB is based on D’Andrade’s Constitutive Rules System [d’A84, D92]. A constitutive rules system is defined as a set of rules that is known, shared, and adhered to by members of a culture and which defines some concept. They modelled the socio-cultural norms for Iraqi-Sunni culture by creating a socio-cultural network. Figure 3.8: shows a representative sample of the Iraqi Socio-Cultural Network in CAB.



**Figure 3.8:** Sample of Socio-Cultural Network for Iraqi Culture [vLCS<sup>+</sup>07]

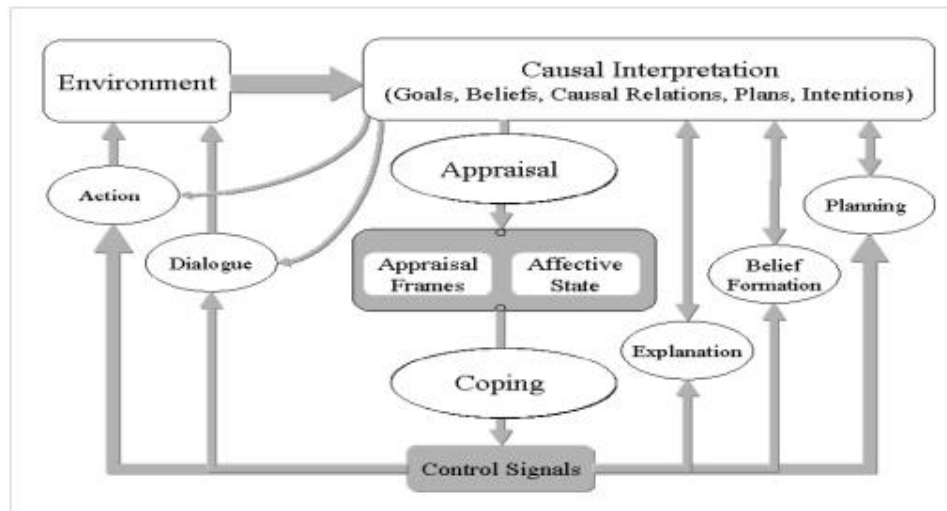
The left rectangular boxes in the network represent actions that the character may perform in the simulation and the right rounded boxes represent states associated with norms which are required for that scenario. The lines represent the effects of actions on states. States have intrinsic utility values which represent the shared importance that the members of the culture place on the socio-cultural norm weighed against other norms: “a norm is important if the number is high”. This value can also be negative, which means that the socio-cultural norm has a negative connotation in the culture.

To understand how the model works, we will give the example presented in [Sol08]. Let's suppose that the user performs action "givealcohol". In the Iraqi socio-cultural network see Figure 3.8, "give-alcohol" has a positive effect on "agent's-view-that-agent-is-familiar-with-participant" and a negative effect on "agent's-view-that-agent-is-observant-of-Islam" and "agent's-view-ofparticipant's-view-that-agent-is-observant-of-Islam". When this action is executed, the effects of the tasks on each state will be calculated and compared with the utility values of all states in the socio-cultural network. In this scenario, the total effect of "give-alcohol" will decrease the Socio-Cultural Satisfaction "the total of the utility of the network". Thus, giving alcohol to someone from an Islamic culture is a very negative social action.

The CAB model focuses on cultural norms by encoding or mapping each one with specific actions: "give alcohol, show picture of wife, etc". However, regarding our goals, the CAB model has some relevant aspects for our work, one being that the model relies on social science theories to generate culturally-affected behaviour and distinguishes between cultural knowledge and domain knowledge to make the change to the agent's culture easier.

### 3.3.3 EMA: EMotion and Adaptation model

The EMotion and Adaptation model (EMA) was developed by Stacy Marsella and Jonathan Gratch at the University of South California, USA [MG06]. They aimed to design synthetic characters with human-like behaviour by applying appraisal and coping mechanisms (see section 2.4.1). Their computational model of dynamic emotional processes is designed as an appraisal and action model. Figure 3.9 illustrates the cognitive-motivational-emotion model where appraisal and coping are connected to the perception, cognition and behavior processes and shows the role of emotion in the agent architecture.



**Figure 3.9:** The EMA Architecture [MG06]

The model consists of six main components: environment, causal interpretations, appraisal, coping, planning and beliefs.

The system creates a causal representation of autonomous agents and their environment, and interprets the agent’s relationship with its environment by connecting this interpretation to appraisal variables (i.e. perspective, desirability, likelihood, causal attribution, temporal status, controllability and changeability) and associating them with specific emotions. The agent will use this interpretation for goals and actions decision making.

Causal representations are used to represent intentions and beliefs “necessary for social attributions” and also developed for decision-theoretic planning to allow the appraisal processes to be processed quickly, as the agent’s beliefs, intentions and plans are uniformly represented within the system [MG06]. Moreover, this approach allows the reactive and deliberative outputs to be integrated in the agent representation.

The EMA model integrates the appraisal of events introduced in the cognitive structure of emotions OCC [OCC90] with the coping mechanism to develop the appraisal process. This approach allows the agent to cope according to their causal interpretation and determines their reaction to appraised events.

Regarding our goals, the EMA model is relevant. Interestingly, the way EMA architecture controls the behaviour of the agents and the most relevant aspect of the EMA architecture enables the agent to make decisions effectively and organise their plans and tasks in regard to their emotional states.

### 3.4 Summary

This chapter has reviewed systems architectures, approaches and concepts of some relevant work in terms of their concepts, and approach or their theoretical background with respect to the design of computational culturally-specific behaviour.

In Table 3.4 we categorized the first two systems as they are using an implicitly model of culture that focuses on external aspects of behaviour by mapping culture to specific behaviour. The other three systems use cognitive models in which culture is explicitly modelled in the internal processes of an agent's mind.

	System	Culture Parameteriz- ation	Social Relations	Cultural Emotional Behaviour	Cultural Verbal Behaviour
Implicitly model of culture	CUBE-G	Yes	No	No	No
	KYRA	No	No	Yes	Yes
Explicitly model of culture	TLCTS	Yes	Yes	No	Yes
	ORIENT	Yes	Yes	Yes	No
	TRAVELLER	Yes	Yes	Yes	No

**Table 3.4:** Comparison of the Reviewed Systems

In this chapter, we also tried to highlight the differences and similarities among these systems and models and reviewed approaches to the social and culture concepts discussed in Chapter 2. In the following Table 3.5, we present where these concepts or elements have been implemented.

System/Model	Social and culture concepts approaches applied
<b>CUBE-G</b>	<b>Hofstede’s cultural Dimensions can be parameterised to adapt agent behaviour to the user’s cultural background.</b>
	This is precisely what CUBE-G was about. The system illustrated how to correlate the cultural dimensions to specific expressive behaviour based on the user’s culture.
<b>Kyra</b>	<b>Cultural elements or characteristic qualities such as <i>Emotional Dynamics</i> can be used to adapt a character to different cultures.</b>
	Kyra illustrated how to apply a framework for ten key characteristic qualities to deal with three different cultures. We especially focused on how they are using the character’s emotional state, what was affected and how.
<b>TLCTS</b>	<b>Characters can be authored with a specific culture and social relationships in mind.</b>
	TLCTS is primarily an agent system that shows how to apply communicative aspects of a culture. It also illustrates how to create characters with Theory of Mind ability which is useful to model cultures. Characters in TKCTS have goals to fulfil cultural obligations.
<b>ORIENT</b>	<b>Cultural model can be integrated into cognitive appraisal and drives-based models to design a cultural system.</b>
	ORIENT is an adaptation of an agent-system where such an approach can manage interactions between characters and users from different cultures to establish relationships and cooperation.

System/Model	Social and culture concepts approaches applied
<b>Traveller</b>	<b>Status-Power theory can be used to model a Social Importance Dynamics (SID) Model to represent cultural differences.</b>
	The main idea in SID model is to establish a link between the two dimensions, Individualism vs. Collectivism and Power Distance, and the cognitive processes of the agent through the notion of cultural influences.
<b>SGD</b>	<b>Can social relation of power and interpersonal relationship be implemented to establish a group of agents?</b>
	SGD illustrated how to develop the collaborative task approach to manipulate interactions between agents and users. It also shows how these types of relations drive agents' interactions and behaviour.
<b>CAB</b>	<b>Synthetic characters' behaviour can be driven by socio-cultural knowledge.</b>
	The model uses Theory Of Mind and Schema Theory to represent cultural stereotypes and norms by modelling the socio-cultural values and attitudes of a culture. Apart from three shared aspects of culture: appearance, external behaviour, and internal knowledge and reasoning CAB only focuses on shared internal knowledge and reasoning of members of culture to modelling.
<b>EMA</b>	<b>Can characters' emotions be affected by physical and social environments?</b>
	EMA illustrated how to implement the appraisal theory where emotion arises from the dynamic interaction of two processes: appraisal and coping. The relationship between a character and its environment is parameterised through appraisal variables which are involved in its assessment process. This process leads to different responses based on how the event was assessed or appraised (coping process).

**Table 3.5:** Concepts and Approaches for Social and cultural system

Based on the work presented in this chapter, emotion plays a significant role in agent action selection mechanisms, and should be taken into account in the design of an agent architecture.

Furthermore, most of the models have in common that they model culture with the pur-

pose of improving the believability of characters that are built to interact with humans. One way to increase believability is to give culture, social skills and emotions to a synthetic character.

Concerning our goal, we have to give the synthetic characters the ability to use their culture and social relationships to influence their behaviour. Therefore, the purpose of this thesis is to develop an agent with culturally-specific behaviour whose emotions, especially the dominant emotion, will be influenced by their cultural and social relationships. The dominant emotion (in an appraisal system) is the strongest emotion that the agent feels when an intention is generated. This emotion (as an initial emotion) can be Hope or Fear, hope to achieve the intention or fear for not being able to achieve the intention. These two emotions play an important role to direct the agent's attention internally according to its beliefs and feelings [DP05].

Finally, we have reviewed some work on synthetic characters that explores the importance of culture, emotions and social behaviour to influence the characters' behavior. The novel approach we aim to develop is different from the one built on existing projects. The idea of the combination of culture and social relationships and the effects on characters' emotions, and techniques to design computational culturally-specific behaviour is a novel one in this research.

In the next chapters, we will focus on some issues in detail such as: is there an agent architecture that can support our approach? How can we define and implement it? How important would this approach be for the design of computational culturally-specific behaviour?



# Chapter 4

## The *FAtiMA* Architecture

### 4.1 Introduction

Through the studies of emotion and culture theories and systems we investigated in previous chapters we aimed to identify some important aspects of developing an agent with culturally-specific behaviour. The cognitive structure of emotions developed by Ortony, Clore and Collins [OCC90], and Lazarus’s appraisal system [Laz91] have been implemented and used to provide influential techniques and understanding for the design of agent action-selection and perception mechanisms [DP05, MG06]. Since our story domain (discussed in chapter 5) is based on character interaction, it is important for our characters to simulate plausible human behaviour.

This chapter focuses on the affective agent architecture called FAtiMA [DP05] and its ability to generate emotions and produce believable behaviour. The FAtiMA Architecture has been selected in this thesis because it is based on a cognitive appraisal approach

(discussed in section 2.4.1) and it is able to create autonomous synthetic characters that simulate human behaviour and interaction [LAD<sup>+</sup>08]. It is relevant because it enables agents to make more rational decisions and to organise their plans and tasks with regard to their emotional states. Characters in FAtiMA are modelled with social relations, emotional reactions to events, goals and memory. Moreover, the existing architecture has some processes that we need in our model such as: action/goal selection mechanisms, and a cognitive appraisal mechanism. Furthermore, we have access to the system and there was expertise in FAtiMA locally. Also, designing and implementing a completely new model from scratch is both time-consuming and not the focus of this research.

Therefore, this chapter describes the FAtiMA Architecture and its ability to integrate new parameters to support the requirement for a successful implementation of an agent with culturally-specific behaviour. In this chapter the structure, components and interaction of the FAtiMA Architecture are reviewed.

## 4.2 An Architecture for Autonomous Agents: FAtiMA

FAtiMA (**F**ear**N**ot **A**ffective **M**ind **A**rchitecture) is an agent architecture developed as part of several EU funded projects (Victec, eCircus, eCute) [DP05, DHV<sup>+</sup>07, LDAP08] and originally aimed at the creation of synthetic characters in the FearNot! (**F**un with **E**mpathic **A**gents to **R**each **N**ovel **O**utcomes in **T**eaching) that are autonomous, engaging and believable<sup>1</sup>. FearNot! dealt with the personal and social education issue of bullying from an agent-based perspective. It also aimed to develop social agents with which users could interact and build empathic relationships [EZV<sup>+</sup>08, MSP<sup>+</sup>13, AHT<sup>+</sup>14].

FAtiMA was developed in JAVA and Extensible Markup Language (XML) is used in configuring the agents for the system. Figure 4.1 shows the FAtiMA architecture.

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<sup>1</sup><http://www.e-circus.org/>

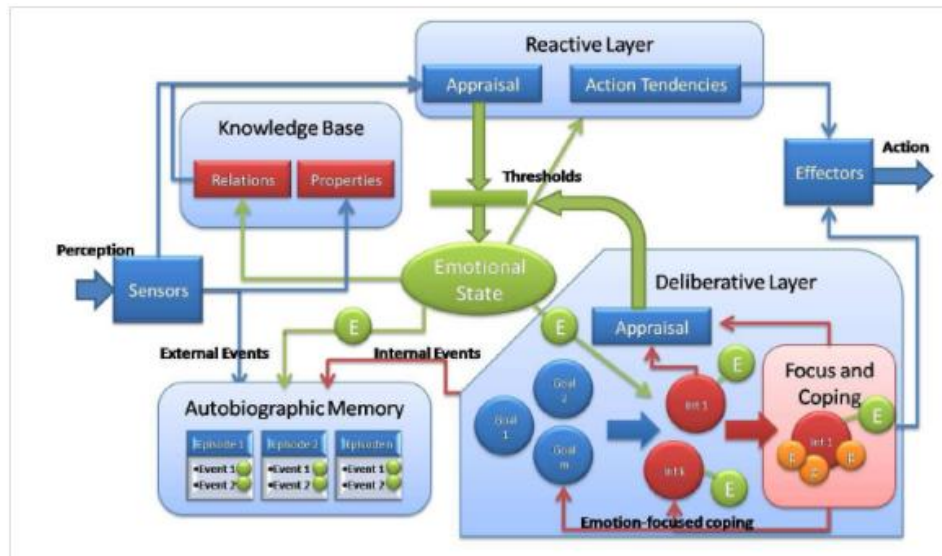


Figure 4.1: The FAtiMA Architecture [AVA<sup>+</sup>09]

For its appraisal and coping mechanisms, two distinct layers were provided in the FAtiMA architecture based on the speed of appraisal and reaction to a given event. The first layer is a *reactive layer* which applies a fast appraisal and reaction mechanism, whilst the second layer is a *deliberative layer* which needs a longer time to appraise and uses planning but gives much more complex and richer behaviour [ADP06]. We will discuss this in the next subsections.

The process, in the FAtiMA architecture, begins with the agent using their sensors to perceive the new event that occurs in the virtual world. This event would be an action of another agent or refer to properties that have changed in the virtual world. If the event received refers to properties, the memory components are updated accordingly by changing world properties and storing the event in Autobiographic Memory (AM). At the same time, when a given event is perceived it is also subjectively appraised by the reactive layer based on a set of appraisal variables according to the OCC appraisal theory. Then, the event is stored with emotional information that resulted from the event's appraisal and all emotions are then added to the agent's emotion state with an initial intensity that decays over time.

The event perceived is also used by the deliberative layer to update existing plans and triggers the goal activation process that checks if any goal has become active. The emotional state and the information stored in memory are then used by the reactive and deliberative layers to decide what the next action is. When an action is selected for execution it is sent to the virtual world through the agent's effectors and the whole process starts over.

#### 4.2.1 Emotion in FAtiMA

The concept of emotions used in FAtiMA is based on the OCC (Ortony, Clore, Collins) cognitive theory of emotions [OCC90]. The fundamental idea of the OCC emotion model is based on cognitive appraisal, so that emotions are labelled as good/bad reactions to events. Similar to the EMA architecture reviewed in section 3.3.3, FAtiMA has implemented the 22 OCC emotion types (see table 2.1) in its architecture and applies both emotional focused and action focused coping in planning processes [MG03, DP05].

As mentioned above in section 2.4.1, the cognitive appraisal process generates emotions; this appraisal is performed based on the agent's *goals*, *standards* and *attitudes*, as presented in OCC cognitive theory of emotions (see Figure 2.2 on page 20). *Goals* refer to the personal goals the character desires to achieve in the world; *Standards* represent the moral principles; whilst *Attitudes* represent the agent's preferences/natural dispositions towards objects or people.

FAtiMA has defined attributes for each emotion. Table 4.1 shows these attributes and their meaning for each emotion.

Attribute	Description
Type	The type of the emotion being experienced (e.g. <i>Fear</i> , <i>Joy</i> , and <i>Anger</i> )
Valence	Denotes the value (positive or negative) for the reaction that caused the emotion.
Target	The name of the agent/object targeted by the emotion
Cause	The event/action that originated the emotion
Intensity	The intensity of the emotion
Time-stamp	The system time when the emotion was generated or updated

**Table 4.1:** Attributes and Descriptions

Some emotions do not have a target, For instance, for the Joy emotion the Target attribute can be empty. Intensity represents how strong the emotion is. This attribute gives the system a dynamic emotion mechanism as the intensity of an emotion changes over time.

The FAtiMA model uses a decay function for emotion intensity suggested by Picard [Pic00]. The intensity parameter of the emotion is calculated based on a function of time:

$$Intensity(em, t) = Intensity(em, t_0) * e^{-bt} \quad (4.1)$$

Where:

*em*: the emotion.

*t* : The time needed before the emotion is removed from the agent's emo-

tional state.

$b$  : how fast the intensity of emotion will decrease over time.

When the value of  $Intensity(em, t)$  reaches its threshold at specific time ( $t$ ), the specific emotion ( $em$ ) will no longer be part of the agents emotional state.

Mood is another parameter modeled in FAtiMA. Mood represents an overall valence of the character's emotional state and is also used to influence the intensity of emotion. Its idea comes from Picard [Pic00], who states that characters with a bad mood will tend to experience more negative emotions, and characters with a good mood will experience more positive emotions. Thus, the potential for positive emotions will be increased in the character with positive/good mood, whilst negative emotion will be decreased. Meanwhile, emotions have an influence on mood depending on their intensity, so that positive emotions put the character in a good mood while negative emotions act in the opposite way by making them feel worse.

#### 4.2.1.1 Personality and Emotion

The FAtiMA architecture does not apply any specific theoretical model to model personality. Instead, in FAtiMA the agent's personality is implicitly defined via OCC variables and is defined by: a set of goals; a set of emotional reaction rules; the character's action tendencies; emotional thresholds and decay rates for each emotion (see Appendix A). Users perceive these patterns of response as different personalities [AVA<sup>+</sup>09]. This model directly implements the 22 emotion types defined in OCC. The emotional threshold specifies a character's resistance towards an emotion type, whilst the emotion decay refers to how long a character will experience that emotion before returning to a neutral state. Figure 4.2 shows an example of emotional properties.

```
<EmotionalThresholds>
  <EmotionalThreshold emotion="Love" threshold="3" decay="7" />
  <EmotionalThreshold emotion="Hate" threshold="5" decay="8" />
  <EmotionalThreshold emotion="Hope" threshold="3" decay="5" />
  <EmotionalThreshold emotion="Fear" threshold="2" decay="5" />
  <EmotionalThreshold emotion="Anger" threshold="6" decay="5" />
</EmotionalThresholds>
```

**Figure 4.2:** Example of Emotional Properties

As an example, if a fearful character is to be defined, this means that the character will have a low threshold for the emotion type of Fear, such that it will experience that emotion easily; and a low decay, such that it will experience fear for a long period of time, thus its Fear emotions will be long and high. Thus, by having different thresholds, it is possible to have two characters react with different emotions to the same event. The character's emotions will have an effect on its action-selection process as a result of its response to events and actions as we will see in the following section.

#### 4.2.2 Reactive Layer

The reactive layer is one of FAtiMA's components (see Figure 4.1) and is responsible for its reactive appraisal process. This process is based on a set of emotional reaction rules introduced in Elliot's Construal Theory [Ell92]. The predefined emotional reaction rules provide a fast appraisal process and reaction to a given event [ALD<sup>+</sup>06]. They are composed of an event that triggers the rules and values for OCC appraisal variables (Desirability, Desirability for other, Praiseworthiness, etc) related to the event. The model only defines and uses three important and relevant appraisal variables for an emotional reaction:

- **Desirability:** This variable shows if the current event has positive or negative impact on the character goals.

- **DesirabilityForOther:** This variable indicates the impact of a specific event perceived and appraised by one character on the others; an event can have a positive impact on one character and a negative impact on another character at the same time. The *desirabilityForOther* variable is important when another character is affected by the event and there is a need to generate *FortuneOfOther* emotions (*HappyFor*, *Pity*, *Gloating*, etc).
- **Praiseworthiness:** Evaluates the actions of characters normatively: do they deserve credit or blame? Characters can appraise action from another character's perspective. One action may be considered praiseworthy from one character's standpoint and blameworthy from another character's standpoint at the same time.

Furthermore, each action rule contains an event that must be true to be able to execute the action and an eliciting emotion that triggers this action. Therefore, the event that will trigger the emotional reaction must be defined and attached to the appraisal variables described above, Figure 4.3 shows an example of an emotional reaction. Event definitions consist of the following fields:

- **Subject:** who performed the action
- **Action:** what action was performed
- **Target:** target of the action
- **Parameters:** a list of additional information about the action.

In this example, the reaction rule will be triggered when the event, anyone ("\*") cries, occurs and the character finds it desirable from its perspective (to see others crying), whilst finds it undesirable for the other character who is crying and slightly blameworthy.



```
<EventReactions>
  <EmotionalReaction desirability="6" desirabilityForOther="-8" praiseworthiness="-5">
    <Event subject="*" action="cry"/>
  </EmotionalReaction>
</EventReactions>
```

**Figure 4.3:** An example of Emotional Reaction

Once an emotional reaction rule is triggered, its values for appraisal variables are used to generate the character's emotions (Attraction, Attribution, Fortune of Others, and Well Being Emotions). For instance, *Joy/Distress* emotion (Well Being Emotions) is created based on the *Desirability* variable. So, if its value is positive, then a *Joy* emotion will be generated, otherwise a *Distress* emotion will be generated.

These emotions are responsible for triggering action tendencies (quick emotional reactions) and dynamically changing the social relationship (liking relation) among characters as discussed above.

#### 4.2.2.1 Action Tendencies

Action tendencies are another essential element in FAtiMA architecture. They represent the reactive action selection process that allows a character to trigger an action when a particular emotion reaches a certain level (see section 2.4.1). Action tendencies are defined in a similar way to emotional reactions. Figure 4.4 shows an example of an action tendency.

```
<ActionTendency action="SpeechAct([Subject],threattalkto)">
  <Preconditions />
  <ElicitingEmotion type="Reproach" minIntensity="1">
    <CauseEvent subject="*" action="cry" />
  </ElicitingEmotion>
</ActionTendency>
```

**Figure 4.4:** An example of an Action Tendency

Its definition consists of three attributes: name or action identifier, preconditions that must be true in order to execute the action and can be used in order to avoid repeating the same reactions, and an eliciting-emotion attribute that refers to the emotion and its cause event and acts as a trigger. The example above Figure 4.4 shows the action of the “*SpeechAct*” when the character is experiencing the “*Reproach*” emotion at a minimum level of 1 towards any character crying.

### 4.2.3 Deliberative Layer

The design approach and function used in the deliberative layer is similar to the one used in the reactive layer, but deliberative appraisal applies a more complex appraisal mechanism than the one in reactive appraisal. The essential work of the layer is an emotion-directed continuous planner that works over the character’s goals and intentions [ADP06]. Furthermore, it is responsible for appraising events based on the character’s goals and generating dominant emotions (Hope and Fear). These emotions will in turn direct and influence the deliberative coping process.

The deliberative layer focuses on cognitive reasoning, where actions are monitored and events are appraised with regard to the goals and plans of the agent. The appraisal process updates the agent’s goals and plans and activates the selection of intentions. An intention is created and associated with a goal when a goal becomes active. It represents the intention of the agent to achieve a specific goal.

#### 4.2.3.1 Goals

Goals in FAtiMA are implemented as two different types, *Active Pursuit* and *Interest goals* which are both taken from the OCC emotion model. Goals for each character

appear in the character configuration file.

Active Pursuit goals (that the character actively tries to achieve) and Interest goals (that the character has but does not actively pursue) are defined in a general goal library file that can be re-used in other scenarios or by any character. Figure 4.5 and Figure 4.6 show an example of both types of goals defined in the goal library.

```
<InterestGoal name="AvoidGettingHarmed">
  <ProtectionConstraints>
    <Property name="[SELF](hurt)" operator="=" value="False" />
  </ProtectionConstraints>
</InterestGoal>
```

**Figure 4.5:** An example of an Interest Goal

```
<ActivePursuitGoal name="AcceptReason(user)">
  <Pre Conditions>
    <RecentEvent occurred="True" subject="[SELF]" action="succeed" target="WaitForReason" parameters="user"/>
    <RecentEvent occurred="False" subject="[SELF]" action="SpeechAct" target="User" parameters="acceptreason"/>
  </Pre Conditions>
  <SucessConditions>
    <RecentEvent occurred="True" subject="[SELF]" action="SpeechAct" target="User" parameters="acceptreason"/>
  </SucessConditions>
  <FailureConditions>
  </FailureConditions>
</ActivePursuitGoal>
```

**Figure 4.6:** An example of an Active Pursuit Goal

The interest goals work, not by trying to achieve the condition (or becoming active or inactive), but by detecting whenever a generated plan may threaten the condition being preserved by the goal. Therefore, they only specify a condition that the character tries to protect: *Protected Conditions*. Figure 4.5 shows an example where the character tries to protect itself from getting hurt by any plan generated to achieve any active pursuit goal.

Active Pursuit goals are modelled based on a set of pre-conditions that activate the goal alongside events triggered by that goal, success conditions and failure conditions. Once all the pre-conditions become true (the deliberative layer is constantly checking those conditions), the goal becomes active and the planner processes all the necessary steps to reach the success condition of the goal. The character may drop a plan to reach the goal if a failure condition becomes true during execution time.

Goals implemented in the main character configuration file (with its personality, emotional reactions, and action tendencies) have two parameters: the importance of success and the importance of failure. Figure 4.7 shows an example of goal attribution to a character.

```
<Goal name="ReplyPositively([speaker],[question])" importanceOfSuccess="4"  
importanceOfFailure="3" />
```

**Figure 4.7:** An example of Goal Attribution to a Character

The two associated parameters allow the character to give priority to a specific goal to follow when several goals are available for activation.

#### 4.2.3.2 Intentions

Once a particular goal verifies its activation conditions and becomes active, the cognitive layer asserts an intention to achieve that goal and this is added to the intention structure. Then, the emotional planner (in the deliberative layer) will generate two initial dominant emotions (Hope and Fear). It is here that the cultural model discussed in Chapter 5 can impact the planning process through affecting the level of Hope/Fear emotions.

The Hope emotion refers to the hope that the character has to achieve the intention or that the intention will be fulfilled. The Hope intensity is determined from the goal's importance of success and the plan's probability of success.

The Fear emotion refers to the emotion that the character may not be able to achieve the intention (associated with possible failure). The Fear intensity is determined from the goal's importance of failure and the plan's probability of failing.

These emotions play an important role in selecting between competing intentions and in influencing coping strategies.

Therefore, the initial dominant emotions (Hope/Fear) are another essential element in specifying a character's behaviour, especially in relation to the future events and behaviour. Aylett [ADP06] stated that, "*these emotions specifically relate to future events either to those congruent with the character's goals (Hope) or threatening those goals (Fear), they offer a specific interface between the affective system and the planning component of coping behaviour*". Table 4.2 shows an intention's attributes.

Attribute	Description
Goal	The instantiated active-pursuit goal the agent wants to achieve
Emotions	The emotions generated by this intention
Plans	A list of alternative plans to achieve the intention

**Table 4.2:** An intention's attributes in FAtiMA

As we see in Table 4.2, the attributes link the intention to the active pursuit goals whose pre-conditions are fulfilled and eligible for activation.

As the planner builds a way to achieve the goal, more than one different plan may be constructed using the goal's *success conditions* as the final preconditions and the planner will select one from all alternative plans in order to continue planning or execution.

The intention to achieve the goal may be removed from intention structure if any of the active goal's *failure conditions* become true during the goal activation.

#### 4.2.4 Autobiographic Memory

The Autobiographic Memory (AM) component integrated into FAtiMA architecture to allow the character to have some kind of awareness over past events and what it felt at that time.

The Autobiographic Memory in FAtiMA was inspired by the research on narrative structure in life stories for humans[[Lin93](#)]. The AM structured is a way to store a set of independent episodes. Each episode represents a set of actions or events that occurred at a specific location and time. The three components: Abstract, Narrative and Evaluation integrate with each episode structure.

- **Abstract field:** used to describe the episode. It has an abstract of information located at *Details* and *Feeling* fields from Narrative descriptions. The abstract is created based on the cause-effect action and its emotional intensities. So, the cause-effect action “action that has an emotional impact” with highest intensities will be selected to create the Abstract field.
- **Narrative field:** used to give more details on events such as: when, who, where and how does this event happen; it also shows the emotional intensities that the character experienced during the event. The time field is composed of three different types: Real time (RT) which represents the real world, the Narrative time (NT) refers to the virtual time that an episode takes place in the whole story, and finally, the Event sequence (ES) indicates the order of the event. Details and Feeling fields are related to each other; the field Feeling stores emotional impacts brought to the character, within an episode, by cause-effect actions stored in the field Details.
- **Evaluation:** the last part is used as a character’s psychological interpretations and to indicate the interpersonal relationships as a result of each cause-effect action in the episodes.

Another advantage of using AM is to store personal experience in it. This is achieved by storing the emotional experience. As we know, the appraisal variables in FAtiMA are specified differently for each character, and used to represent the subjective emotional experience. Therefore, each character will experience and remember an event with different emotions to another character who perceives the same event; this also will lead to determining how important the event is for both characters.

During the appraisal process, more than one emotion may be generated for the same event, but one emotion with high intensity will be selected to associate to the event and store it in AM.

Another feature in FAtiMA is the character's ability to retrieve and generate a summary of a past episode, from the AM, by specifying information to search for a specific event such as the event's location or which character shared the event.

Each episode summary contains the following information: location, time, and event description. Location and time refer to where and when the episode happened; the information is stored within the episode, whilst, event description refers to two relevant events that happened in the episode (generated a stronger emotion). Furthermore, the emotion experienced by the character during event appraisal is stored in event description to provide more information on the character's personal experience.

#### 4.2.5 Knowledge Base

The Knowledge Base (KB) is one of two memory components in FAtiMA architecture. This component is different from the Autobiographic Memory (AM), which stores events and emotions. KB is responsible for storing semantic knowledge, see Figure 4.1, such as the relationships among characters and properties about the world. To do this efficiently, the KB uses an indexing technique for storing properties and relations

using their names. Once the information or properties is needed then, KB uses their names to retrieve information about them. Therefore, two different functions are used in the model, one is to receive the complete name of a property or relation and its value is stored in memory; whilst, the second function is used to search for a property or relation, with that name, stored in the KB.

### 4.3 Conclusion

The FAtiMA agent architecture features an affectively driven planning and cognitive appraisal system that could offer a useful platform for the computational implementation of agents. It creates agents that are emotionally driven; any significant interaction with another agent will result in the alteration of the agent's emotional state. Moreover, agents created using the FAtiMA architecture make decisions based on their emotional state. This, thus, affects their perception of actions and the plan's success probability which is used to generate initial prospect emotions of Fear/Hope. These emotions will influence their decisions about actions' selection.

The main purpose of this chapter was to describe an agent architecture called FAtiMA. We started by describing the main components of the architecture and investigated the role of emotions and personality and how emotions are represented and modelled for the creation of agents that are autonomous synthetic characters, with a view to integrating parameters to support a successful implementation of an agent with culturally-specific behaviour into the FAtiMA architecture.

Sections [4.2.1](#), [4.2.2](#) and [4.2.3](#) underlined the importance of emotions and showed that they are essential for agents' behaviour in order to establish enough believability. It is also apparent that the emotions play a significant role in an agent-based action selection mechanism.



# Chapter 5

## Conceptual Model

### 5.1 Introduction

In this chapter we present the architecture and the conceptual model for a synthetic agent that acts according to its own personality and culture. The model presented in this chapter was created by extending the existing autonomous agent architecture FA-tiMA described in chapter 4. As we mentioned earlier, in chapter 2 and 3, the main work undertaken in this thesis focuses on theories of culture, social power and computational modelling of synthetic agents. Moreover, it is important to address another element that plays an important role in shaping the type of communication between characters. A character will be affected by its emotion, taking decisions based on its emotion in all cases with a cognitive appraisal architecture. Therefore, in the following sections and subsections we will focus on the role and function of culture, social power and emotion with respect to a character's behaviour. The goal and intention selection mechanisms involved in generating a character's behaviour help to determine the research areas that need to be considered for the theoretical formulation and implemen-

tation of the culturally-specific behaviour concept due to their importance in driving the behaviour of synthetic characters.

Therefore, we will first start with the cultural architecture and the internal components of the model followed by the definition of elements that are used to specify culture and their effect on the agent's behaviour through goal and intention selection. Finally, we introduce and describe the scenarios we used in our research.

## 5.2 Cultural Architecture

The Cultural Agent Architecture Model is the core element of this research. Taking the autonomous agent architecture FAtiMA model as a basis, we have added social relations, cultural goal selection mechanisms and cultural parameterisation (the blue boxes) into FAtiMA which resulted in the following architecture. In the following chapter we will describe the implementation of each component. Figure 5.1 shows the Cultural Agent Architecture. We put more emphasis on goals selection and intention generation mechanisms than the other components in the architecture.

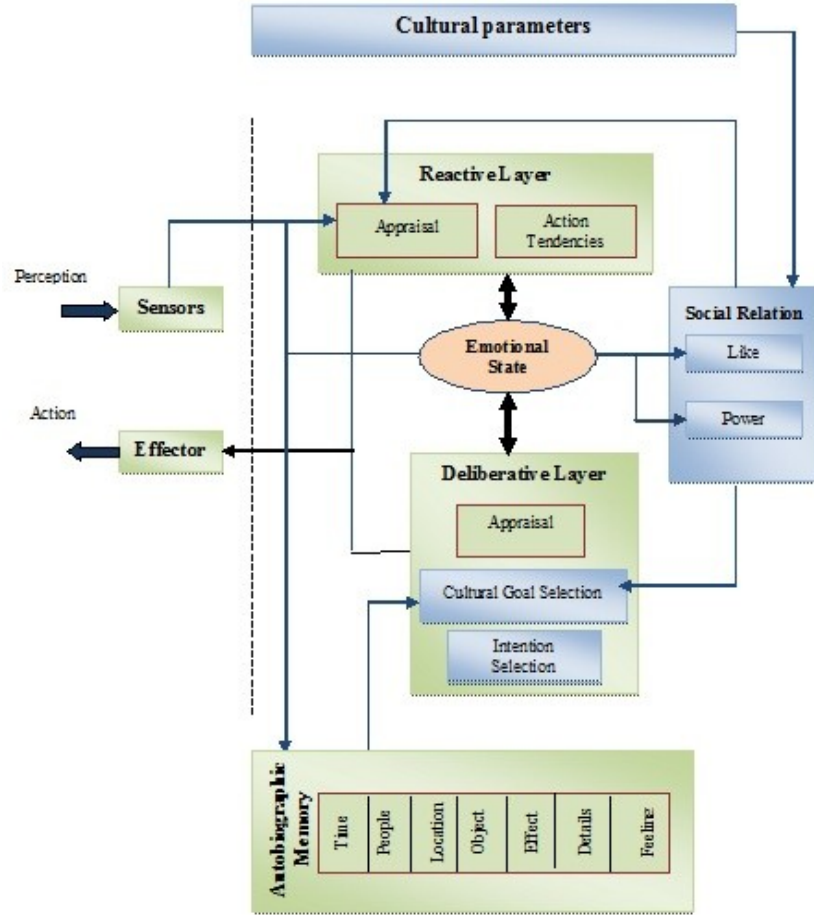


Figure 5.1: Cultural Agent Architecture

### 5.3 Cultural Definition

The main idea of our model is inspired by Hofstede’s culture theory, especially his cultural dimensions which we reviewed in chapter 2. One of his fundamental ideas is that of behavioural tendencies; these behaviours are shared by all the people within the same culture, and these tendencies are based on differences in the level values held by dimensions [GJ91].

As we mentioned earlier in Related Work chapter 3, some work already uses Hofstede’s cultural dimensions model to create cultural agents [Mas09, RNA<sup>+</sup>09]. CUBE-G [RNA<sup>+</sup>09] focuses on expressive behaviour by correlating the cultural dimensions to

specific expressive behaviour based on the user's culture. The Social and Cultural model [Mas09] is a cultural model that is based on three behavioural elements of human cultures: cultural dimensions, symbols and rituals to generate different cultural behaviours in groups of synthetic characters.

But, we aim to use a different approach. We will use these dimensions to influence the synthetic character through its goal and intention mechanism, and especially focus on the cognitive layer where plans are brought into focus and dominate emotions that drive agent selection between the competing intentions generated.

Our idea comes from defining cultural dimensions for a number of characters that will share them and behave based on these cultural dimensions.

This definition is based on two of Hofstede's dimensions; Hierarchy and Identity to present two culture dimensions "High/low Power-Distance and Individualism/Collectivism dimensions":

#### **- Identity**

This parameter defines how collectivistic this culture is. The values range from 1 to 10: the higher the value the more collectivistic the culture; the lower the value, the more individualistic the culture.

#### **- Hierarchy**

This parameter defines how great the power distance is in this culture. The values range from 1 to 10: the higher the value the greater the power distance in the culture (high power culture), and vice versa. We will show how we use these parameters in the following sections.

We aim to use these dimensions and their values to affect the characters' behaviour to match Hofstede's findings. An example of how to use them will be discussed in the following chapter.

The reason for selecting only two dimensions is that, in short-term interaction these two dimensions cause behaviour changes that seemed to be more easily recognisable [MPPH13] and we would like to see if participants are able to recognise the differences between the characters' behaviour in our experiments later; this also would support our hypothesis discussed in chapter 1.

### 5.3.1 Social Power Parameter

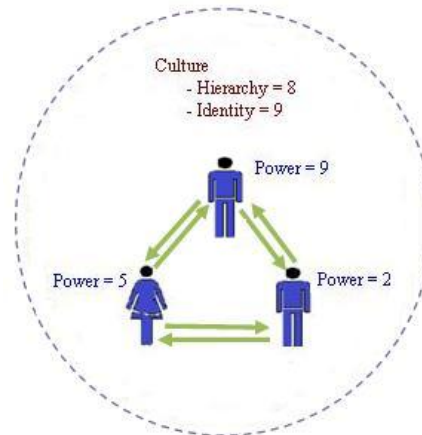
Power is a type of social relation defined as the character's ability to influence the character's environment including others around them [Bou95]. As we mentioned in section 2.3.1 one of the bases for power is the cultural values that one individual has over another and influences one who is obligated to accept this influence [FJR59].

Therefore, alongside cultural dimensions, our model also encompasses another parameter that can affect the interaction between characters. This parameter is social power which is one of the characteristics of group structures and defines the interpersonal relations of the group members [HZH68, LPR52].

The social power value for each character depends on its role. For instance, in a high power culture a husband or father may have a broad range of powers over his family, but a narrow range of powers over other people

As we mentioned in subsection 2.3.1 Hofstede [Hof03] reports a high correlation between the power distance and collectivism dimensions on the basis of national culture. He found that countries that are highly collective are found to be high on power distance with a few exceptions (see Table 7.4). On the other hand, there is no or less correlation between power distance and the Masculinity/Femininity and Uncertainty avoidance

dimensions [CB97].



**Figure 5.2:** Cultural Definition

Figure 5.2 shows the cultural parameters, Hierarchy and Identity, which are used to make an instance of a global social system within which all characters are individual entities. These parameters are the same for all characters as they belong to the same culture.

We use the power variable to define the status of a character in the culture by determining the amount of power of an individual. It also describes the social power relationship between characters, as we will discuss in the scenario later in this chapter involving John, Tom and Ann. If power distance is high then, power value is high for John as he is a father. Power values are lower for Tom and that for the mother, Ann, who is in the middle.

These parameters will be used to influence the character's behavior by influencing its emotions and goal selection.

## 5.4 Deliberative Layer

The deliberative layer in FAtiMA is an emotional continuous planner which works over the character's goals and intentions [ADP06]. The deliberative layer mechanism is

based on cognitive reasoning rather than a simple rule activation as in the reactive layer. The appraisal mechanism in the deliberative layer takes longer to react to a given event but allows for a much more complex and rich behaviour [Lou07].

The layer appraises events according to the character's goals, generating prospect-based emotions (e.g. Hope and Fear). These emotions specifically relate to future events and offer an interface between the affective system and the planning component of coping behaviour [ADP06].

Furthermore, we have seen, in FAtiMA (Chapter 4), that these emotions will be very important in selecting between competing intentions. This idea is based on the fact that two different people can show a different response to the same event and this difference reflects their emotional state.

In the following subsection, we will show how culture and social power relationships can be added to influence the goals and intentions selection mechanisms.

#### 5.4.1 Cultural goal selection

According to Hofstede, in a collectivistic culture, people tend to look out for one another as well as themselves, which is different from people in individualistic cultures, where people are expected to be only responsible for themselves and their immediate family [GJ91]. On the other hand, in high-power distance cultures people tend to respect and treat others based on their formal status. Whereas, in low-power distance cultures, people are expected to deal with others as equals. Also, interpersonal relationships (e.g. Liking) are very important to all cultures and play a significant role in human behaviour. Therefore our characters should evaluate goals based on these elements.

On the other hand, beliefs are always changing in a dynamic environment, which means that the intensity of emotion, with respect to a certain goal, can increase or decrease over time.

#### 5.4.1.1 Intention selection mechanisms

In FATiMA, when a goal verifies its activation conditions, an intention to achieve the goal is added to the intention structure. Initial hope and fear emotions based on the intention's probability and the goal's importance are created in this process and stored with the intention. This means that, the intention to achieve any goal is always based on the intensity of initial emotions and these emotions will be very important in helping to choose between competing intentions and in influencing the coping strategies to be applied.

These two initial emotions (fear and hope) are created once the goal verifies its activation conditions, and numeric values that indicate the intensity of both emotions are returned based on the character's current beliefs about the goal's importance of success/failure and the plan's probability of success/failure.

An intention is composed of three attributes (Goal, Emotions and Plans). The goal is the active-pursuit goal that the agent wants to achieve (see Figure 4.6); the emotions are (Hope and Fear) that are generated by this intention; and finally the plans which hold a list of alternative plans to achieve the intention. An example of generating and selecting an intention is shown in chapter 6.3.1.

#### 5.4.1.2 Fear and Hope Emotions

The difference between hope and fear emotions is observable in situations where threat and danger are perceived for instance, or in a situation of conflict. According to [Sny00] Hope is a cognitive activity of deliberative appraisal with positive affect. On the other hand, Fear is defined as a negative type of emotion based on past and present affective experiences.

The way we evaluate and express a particular emotion is affected by our culture and



reflects the norms, values and expectations of that culture [SL90]. Also, people learn from an early age, what event can cause a particular emotion, how to appraise that event, how to express the emotion, and how to behave in accordance with it [LMFF82, ACC90, SH91].

As we mentioned earlier in chapter 2, [MK91] a person from an individualistic culture is more focused on their independence and self-actualization, while a person from a collectivistic culture is focused predominantly on their relationship with in-group members or with the in-group as a whole. This means that a character from an individualistic culture will appraise events in terms of their individual achievement. A collectivistic character appraises events in terms of the group they belong to or in terms of the effect they will have on their interpersonal relationships.

OCC (see 2.4.1.1) distinguishes between the importance of the success of a goal and the importance of its failure. The importance of success or failure to achieve the goal is influenced by cultural norms. This means that, for two characters from different cultures, it would be possible to have the importance of success differing for the same goal. Suppose that the character has a goal of marriage approval. In this case the importance of success of a goal for the character in a collectivistic culture will be high as he has to get approval, whereas the importance of success for a character from an individualistic culture is low.

In FatiMA (see Equations (5.1), (5.2)), the first equation only uses the plan's probability of success and the goal's importance of success to calculate the Base Potential of Hope emotion. The second equation uses the plan's probability of failing (determined by 1 minus the probability of success) and the goal's importance of failure to calculate the Base Potential of Fear emotion. The equations also modify and extend to calculate the goal's utility, indicating how useful the goal is for the character [Mas09].

$$HopeBasePotential = Probability(Plan) * ImportanceOfSucess \quad (5.1)$$

$$FearBasePotential = (1 - Probability(Plan)) * ImportanceOfFailure \quad (5.2)$$

Since the range of  $Probability(Plan)$  is from  $\{0-1\}$  and the range of  $Importance Of Sucess/Failure$  is from  $\{0-10\}$ , the range for Hope emotion will be between  $\{0 - ImportanceOfSucess\} \implies \{0-10\}$  and the range for Fear emotion will be between  $\{0 - ImportanceOfFailure\} \implies \{0-10\}$

In our work, we argue that, the attributes Cultural Dimensions, Social Power and Personal Relationships will all have different impacts on generating Hope and Fear emotions in both cultures. This, in turn, influences the actions selected for execution by the agent. To achieve that, we propose replacing the two equations above with two equations that have additional parameters to calculate the Base Potential of Hope and Fear emotions. Equation (5.3) and Equation (5.4) show the impact of these attributes on Hope and Fear emotions.

$$HopeBasePotential = [p(plan)*IOS]*[(1+(10-IDY))+Hiy*|Power(g)-PR(g)|] \quad (5.3)$$

$$FearBasePotential = [(1-p(plan))*IOF]*[(1+(10-IDY))+Hiy*|Power(g)-PR(g)|] \quad (5.4)$$

Where the attributes of these equations are:

- $P(plan)$ : The plan probability “the probability of achieving all the plan’s success conditions”.

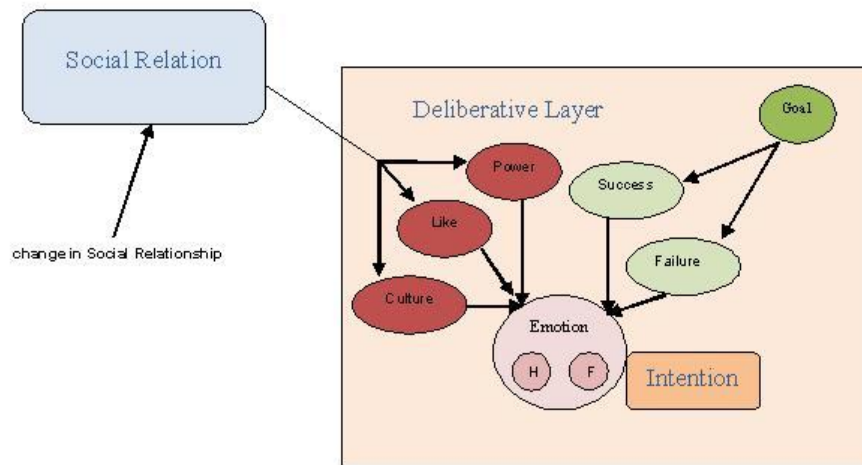
- *IOS*: Goal's Importance Of Success.
- *IOF*: Goal's Importance Of Failure.
- *IDY*: The Identity dimensional score rated from 0 to 10 (high score means collectivistic culture and vice versa).
- *HIY*: The Hierarchy dimensional score rated from 0 to 10 (high score means high power culture and vice versa).
- *Power(g)*: The amount of power the target has over the character and rated from 0 to 10 .
- *PR(g)*: The Liking relationship between the character and target, rated from 0 to 10.

Since the social relationships are always changing in a dynamic environment, it is very likely that the Social Power and Liking relationship between agents increases or decreases in value over time. This means that the intensity of Hope and Fear emotions will have different values for the same event depending on the cultural parameters and also on the power and liking relationships between characters, especially in very strong or very weak relationships. So, how can culture affect hope and fear emotions? Table 5.1 shows these affects based on the values of IDY, HIY, Power(g) and PR(g) parameters.

IDY	HIY	Power	PR	Hope		Fear	
				$PoPor$	$PoPor$	$1 - PoPor$	$1 - PoPor$
				$IOS = 0$	$IOS \neq 0$	$IOF = 0$	$IOF \neq 0$
10	10	10	10	0	IOS	0	IOF
10	10	10	0	0	↑	0	↓
10	10	0	10	0	↑	0	↓
10	10	0	0	0	IOS	0	IOF
0	0	10	10	0	↑	0	↓
0	0	10	0	0	↑	0	↓
0	0	0	10	0	↑	0	↓
0	0	0	0	0	↑	0	↓

**Table 5.1:** The new range for Hope and Fear emotions

The equations we propose are based on the impact of these attributes on the character to generate hope/fear emotions. For example, if the character is from a collectivistic high power culture (IDY=HIY=10), he has power on the other character (Power=10), and there is no relationship between them (PR=0); the plan probability and goal's importance of success  $\neq$  zero. In this case the base potential of hope emotion will be high for the character to achieve the goal whilst the base potential of fear emotion will be low. Figure 5.3 shows how the initial Hope and Fear emotions are generated.



**Figure 5.3:** Initial Hope and Fear emotions

From figure 5.3 we see how the Hope and Fear emotions that are associated with the intention (in the deliberative layer) are affected by the extra attributes. This is different from the way these emotions were generated in FAtiMA baseline, where only the goal's importance of success and failure is used (see Equations (5.1), (5.2)).

## 5.5 Marriage Approval Scenarios

Before we start to introduce our scenario, we will present the three scenarios (see Table 5.2) implemented in FatiMA using three different systems discussed in chapter 3.

The first scenario “Bullying” was used in FearNot! and aimed to deal with personal and social education issues through developing agents and building empathic relationships with users.

In the second scenario “Sprytes on a planet” used in ORIENT the characters were chosen to be unfamiliar to any specific human culture which makes it hard for users to perceive the personality of Sprytes. The characters were developed as aliens and integrate an explicit model of culture where characters are configured to behave according to the cultural norm. The scenario aimed to increase the intercultural sensitivity and competence

of adolescent users. The third “Diner party” scenario aimed to show the eating ritual differences through five different characters acting at a simple dinner party.

FAtiMA in	Scenario	Cultural Traits	Description
<b>FearNot!</b>	Bullying	None	Developing social agents with which users could interact and build empathic relationships. The agent plays the role of a victim in a bullying scenario in which bullying take place in a virtual school. The child user acts as an invisible friend and is asked by the victimised character for their help and advice.
<b>ORIENT</b>	Sprytes on a planet	High Power and Collectivistic Culture	Aimed at developing the domain of inter-cultural empathy. Users interact with a group of Sprytes, an unfamiliar fictional foreign culture whose planet is about to be destroyed by a large meteor and have to become familiar with the Sprytes gestures and rituals (strange customs) in order to convince the Sprytes to cooperate with them in saving the planet. The hierarchy in Spryte culture has three layers: Elder, Members of its Council, followed by the Spryte population.

FAtiMA in	Scenario	Cultural Traits	Description
<b>Social and Cultural Agents</b>	Dinner Party	Rituals and Symbols	Applying cultural dimensions to gestures, and symbols, and creates three rituals: Greeting/Welcoming/Dining, to reflect high/low power distance cultures. The scenario has five different characters attending a dinner party, the characters arrive at the party location; greet each other; socialise for a while; and then sit down together at the dinner table and start to eat.

**Table 5.2:** Scenarios used in FAtiMA

The two scenarios (see Appendix B, C) that were employed for our research study were carefully designed. We used the marriage approval scenarios to investigate the difference between two behaviours. Our scenario is located in a specific culture and includes family members who belong to the same culture.

The reason behind using the marriage approval scenario is its cultural variation [MFVV12]. We also took into consideration the type of target user for evaluation experiments and their age. In addition, research on adolescents' inter-ethnic relations indicates that parents can resist their children's ethnic outgroup relations [EK09] and outgroup marriage and dating behaviour [TLC08, MOF04]. The underlying reasons for this could be related to their culture, family reputation, or parents' religiosity [MFVV12].

Hofstede [HPH02] also emphasized the role of family in culture. The family has an important role in a marriage decision, especially in collectivist cultures, as the marriage can be seen as not only between boy and girl, but also between families.

In individualistic cultures, individual opinion is based on self-evaluation and it is an important determinant of behaviour, whereas in a collectivistic culture, the opinions of

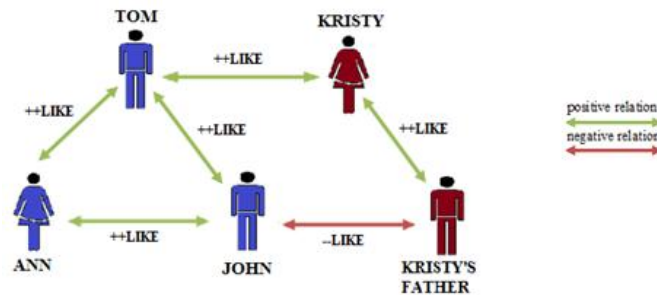
others are more important [LC11]. This suggests that family influence is less important in individualistic culture than in collectivistic culture, leading to differences in parental acceptance of their children's relationships [MFVV12].

An important distinction between cultures may lie in a specific action performed by characters. For instance, a given action that may be seen as unfamiliar in one culture might be considered a sign of respect in another culture. These types of actions help in recognizing the differences between cultures.

In FAtiMA, authors have control over the character's behaviour, because they are responsible for defining the goals and in which situations they can be active. This means that part of the agent behaviour is authored externally, while other parts of the behaviour are handled by internal processes.

In our scenarios there are 3 active characters: Tom, Mother and Father. "Tom" is 26 years old. His father is "John" and his mother is named "Ann". Tom likes a girl named "Kristy" (who is not present in the scenarios), but Tom's father hates Kristy's father (also not present in the scenarios). His Mother loves Tom; Mother also loves Father, Father loves Tom and Father loves Mother. The choice of three characters makes it easier to run the scenarios, avoiding a more complex situation with more characters.

To illustrate further, we present the following example. Figure 5.4 shows the characters and the type of relationships between them.



**Figure 5.4:** Characters and their relationships



In a real collectivistic culture, “**AskForApproval**” for marriage is very important and the son knows the importance of his family’s consent; therefore the son will ask for approval from his family. Also, in our second scenario (see Appendix C) where Tom told his mother about the girl that he is going to marry and he asks for his parents’ approval (this situation is considered as cultural differences).

Another situation or action, the son might try to avoid in a high power culture is to speak directly to his father about his marriage if he feels his father may reject it. Therefore he asks for his mother’s help in talking to his father. If the father rejects his son’s request, due to his negative relationship with Kristy’s father, the mother may also reject it (cultural differences) as the father rules the family in a collectivistic culture and the Father has the final decision on the marriage of his son. The role of Ann as a mother in a high power collectivistic culture is important here as she wants to keep the family and its members on good terms.

Whilst in an individualistic low power culture, the situation will be different. The son might not try to ask for his parents approval and he might tell his parents about his marriage even if they do not agree with his choices. The son will speak directly and express his opinion freely to his parent. The parents objections will be less in this culture.

## 5.6 Conclusion

This chapter identified the necessary concepts for the synthetic agent that behaves based on its own personality and culture. It also presented elements towards developing a synthetic agent according to knowledge acquired in previous chapters. The conceptual model presented argues for the consideration of goal and intention mechanisms where culture and social power influence the characters’ behaviour by affecting their dominant emotion and the intention to achieve their goals.

We also introduced our scenarios (Marriage Approval) that were employed for our study and their relation to cultural variation.

# Chapter 6

## Implementation

### 6.1 Introduction

This chapter describes an implementation of the conceptual model for the development of agents with culturally-specific behaviour presented in chapter 5. The implemented work presented in this thesis was carried out by adapting the FAtiMA architecture presented in chapter 4.

The implementation has been oriented towards the most relevant elements that specify a culture and have an effect on the behaviour of characters. The implementation is therefore composed of two main tasks: character definitions (Authoring) and overall scenario development, and modification of intention-selection mechanisms. We focused on these two elements due to their potential to contribute answers to our research questions.

Authoring in FAtiMA involves defining the following characteristics for each character:

1. Emotional Thresholds - refers to how easy or difficulties for the character to experience a given emotion.

2. Emotional Decay Rates - refers to how long a character will experience that emotion before it returns to a neutral state.
3. Goals - the Active Pursuit and Interest goals of the character.
4. Emotional Reaction Rules - how the character evaluates events.
5. Action Tendencies - reactive actions that are triggered by a certain emotion when it reaches a certain level.
6. Cultural Parametrisation - refers to the character's culture.

As described in chapter 5, the technical implementation focuses on the intention-selection mechanisms and makes required changes in the FAtiMA baseline within the original intention-selection mechanisms. The language used to develop the agents' internal reasoning system is Sun Microsystems JAVA and the language used in configuring the agents for the system is Extensible Markup Language (XML).

## 6.2 Agent Configuration

The characters, used in our scenarios, have been configured using XML which is composed as mentioned above of the following components: perceived personality, emotional reactions, goals, action tendencies, culture and social power. In the following subsections we briefly describe the functionality of each of these components and their configurations in the system.

### 6.2.1 Perceived Personality

In our module, we follow the FAtiMA architecture to define the agent's personality (see section 4.2.1.1). It is represented by defining and authoring characteristics associ-

ated with characters.

We define emotion thresholds which specify a character's resistance towards an emotion type, and emotion decay, which refers to how long it takes for the character to return to a neutral state after experiencing a particular emotion.

In chapter 2 we discussed the relationship between culture and emotions; the differences and similarities in emotions between different cultures. Culture has some influence on the emotions that people express and perceive (see section 2.4). However, even within one culture, emotions show considerable individual differences and have a stronger effect on some individuals than others in the way they are expressed and perceived. Furthermore, some emotional expressions expressed by people from one culture are easily recognized by their own culture whereas in another culture they may not be recognized [Arg88].

In FAtiMA the personality is authored and gives the authors a direct implementation by defining a set of goals, a set of emotional rules, the character's action tendencies, emotional thresholds and decay rates for each of the OCC emotion types [DP05], which is a large set of interacting factors to generate a certain personality for a character.

The personality of the character is expressed through the emotions defined by types, thresholds and decays. The character's emotion profile is the 22 OCC emotion types that can be generated or emerge together to generate a specific emotion and influence the way it responds to events and actions. Therefore, we set up the characters, as defined in our scenarios, by authoring threshold and decay levels with numbers that define a character based on its personality and culture.

Table 6.1 shows Tom's personality configuration in the second scenario developed for the implementation.

Emotion	Threshold	Decay	Emotion	Threshold	Decay
<b>Love</b>	3	7	Pity	2	8
<b>Hate</b>	5	8	Resentment	2	8
<b>Hope</b>	3	5	Gloating	8	2
<b>Fear</b>	2	5	Pride	3	8
Satisfaction	5	5	Shame	3	7
Relief	4	5	Gratification	2	5
Fears-Confirmed	5	5	Remorse	6	5
Disappointment	6	2	Admiration	2	8
Joy	2	5	Reproach	3	8
Distress	4	2	Gratitude	4	5
Happy-For	8	2	<b>Anger</b>	6	5

**Table 6.1:** Personality Configuration “Tom”

The threshold and decay levels range from 0 to 10. Setting up the threshold and decay levels with numbers is always a tricky issue [LDAP12]. We pay more attention to the emotions our characters are more likely to generate (the Bold ones). We set up the numbers for each character, differently for different characters, depending on the desired personalities of the characters and their role in the story. For instance, in the second scenario if we want Tom to be a fearful character it would be set up with a very low threshold for fear and with a low decay level for fear, such that Tom will experience the fear emotion easily and for a long period of time.

The characters’ emotion profiles are directly implemented based on the OCC cognitive theory of emotions [OCC90] to influence the way a character responds to actions, events and its own decision-making process.

The personality configuration of all the characters developed for both scenarios has been included in this thesis in Appendix A

### 6.2.2 Emotional Reactions

In the FAtiMA baseline architecture, discussed in chapter 4, the emotional reaction rules are responsible for generating emotions that trigger action tendencies with regard to particular events. The emotional reactions are defined according to the parameters: desirability, desirability for other, and praiseworthiness, which were described in detail in chapter 4. In FAtiMA these rules are actually authored and fixed throughout the whole lifetime of an agent.

We have specified a scenario (discussed in section 5.5) in a specific culture for family members who belong to the same culture. Therefore, we create the emotional reaction rules according to the character's defined personality and culture especially for events that have a significant impact on this defined culture. The example below in Figure 6.1 illustrates a character's emotional reaction configured according to a particular event.

```
<EmotionalReaction desirability="8" desirabilityForOther="8" praiseworthiness="4">  
  <Event subject="[SELF]" action="SpeechAct" parameters="talkingaboutgirl"/>  
</EmotionalReaction>
```

**Figure 6.1:** Emotional Reaction configuration

The values of *Desirability*, *DesirabilityForOther* and *Praiseworthiness* range from -10 to 10. The *Desirability* value -10 indicates an extremely undesirable event, 0 a neutral (nor good nor bad), 10 an extremely desirable event. The value of *DesirabilityForOther* specifies generally how good or bad that event is for the other character. The *Praiseworthiness* value indicates if the action performed is praiseworthy or blameworthy, -10 represents an extremely bad action from the observer's point of view, while 10 represents an extremely good action.

In Figure 6.1, we created an emotional reaction for the son from collectivistic high power culture, so that when this character performs the action (SpeechAct) to talk about the girl he loves with his mother it will modify its emotional state according to the defined emotional reaction's parameters. The son, in this culture, will consider the action (talk about the girl) as a desirable event for him, a good event for his mother and praiseworthy.

There is no significant extension over the previous architecture, in the emotional reaction rules configuration, but we have created emotional reactions rules so that characters appraise events that are blameworthy/praiseworthy in the character's culture by manually authoring each character's emotional reaction based on its personality.

### 6.2.3 Goals

As we mentioned earlier, in chapter 3, goals in FAtiMA are defined in two distinct XML files (the agent configuration file and goal library). Their purpose is to define goals that can be used by more than one agent. Thus, goals in the character's role file refer to goals in the goal library file that may be activated by this character.

Goals in the goal library file, in FAtiMA, are configured based on a set of attributes: pre-conditions, success conditions, failure conditions and effects.

Hofstede [HPH02] states that, people in a collectivistic culture feel equally responsible for other people in their society as for themselves. On the other hand, people in a high power distance culture tend to treat each other based on their status and expect to accept the decisions of high power characters.

Using the goal Effects attribute, implemented in FAtiMA, within the goal definition we can make changes in agent relations by increasing or decreasing the agent 'liking' relationships according to the goal's importance. Figure 6.2 shows a goal definition in



an agent file. Figure 6.3 shows an example of the XML code for an Active Pursuit Goal of 'Get Approval' goal configuration in the goal library. Figure 6.4 shows a screenshot from the system

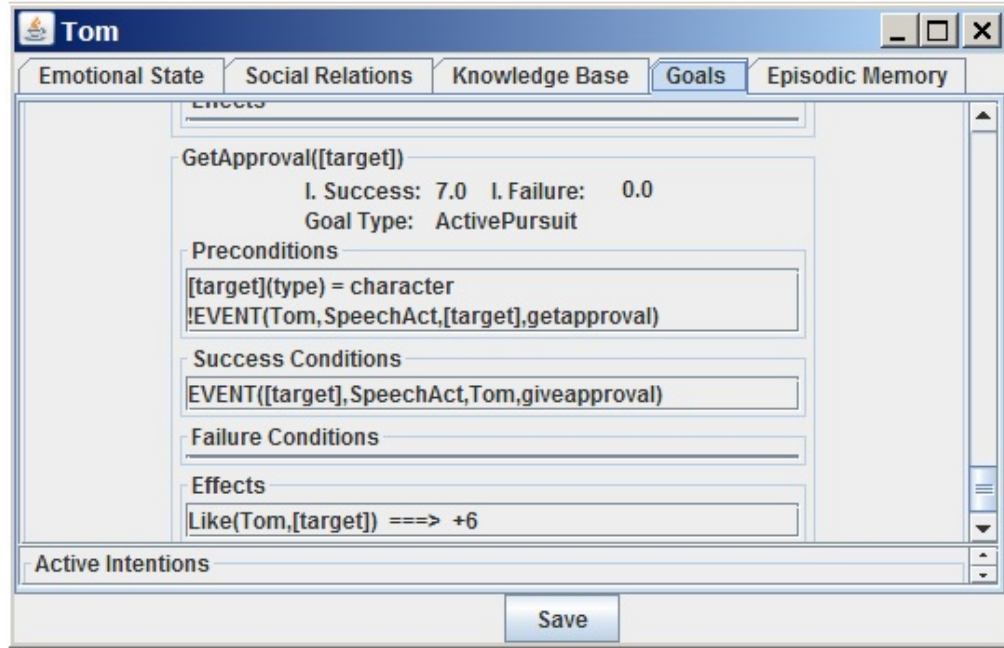
```
<Goal name="GetApproval([target])" importanceOfSuccess="7" importanceOfFailure="1"/>
```

**Figure 6.2:** Goal in "Tom" configuration file

```
<ActivePursuitGoal name = "GetApproval([target])">
  <PreConditions>
    <Property name="[target](type)" operator="=" value="character" />
    <RecentEvent occurred="False" subject="[SELF]" action="SpeechAct"
      target="[target]" parameters = "getapproval" />
  </PreConditions>
  <SuccessConditions>
    <RecentEvent occurred="True" subject="[target]" action="SpeechAct"
      target="[SELF]" parameters="giveapproval" />
  </SuccessConditions>
  <Effects>
    <Effect name="Like([SELF],[target])" operator="+" value="6"/>
  </Effects>
</ActivePursuitGoal>
```

**Figure 6.3:** XML code of goal configuration

This type of goal "GetApproval" for a character from a collectivistic high power culture is important to activate and achieve successfully "ImportantOfSuccess = 7". The goal is activated when two conditions occur; as preconditions for this goal, the first condition is "the target of the goal is a character and the same event did not occur recently". The condition for success of the goal is the target perform "Speech Act" action and to give approval to the character who asked for approval. The predefined effect of this goal is to increase the value of the 'like' relation of the character who asked for approval toward the character who gives approval, because the target of the goal (character) accepted to give him approval.



**Figure 6.4:** Screenshot of Tom's goal

All goals in the goal library have been included in this thesis in [Appendix D](#)

#### 6.2.4 Action tendencies

Action tendencies are another important element in the FATiMA agent configuration. Action tendencies are reactive actions that are triggered when an agent reaches a certain level for a particular emotion. For example an agent may start crying if its distress level reaches a certain level, as in human beings.

Hofstede [[Hof03](#)] states that culture has some influence over the way people perceive and express emotions, so expressing some emotions is easier and accepted in one culture rather than in others (e.g. individual anger in an individualist culture). Based on the synthetic culture profile presented by Hofstede [[HPH02](#)] we select and set the values of action tendencies. Therefore, in our implementation we tried to model some action

tendencies for our agents so that they depend on their culture and roles in the scenario.

Figure 6.5 shows an example of John's action tendencies configuration.

```
<ActionTendency action="SpeechAct([Subject],insult)">
  <Preconditions>
  </Preconditions>
  <ElicitingEmotion type="Anger" minIntensity="3">
    <CauseEvent/>
  </ElicitingEmotion>
</ActionTendency>
```

**Figure 6.5:** An example of John's Action Tendency

John, as a father in the story, may be performing an action (insult) when he experiences the Anger emotion with an intensity equal or greater than 3. This is more likely to occur as the character is from a collectivistic and high power distance culture with more powers over his family.

### 6.2.5 Cultural Parameterisation

In our model, culture is represented by cultural parameterisation of hierarchy and identity dimensions. The parameterisation of the cultural dimensions is predefined and very simple; this parameterisation is done in the character's file. The specific degree of collectivistic and high power distance culture is defined in the XML file for a character, as shown in Figure 6.6: The cultural parameters configuration is associated with all characters that belong to a specific culture. Table 6.2: Cultural dimension parameters, shows the cultural parameters: the values are set high to define the culture as a collectivistic and high power distance culture.

Figure 6.7 displays the cultural parameters for Tom's social relationships. We can see that the value of each cultural parameter is high.

The agent will be configured for its culture after loading and the value of culture set into its social relation (see Figure 6.7).

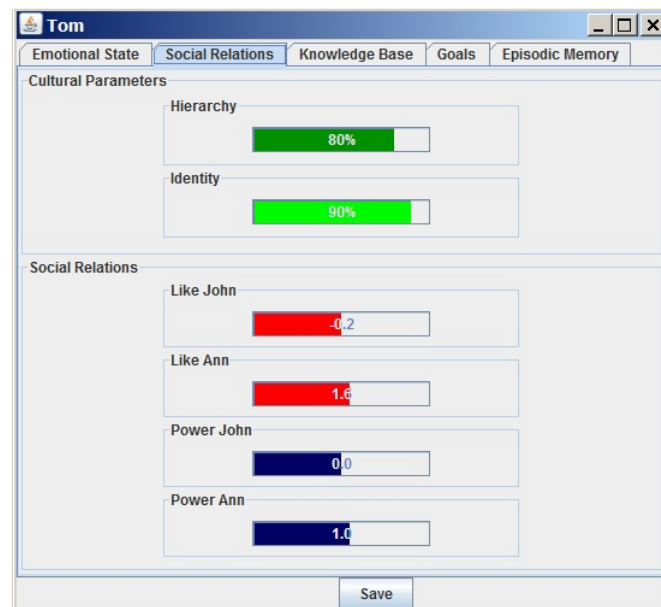
As we will see later in this chapter, these cultural parameters of the agent are fundamental to the generation and selection of intentions.

```
<CulturalParameters>
  <Culture hierarchy="8" identity="9"/>
</CulturalParameters>
```

**Figure 6.6:** Cultural parameters configuration for all agents

Parameter	Range	Description
Hierarchy	[0..10]	The value associated to the hierarchy dimension.
Identity	[0..10]	The value associated to the identity dimension.

**Table 6.2:** Cultural dimensions parameters



**Figure 6.7:** Screenshot of Tom's cultural parameters

The other parameters in Figure 6.7 and their values will be discussed in the following sections.

### 6.2.6 Social-Power Parameterisation

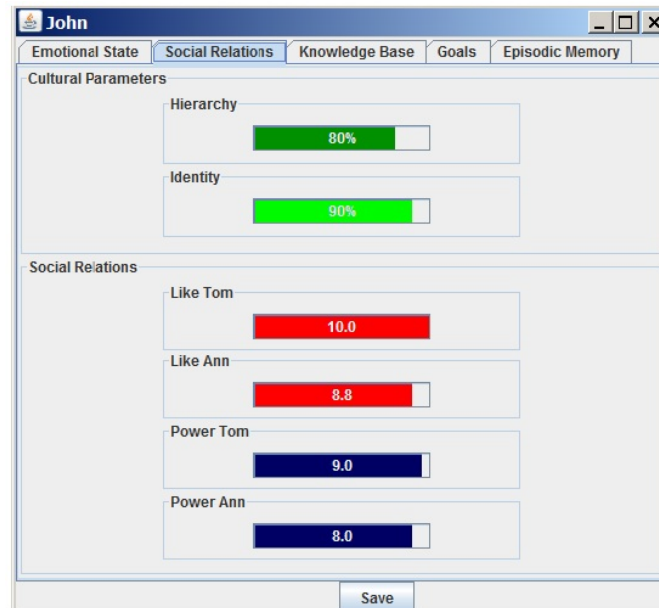
Social power is another element we added to our agent configuration. This element determines the power an agent has to influence the behaviour of another agent. In the cultural model presented by Hofstede, he suggests that this type of social relation is greatly affected by culture [Hof03].

Social power is predefined for each character as one of its social relation properties. Figure 6.8: shows an example of John's social relations configuration.

```
<SocialRelations>
  <Relation target="Tom" like="5" power="9" />
  <Relation target="Ann" like="7" power="8" />
</SocialRelations>
```

**Figure 6.8:** An example of John's social relations

The amount of social power John has over Tom is 9 and 8 over Ann which is set high for cultural reasons, as the family is from a collectivistic and high power distance culture. Since the culture of all agents, in this scenario, is parameterised as highly collectivistic with a high power distance score, we also use a social power parameter as another element to specify which agent can influence the behavior of another. Therefore, once the agent is created, all its relations with other agents are loaded from a knowledge base which lets the agent know how much social power he has over other agents. Figure 6.9 shows a screenshot of John's social relations. We can see how much social power the agent (John) has over the other two agents (John over Tom = 9 and over Ann = 8).



**Figure 6.9:** Screenshot of John's social relations

### 6.3 Cultural Goal Selection

The FATiMA architecture uses the Belief-Desire-Intention (BDI) concept in its agent design. In FATiMA, Beliefs are represented in the form of a Knowledge-base where the agent stores information and its beliefs about itself and other agents in the world, FATiMA Goals correspond to Desires in BDI whereas Intentions in FATiMA correspond to Intentions in BDI.

Chapter 3 discussed how goals and intentions are presented in FATiMA and how intentions are applied to choose which goal to fulfil first and how intentions are then developed into a set of plans for achieving the goals. This shows the difference between goals and intentions and the way they affect each other.

Goals refer to generic goals whereas Intentions refer to their concrete realization. For

instance, an agent can activate the generic goal of GetApproval when the agent lives with its parents and wants to get married (goal activation conditions). If the agent meets his father, the activation process will create a specific intention to GetApproval from the agent's father.

Once the goal activation conditions are verified and the intention to achieve the goal is added to the intention structure, then the deliberative process creates two initial emotions (Hope and Fear emotions) and associates them with the intention.

### 6.3.1 *Generate and Select Intention*

The importance of these initial emotions, Hope and Fear emotions, comes from their influence on the agent's behavior and all the decisions it is going to take. These emotions are very important to help select between competing intentions. Therefore, we believe that these initial emotions should be affected by the culture and social relationships of an agent to determine the intensity of its emotion.

To make characters' culture and relationships direct their intentions, we use them to affect the ways we determine the intensity of these two prospect-based emotions. Figure 5.3 in the previous chapter on page 78 shows how the initial Hope and Fear emotions are generated.

Hope and Fear emotions to achieve the intention and their intensity are determined from the social relationships in the Knowledge Base alongside the goal's importance of success and the plan's probability of success. Every time social relationship values increase or decrease among agents, the intensity of fear and hope emotions are changed.

To achieve this aim, we modified the formulas used in FAtiMA, see formulas (5.1), (5.2), to calculate the intensity of Hope/Fear emotions for each activated goal by considering the culture and differences of power between characters and target. Appendix E illustrates the coding of the initial Hope and Fear emotions implemented in this thesis.

Thus, the potential emotions in the Deliberative process will be calculated by the following formule (discussed in chapter 5):

$$HopeBasePotential = [p(plan)*IOS]*[(1+(10-IDY))+Hiy*|Power(g)-PR(g)|] \quad (6.1)$$

$$FearBasePotential = [(1-p(plan))*IOF]*[(1+(10-IDY))+Hiy*|Power(g)-PR(g)|] \quad (6.2)$$

Where,

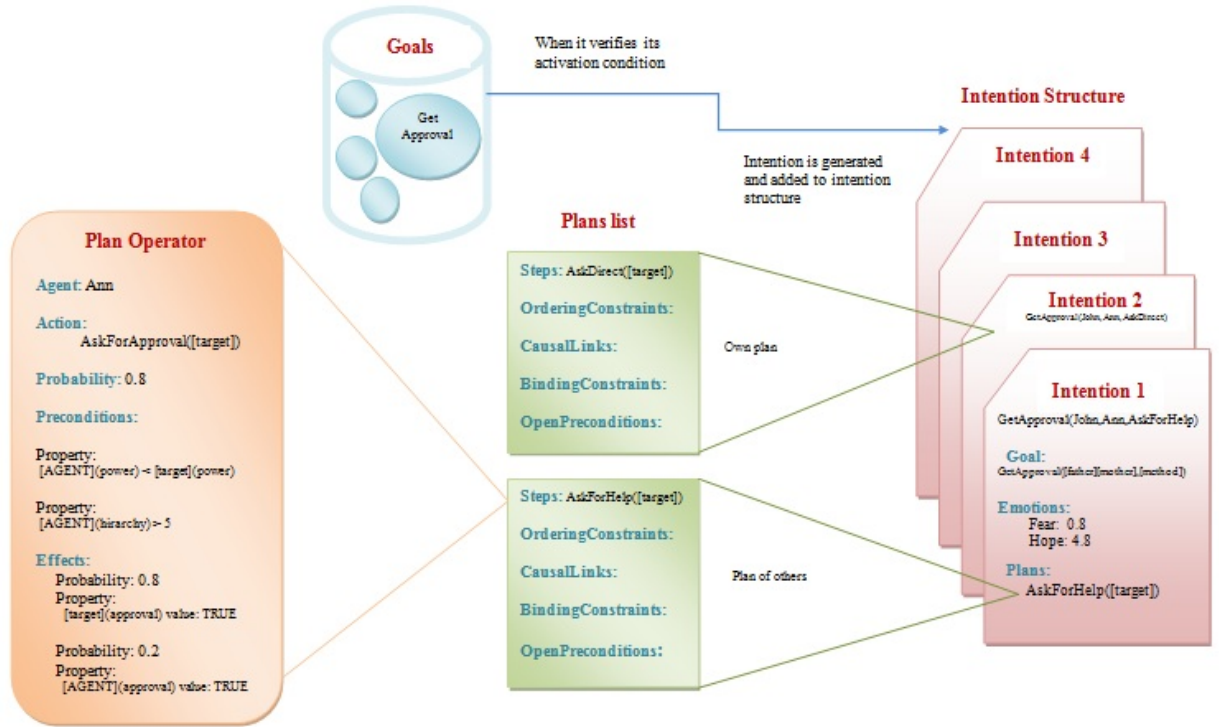
- $P(plan)$ : The plan probability “the probability of achieving all the plan’s success conditions”.
- $IOS$ : Goal’s Importance Of Success.
- $IOF$ : Goal’s Importance Of Failure.
- $IDY$ : The Identity dimensional score rated from 0 to 10 (high score means collectivistic culture and vice versa).
- $HIY$ : The Hierarchy dimensional score rated from 0 to 10 (high score means high power culture and vice versa).
- $Power(g)$ : The amount of power the target has over the character rated from 0 to 10.
- $PR(g)$ : The Liking relationship between the character and target, rated from 0 to 10.

As an example, we suppose that, the son “Tom” has the goal of “Get Approval”, which is activated when the son does not have approval and when he sees an approver. If the approver is his father “John”, the activation process will create a specific intention to



“Ask John for Approval”.

Then, the intention “Ask John for Approval” to achieve the Get Approval goal is added to the intention structure and a list of plans to achieve the intention is constructed by the planning process. Figure 6.10 shows an example of generate and select intention.

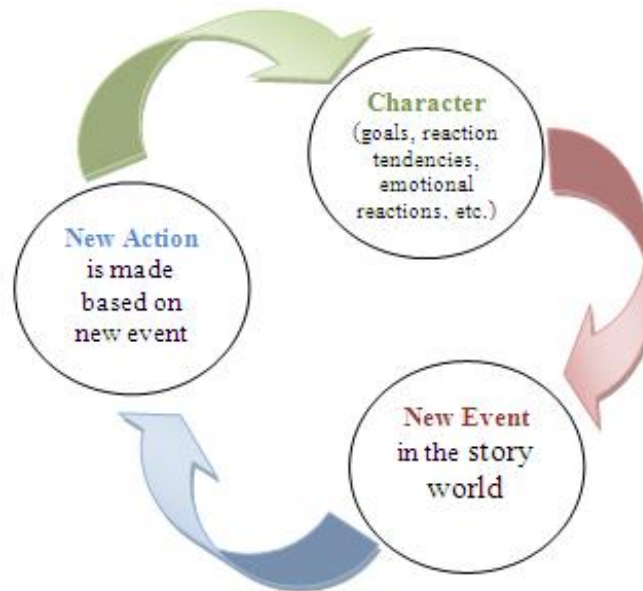


**Figure 6.10:** An example of generate and select intention

In our example, Tom will have access to a list of plans to achieve the intention. For each plan that comes into focus, initial prospect emotions “Fear/Hope” are created based on the plan’s probability and the goal’s importance. In an emotional planner, if the emotion intensity of a new intention is higher than the previous one, then the new emotion intensity will be considered as the highest and the maximal attention will be paid, by the agent, to the new intention. After a set of intentions has been constructed, the Deliberative process gets the most relevant intention “the one supported by the strongest emotions”. Once the planner has selected one intention, it will try to achieve the goal success conditions as the final step preconditions.

## 6.4 Scenario Implementation

The implementation used for the scenario is to give characters a certain amount of information about themselves (goals, action tendencies, emotional reactions, etc.) and to immerse them into the story world/given situation. The reactions generated by the characters, as a result of their goals and emotional state, generate further reactions and take the story forward from that point. The following Figure 6.11 shows the development process.



**Figure 6.11:** The development process

The scenario starts with the event where Tom meets and greets Ann and Ann greets him back (actions that have a positive effect on both characters). All characters participate in the event, the intensity of their relationship is updated according to the event's predefined effects.

As previously mentioned in chapter 4 (The FAtiMA architecture) the Emotional Reaction Rules are responsible for dynamically changing the interpersonal relations between agents. These emotions can be seen as a feed-back mechanism that allows the agent

to realize the effect of a given event on its well being. For instance, when Tom (son) receives an event that his marriage approval has been refused by John (father), he feels very unpleasant emotions, thus lowering his “like” relation with John. The following Table 6.3 shows the influence of some emotions on the “like” relation.

Decreases the like relation	Increases the like relation
Gloating	Pity
Resentment	Happy-for
Distress	Joy
Reproach	Admiration

**Table 6.3:** Influence of Emotions on like relation

Also, when an event happens, the associated action can have a predefined effect that is used to update the “Like” and “Power” relationships. Appendix D shows a list of goals and their effects on characters’ relationships.

In our scenarios the initial values of “Like” and “Power” relationships are predefined in each character’s role file. Figure 6.12 shows the predefined relationships between characters. These relationships are stored in the Knowledge Base and change dynamically as characters interact (see Appendix F).

```

Tom
<Relation target="John" like="5" power="2"/>
<Relation target="Ann" like="8" power="2"/>

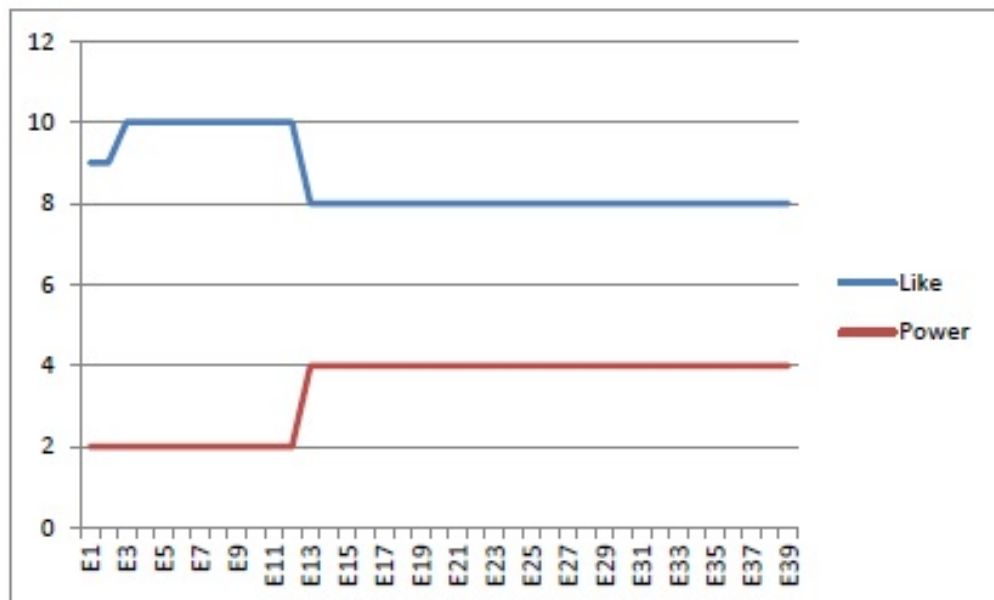
John
<Relation target="Tom" like="7" power="7"/>
<Relation target="Ann" like="8" power="5"/>

Ann
<Relation target="John" like="9" power="2"/>
<Relation target="Tom" like="9" power="5"/>

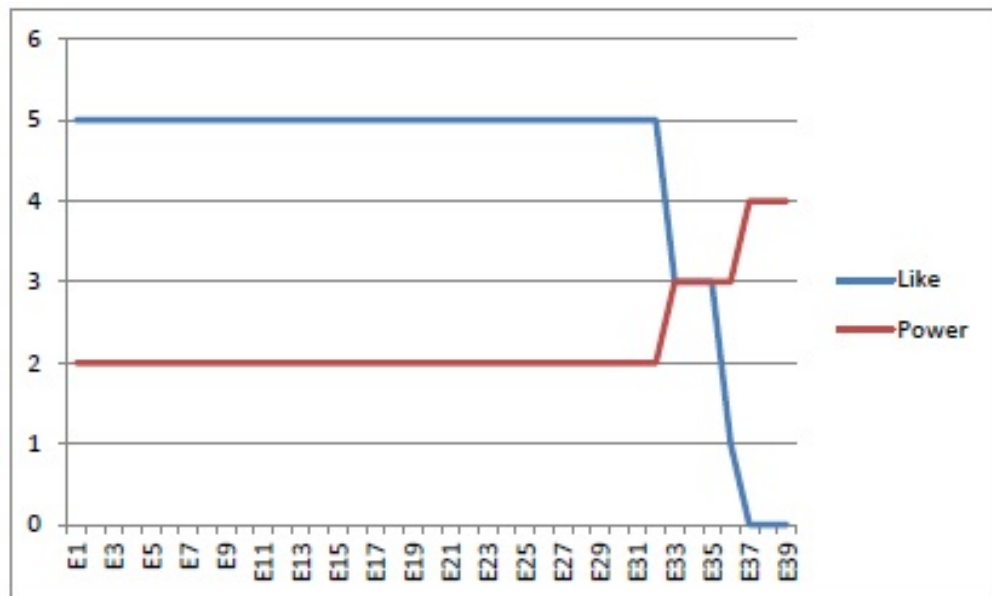
```

**Figure 6.12:** The predefined relationships between characters

Figure 6.13 and Figure 6.14 show how these relations change during the scenario between Tom and Ann and between Tom and John. The E (Event) indications in the following diagrams are defined in Appendix F.



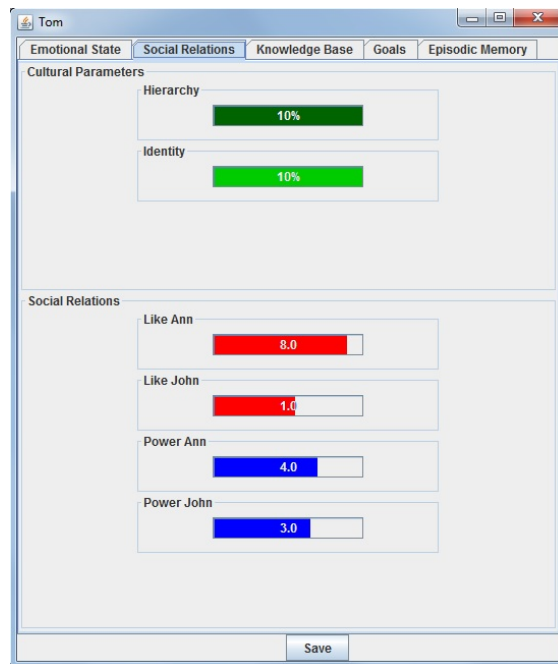
**Figure 6.13:** Like and Power relationships between Tom and Ann



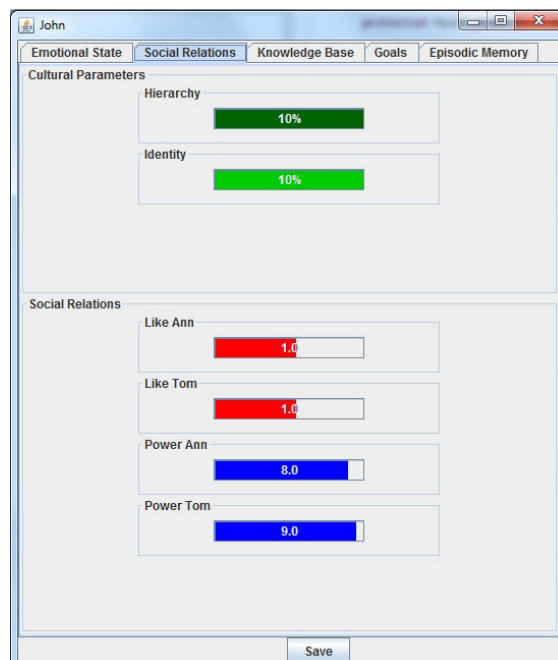
**Figure 6.14:** Like and Power relationships between Tom and John

The relationships between them stay constant until Ann Replies Negatively about the girl's father (E12); in this event Tom decreases his "like" relation with Ann. Also, we can see the change in relationship between Tom and John (E30 and E35) where Tom is receiving an event that his father does not agree with.

Figure 6.15 and Figure 6.16 was taken at the end of running the simulation. The figures display the intensity of their social relationships with each other. We can see that their social relationships are different from the initial values.

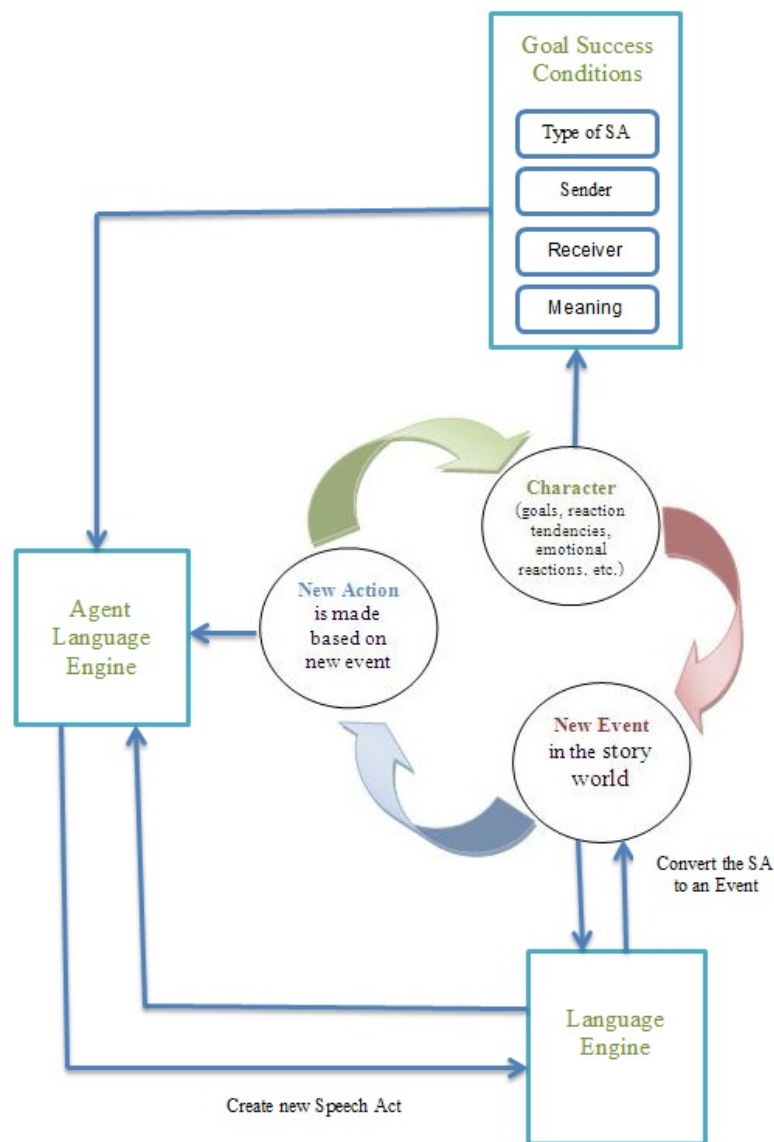


**Figure 6.15:** Social Relations of Tom



**Figure 6.16:** Social Relations of John

The model has been used to implement the agents and generate a story within a text-based version of the FAtiMA software. Since Natural Language Generation (NLG) is not part of our work, we use the same technique used in FAtiMA to generate the story by extracting the story text into an XML file. Figure 6.17 shows the scenario implementation process.



**Figure 6.17:** The Scenario Implementation process

We then use the FAtiMA natural language system (Language Engine) which is responsible for generating proper utterances for a requested “Speech Act”. A speech act is a

special type of action used to perform speech related actions. A speech act can be modelled as one of a set of types (e.g. Question, Reply).

The Speech Act is created from: the type of the speech act, the sender of the speech act (who is saying the speech), the receiver of the speech act and the speech act's meaning (Greeting, AskForHelp, etc).

Once all the information about the speech act is gathered, it is sent to a Language Engine to return the appropriate utterance for the speech act. For example, when “Tom” has a goal “Ask for Help” (see Figure 6.18 ), the activation process creates intention “Ask Ann for Help” and is added to the intention structure where a list of plans to achieve the intention is constructed by the planning process.

```
<ActivePursuitGoal name="AskForHelp([target])">
  <PreConditions>
    <Property name="[target](type)" value="character" operator="="/>
    <Property name="[target]" value="[SELF]" operator="!="/>
    <RecentEvent parameters="talkaboutgirl" action="Question" target="[target]"
      subject="[SELF]" occurred="true"/>
  </PreConditions>
  <SuccessConditions>
    <RecentEvent parameters="askforhelp" action="Question"
      target="[target]" subject="[SELF]" occurred="true"/>
  </SuccessConditions>
  <FailureConditions>
  </FailureConditions>
  <Effects>
  </Effects>
</ActivePursuitGoal>
```

**Figure 6.18:** Ask for Help Goal

For each plan “Fear/Hope” emotions are created based on some attributes (see figure 5.3).

After a set of intentions has been constructed, the deliberative process gets the most relevant intention “the one supported by the strongest emotion” and the planner will try to achieve the goal success conditions. All the attributes in the success conditions will be used to create a Speech Act: the type of speech act he wants to perform (AskForHelp



in this case), the sender of the speech act (Tom), and the receiver of the speech act (Ann). Afterwards all of this information will be sent to the Language Engine to get an appropriate utterance. The speech act with all information including the utterance [Tom says to Ann: please you have to talk to him] is then sent to the virtual world as an event and perceived by other agents, thus agents do not have to carry out NL understanding but get the action representation directly (see figure 6.17). Once “Ann” has received it, she will try to activate the “GiveHelp” goal (see Figure 6.19) and the activation process will create an intention “Give Help to Tom”.

```
<ActivePursuitGoal name="GiveHelp([target])">
  <PreConditions>
    <Property name="[target](type)" value="character" operator="="/>
    <Property name="[target]" value="[SELF]" operator="!="/>
    <RecentEvent parameters="askforhelp" action="Question" target="[SELF]"
      subject="[target]" occurred="true"/>
  </PreConditions>
  <SuccessConditions>
    <RecentEvent parameters="askforhelppositiveanswer" action="Question"
      target="[target]" subject="[SELF]" occurred="true"/>
  </SuccessConditions>
  <FailureConditions>
  </FailureConditions>
  <Effects>
  </Effects>
</ActivePursuitGoal>
```

**Figure 6.19:** Give Help Goal

The relationship (liking) between Ann and Tom is high, the social power is low, and the identity/hierarchy dimension is high. Thus, the base potential for the Hope emotion based on equation (6.1) will be high and Ann will try to achieve the goal success conditions. A Speech Act with all information will be created: [Ann says to Tom: I will try] and sent to the virtual world (see figure 6.17).

The story is composed of interacting agents who act a role and have their own personalities and goals. We aim to assess the agent behaviour in the story within a common format so that extraneous factors such as graphic quality, sound or user interaction do not influence the outcomes assessed. Therefore, the stories have been reduced to a text form and the interactions between agents recorded using Camtasia Studio software for screen recording and video editing. Figure 6.20 and Figure 6.21 show the screen-shots of recorded stories.

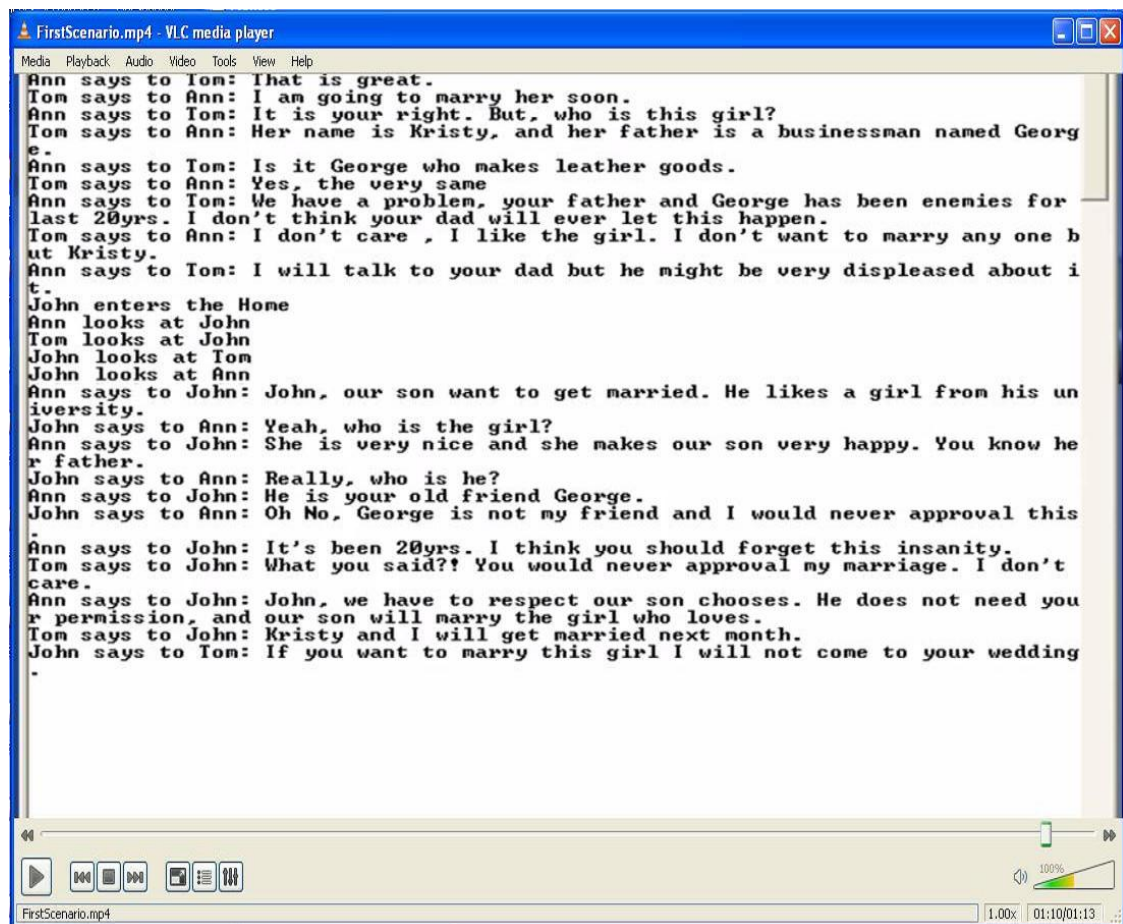
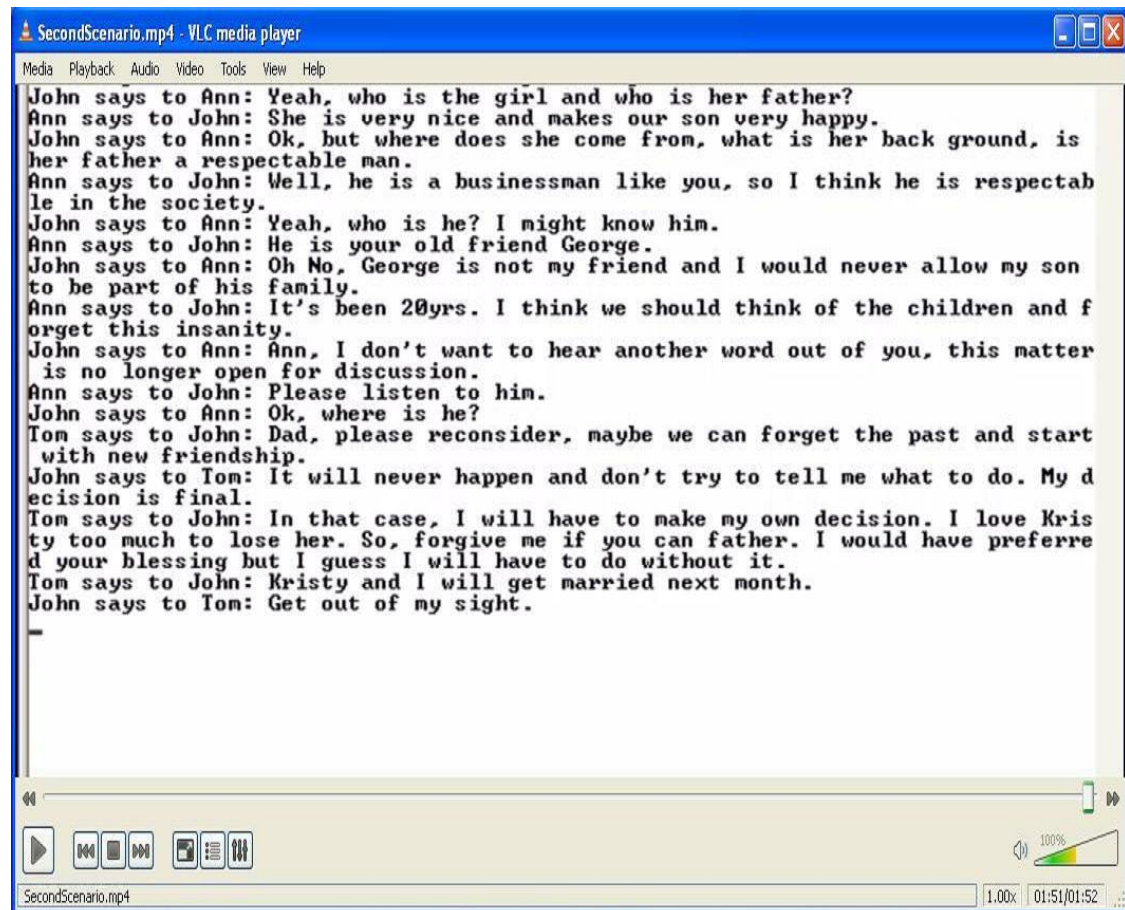


Figure 6.20: Screen-Shot for first scenario recording



**Figure 6.21:** Screen-Shot for second scenario recording

These recorded stories were then presented to the users to assess. We selected these stories as the character's behaviour is rated high for some actions (see the pilot test in next chapter). In the following chapter we will discuss the evaluation of these stories and the results.

## 6.5 Conclusion

The purpose of this chapter was to describe the implementation work of our cultural model. The implementation work for this thesis has been divided into two distinct sections, character definition and intention-selection within the agent goal selection mechanism, to meet the purpose of this research presented in chapter 1 and chapter 5.

We started by presenting the description and the functionality of the agent's components with examples of their configurations in the system. Additionally, we described the way goals and intentions are generated and selected and how culture and social relationship affect them. Finally, we showed the development process of scenario implementation. Chapter 7 describes and discusses the overall evaluation approach, and presents the results of two different experiments conducted in order to answer our research questions and prove the validity of our approach.

# Chapter 7

## Evaluation

### 7.1 Introduction

This chapter describes and discusses the evaluation and results of two different experiments that we have conducted using the Marriage Approval scenarios “see Appendix [B](#), [C](#)”.

It aims at evaluating the impact of cultural parameters both on agent behaviour and the perceptions of users. The question considered here is: do these cultural parameters contribute to creating synthetic characters which are perceived differently by users from different cultures?

The two scenarios that were employed for our research studies were carefully designed so that the stories are based on the same situation but contain different character behaviours.

The evaluation of an application based on user satisfaction and experience is known to be very difficult [[KM05](#)]. On the other hand, Riedl and Young [[RY05](#)] suggested that,

to have a successful story it must have an emotional impact on the readers. Also, that the story invokes attention from readers. In our evaluation we start each scenario by providing a scripted story background that introduces the characters, their relationships and the situation because Zillmann [Zil96] suggested that the reader needs a strong background about the characters so that they feel empathy about the situation in which the characters are involved.

In order to investigate whether the addition of culture to the synthetic character is recognised by users, experiments with real users were designed and divided into two phases: a pilot test and the full evaluation.

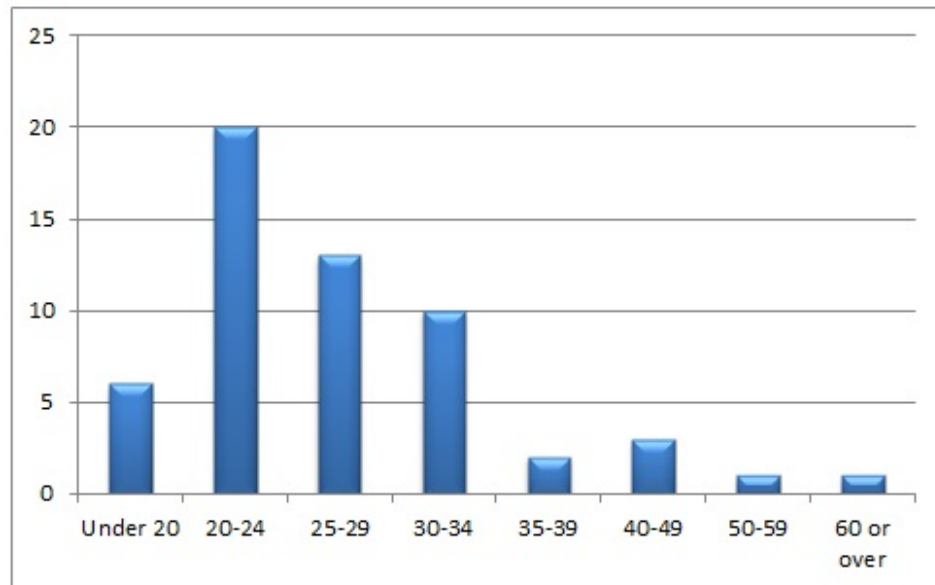
Therefore, this chapter starts with the participants that took part in our experiments, then we discuss the methodology and the main objective of the evaluation, followed by a pilot test aimed to investigate whether the questionnaire is helpful to measure our application, and then present the two different experiments, describing their differences and discussing their results.

## 7.2 Participants

The number of participants that took part in both experiments is  $N=59$  ( $M=43$ ;  $F=16$ ). We removed three of the participants from the experiments because their countries (France, Italy and Spain) are exceptions from the correlation between the power distance and collectivism dimensions based on Hofstede's finding [Hof03]. For example, France scores fairly high on power distance with a score of 68 but France's score on collectivism dimension (29) means it has an individualist society.

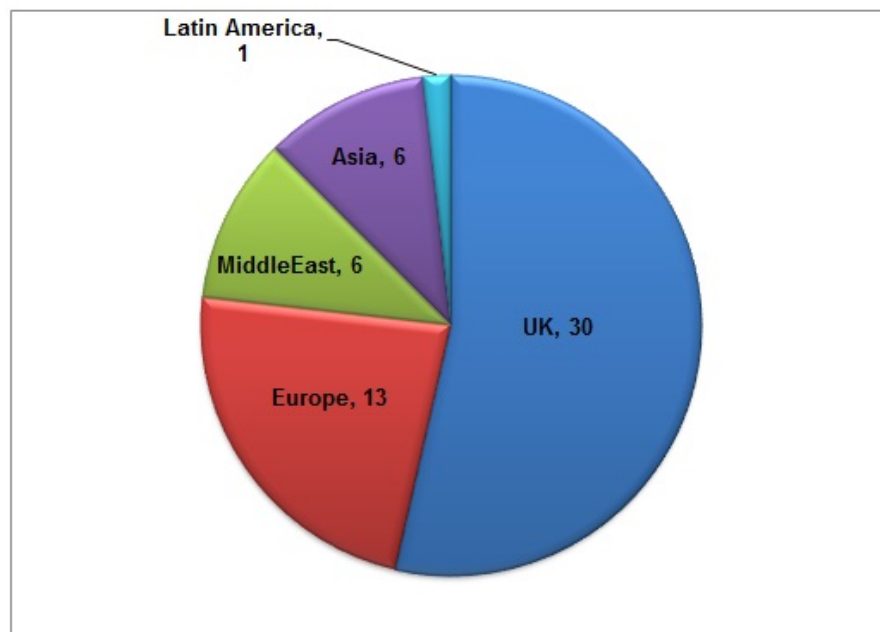
All participants were university students and staff. The age of 48 participants ranged from 20 to 49 years old with 6 participants under 20 and only 2 participants over 50.

Figure 7.1 shows the age distribution of the participants.



**Figure 7.1:** Age Distribution

Thirty participants are British and twenty six participants are from different nationalities. The following Figure 7.2 shows the geographical distribution of the participants. Fifty three of them spent their childhood years and all their life in their home countries. None of the non-British participants have lived in the UK longer than six months.



**Figure 7.2:** The Geographical Distribution

## 7.3 Evaluation Methodology

Since this evaluation aims to assess the agent behaviour, from the perspective of users, through the stories generated by the system, it is necessary to carry out the evaluation in two different experiments. In the first experiment we use the FAtiMA baseline where we only define each character with their goals and actions as discussed in chapter 4. The second experiment uses FAtiMA with our extensions.

To avoid extraneous factors such as graphic quality or specific user interaction modalities that can influence the outcome and play a role in the users' judgment, we use a text format for stories in both scenarios. The experimental setup for this evaluation was to generate stories through agents' interactions and present them to the users to evaluate agents' behaviours from their perspectives. Participants completed the evaluation by assessing the generated stories.

The evaluation plan was designed to assess our hypotheses; therefore we conducted a number of experiments to evaluate the model and answer the research questions. We used the marriage approval scenarios to investigate the behaviour of the two different groups of characters with and without cultural parameters. The same participants participated in both experiments each time and were asked to answer a questionnaire regarding both stories.

The aim of the pilot test is to improve the initial prototype of the proposed model during the design stage and to diagnose the possible errors that can occur. The pilot test for both scenarios was implemented. The pilot test and its finding are discussed in section 7.4.



In this research we formulated questionnaires covering issues such as users' background, users' attitude toward the story ... etc. "see Appendix [G](#)".

Furthermore, we used several question styles on the questioners namely, the Likert scale, open answer questions and multiple choice questions. In order to provide more flexibility to the participant for expressing varying degrees of agreement, it was decided to mark questions on a 5-point Likert scale. Participants had to choose a number on a scale from 1 to 5; it gives participants more scope to express what they thought fit best with the characters.

As mentioned earlier, we sent an email to all university students and staff to introduce our online experiments and asked them to participate in both experiments "see Appendix [H](#)".

This study uses repeated measures (or 'within-subjects') designs with the same participants in both experiments.

This kind of research has two sides [[Hay00](#)]: collecting the data that we need, and making sense out of it, so we can understand what it means. Therefore, after collecting the data by using the questionnaires, we analyse the data using statistical tests.

The evaluation methodology has been designed in order to answer the research questions defined in chapter [1](#). For the first research question: "What is the effect of the cultural dimensions in the synthetic characters' behaviour?" we expect users to assess characters, in the second scenario, as displaying more "anger" than in the first scenario (see section [2.4](#)).

The second research question: "What differences in motivations do observers attribute to synthetic characters, when different cultural parameters and social power are embedded in the "mind" of synthetic characters?" we expect that the agents' behaviour in the second story, generated by using cultural and social parameters, to score higher "based on

two categories Collectivistic/High Power” than the agent’s behaviour in the first scenario generated by using the FAtiMA base-line model.

Whereas, for the third research question: “Do users from different cultures perceive the different agent cultures differently?” we expect that the participants from a similar culture to the characters’ culture, as defined by Hofstede, will rank the character’s behaviour as more believable.

### 7.3.1 Variables and Measurement

We aim to manipulate the variables (culture and social power) to observe their effect on agent behaviour. Therefore, cultural parameters will be called the independent variable (because their values depend on the experimental designer), whereas the perception of the agent behaviour, as an outcome of the system, is a dependent variable (because its value depends on the culture and social power parameters). Table 7.1 shows the independent and dependent variables in our research based on our research questions.

No.	Questions	Independent variables	Dependent variables
Q1	What is the effect of the cultural dimensions in the synthetic characters' behaviour?	Agent's culture and social power.	The perception of behaviour <i>"especially the level of angry adjective in agents' behaviour perceived by the users."</i>
Q2	What differences in motivations do observers attribute to synthetic characters, when different cultural parameters and social power are embedded in the "mind" of synthetic characters?	Agent's culture and social power.	Users' perceptions of agent behaviour. <i>"questions classified into two different categories to assess the agent behaviour based on Collectivistic/High Power distance culture"</i>
Q3	Do users from different cultures perceive the different agent cultures differently?	Participant's culture and agent's culture.	Participant's judgment. <i>"participants from Collectivistic/High Power distance culture will perceive the agents behaviour more believable"</i>

**Table 7.1:** Independent and Dependent variables

Once we identify what to measure and what to manipulate, we then need to select an appropriate tool for measuring [FH03]. The questionnaires are one of the evaluation techniques used to collect the users' opinions [Gen05]. Furthermore, a questionnaire consists of a group of questions and answers used for gathering information from the user about the system [AGT<sup>+</sup>04]. The questions may be open-ended or fixed choice. Self-report/questionnaires are a good tool to use in our research to measure participants'

beliefs and feelings about our scenarios, and assess their subjective experience after taking part in the experiments. Furthermore, we use several question styles in the questionnaires. Most of the questions use a 5-point Likert scale; this type of scale consists of a statement to which participants can express varying degrees of agreement.

We also use open answer questions as well as multiple choice questions. The open answer questions are used to extract participants' opinions about scenarios and characters. This part of the questionnaire is applied at the end of each scenario and all participants are requested to complete it. This helps to determine the effect of the characters and scenarios on the participant. Participants could take as long as necessary to complete the test.

### *7.3.2 Statistical Test*

One fundamental aspect of the experimental design for us is to choose an appropriate statistical test for analysing the data obtained from it.

There are several factors to take into account when selecting statistical tests. As we know, it is important to decide what to measure and how to analyse the data and which statistics we intend to use in the experimental design stage.

In order to answer these questions, we have to conduct a first statistical test to see if our data are parametric or nonparametric using SPSS (the most popular statistical package). We use the two tests that SPSS provides (Kolmogorov-Smirnov and Shapiro-Wilk tests). These tests compare the set of scores in the sample to a normally distributed set of scores with the same mean and standard deviation. If  $P > 0.05$  "the test is non-significant" and the distribution of the sample is normal; if  $P < 0.05$  "the test is significant" and the distribution is non-normal.

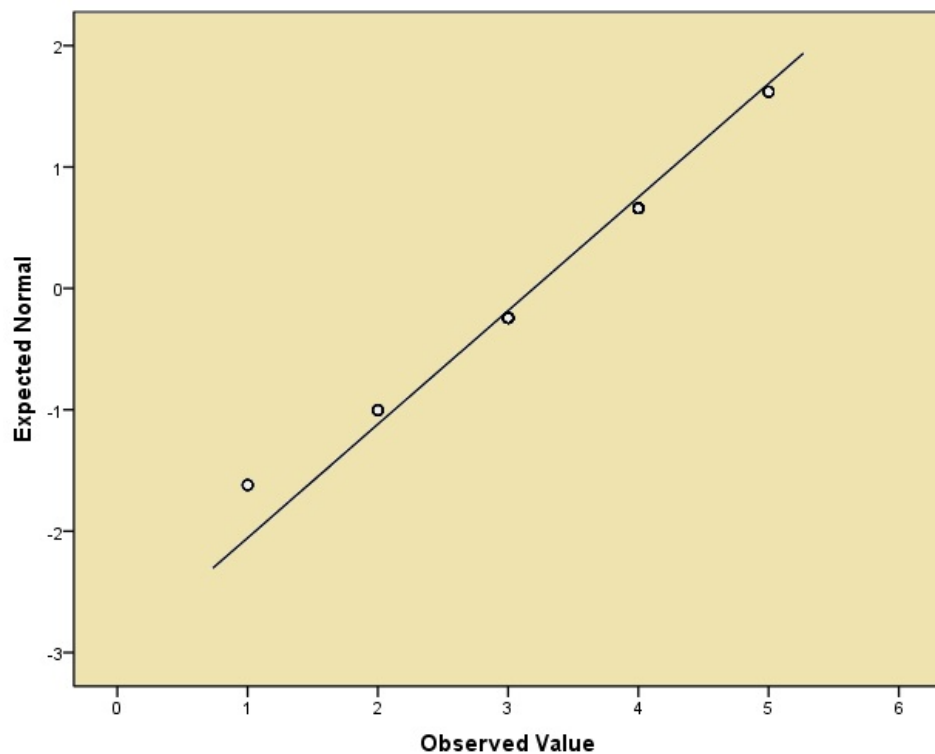
Tests of Normality						
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Q1	.213	56	.000	.899	56	.000
Q2	.212	56	.000	.881	56	.000

a. Lilliefors Significance Correction

**Figure 7.3:** Test of Normality

The result in SPSS can be seen in Figure 7.3 indicating that the test is highly significant for both questions ( $P=0.000 < 0.05$ ). This means that, the distribution is not normal.

Both Figure 7.3 and Figure 7.4 tell us that we cannot use a parametric test, because the assumption of normality is not tenable.

**Figure 7.4:** Normal Q-Q Plots

We also used the flow-chart (see Appendix I) to decide which statistical test is most appropriate for our data. Therefore, in this study, Wilcoxon, Chi-Square and Mann-Whitney tests have been used to answer our research questions.

## 7.4 Pilot Test

### 7.4.1 Aim

In order to investigate whether the questionnaire (see Appendices [J](#), [K](#), [L](#)) is a good tool for the experiments, a pilot test for questionnaires with a small number of participants was conducted to get feedback and comments about the two story scenarios and to make enhancements to both questionnaire and story.

Seven participants, five males and two females from five different nationalities (Libyan, Malaysian, Saudi Arabian, Indian, German) were involved in the pilot test.

The questionnaire was divided into three parts: in the first one (see Appendix [J](#)), participants were asked general questions.

The first 15 general questions were designed to assess the type of participants “What the participant’s culture is”. These were applied in Hofstede’s study [[HH05](#)].

After that, the first scenario was provided. In the first scenario, the story takes place without an explicit cultural model using the baseline FAtiMA system. Participants were asked to answer the second part of the questionnaire (see Appendix [J](#)) “6 questions” about this scenario and to comment on each character and give their general opinion about the first scenario.

The same steps were then conducted for the second scenario where we tried to simulate a story that could occur in a high power collectivistic culture.

At the end, in a third questionnaire, (see Appendix [J](#)) we asked 4 questions about participants’ gender, age and nationality for statistical purposes.

### 7.4.2 Findings and Refinements

The pilot test validated the ease of use of the questionnaire to evaluate our scenarios. One important bit of feedback received concerned the structure of the questionnaire and the 5 point Likert scale. When we designed the 5-point Likert scale we did not follow the rules of design for questions (Q5, Q9, and Q12). In this type of question, answers must take the same “trend” from positive to negative or from negative to positive.

Another comment concerned the number of questions, because a long questionnaire might lead participants to lose their motivation to answer all the questions. Therefore, we refined the questionnaire and reduced the number of questions from 35 questions to 28 questions (see Appendix G for final questionnaire). The structure of the questions must follow the rule that the answers take the same trend from positive to negative or from negative to positive which we did not take in to account when we designed the questionnaire. Therefore, we solved this problem in some questions.

Regarding the questions about the scenarios: four participants saw the son, in the first scenario, as a disrespectful person and felt that tension within the family was high. They described the characters as selfish characters.

Second scenario: we can see in all participants’ comments a different description of characters from the first scenario. Four participants do not agree with the father’s decision and took the son’s side. They described the father as a ‘macho’, ‘stubborn’ and ‘strict man’ who does not listen to others and thinks he knows what is good for his son. While the son was described as ‘very polite’, ‘sensitive’ and showing ‘respect’ to his family. Three participants described the mother’s behaviour as typical and natural. Three of seven participants found this scenario typical and that this situation always happens in their home countries.

Additionally, 4 out of 7 participants relate the differences between the two scenarios to

both the culture and the personality of the characters and two participants related it only to the personality; while one participant related it only to the characters' culture. The feedback from the participants is provided in Appendix M.

## 7.5 Questionnaires

The questionnaire used in our study was located online by using “free online surveys”

<http://freeonlinesurveys.com/rendersurvey.asp?sid=p8jyyn33d6c47zd825421>

to make it easy for participants to take part in our study and answer the questions. It also gave easy access to many participants and made collecting the data easier.

We took into consideration the comments from the pilot test mentioned in subsection 7.4.2. Therefore, in our evaluation we divided the questionnaire into three parts. “See Appendix G”.

Questionnaire A was answered before running the application and is used to identify the participant's background, using 5-point Likert scale questions. Question 1 is used to see if the participant has an ability to know what other people are feeling. The questions (2,3,4,5 and 6) are used to identify the participant's culture, whether a collectivistic/individualistic or high/low power distance culture, by rating the answer from very important or strongly agree to very little/not important or strongly disagree.

Questionnaire B is applied right after the participant has watched the first scenario recording. The first four questions (7, 8, 9 and 10) ask participants to assess the characters' behaviour and participants' feelings in the first scenario. In addition to these first questions, another Likert-scale question (11) and two open answer questions (12 and 13) obtain the participants' subjective opinions regarding the characters and the scenario.



They were requested to write down a few words to describe each character and their opinion about this scenario in their own words. They were also asked to rate their level of agreement with the son's reaction.

Questionnaire C, taken after running the second scenario, is similar to questionnaire B. The first five questions (15, 16, 17, 18 and 19) ask participants to assess the characters' behaviour and feelings. Furthermore, question (20) was asked to rate their level of agreement with the son's reaction and they are asked, in question (21), to describe each character. Question (22) requested participants to give their opinion about this scenario.

Finally, participants were asked to relate the differences in both scenarios to culture/personality or both. At the end, we asked participants questions about themselves (gender, age, nationality and in what country they spent their childhood) for statistical purposes.

## 7.6 First Experiment

Since we are interested in the impact of a culture model and social power on synthetic character behaviour, we had to ensure that the only difference between the different versions of the software used in experiments was the presence or absence of a model of culture.

Therefore, in this experiment, the FAtiMA baseline without any adaptation has been used as discussed in chapter 4. In this first scenario, agents have their own personalities, roles and goals to interact with each other and make decisions about the world environment. The design of this first experiment consisted of using the online questionnaire, see Appendix G, which started by asking the participants some pre-test questions (from Q1 to

Q6) to collect some information about their culture and their opinion about the situations posed in the questionnaire.

Afterwards, a brief introduction about the story and characters is given and the participants are asked to watch the first scenario recording, Figure 7.5 shows a screen-shot. The full story can be read in Appendix B

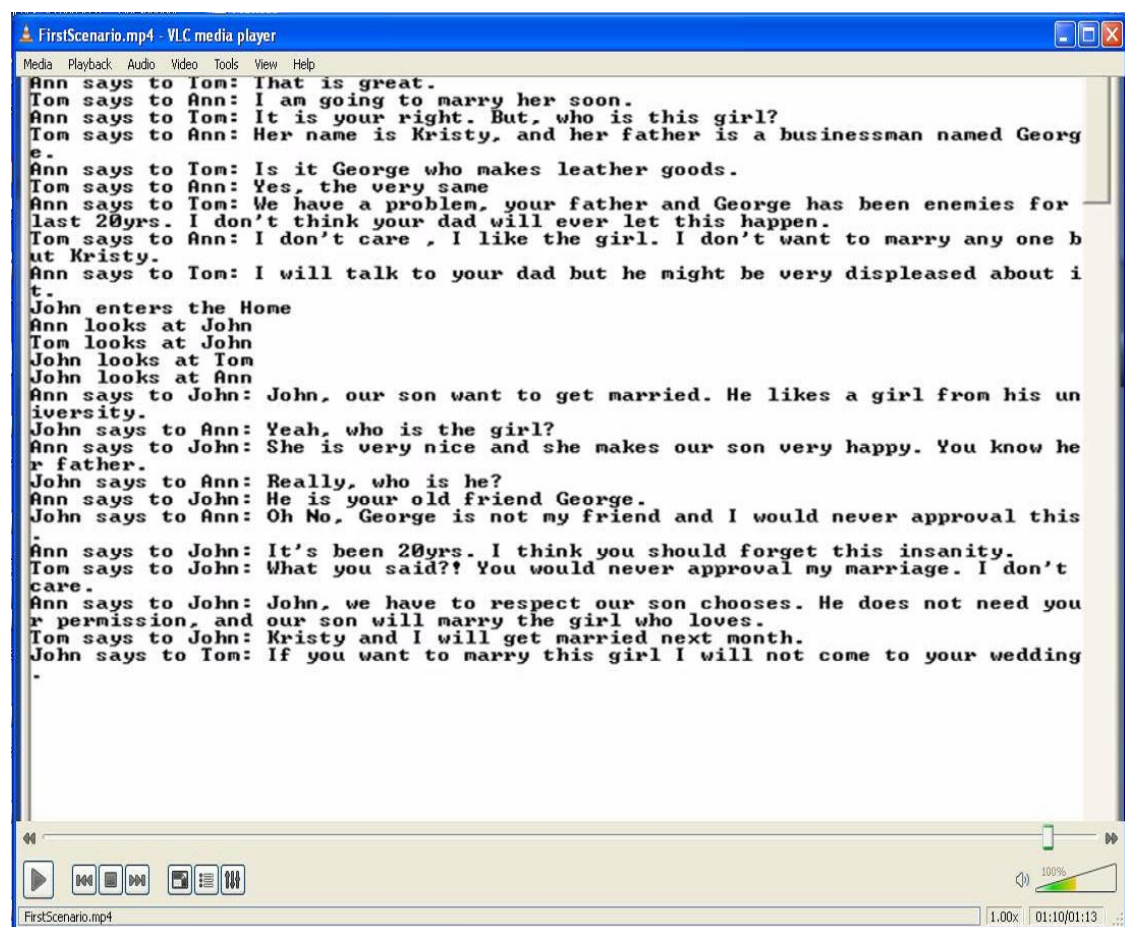
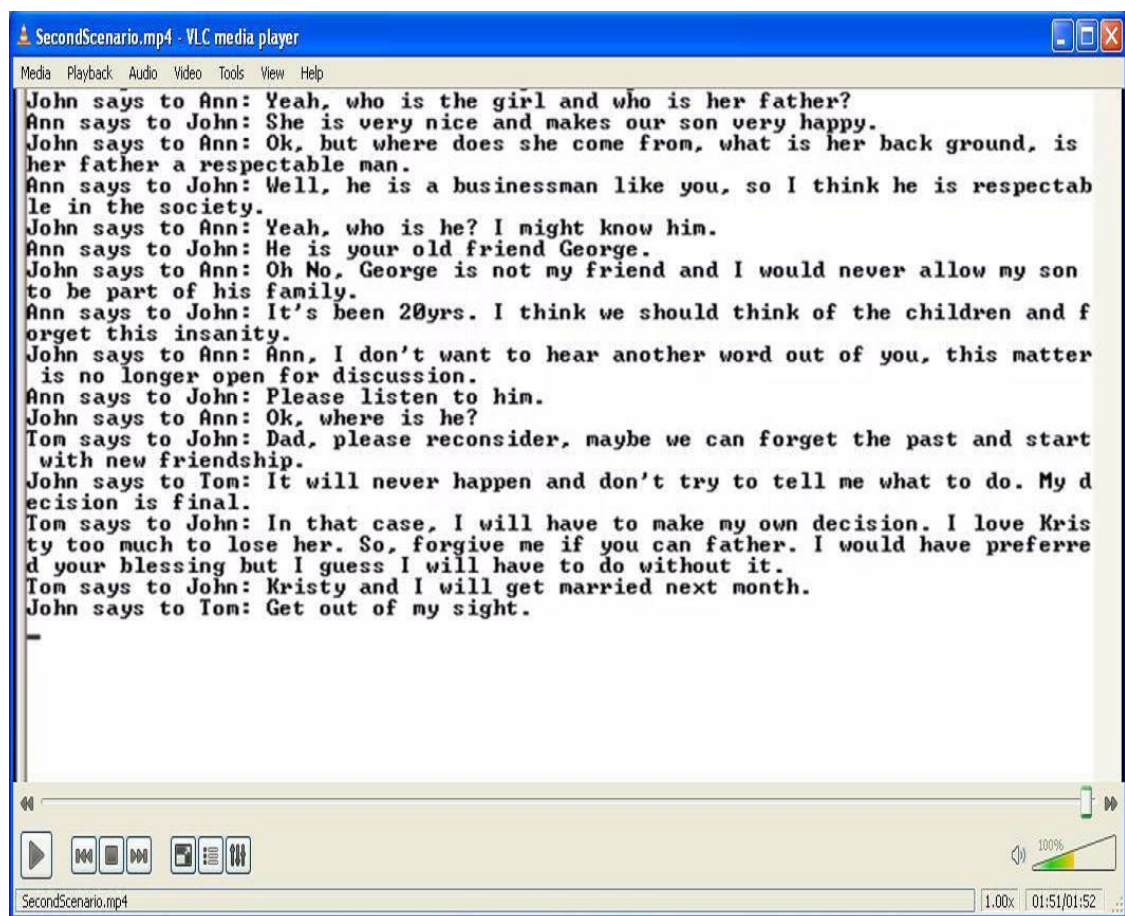


Figure 7.5: Screen-Shot for first scenario recording

They are then asked to answer a group of questions about the characters. We finish these questions by asking for their opinions about the characters and the scenario.

## 7.7 Second Experiment

After finishing the first experiment, the participants were asked to watch the second recording, Figure 7.6 shows the second scenario screen-shot ”The full story can be read in Appendix C”. Again they are asked to answer a group of questions.



**Figure 7.6:** Screen-Shot for second scenario recording

The distinguishing factor in this experiment is that the dominant emotions for the agent generated in this experiment relate to the additional parameters added to the model used in the first experiment and discussed in chapters 5 and 6.

After participants have seen both recordings and given their opinion about both scenarios, the questionnaire assesses the impact of the agents' behaviour on the participants in both recordings. It asks whether they believe the differences are related or caused by the culture of the characters, or by their personalities, or by neither. Finally we asked participants questions about their gender, age, nationality and how long they lived in the UK and where they spent their childhood years.

## 7.8 Results

In order to demonstrate the validity of our approach, in this evaluation process, we have identified specific expected outcomes for each research question.

### 7.8.1 *Question 1*

*“What is the effect of the cultural dimensions on the synthetic characters' behaviour?”*

As we mentioned earlier in chapter 2 there are relationships between cultural dimensions and the type of behaviour they produce. For instance, a character with high power would feel anger if another character with low power refused to follow its instructions (goal failure). Therefore, we will see if there is a significant effect of the cultural dimensions on the synthetic characters' behaviour specifically on the anger adjective.

We would expect users to assess characters as displaying more anger and thus compare the scores for the questions (see table 7.2) relating to user perception of character anger.

Question	Dimension
Please rate to what degree Tom appeared angry.	High Power distance
Please rate to what degree John appeared angry.	High Power distance

**Table 7.2:** Participants' adjective classification

To answer this question, we conduct a statistical test to evaluate the angry adjective. Table 7.2 shows participants' adjective classification.

We used the Wilcoxon test to look for differences in ranked positions of scores *for the anger adjective*, in the two experiments.

The result, in Figure 7.7, was statistically significant ( $P=0.014 < 0.05$ ). Which signifies that the cultural parameters had influence on this particular adjective and the characters in the first scenario are perceived by the participants as less angry than in the second scenario.

Test Statistics <sup>b</sup>	
	Q2 - Q1
Z	-2.574 <sup>a</sup>
Asymp. Sig. (2-tailed)	.010

a. Based on negative ranks.  
b. Wilcoxon Signed Ranks Test

**Figure 7.7:** Wilcoxon Test for anger adjective

We applied a Wilcoxon test once more to check if we would get different results if we split the participants based on their culture. Therefore, we used Hofstede's finding (see Table 7.4) and divided the participants into two culture groups: individualist low-power culture and collectivist high-power culture. Based on that, we have 36 participants from culture one and 20 participants from culture two.

The results are shown in Figure 7.8 and Figure 7.9. There were no significant distinctions between results, for individualistic participants ( $P=.272$ ), in the first and second scenar-

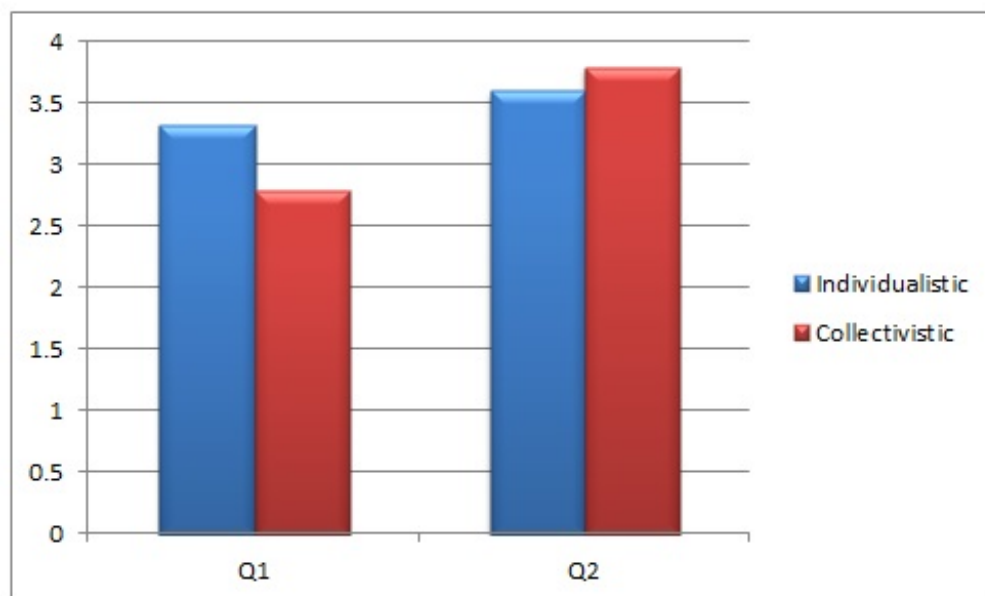
ios. However, collectivist participants ( $P=.005$ ) showed significantly different results in the scenario ranking. This is interesting as it suggests that the collectivist participants see a difference between the anger of characters in the two scenarios while individualist participants do not see a difference between the anger of the characters in the two scenarios.

Test Statistics <sup>a</sup>		
Group		Q2 - Q1
Individualistic	Z	-1.100 <sup>a</sup>
	Asymp. Sig. (2-tailed)	.272
Collectivistic	Z	-2.790 <sup>a</sup>
	Asymp. Sig. (2-tailed)	.005

a. Based on negative ranks.

b. Wilcoxon Signed Ranks Test

**Figure 7.8:** Wilcoxon Test for each group



**Figure 7.9:** Anger ranking in both scenarios

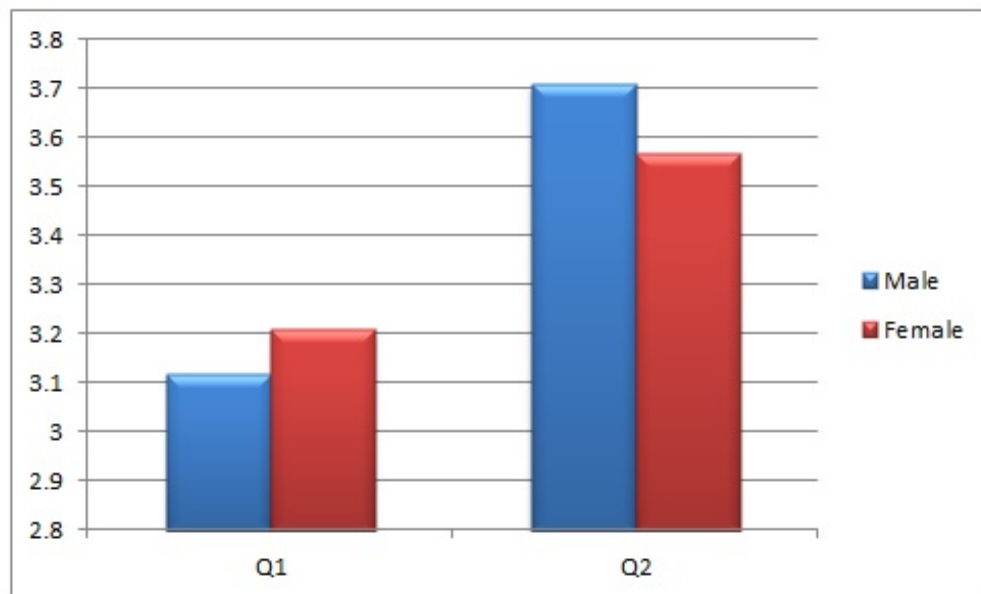
Due to differences between the numbers of men to women who participated in this evaluation, we conduct a Wilcoxon test to see if there are differences in the way the anger adjective, in both scenarios, is appreciated by genders. Figure 7.10 and Figure 7.11 show the Wilcoxon result and the ranking of anger adjective based on the gender of test subjects.

Test Statistics <sup>b</sup>		
Gender		Q2 - Q1
Male	Z	-2.365 <sup>a</sup>
	Asymp. Sig. (2-tailed)	.018
Female	Z	-1.046 <sup>a</sup>
	Asymp. Sig. (2-tailed)	.296

a. Based on negative ranks.

b. Wilcoxon Signed Ranks Test

**Figure 7.10:** Wilcoxon test for Q1Q2 Male/Female



**Figure 7.11:** Comparison of Male/Female participants' rating for Anger Adjective

The results for Male participants showed that a significant difference is detected ( $P=0.018<0.05$ ). Men appreciated anger differently, men ranking the anger adjective in the second scenario higher than in the first scenario. Whilst there are no significant differences for Female participants in both scenarios.

### 7.8.2 Question 2

*“What differences in motivation do observers attribute to synthetic characters, when different cultural parameters and social power are embedded in the “mind” of synthetic characters?”*

The objective of this question is to check if participants could recognise cultural differences between the characters' behaviours in the two scenarios.

Therefore, for this question, we expect that, the first scenario (generated via FAtiMA baseline) should score lower than the second scenario (generated via FAtiMA+culture) in terms of some categories/variables (Collectivistic and High Power distance in both scenarios).

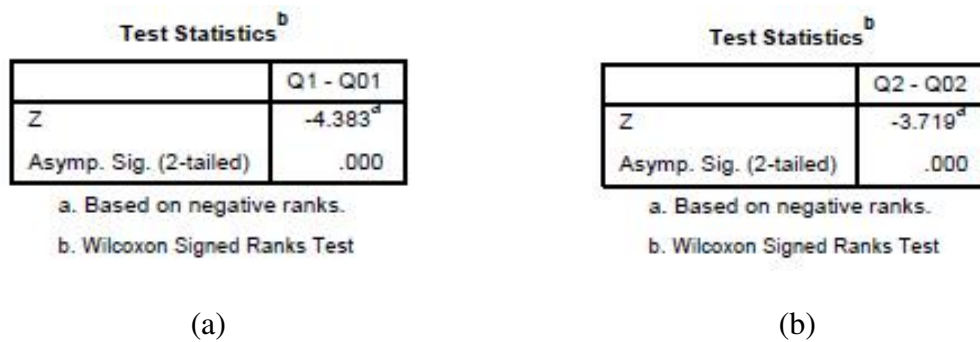
Table 7.3 shows the questions elated to Collectivism and High Power distance asked after each scenario.

Question	Dimension
Please rate to what degree Tom appeared concerned about getting marriage approval.	Collectivism
Please rate to what degree Tom was intimidated by his father.	High Power distance

**Table 7.3:** Questions classification

The results shown below in Figure 7.12 contribute to answering research Question 2. These results obtained from Q1 and Q2 (see Table 7.3) reflect participants' perspective on the ranking of the two scenarios. We used a Wilcoxon test for Q1 in the first and second scenarios for all participants. We repeated the same test for Q2. The result is highly significant ( $p=.000$ ) for both questions.

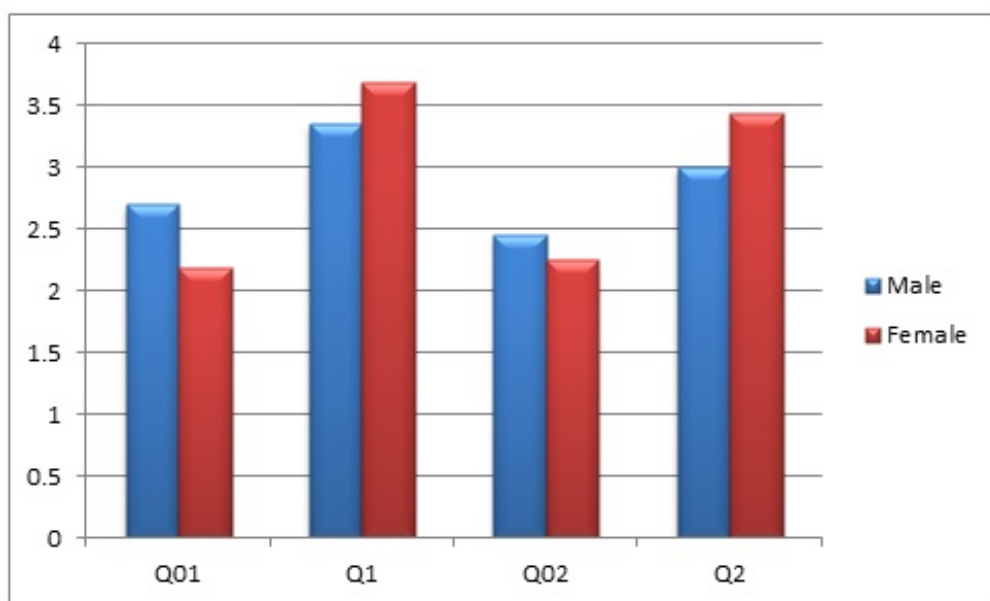




**Figure 7.12:** (a) Wilcoxon Test for Q1. (b) Wilcoxon Test for Q2

The results indicate clearly that characters in the second scenario, generated by our model, scored high for collectivism and power distance.

Gender differentiation is also observed, their rating varies and women felt more strongly about Tom's concerns in the second scenario than their male counterparts, and vice versa in the first scenario. Figure 7.13 shows the two scenarios ranking based on the gender of test subjects.



**Figure 7.13:** The two scenarios ranking Male/Female

### 7.8.3 Question 3

*“Do users from different cultures perceive the different agent cultures differently?”*

For this question we expect that the results in the second scenario will also be impacted by participants’ culture so some participants will perceive the scenario as more realistic or like their culture whilst participants from other cultures would view behaviour more negatively and score lower.

To achieve that, we classified participants to one of two cultures (Collectivistic High-Power or Individualistic Low-Power culture) based on Hofstede’s study. Table 7.4 and Figure 7.14 show the ratings of the eighteen countries that our subjects related to, according to Hofstede’s finding from a large empirical study of IBM’s employees in more than seventy countries.

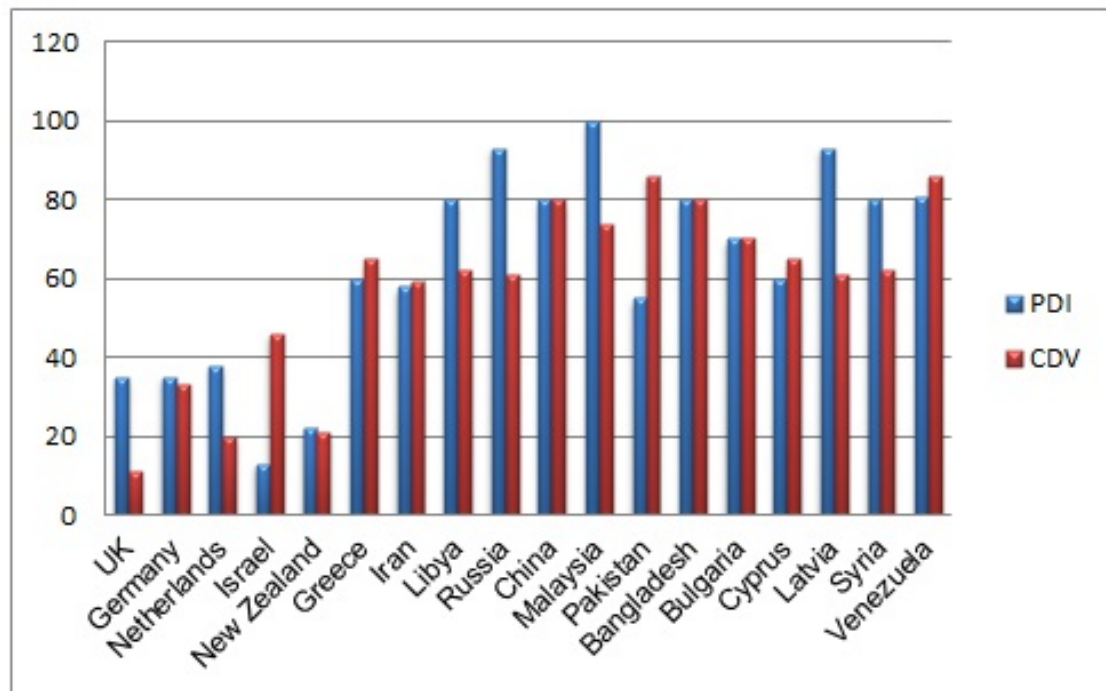
Hofstede rates each dimensional score from 0 to 100. The dimension value 0 indicates extremely low in Power Distance, Collectivism, Masculinity, etc. 50 indicates neutral, and 100 extremely high in Power Distance, Collectivism, Masculinity, etc.

Based on that we have 36 participants from five Individualistic/Low power culture countries and 20 participants from thirteen Collectivistic/High power culture countries.

Countries	Hofstede's finding	
	PDI	CDV
UK	35	11
Germany	35	33
Netherlands	38	20
Israel	13	46
New Zealand	22	21
Greece	60	65
Iran	58	59
Libya	80	62
Russia	93	61
China	80	80
Malaysia	100	74
Pakistan	55	86
Bangladesh	80	80
Bulgaria	70	70
Cyprus	60	65
Latvia	93	61
Syria	80	62
Venezuela	81	86

PDI : Power Distance Index  
low = small power distance  
CDV : Collectivism  
low = individualist  
Red : Low Power Individualist Culture  
Cyan : High Power Collectivism Culture

**Table 7.4:** Hofstede's ratings for participants' countries



**Figure 7.14:** Hofstede's findings

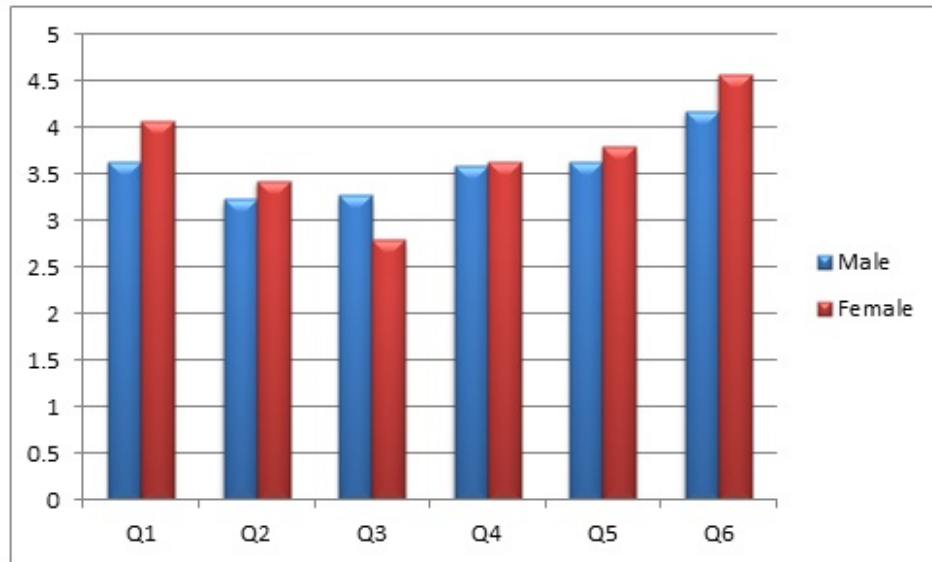
In order to gain a clearer idea of the validity of our assumption, in Question 3, we applied a Chi-Square test just to see if there is a relationship between two variables (participants' culture and all their answers).

The result (see Appendix N) indicates that there is no statistically significant association between the participants' culture and their opinion about the scenario ( $p > 0.05$ ). It therefore contributes negatively to the hypothesis that the participant's culture has an effect on their judgment about characters' behaviour. All the Chi-Square results obtained for this question are available in Appendix N.

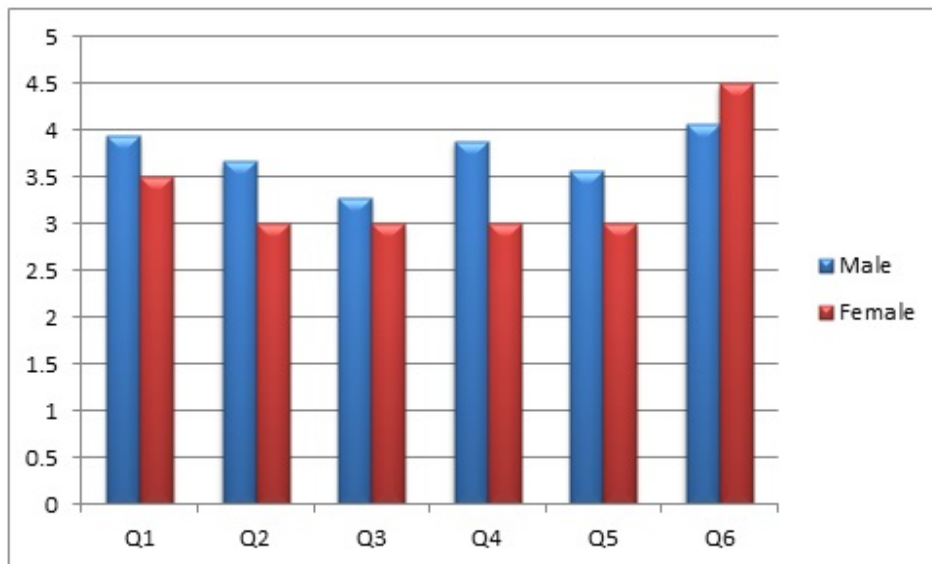
We also split the participants based on their gender in each culture. Figure 7.15 and Figure 7.16 show the overall ranking of the first and second scenarios based on the gender of test subjects.

A first observation is that the second scenario has been ranked differently by both men

and women from each culture. Fourteen females in Individualistic/Low power culture and eighteen males in Collectivistic/High power culture rank the second scenario slightly superior to their male and female counterparts.



**Figure 7.15:** Individualistic/Low power Male/Female ranking



**Figure 7.16:** Collectivistic/High power Male/Female ranking

The results presented for this research question do not contribute positively to the question. One possible explanation for this could be the fact that the number of each group is not big enough to conduct statistical tests and detect an effect. Therefore, it would be interesting to repeat this experiment with a big number of participants from both cultures.

#### 7.8.4 *Order Factor Consideration*

Whilst the results presented in the previous sections support the hypotheses advanced in this thesis, it is also important to consider a factor that could affect the results presented above. Even if our experimental manipulations had no effect on a participant's behaviour at all, the subject would still probably give slightly more or less different responses in our different experimental conditions.

This section considers the order of experiments (or conditions) presented to the participants for scoring and rating. The order of experiments is an important factor as participants could rate the scenario in the second experiment just compared to the scenario in the first experiment.

Therefore, in order to ensure that the results obtained were only produced by our experimental manipulations, another group of participants were asked to carry out the experiments in the opposite order, starting with the second scenario first and the first scenario second.

By using another group with a different order of presentation of conditions, the order effect will be easier to detect.

Using another group requires an awareness of some factors which might affect our results. So, we would make sure that participants in group B were of a similar age, sex, etc. as those in group A, which is a lot of effort and time-consuming.

We repeated the experiments with a small group N=16 (M=8 F=8). The age of 14 participants ranged from 20 to 49 years old with 1 participant under 20 and 1 participant over 50. All participants were also university students.

Based on Hofstede's finding (see table 7.4) we have 5 participants from Individualistic/Low power culture and 11 participants from Collectivistic/High power culture.

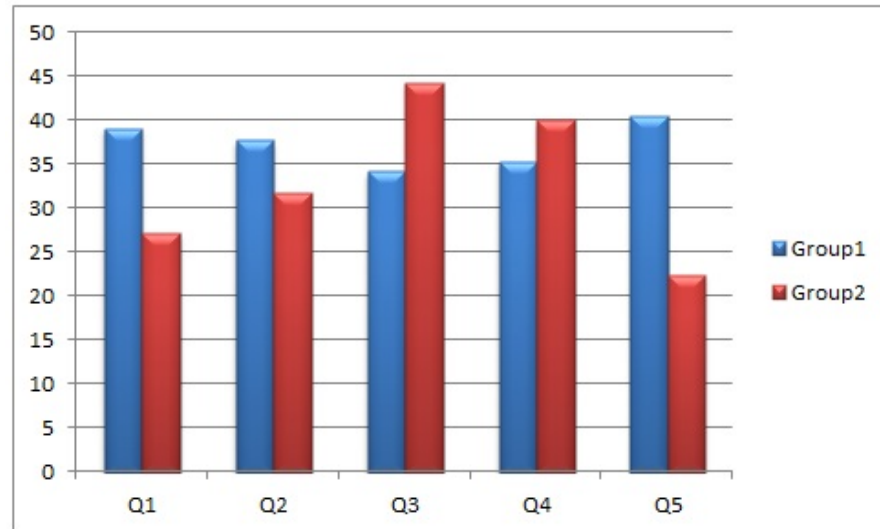
Since we use two groups and different participants in each group, we conducted a Mann-Whitney Test to look for differences in the ranked positions of scores in the two groups. Therefore, by comparing the results for both groups in each scenario, one can assess accurately the influence of order factor on the overall results. All the results obtained for order factor consideration are available in Appendix N.

The results, in Figures ( 7.17, 7.18, 7.19 and 7.20) were statistically not significant in most of the questions. This signifies that they had no influence on the order of experiments presented to the users with the exception of Q1 and Q5 in the first scenario and Q2 and Q5 in the second scenario.

Test Statistics <sup>a</sup>					
	Q1	Q2	Q3	Q4	Q5
Mann-Whitney U	298.500	372.000	322.000	390.000	224.500
Wilcoxon W	434.500	508.000	1918.000	1986.000	360.500
Z	-2.095	-1.065	-1.780	-.840	-3.119
Asymp. Sig. (2-tailed)	.036	.287	.075	.401	.002

a. Grouping Variable: Group

**Figure 7.17:** Mann-Whitney Test for the First Scenario

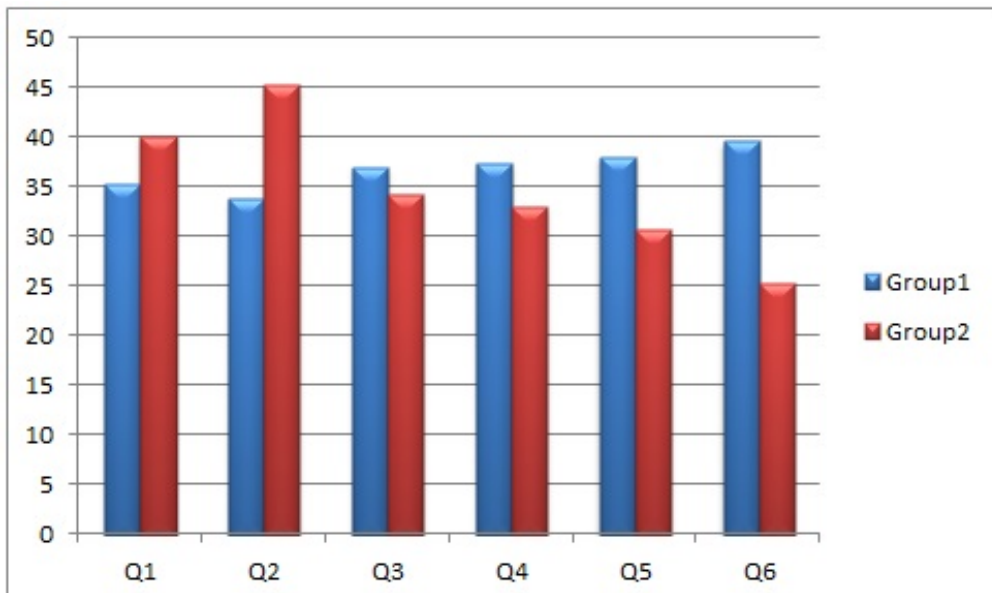


**Figure 7.18:** Comparison of two groups overall rating for the First Scenario

Test Statistics <sup>a</sup>						
	Q1	Q2	Q3	Q4	Q5	Q6
Mann-Whitney U	388.000	306.000	413.500	394.500	355.000	269.000
Wilcoxon W	1984.000	1902.000	549.500	530.500	491.000	405.000
Z	-.862	-2.011	-.485	-.750	-1.343	-2.578
Asymp. Sig. (2-tailed)	.389	.044	.628	.453	.179	.010

a. Grouping Variable: Group

**Figure 7.19:** Mann-Whitney Test for the Second Scenario



**Figure 7.20:** Comparison of two groups overall rating for the Second Scenario



We therefore argue that there are no significant distinctions between the results from both groups. The order of experiments has not affected the overall scoring and rating trends observed in both experiments.

## 7.9 Concluding Remarks

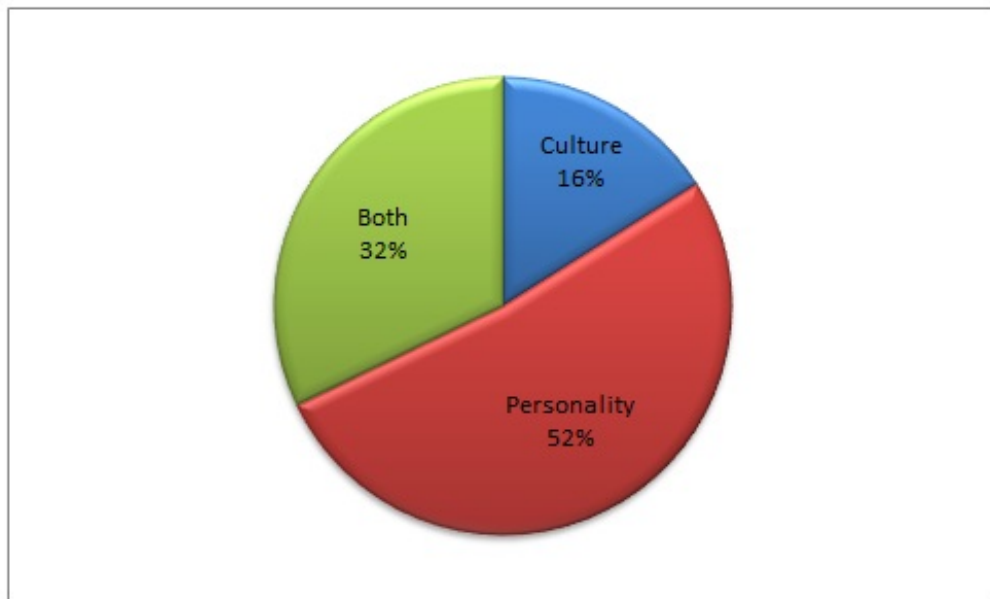
This chapter presented and describes the evaluation of the cultural architecture, using the marriage approval scenario. Both experiments designed used similar methodology and have produced significant results that support the overall hypothesis and validity of the theoretical formulation and implementation of the culturally-specific behaviour concept.

Extending the already existing autonomous agent architecture (FA<sub>ti</sub>MA) to equip agents with culturally-specific behaviour has shown, through the results shown above, a positive impact. When comparing participants' comments for both scenarios, the characters' behaviours in the second scenario were rated as more culturally believable than the first scenario generated by the FA<sub>ti</sub>MA baseline architecture.

The overall objective of the evaluation was to determine if the participants could recognise cultural differences in the characters' behaviours between scenarios. Specifically, we wanted to check if participants could recognise one scenario as more collectivistic and high power distance than the other. This would lead to the conclusion that our model creates characters with culturally-specific behaviour.

Regarding the questions where we ask the participants' opinion about each character and both scenarios, fifteen of the participants found the second scenario much more realistic than the first scenario. One of the participants commented that "I had almost the same situation", see Appendix O "Participants' opinion". Regarding the other explicit question where we asked the participants if the differences between these two scenarios are

related to culture, personality or both. see Figure 7.21.



**Figure 7.21:** The participants' opinion about both scenarios

Figure 7.21 shows that, a minority of participants found the differences were related only to culture, this result corroborating Hofstede's finding and argument [Hof03, Mas09] that behavioural tendencies are harder to interpret as cultural especially by non specialists.

It should be noted that in this evaluation 64% of the subjects are from an individualist/Low power culture. It is quite possible that other results could be produced if subjects from other cultures were asked to take part in the evaluation. Therefore, in order to improve the reliability of the test, a variety of subjects is required.

The results presented in the previous section mentioned that, the order of experiments presented to the participants has no impact on the way of scoring and rating.

# Chapter 8

## Conclusions and Future Work

### 8.1 Conclusion

In this dissertation, we argued that believable synthetic characters that simulate human behaviour need to have an explicit cultural aspect, a fundamental feature of human societies, as part of their identity. These types of characters could play an important role in helping users learn about cultures, the way people live and interact and about their beliefs. This means a synthetic character can play a role in solving misunderstandings amongst cultures. The work presented herein constitutes an important step towards our objective introduced in Chapter 1:

*How can we develop a computational model that illustrates cultural differences and supports users in learning about cultural aspects by simulating the same situation in different ways based on different culture?*

Our main hypothesis, introduced in Chapter 1, to reach our research objective was:

*Social relationships and cultural dimensions are essential elements in the specification of synthetic character's behaviour. Characters with these parameters will be better recognised and their behaviour will be scored more highly for believability than characters without them.*

In order to support this hypothesis, we reviewed studies and theories of culture, social power and the relationship between culture and emotion studied by psychologists and in anthropology. In this thesis we studied these theories with respect to their potential in contributing to the development of synthetic characters and developed a system that has its roots in culturally-specific human behaviour. We also reviewed existing synthetic character systems, based on a number of theories and models of culture and emotions developed in recent years.

Based on our findings, we defined a conceptual model for a synthetic agent that behaves according to its own personality and culture, which involved the Hofstede dimensional model of behavioural tendencies. The FAtiMA Architecture was selected in this thesis to integrate this model, because it was already able to create agents that are autonomous synthetic characters and simulate human-like behaviour in the ways that they behave and interact with each other.

Our architecture considered the mechanisms for generation and selection of goals and intentions and how culture and social relationships might affect them. Once goal activation conditions are verified and an intention to achieve the goal is added to the intention structure, then the deliberative process creates two initial emotions (Hope and Fear emotions) and associates them to the intentions. Culture and social power influenced the

characters' behaviour by affecting these dominant emotions and thus the intention to achieve their goals.

Two experiments were designed to evaluate two marriage scenarios, where culture was introduced in the second scenario to model a collectivistic high power distance culture. Participants were asked to watch two recordings, each one followed by an online questionnaire.

The Results, presented in Chapter 7, showed that characters in the second scenario were seen as behaving significantly more collectivistically and with higher power distance than the characters in the first scenario. These results are consistent with the hypothesis that an agent with cultural aspects behaves differently from an agent without them. However, 16% of participants thought the differences were related to the characters' culture and 32% of participants related it to both culture and personalities. Also, the results show a statistically significant difference in the description of the characters, in terms of the use of the angry adjective. The association between the participants' culture and their opinion about the scenario showed that there was no statistically significant association.

Finally, the results show that the order of experiments has not affected the overall scoring and rating trends observed in both experiments.

## 8.2 Contributions

This research includes a set of contributions to knowledge. These have been achieved in the completion of this thesis and can be summarized as follows:

1. A review of current research into culture, social power, emotion and synthetic characters, examining the questions: how can such a model illustrate cultural differences?; and how can it be used to support users in learning about cultural aspects?
2. The design and development of a novel computational model for synthetic characters that can behave according to a specific culture. This has been achieved through defining a conceptual model of culture, which involved combining approaches to modelling culture and social power in the computational model presented in Chapter 5.
3. The adaptation of an existing computational model to meet this design, including the creation of new characters. This involved the integration of cultural dimensions with a cognitive appraisal-based system. An extension to the goals and intentions mechanism has been proposed where culture and social power influence the agents' behaviour by affecting their dominant emotion.
4. Results, obtained from two experiments with human participants, were presented and discussed in Chapter 7, indicating the effect of culture on the agent's behaviour and the perceptions of users.

These are very encouraging results as they show that our adaptation of an existing model for the creation of synthetic characters using cultural parameters and social power are perceived differently by users from different cultures. This means that, agents with different culture could be created and perceived by users as different just by changing the cultural parameters and social power of agents. Detailed results can be found in Appendix O.

## 8.3 Limitations

Despite the scope of these contributions, this thesis, like most research, was not exempt from problems and issues, and lessons have been learnt.

There are plenty of issues left unresolved and unexplored in creating culturally-specific synthetic characters. These include:

### 1. *Cultural dimensions:*

As mentioned in Section 5.3, two of the cultural dimensions in Hofstede's model [Hof03] have been selected, High/Low Power-Distance and Individualism/Collectivism dimensions.

We think, as Hofstede stated, that there is a correlation between cultural dimensions. For example, there is a correlation between behaviour relating to a low power dimension and the behaviour relating to the individualism dimension. Conversely, there is also correlation between high power dimension and the behaviour in the collectivism dimension.

For instance, in a hierarchical society subordinates accept and expect to be told what to do, and in collectivistic cultures, people are integrated into strong and cohesive groups and everyone looks out for one another in exchange for unquestioning loyalty.

The inclusion of the other four dimensions is not trivial; the correlations between cultural dimensions need to be carefully studied and implemented and would provide an interesting challenge.

### 2. *Characters and Cultures:*

Characters in our scenarios have only a single associated culture. The current architecture does not consider the behaviour learned from another culture; whereas,

people adapt some of their culture behaviour when they live in another culture [S<sup>+</sup>66, HH69, Abu08, SSJ11].

Unfortunately, this model cannot deal with these requirements which limits the use of our model to creating only characters with a single associated culture .

It would be interesting to extend the model through learning capabilities that enable individual characters to deal easily with adaptation to different subcultures, due to their living in certain cultures.

3. *Graphics, animation, and sound effects:*

The current system does not include graphics or sound effects. Text by itself can be boring and rejected by readers; culture could also be expressed through body language, gesture and speech.

Therefore, an interesting area to investigate is the integration of graphical characters, animation, and sound effects into the system instead of written text.

4. *Type of participants:*

The language of stories generated by our model has an effect on the type of participants who participate in the evaluation. In particular, because the language of the stories is in English this limits the number and the type of participants to those who understand the English language.

Although the evaluation presented in Chapter 7 is largely conducted by English subjects from Individualist/Low power culture, it is quite possible that other results could be produced if subjects from other cultures, could understand the stories and participate in the evaluation.



## 8.4 Future Work

This section considers further work and other directions that could improve this research which would also address other research questions which were raised at various points in the thesis.

1. It would be interesting to further develop this work by integrating graphical characters into the system; this would represent a forward step towards the integration of expressive behaviour and user interaction (i.e. speech, action, gesture) with the system where the user can help the synthetic character to select the proper action. Furthermore, it could be interesting to find the relationship between the user's culture and its suggestions to the synthetic character; this would also impact the evaluation of the system and it is possible that other results could be produced.
2. Since the scenarios developed for this research covered a particular situation and were relatively short, it would be interesting to change the story domain or extend the existing scenario to assess whether or not the story domain and the length of the story can have an effect on the participant experience.
3. Our current approach takes only two of the Hofstede dimensions into consideration. The model may require additional adjustment to add the other dimensions. We think adding the other dimensions and investigating the interaction between dimensions for further work might provide interesting results and future challenges.
4. In the current implementation, the model was centred on the interaction of in-group members (family members) without considering their interaction with out-group members. It would be interesting to extend the current work especially for scenarios where other different members engage in the scenario.

5. Finally, we believe that there are several issues that should be further evaluated.

It would be interesting to investigate whether there is a correlation between users' culture and their opinion on the character's behaviour by selecting two different groups of users from different cultures. We think that this correlation should be further studied by repeating the experiment with participants from a strong collectivistic culture.

## 8.5 Concluding Remarks

This thesis investigated the effectiveness of embedded culture in the “minds” of synthetic characters. It show how culture represented and influenced emotional processes which led to affecting the character behaviour. The author hopes that this work provides further knowledge on the subject of cultural synthetic characters.

# Chapter A

## Character Personality Configurations

### First scenario:

Role: Son

Emotion	Threshold	Decay
Love	3	7
Hate	5	8
Hope	3	5
Fear	2	5
Satisfaction	5	5
Relief	4	5
Fears-Confirmed	5	5
Disappointment	6	2
Joy	2	5
Distress	4	2
Happy-For	8	2
Pity	2	8
Resentment	2	8
Gloating	8	2
Pride	3	8
Shame	3	7
Gratification	2	5
Remorse	6	5
Admiration	2	8
Reproach	3	8
Gratitude	4	5
Anger	6	5

Role: Father

Emotion	Threshold	Decay
Love	6	3
Hate	6	8
Hope	6	3
Fear	8	3
Satisfaction	5	5
Relief	4	5
Fears-Confirmed	8	5
Disappointment	6	2
Joy	2	5
Distress	7	2
Happy-For	8	2
Pity	2	8
Resentment	2	8
Gloating	2	8
Pride	3	8
Shame	8	2
Gratification	2	5
Remorse	9	5
Admiration	2	8
Reproach	3	8
Gratitude	4	5
Anger	2	8

Role:Mother

Emotion	Threshold	Decay
Love	2	5
Hate	7	3
Hope	3	2
Fear	2	8
Satisfaction	5	5
Relief	4	5
Fears-Confirmed	5	8
Disappointment	4	5
Joy	6	5
Distress	2	3
Happy-For	5	8
Pity	8	8
Resentment	4	2
Gloating	8	2
Pride	2	8
Shame	5	2
Gratification	3	5
Remorse	4	8
Admiration	3	8
Reproach	5	3
Gratitude	6	5
Anger	7	2

**Second scenario:**

Role: Son

Emotion	Threshold	Decay
Love	3	7
Hate	5	8
Hope	3	5
Fear	2	5
Satisfaction	5	5
Relief	4	5
Fears-Confirmed	5	5
Disappointment	6	2
Joy	2	5
Distress	4	2
Happy-For	8	2
Pity	2	8
Resentment	2	8
Gloating	8	2
Pride	3	8
Shame	3	7
Gratification	2	5
Remorse	6	5
Admiration	2	8
Reproach	3	8
Gratitude	4	5
Anger	6	5

Role: Father

Emotion	Threshold	Decay
Love	6	3
Hate	3	8
Hope	3	3
Fear	8	3
Satisfaction	5	5
Relief	4	5
Fears-Confirmed	8	5
Disappointment	6	2
Joy	2	5
Distress	7	2
Happy-For	8	2
Pity	2	8
Resentment	2	8
Gloating	2	8
Pride	3	8
Shame	8	2
Gratification	2	5
Remorse	9	5
Admiration	2	8
Reproach	3	8
Gratitude	4	5
Anger	2	8

Role:Mother

Emotion	Threshold	Decay
Love	2	5
Hate	7	3
Hope	3	2
Fear	2	8
Satisfaction	5	5
Relief	4	5
Fears-Confirmed	5	8
Disappointment	4	5
Joy	6	5
Distress	2	3
Happy-For	5	8
Pity	8	8
Resentment	4	2
Gloating	8	2
Pride	2	8
Shame	5	2
Gratification	3	5
Remorse	4	8
Admiration	3	8
Reproach	5	3
Gratitude	6	5
Anger	7	2

# Chapter B

## Marriage Approval Story (First Scenario)

*“John had a son Tom who was 26 years old. He had a wife named Ann. John and his son were in good relationship. Tom likes a girl named Kristy, but John and Kristy’s father were old enemies.”*

This is what we expect the system to generate.

**Tom:** Mum, I like a girl from my class and we have been having good understanding lately.

**Ann:** That is great.

**Tom:** I am going to marry her soon.

**Ann:** It is your right. But, who is this girl?

**Tom:** Her name is Kristy, and her father is a businessman named George.

**Ann:** Is it George who makes leather goods.

**Tom:** Yes, the very same.

**Ann:** We have a problem, your father and George has been enemies for the last 20yrs. I don't think your dad will be happy with your choice.

**Tom:** I don't care, I like the girl. I don't want to marry any one but Kristy.

**Ann:** I will talk to your dad but he might be very displeased about it.

**Ann:** Hey John, our son wants to get married. He likes a girl from his university.

**John:** yeah, who is the girl?

**Ann:** She is very nice and she makes our son very happy. You know her father.

**John:** Really, who is he?

**Ann:** He is your old friend George.

**John:** Oh No, George is not my friend and I would never approval this.

**Ann:** It's been 20yrs. I think you should forget this insanity.

**Tom:** what you said?! You would never approval my marriage. I don't care.

**Ann:** John, we have to respect who our son chooses. He does not need your permission, and our son will marry the girl he loves.

**Tom:** Kristy and I will get married next month.

**John:** If you want to marry this girl I will not come to your wedding.



# Chapter C

## Marriage Approval Story (Second Scenario)

*“John had a son Tom who was 26 years old. He had a wife named Ann. John and his son were in good relationship. Tom likes a girl named Kristy, but John and Kristy’s father were old enemies.”*

This is what we expect the system to generate.

**Tom:** Mum, I like a girl from my class and we have been having good understanding lately.

**Ann:** That is great, I think you have to start your own family, but of course you need your dad’s approval .

**Tom:** Of course, I am a bit afraid of asking him . Would you please ask him for me?

**Ann:** Who is this girl?

**Tom:** Her name is Kristy, and her father is a businessman named George.

**Ann:** Is it George who makes leather goods.

**Tom:** Yes, the very same.

**Ann:** We have a problem, your father and George has been enemies for the last 20yrs. I don't think your dad will ever let this happen.

**Tom:** Please, you have to talk to him ; I really like the girl and besides why should we be punished if our dads don't like each other.

**Ann:** I will try but your dad might be very displeased about it.

**Ann:** Hey John, I have to talk to you about our son's marriage . I think we need to discuss this in detail.

**John:** There is nothing to discuss, I already told you I have chosen a girl for him .

**Ann:** But I think he likes some girl from his university.

**John:** yeah, who is the girl and who is her father ?

**Ann:** She is very nice and makes our son very happy.

**John:** Ok, but where does she come from, what is her background, is her father a respectable man .

**Ann:** Well, he is a businessman like you, so I think he is respectable in the society.

**John:** yeah, who is he? I might know him.

**Ann:** He is your old friend George.

**John:** Oh No, George is not my friend and I would never allow my son to be part of his family .

**Ann:** It's been 20yrs. I think we should think of the children and forget this insanity.

**John:** Ann, I don't want to hear another word out of you, this matter is no longer open for discussion .

**Ann:** Please listen to him .

**John:** Ok, where is he?

**Tom:** Dad, please reconsider, maybe we can forget the past and start with a new friend-

ship.

**John:** It will never happen and don't try to tell me what to do. My decision is final .

**Tom:** In that case, I will have to make my own decision. I love Kristy too much to lose her. So, forgive me if you can father. I would have preferred your blessing but I guess I will have to do without it.

**Ann:** Cries and pleads to John .

**Tom:** Kristy and I will get married next month.

**John:** Get out of my sight .

# Chapter D

## Active Pursuit Goals in the Goal Library

```
<GoalLibrary>
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  <Property name="[target] (type)" operator="="
    value="character" />
  <Property name="[target]" operator="!=" value="[SELF]" />
  <Property name="[target]" operator="!=" value="John" />
  <RecentEvent occurred="true" subject="[SELF]"
    action="look-at" target="[target]" />
  <RecentEvent occurred="false" subject="[SELF]"
    target="[target]" action="Question"
    parameters="greeting"/>
</PreConditions>
<SucessConditions>
```

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<RecentEvent occurred="true" subject="[SELF]"
  target="[target]" action="Question"
  parameters="greeting"/>
</SucessConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="1"
    operator="+"/>
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="GreetAccept([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="John"/>
    <Property name="Like([SELF],[target])"
      operator="GreaterThan" value="1" />
    <RecentEvent occurred="true" subject="[target]"
      target="[SELF]" action="Question" parameters="greeting"/>
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="greetingpositiveanswer" />
  </SucessConditions>
  <Effects>
    <Effect name="Like([SELF],[target])" value="1"
```

```
        operator="+"/>
    </Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="ProposeMarriage([target])">
    <PreConditions>
        <Property name="[target] (type)" operator="="
            value="character"/>
        <Property name="[target]" operator="!="
            value="[SELF]" />
        <Property name="[target]" operator="!="
            value="John" />
        <RecentEvent occurred="true" subject="[target]"
            target="[SELF]" action="Question"
            parameters="greetingpositiveanswer" />
    </PreConditions>
    <SucessConditions>
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            target="[target]" action="Question"
            parameters="proposemarriage" />
    </SucessConditions>
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            operator="+" />
    </Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="TalkingAboutProposal([target])">
    <PreConditions>
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  value="character"/>
<Property name="[target]" operator!=" value="[SELF]" />
<Property name="[target]" operator!=" value="John"/>
<RecentEvent occurred="true" subject="[target]"
  target="[SELF]" action="Question"
  parameters="proposemarriage" />
<Property name="applyHopeFearClause"
  operator="PropertyEqual" value="true" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" target="[target]"
    subject="[SELF]" action="Question"
    parameters="talkingaboutproposalreply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" target="[target]"
    subject="[SELF]" action="Question"
    parameters="talkingaboutproposalreply2" />
</FailureConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="1"
    operator="+" />
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="AskForHelp([target])">
  <PreConditions>
```

```
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  value="character"/>
<Property name="[target]" operator="!="
  value="[SELF]" />
<Property name="[target]" operator="!=" value="John"/>
<Property name="applyHopeFearClause"
  operator="PropertyEqual" value="true" />
</PreConditions>
<OrTypePreConditions>
  <RecentEvent occurred="true" subject="[target]"
    target="[SELF]" action="Question"
    parameters="talkingaboutproposalreply1" />
  <RecentEvent occurred="true" subject="[target]"
    target="[SELF]" action="Question"
    parameters="talkingaboutproposalreply2" />
</OrTypePreConditions>
<SucessConditions>
  <RecentEvent occurred="true" target="[target]"
    subject="[SELF]" action="Question"
    parameters="askforhelpreply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" target="[target]"
    subject="[SELF]" action="Question"
    parameters="askforhelpreply2" />
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<Effects>
```



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  operator="+" />
</Effects>
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    value="character"/>
  <Property name="[target]" operator="!=" value="[SELF]"/>
  <Property name="[target]" operator="!=" value="John"/>
  <Property name="applyHopeFearClause"
    operator="PropertyEqual" value="true" />
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    target="[SELF]" action="Question"
    parameters="askforhelpreply1" />
  <RecentEvent occurred="true" subject="[target]"
    target="[SELF]" action="Question"
    parameters="askforhelpreply2" />
</OrTypePreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askaboutgirlreply1" />
</SucessConditions>
<FailureConditions>
```

```
<RecentEvent occurred="true" subject="[SELF]"
  target="[target]" action="Question"
  parameters="askaboutgirlreply2" />
</FailureConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="AskAboutGirlScenario2([target])">
<PreConditions>
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    value="character"/>
  <Property name="[target]" operator="!=" value="[SELF]"/>
  <Property name="[target]" operator="!=" value="John"/>
  <RecentEvent occurred="true" subject="[target]"
    target="[SELF]" action="Question"
    parameters="askforhelpreply2" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askaboutgirlreply2" />
</SucessConditions>
</ActivePursuitGoal>
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<PreConditions>
  <Property name="[target]" operator="!="
    value="[SELF]" />
  <Property name="[target]" operator="!=" value="John"/>
  <Property name="[target] (type)" operator="="
```

```
    value="character"/>
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  <OrTypePreConditions>
    <RecentEvent occurred="true" target="[SELF] "
      subject="[target]" action="Question"
      parameters="askaboutgirlreply1" />
    <RecentEvent occurred="true" target="[SELF] "
      subject="[target]" action="Question"
      parameters="askaboutgirlreply2" />
  </OrTypePreConditions>
  <SucessConditions>
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      target="[target]" action="Question"
      parameters="talkingaboutgirl" />
  </SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="AskAboutFather([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="John"/>
    <RecentEvent occurred="true" target="[SELF] "
      subject="[target]" action="Question"
      parameters="talkingaboutgirl" />
  </PreConditions>
  <SucessConditions>
```

```
<RecentEvent occurred="true" subject="[SELF]"
  target="[target]" action="Question"
  parameters="askingaboutfather" />
</SucessConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="1"
    operator="-" />
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="ReplyPositively([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]" />
    <Property name="[target]" operator="!=" value="John"/>
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="askingaboutfather" />
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="askingaboutfatherpositiveanswer"/>
  </SucessConditions>
  <Effects>
    <Effect name="Like([SELF],[target])" value="4"
      operator="+" />
  </Effects>
</ActivePursuitGoal>
```

```
</Effects>

</ActivePursuitGoal>

<ActivePursuitGoal name="ReplyNegatively([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="John"/>
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="askingaboutfatherpositiveanswer" />
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="askforhelpnegativeanswer" />
  </SucessConditions>
  <Effects>
    <Effect name="Like([SELF],[target])" value="2"
      operator="-" />
  </Effects>
</ActivePursuitGoal>

<ActivePursuitGoal name="AskForHelp2([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!="
```

```
    value="[SELF]" />
  <Property name="[target]" operator="!=" value="John"/>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="askforhelpnegativeanswer" />
  <Property name="applyHopeFearClause"
    operator="PropertyEqual" value="true" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askforhelp2reply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askforhelp2reply2" />
</FailureConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="GiveHelp([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="John"/>
  </PreConditions>
  <OrTypePreConditions>
```

```
<RecentEvent occurred="true" target="[SELF]"
  subject="[target]" action="Question"
  parameters="askforhelp2reply1" />
<RecentEvent occurred="true" target="[SELF]"
  subject="[target]" action="Question"
  parameters="askforhelp2reply2" />
</OrTypePreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askforhelp2positiveanswer" />
</SucessConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="2"
    operator="+" />
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="TalkingAboutMarriage([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="Tom" />
    <RecentEvent occurred="true" target="Tom"
      subject="[SELF]" action="Question"
      parameters="askforhelp2positiveanswer" />
    <Property name="applyHopeFearClause"
```

```
    operator="PropertyEqual" value="true" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="talkingaboutmarriagereply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="talkingaboutmarriagereply2" />
</FailureConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="MarriageNegativeAnswer([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character" />
    <Property name="[target]" operator="!=" value="[SELF]" />
    <Property name="[target]" operator="!=" value="Tom" />
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="talkingaboutmarriagereply2" />
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="talkingaboutmarriagenegativeanswerreply2" />
```



```
</SucessConditions>

<Effects>

  <Effect name="Like([SELF],[target])" value="2"
    operator="-" />

  <Effect name="Power([SELF],[target])" value="2"
    operator="+" />

</Effects>

</ActivePursuitGoal>

<ActivePursuitGoal name="TalkAboutGirl([target])">

  <PreConditions>

    <Property name="[target](type)" operator="="
      value="character"/>

    <Property name="[target]" operator="!=" value="[SELF]"/>

    <Property name="[target]" operator="!=" value="Tom"/>

  </PreConditions>

  <OrTypePreConditions>

    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="talkingaboutmarriagenegativeanswerreply2"/>

  </OrTypePreConditions>

  <SucessConditions>

    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="talkaboutgirl" />

  </SucessConditions>

</ActivePursuitGoal>

<ActivePursuitGoal name="AskAboutHerFamily([target])">
```

```
<PreConditions>
  <Property name="[target] (type)" operator="="
    value="character" />
  <Property name="[target]" operator="!="
    value="[SELF]" />
  <Property name="[target]" operator="!=" value="Tom"/>
  <Property name="applyHopeFearClause"
    operator="PropertyEqual" value="true"/>
</PreConditions>

<OrTypePreConditions>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="talkingaboutmarriagereply1" />
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="talkaboutgirl" />
</OrTypePreConditions>

<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askaboutherfamilyreply1" />
</SucessConditions>

<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askaboutherfamilyreply2" />
</FailureConditions>
```

```
</ActivePursuitGoal>
<ActivePursuitGoal name="ReplyPositivelyAboutGirl([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character" />
    <Property name="[target]" operator="!="
      value="[SELF]" />
    <Property name="[target]" operator="!=" value="Tom"/>
  </PreConditions>
  <OrTypePreConditions>
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="askaboutherfamilyreply1" />
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="askaboutherfamilyreply2" />
  </OrTypePreConditions>
  <SuccessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="aboutgirl" />
  </SuccessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="AskAboutHerFamily2([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
  </PreConditions>
```

```
<Property name="[target]" operator="!=" value="[SELF]" />
<Property name="[target]" operator="!=" value="Tom" />
<RecentEvent occurred="true" target="[SELF]"
  subject="[target]" action="Question"
  parameters="aboutgirl" />
<Property name="applyHopeFearClause"
  operator="PropertyEqual" value="true" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askaboutthefamilyreply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="askaboutthefamilyreply2" />
</FailureConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="TalkAboutHerFather([target])">
  <PreConditions>
    <Property name="[target](type)" operator="="
      value="character" />
    <Property name="[target]" operator="!="
      value="[SELF]" />
    <Property name="[target]" operator="!=" value="Tom" />
  </PreConditions>
```

```
<OrTypePreConditions>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="askaboutthefamilyreply1" />
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="askaboutthefamilyreply2" />
</OrTypePreConditions>

<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="talkabouttherfather" />
</SucessConditions>

</ActivePursuitGoal>

<ActivePursuitGoal name="AskAboutHerFather([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="Tom" />
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="talkabouttherfather" />
  </PreConditions>

  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
```

```
    parameters="askaboutherfather" />
</SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="AboutHerFather([target])">
<PreConditions>
  <Property name="[target] (type)" operator="="
    value="character"/>
  <Property name="[target]" operator="!=" value="[SELF]"/>
  <Property name="[target]" operator="!=" value="Tom"/>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="askaboutherfather" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="aboutherfather" />
</SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="NegativeResponse([target])">
<PreConditions>
  <Property name="[target] (type)" operator="="
    value="character" />
  <Property name="[target]" operator="!=" value="[SELF]"/>
  <Property name="[target]" operator="!=" value="Tom"/>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
```

```
    parameters="aboutherfather" />
  <Property name="applyHopeFearClause"
    operator="PropertyEqual" value="true" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="aboutherfathernegativeresponsereply1"/>
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="aboutherfathernegativeresponsereply2"/>
</FailureConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="3"
    operator="-"/>
  <Effect name="Power([SELF],[target])"
    value="2" operator="+"/>
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="ConvinceToAcceptProposal([target])">
  <PreConditions>
    <Property name="[target](type)" operator="="
      value="character" />
    <Property name="[target]" operator="!=" value="[SELF]" />
    <Property name="[target]" operator="!=" value="Tom" />
```

```
</PreConditions>
<OrTypePreConditions>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="abouttherfathernegativeresponsereply1" />
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="abouttherfathernegativeresponsereply2" />
</OrTypePreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="convincetoacceptproposal" />
</SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="DeclineProposal([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character" />
    <Property name="[target]" operator="!=" value="[SELF]" />
    <Property name="[target]" operator="!=" value="Tom" />
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="convincetoacceptproposal" />
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
```



```
    target="[target]" action="Question"
    parameters="declineproposal" />
</SucessConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="2"
    operator="-" />
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="AskToTalk([target])">
<PreConditions>
  <Property name="[target] (type)" operator="="
    value="character"/>
  <Property name="[target]" operator="!=" value="[SELF]" />
  <Property name="[target]" operator="!=" value="Tom"/>
  <RecentEvent occurred="true" target="[SELF]"
    subject="[target]" action="Question"
    parameters="declineproposal" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="asktotalk" />
</SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="AcceptToTalk([target])">
<PreConditions>
  <Property name="[target] (type)" operator="="
```

```
    value="character"/>
<Property name="[target]" operator="!=" value="[SELF]" />
<Property name="[target]" operator="!=" value="Tom" />
<RecentEvent occurred="true" target="[SELF]"
  subject="[target]" action="Question"
  parameters="asktotalk" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="acceptttotalk" />
</SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="TryToConvince([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]" />
    <Property name="[target]" operator="!=" value="Ann" />
    <RecentEvent occurred="true" target="Ann"
      subject="[target]" action="Question"
      parameters="acceptttotalk" />
    <Property name="applyHopeFearClause"
      operator="PropertyEqual" value="true" />
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
```

```
    target="[target]" action="Question"
    parameters="trytoconvincereply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="trytoconvincereply2" />
</FailureConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="ConvinceNegativeResponse([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="Ann"/>
  </PreConditions>
  <OrTypePreConditions>
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="trytoconvincereply1" />
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="trytoconvincereply2" />
  </OrTypePreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
```

```
    parameters="convincenegativeresponse" />
  </SucessConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="4"
    operator="-"/>
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="TakeDecision([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
    <Property name="[target]" operator="!=" value="[SELF]"/>
    <Property name="[target]" operator="!=" value="Ann"/>
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="convincenegativeresponse" />
  </PreConditions>
  <SucessConditions>
    <RecentEvent occurred="true" subject="[SELF]"
      target="[target]" action="Question"
      parameters="takedecision" />
  </SucessConditions>
</ActivePursuitGoal>
<ActivePursuitGoal name="AnnounceMarriage([target])">
  <PreConditions>
    <Property name="[target] (type)" operator="="
      value="character"/>
```

```
<Property name="[target]" operator="!=" value="[SELF]" />
<Property name="[target]" operator="!=" value="Ann" />
<RecentEvent occurred="true" target="[target]"
  subject="[SELF]" action="Question"
  parameters="takedecision" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="announcemarriage" />
</SucessConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="2"
    operator="-" />
  <Effect name="Power([SELF],[target])" value="1"
    operator="+" />
</Effects>
</ActivePursuitGoal>
<ActivePursuitGoal name="Insult([target])">
  <PreConditions>
    <Property name="[target](type)" operator="="
      value="character" />
    <Property name="[target]" operator="!=" value="[SELF]" />
    <Property name="[target]" operator="!=" value="Ann" />
    <RecentEvent occurred="true" target="[SELF]"
      subject="[target]" action="Question"
      parameters="announcemarriage" />
```

```
<Property name="applyHopeFearClause"
  operator="PropertyEqual" value="true" />
</PreConditions>
<SucessConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="insultreply1" />
</SucessConditions>
<FailureConditions>
  <RecentEvent occurred="true" subject="[SELF]"
    target="[target]" action="Question"
    parameters="insultreply2" />
</FailureConditions>
<Effects>
  <Effect name="Like([SELF],[target])" value="4"
    operator="-"/>
  <Effect name="Power([SELF],[target])" value="2"
    operator="-"/>
</Effects>
</ActivePursuitGoal>
</GoalLibrary>
```

# Chapter E

## Hope and Fear Code

```
package FAtiMA.emotionalState;

/**
 * Adds an EmotionDisposition (threshold + decay) to
 * a particular emotion type
 * @param emotionDis - the EmotionDisposition to add
 * @see EmotionDisposition
 */

public void AddEmotionDisposition(EmotionDisposition emotionDis){
    _emotionDispositions[emotionDis.GetEmotionType()] = emotionDis;
}

/**
 * Appraises a Goal's Failure according to the emotions that
```

```
* the agent is experiencing
* @param hopeEmotion - the emotion of Hope for achieving
* the goal that the character feels
* @param fearEmotion - the emotion of Fear for not achieving
* the goal that the character feels
* @param g - the Goal that failed
*/

public void AppraiseGoalFailure(ActiveEmotion hopeEmotion,
ActiveEmotion fearEmotion, Goal g){

AppraiseGoalEnd(EmotionType.DISAPPOINTMENT,
    EmotionType.FEARSCONFIRMED, hopeEmotion, fearEmotion,
    g.GetImportanceOfFailure(), false, g);
}

/**
* Appraises a Goal's likelihood of failure
* @param g - the goal
* @param probability - the probability of the goal to fail
* @return - an ActiveEmotion if any emotion was created and
* added to the emotional state, null otherwise
*/

public ActiveEmotion AppraiseGoalFailureProbability(Goal g,
float probability) {
```



```
Event e = g.GetActivationEvent();
String self = AutobiographicalMemory.GetInstance().getSelf();
String target = e.GetParameters().get(0).toString();
float likeRelation = LikeRelation.getRelation(self,
    target).getValue();
float powerRelation = PowerRelation.getRelation
    (self, target).getValue();
float hierarchy = CulturalDimensions.GetInstance()
    .getHierarchy();
float identity = CulturalDimensions.GetInstance()
    .getIdentity();
float potential;
potential = (probability * g.GetImportanceOfFailure()) *
    ((1+(10-identity)) + hierarchy * Math.abs
    (powerRelation - likeRelation));

BaseEmotion em = new BaseEmotion(EmotionType.FEAR, potential,
    g.GetActivationEvent(), null);

return UpdateProspectEmotion(em);
}

/**
 * Appraises a Goal's success according to the emotions that
 * the agent is experiencing
 * @param hopeEmotion - the emotion of Hope for achieving
 * the goal that the character feels
```

```
* @param fearEmotion - the emotion of Fear for not achieving
* the goal that the character feels
* @param g - the Goal that succeeded
*/

public void AppraiseGoalSuccess(ActiveEmotion hopeEmotion,
    ActiveEmotion fearEmotion, Goal g) {
    AppraiseGoalEnd(EmotionType.SATISFACTION, EmotionType.RELIEF,
        hopeEmotion, fearEmotion, g.GetImportanceOfSuccess(),
        true, g);
}

/**
 * Appraises a Goal's likelihood of succeeding
 * @param g - the goal
 * @param probability - the probability of the goal to succeed
 * @return - an ActiveEmotion if any emotion was created and
 * added to the emotional state, null otherwise
 */

public ActiveEmotion AppraiseGoalSuccessProbability(Goal g,
    float probability) {

    Event e = g.GetActivationEvent();

    String self = AutobiographicalMemory.GetInstance()
        .getSelf();

    String target = e.GetParameters().get(0).toString();
```

```
float likeRelation = LikeRelation.getRelation(self, target)
    .getValue();
float powerRelation = PowerRelation.getRelation
    (self, target).getValue();
float hierarchy = CulturalDimensions.getInstance()
    .getHierarchy();
float identity = CulturalDimensions.getInstance()
    .getIdentity();
float potential = (probability * g.GetImportanceOfSuccess())
    * ((1+(10-identity)) + hierarchy *
    Math.abs(powerRelation - likeRelation));

BaseEmotion em = new BaseEmotion(EmotionType.HOPE,
    potential, g.GetActivationEvent(), null);
return UpdateProspectEmotion(em);
}
```

```
package FAtiMA.culturalState;
```

```
import java.io.Serializable;
import FAtiMA.knowledgeBase.KnowledgeBase;
import FAtiMA.wellFormedNames.Name;
```

```
public class CulturalDimensions implements Serializable {
```

```
private static final long serialVersionUID = 1L;
public static final String HIERARCHY = "Hierarchy";
public static final String IDENTITY = "Identity";
private static CulturalDimensions culturalDimensions;
private int hierarchy;
private int identity;
public static CulturalDimensions getInstance() {
    if(culturalDimensions == null) {
        culturalDimensions = new CulturalDimensions();
    }
    return culturalDimensions;
}

private CulturalDimensions() {

}

/**
 * Creates a new CulturalDisposition
 *
 * @param identity - the identity rate for the culture
 * @param hierarchy - the hierarchy rate for the culture
 *
 */

public void saveCulturalDimensions(int hierarchyParam,
    int identityParam) {
```

```
        identity = getValueWithInRange(identityParam);
        hierarchy = getValueWithInRange(hierarchyParam);
        Name identityProperty = Name.ParseName
            ("Culture(Identity)");
        Name hierarchyProperty = Name.ParseName
            ("Culture(Hierarchy)");
        KnowledgeBase.GetInstance().Tell(identityProperty,
            Integer.valueOf(identity));
        KnowledgeBase.GetInstance().Tell(hierarchyProperty,
            Integer.valueOf(hierarchy));
    }

/**
 * Gets the hierarchy rate for the culture
 * @return the hierarchy rate
 */

public int getHierarchy() {
    return hierarchy;
}

/**
 * gets the identity rate for culture
 * @return the identity
 */
```

```
public int getIdentity() {
    return identity;
}

/**
 * Converts the cultural disposition to a String
 * @return the converted String
 */

public String toString() {
    return "Hierarchy: " + hierarchy + " Identity: "
        + identity;
}

private int getValueInRange(int valueParam) {
    int newValue = valueParam;

    if(valueParam > 10) {
        newValue = 10;
    } else if(valueParam < 0 ) {
        newValue = 0;
    }

    return newValue;
}
}
```

# Chapter F

## Events and their Effects on Characters' Relationships

BLUE Goals activated by Tom. GREEN Goals activated by Ann. RED Goals activated by John.

Event			Like	Power
Greeting	How are you?	E1	9	2
Greetingpositiveanswer	How are you today?	E2	10	5
ProposeMarriage	Mum, I like a girl from my class and we have been having good understanding lately.	E3	10	2
TalkingAboutProposal1	That is great.	E4	10	5
TalkingAboutProposal2	That is great, I think it is true for you to start your own family, but of course you need your dad's approval.	E5	10	5

*Appendix F: Events and their Effects on Characters' Relationships*

Event			Like	Power
AskForHelp	Of course, I am a bit afraid of asking him. Would you please ask him for me?	E6	10	2
AskAboutGirl1	It is your right. But, who is this girl?	E7	10	5
AskAboutGirl2	Who is this girl?	E8	10	5
TalkingAboutGirl	Her name is Kristy, and her father is a businessman named George.	E9	10	2
AskAboutFather	Is it George who makes leather goods.	E10	10	2
ReplyPositively	Yes, the very same	E11	7	5
ReplyNegatively	We have a problem, your father and George have been enemies for last 20yrs. I don't think your dad will ever let this happen.	E12	7	5
NegativelyReplayAboutFather1	I don't care, I like the girl. I don't want to marry any one but Kristy.	E13	8	4
NegativelyReplayAboutFather2	Please you have to talk to him; I really like the girl and besides why should we be punished if our dads don't like each other.	E14	8	4
GiveHelp	I will try but your dad might be very displeased about it.	E15	9	5
TalkingAboutMarriage1	Our son wants to get married. He likes a girl from his university.	E16	9	2
TalkingAboutMarriage2	I have to talk to you about our son's marriage. I think we need to discuss this in detail.	E17	9	2
MarriagePositiveAnswer	yeah, who is the girl?	E18	8	5
MarriageNegativeAnswer	There is nothing to discuss, I already told you I have chosen a girl for him.	E19	6	7
TalkAboutGirl	But I think he likes another girl from his university.	E20	9	2
AskAboutHerFamily1	yeah, who is the girl.	E21	6	7



*Appendix F: Events and their Effects on Characters' Relationships*

Event			Like	Power
AskAboutHerFamily2	yeah, who is the girl and who is her father?	E22	6	7
ReplyPositivelyAboutGirl	She is very nice and makes our son very happy.	E23	9	2
AskAboutHerFamily3	Ok, but where does she come from, what is her back ground, is her father a respectable man.	E24	6	7
TalkAboutHerFather	Well, he is a businessman like you, so I think he is respectable in the society.	E25	9	2
AskAboutHerFather	yeah, who is he? I might know him.	E26	6	7
AboutHerFather	He is your old friend George.	E27	9	2
NegativeResponse	Oh No, George is not my friend and I would never allow my son to be part of his family.	E28	3	9
ConvinceToAcceptPro-posal	It's been 20yrs. I think we should think of the children and forget this insanity.	E29	9	2
DeclineProposal	I don't want to hear another word out of you, this matter is no longer open for discussion.	E30	1	9
AskToTalk	Please listen to him.	E31	9	2
AcceptToTalk	Ok, where is he?	E32	1	9
ConfrontFather	What you said?! You would never approval my marriage. I don't care.	E33	3	3
TryToConvince	Dad, please reconsider, maybe we can forget the past and start with new friendship.	E34	e3	3
ConvinceNegativeResponse	It will never happen and don't try to tell me what to do. My decision is final.	E35	4	9
TakeDecision	In that case, I will have to make my own decision. I love Kristy too much to lose her. So, forgive me if you can father. I would have preferred your blessing but I guess I will have to do without it.	E36	1	3

*Appendix F: Events and their Effects on Characters' Relationships*

---

Event			Like	Power
AnnounceMarriage	Kristy and I will get married next month.	E37	0	4
RefuseDecision	If you want to marry this girl I will not come to your wedding.	E38	1	8
Insult	Get out of my sight.	E39	0	7

# Chapter G

# Questionnaire Screen-Shots

Page 1 of 5

Please answer these questions



Questionnaire A: Before running the application

\*1) Do you feel you know what other people are feeling?

- ☐ yes, always
- ☐ yes, often
- ☐ don't know
- ☐ sometimes
- ☐ rarely

Please think of an ideal job, disregarding your present job, if you have one.  
In choosing an ideal job, how important would it be for you to ...

\*2) Have sufficient time for your personal or home life.

- ☐ of utmost importance
- ☐ very important
- ☐ of moderate importance
- ☐ of little importance
- ☐ of very little or no importance

\*3) When I work with others, it's important for me to receive approval from my co-workers.

- ☐ of utmost importance
- ☐ very important
- ☐ of moderate importance
- ☐ of little importance
- ☐ of very little or no importance

Next Page



To what extent do you agree or disagree with each of the following statements?

\*4) A household runs better if one person is the head.

- ☐ strongly agree
- ☐ agree
- ☐ neutral
- ☐ disagree
- ☐ strongly disagree

\*5) It's better for young adults to stay in the family home.

- ☐ strongly agree
- ☐ agree
- ☐ neutral
- ☐ disagree
- ☐ strongly disagree

\*6) Parents should be involved closely in choosing the spouse for their children.

- ☐ strongly agree
- ☐ agree
- ☐ neutral
- ☐ disagree
- ☐ strongly disagree

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### First Scenario

*"John had a son Tom who was 26 years old. He had a wife named Ann. John and his son were in good term. Tom likes a girl named Kristy, but John and Kristy's father were old enemies. Tom went to his mother to tell her about the girl."*

Run the video below

For Best View, Please switching to HD and full screen (at the bottom of the video move the view from 360p to 720p)



Questionnaire B: After running the first scenario

(All questions were rated on a 5 point Likert scale where 1 is Lowest and 5 is Highest)

\*7) Please rate to what degree Tom appeared concerned about getting marriage approval.

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest  
☐ Other (Please Specify):

---

\*8) Please rate to what degree Tom intimidated by his father.

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest  
☐ Other Comment:

---

\*9) Please rate to what degree Tom appeared angry.

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest

---

\*10) Please rate how tense the characters' dialogue was

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest

---

\*11) Please rate to what degree you agree with Tom reactions.

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest  
☐ Other (Please Specify):

---

\*12) Please write down a few words to describe each character

---

\*13) What is your opinion about this scenario?

### Second Scenario

*"John had a son Tom who was 26 years old. He had a wife named Ann. John and his son were in good term. Tom likes a girl named Kristy, but John and Kristy's father were old enemies. Instead of talking directly to John, Tom asked his mother to talk to his father."*

Run the video below

For Best View, Please switching to HD and full screen (at the bottom of the video move the view from 360p to 720p)



Questionnaire C: After running the second scenario

(All questions were rated on a 5 point Likert scale where 1 is Lowest and 5 is Highest)



\*15) Please rate to what degree Tom appeared polite

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest

---

\*16) Please rate to what degree Tom appeared concerned about getting marriage approval

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest  
☐ Other (Please Specify):

---

\*17) Please rate to what degree Tom intimidated by his father

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest

---

\*18) Please rate to what degree John appeared angry

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest

---

\*19) Please rate how tense the characters' dialogue was

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest

---

\*20) Please rate to what degree you agree with Tom's reactions

☐ 1 Lowest  
☐ 2  
☐ 3  
☐ 4  
☐ 5 Highest  
☐ Other (Please Specify):

---

\*21) Please write down a few words to describe each character

---

\*22) What is your opinion about this scenario?



\*24) Do you think the differences between these two scenarios are related to:

☐ Culture

☐ Personality

Other (Please Specify):

Some information about yourself (for statistical purposes):

\*25) Are you:

☐ male

☐ female

\*26) How old are you?

☐ Under 20

☐ 20-24

☐ 25-29

☐ 30-34

☐ 35-39

☐ 40-49

☐ 50-59

☐ 60 or over

\*27) What is your nationality?

\*28) How long have you lived in the UK?

\*29) In what country did you spend your childhood years?

30) Please enter your email address which will be used for voucher draw ONLY:

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[Finish Survey](#)

# Chapter H

## Email Sent to Participants

Dear All,

Please take 30 minutes to do my online experiment and you might win Amazon vouchers worth £30.

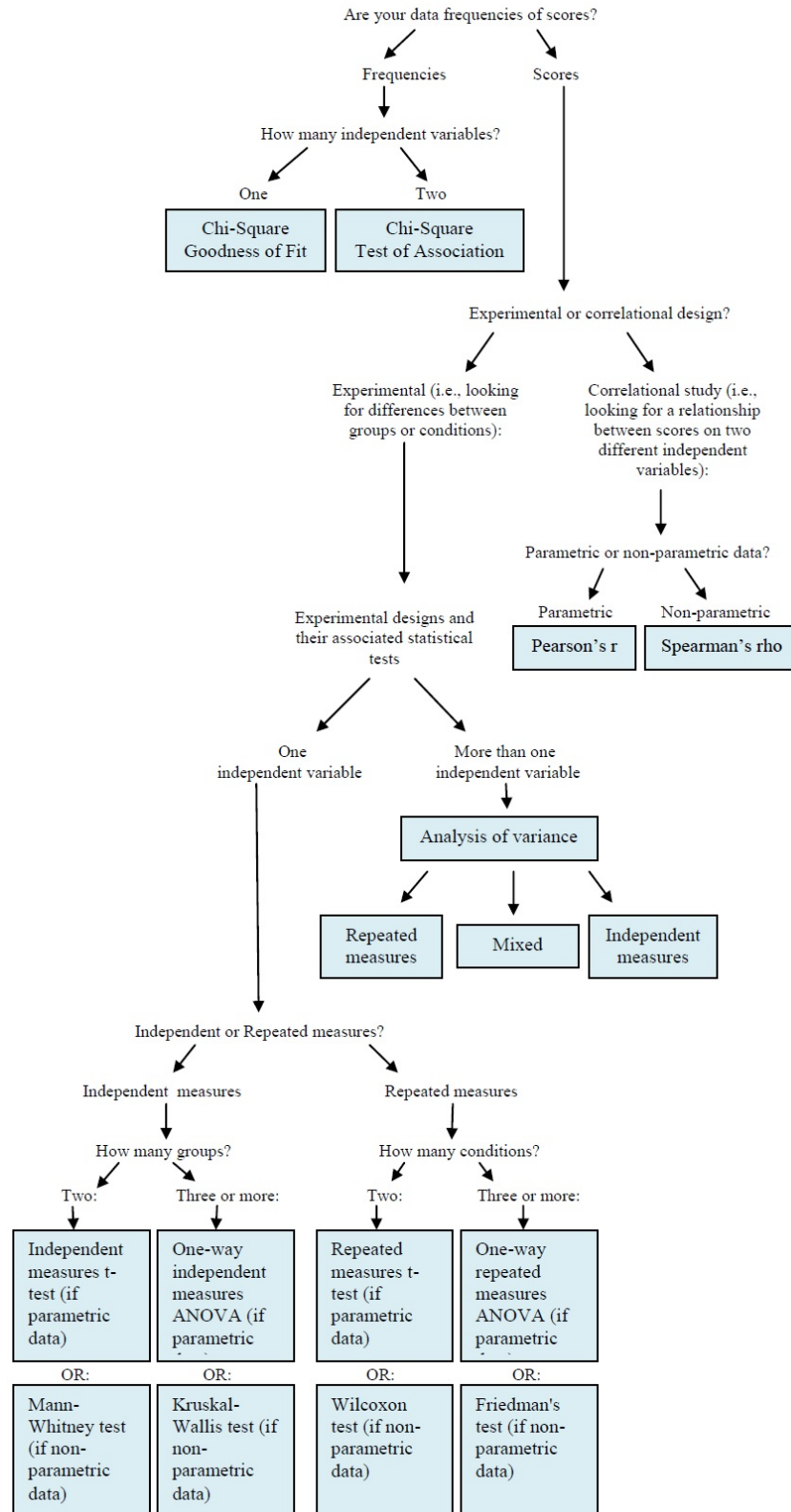
<http://freeonlinesurveys.com/rendersurvey.asp?sid=p8jyyn33d6c47zd825421>

Best wishes,

Ellafi

# Chapter I

# A Statistical Test Flow-chart [FH03]



# Chapter J

## Questionnaire A

### **Questionnaire A:** Before running the application

Please answer these questions

Please think of an ideal job, disregarding your present job, if you have one. In choosing an ideal job, how important would it be for you to ... (please circle one answer in each line across):

1 = of utmost importance

2 = very important

3 = of moderate importance

4 = of little importance

5 = of very little or no importance

*Appendix J: Questionnaire A*

---

01: Have sufficient time for your personal or home life	1	2	3	4	5
02: Have a boss (direct superior) you can respect	1	2	3	4	5
03: Have pleasant people to work with	1	2	3	4	5
04: Do work that is interesting	1	2	3	4	5
05: Be consulted by your boss in decisions involving your work	1	2	3	4	5
06: Have a job respected by your family and friends	1	2	3	4	5
07: When I work with others, it is not im- portant for me to receive individual recog- nition	1	2	3	4	5

**In your private life, how important is each of the following for you: (please circle one answer in each line across):**

08: Do you behave different at work (or at school if you're a student) and at home?

1. quite different
2. mostly different
3. don't know
4. mostly the same
5. quite the same

09: Do other people or circumstances prevent you from expressing your opinion at work (or at school if you're a student) and at home?

1. yes, always
2. yes, usually
3. sometimes
4. no, seldom
5. no, never

10: How often, in your experience, are subordinates afraid to contradict their boss (or students their teacher?)

1. always
2. usually
3. sometimes
4. seldom
5. never

**To what extent do you agree or disagree with each of the following statements? (Please circle one answer in each line across):**

- 1 = strongly agree  
2 = agree  
3 = undecided  
4 = disagree  
5 = strongly disagree

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 11: A household runs better if one person is the head.   | 1 | 2 | 3 | 4 | 5 |
| 12: It's not good for young adults to move away from their family home.  | 1 | 2 | 3 | 4 | 5 |
| 13: Parents should be involved closely in choosing the spouse for their children.  | 1 | 2 | 3 | 4 | 5 |
| 14: One can be a good manager without having a precise answer to every question that a subordinate may raise about his or her work | 1 | 2 | 3 | 4 | 5 |
| 15: A company's or organization's rules should not be broken under any circumstances.  | 1 | 2 | 3 | 4 | 5 |



# Chapter K

## Questionnaire B

**Questionnaire B:** After running the first scenario

(All questions were rated on a 5 point Likert scale where 1 is Lowest and 5 is Highest)

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 01: Please rate to what degree Tom appeared indifferent                               | 1 | 2 | 3 | 4 | 5 |
| 02: Please rate to what degree Tom doesn't feel fear of not getting marriage approval | 1 | 2 | 3 | 4 | 5 |
| 03: Please rate to what degree Tom appeared in anger                                  | 1 | 2 | 3 | 4 | 5 |
| 04: Please rate how tense the characters' dialogue was                                | 1 | 2 | 3 | 4 | 5 |
| 05: Please rate to what degree you don't agree with Tom reactions                     | 1 | 2 | 3 | 4 | 5 |

06: Please write down a few words to describe each character

.....  
.....  
.....

07: What is your opinion about this scenario?

.....  
.....  
.....

# Chapter L

## Questionnaire C

### Questionnaire C: After running the second scenario

(All questions were rated on a 5 point Likert scale where 1 is Lowest and 5 is Highest)

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 01: Please rate to what degree Tom appeared polite                             | 1 | 2 | 3 | 4 | 5 |
| 02: Please rate to what degree Tom feels fear of not getting marriage approval | 1 | 2 | 3 | 4 | 5 |
| 03: Please rate to what degree John appeared in anger                          | 1 | 2 | 3 | 4 | 5 |
| 04: Please rate how tense the characters' dialogue was                         | 1 | 2 | 3 | 4 | 5 |
| 05: Please rate to what degree you don't agree with Tom reactions              | 1 | 2 | 3 | 4 | 5 |

06: Please write down a few words to describe each character

.....

.....

.....

*Appendix L: Questionnaire C*

---

07: What is your opinion about this scenario?

.....

.....

.....

Some information about yourself (for statistical purposes):

08 Do you think most of differences between these two scenarios are related to:

- Culture
- personality

09: Are you:

- Male
- Female

10: How old are you?

1. Under 20.
2. 20-24.
3. 25-29.
4. 30-34.
5. 35-39.
6. 40-49
7. 50-59
8. 60 or over

11: What is your nationality?

12: What was your nationality at birth (if different)?

**Thank you very much for your cooperation!**

# Chapter M

## Pilot Test Results

No	Evaluation criteria	Comments
<b>Participant 1</b>		
1	Participant's identity	He seems to be from individualistic.
2	Participant's hierarchy	He seems to be from high hierarchy.
3	Characters' identity (first scenario)	Rated as neutral.
4	Characters' hierarchy (first scenario)	Rated as neutral.
5	Characters description	Tom shows more serious.
6	Participant opinion about this scenario	It really depends and different from culture to another
7	Characters' identity (second scenario)	Rated as neutral.
8	Characters' hierarchy (second scenario)	Neutral.
9	Characters description	John is too restricted. Ann shows the nature mother act. Tom is very polite.

*Appendix M: Pilot Test Results*

No	Evaluation criteria	Comments
10	Participant opinion about this scenario	Very well.
11	The differences related to	Culture and personality.
<b>Participant 2</b>		
1	Participant's identity	Collectivistic
2	Participant's hierarchy	Neutral
3	Characters' identity (first scenario)	Neutral
4	Characters' hierarchy (first scenario)	Neutral
5	Characters description	Tom: disrespectful, hot-headed and determined. John: stubborn and conservative. Ann: open-minded.
6	Participant opinion about this scenario	I think the characters should learn to be more tolerance and open-minded and try to look at the situation from each others perspective to come to a compromise.
7	Characters' identity (second scenario)	Rated as collectivistic.
8	Characters' hierarchy (second scenario)	High hierarchy.
9	Characters description	Tom: strong character (determined), showing respect. John: stubborn, unforgiving, selfish, conservative. Ann: considerate, soft-hearted.
10	Participant opinion about this scenario	I think if a scenario that should not happen in our modern world is. Everyone should have the right to chose and plan its own path of life.
11	The differences related to	Culture and personality.
<b>Participant 3</b>		
1	Participant's identity	Neutral
2	Participant's hierarchy	Low hierarchy
3	Characters' identity (first scenario)	Neutral to individualistic

*Appendix M: Pilot Test Results*

No	Evaluation criteria	Comments
4	Characters' hierarchy (first scenario)	Neutral to low hierarchy
5	Characters description	Tom showing less respect and being less polite
6	Participant opinion about this scenario	I think Tom is right, but I do think he could be more polite talking to his parents, especially since they supposedly are on good terms.
7	Characters' identity (second scenario)	Rated as collectivistic.
8	Characters' hierarchy (second scenario)	High hierarchy.
9	Characters description	Tom: brave, determined, while still showing respect. John: traditional, image and face are more important than sons happiness (egoistic). Ann: loves her son and husband, afraid of husband, in conflicting emotions.
10	Participant opinion about this scenario	I do not agree with arranged marriages especially against the childrens will, so I respect and understand Toms behaviour.
11	The differences related to	Personality
<b>Participant 4</b>		
1	Participant's identity	Collectivistic.
2	Participant's hierarchy	High hierarchy.
3	Characters' identity (first scenario)	Individualistic.
4	Characters' hierarchy (first scenario)	Low hierarchy.
5	Characters description	Tom and John are both very stubborn and care only for their own well being. Ann is more inclined towards her son and wants best for him.
6	Participant opinion about this scenario	The son could have been more polite in his approach and tried to pay respect to his father, but in the end both are selfish and the story does not end well.

*Appendix M: Pilot Test Results*

No	Evaluation criteria	Comments
7	Characters' identity (second scenario)	Rated as collectivistic.
8	Characters' hierarchy (second scenario)	High hierarchy.
9	Characters description	John: is a business minded person and very stubborn. Tom: is considerate and sensitive man. Ann: is a good and understanding wife and mother.
10	Participant opinion about this scenario	I think the son tried his best to convince his father, but John too stubborn and only care for his image. I think the son did the right thing in the end.
11	The differences related to	Culture.
<b>Participant 5</b>		
1	Participant's identity	Collectivistic
2	Participant's hierarchy	Neutral
3	Characters' identity (first scenario)	Individualistic
4	Characters' hierarchy (first scenario)	Low hierarchy
5	Characters description	Tom: an angry guy for no reason.
6	Participant opinion about this scenario	The tense between the family is clear
7	Characters' identity (second scenario)	Rated as collectivistic
8	Characters' hierarchy (second scenario)	High hierarchy
9	Characters description	Tom: a young man who wants to marry girl without the approval of his parents. Ann: a mum a typical mother who try to do things although she knew that there are no results of doing such. John: a man who thinks he knows what is good for his son.



*Appendix M: Pilot Test Results*

No	Evaluation criteria	Comments
10	Participant opinion about this scenario	Without the names Ive thought that this scenario is typical in eastern societies.
11	The differences related to	Culture and personality.
<b>Participant 6</b>		
1	Participant's identity	Collectivistic
2	Participant's hierarchy	High hierarchy
3	Characters' identity (first scenario)	Individualistic
4	Characters' hierarchy (first scenario)	Low hierarchy
5	Characters description	John: ego. Ann: sensible. Tom: stubborn.
6	Participant opinion about this scenario	They should compromise and be natural to get the best solution.
7	Characters' identity (second scenario)	Rated as collectivistic.
8	Characters' hierarchy (second scenario)	High hierarchy.
9	Characters description	John: ego and doesnt want to listen to others. Ann: she is sensitive.Tom: firm with his decision.
10	Participant opinion about this scenario	I think the dad should forget about the past and let his son decides on who's going to be his wife.
11	The differences related to	Personality.
<b>Participant 7</b>		
1	Participant's identity	Collectivistic
2	Participant's hierarchy	High hierarchy
3	Characters' identity (first scenario)	Individualistic
4	Characters' hierarchy (first scenario)	Low hierarchy
5	Characters description	Ann was in the side of her son. John is strict man. Tom was impolite person.
6	Participant opinion about this scenario	Always happened, but most of the time, sons goes to parent's opinion.

---

*Appendix M: Pilot Test Results*

---

No	Evaluation criteria	Comments
7	Characters' identity (second scenario)	Neutral
8	Characters' hierarchy (second scenario)	Neutral
9	Characters description	Ann is very kind and tries to support her son without losing her husband. John is very strict man and this kind of people doesn't change their mind in all cases. Tom was polite at the beginning, but starts to be angry at the end.
10	Participant opinion about this scenario	As I said before, this always happened, especially in Libya. But I think this scenario should be ended. I mean is Tom going to marry his girl or no?
11	The differences related to	Culture and personality

# Chapter N

## Evaluation Results

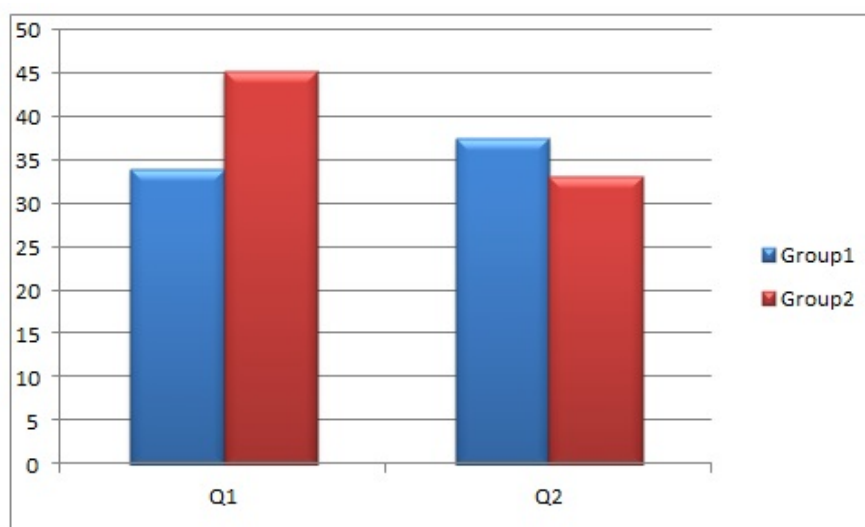
Results for the first research question:

Ranks				
	Group	N	Mean Rank	Sum of Ranks
Q1	Group1	56	34.02	1905.00
	Group2	16	45.19	723.00
	Total	72		
Q2	Group1	56	37.46	2097.50
	Group2	16	33.16	530.50
	Total	72		

Test Statistics <sup>a</sup>		
	Q1	Q2
Mann-Whitney U	309.000	394.500
Wilcoxon W	1905.000	530.500
Z	-1.957	-.750
Asymp. Sig. (2-tailed)	.050	.453

a. Grouping Variable: Group

## Appendix N: Evaluation Results



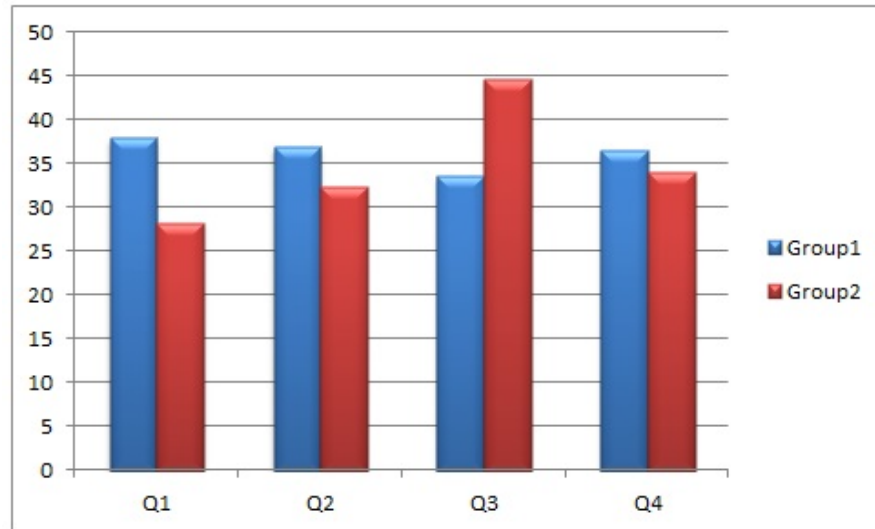
Results for the second research question:

Ranks				
	Group	N	Mean Rank	Sum of Ranks
Q1	Group1	56	38.05	2131.00
	Group2	15	28.33	425.00
	Total	71		
Q2	Group1	56	36.96	2069.50
	Group2	15	32.43	486.50
	Total	71		
Q3	Group1	56	33.65	1884.50
	Group2	15	44.77	671.50
	Total	71		
Q4	Group1	56	36.53	2045.50
	Group2	15	34.03	510.50
	Total	71		

Test Statistics <sup>a</sup>				
	Q1	Q2	Q3	Q4
Mann-Whitney U	305.000	366.500	288.500	390.500
Wilcoxon W	425.000	486.500	1884.500	510.500
Z	-1.682	-.780	-1.934	-.431
Asymp. Sig. (2-tailed)	.093	.435	.053	.667

a. Grouping Variable: Group

## Appendix N: Evaluation Results



Results for the third research question:

Group \* Q1

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.830 <sup>a</sup>	4	.934
Likelihood Ratio	1.155	4	.885
Linear-by-Linear Association	.114	1	.736
N of Valid Cases	56		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is .36.

Group \* Q4

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.522 <sup>a</sup>	4	.641
Likelihood Ratio	3.503	4	.477
Linear-by-Linear Association	.323	1	.570
N of Valid Cases	56		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 1.07.

Group \* Q2

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.152 <sup>a</sup>	4	.086
Likelihood Ratio	11.144	4	.025
Linear-by-Linear Association	.972	1	.324
N of Valid Cases	56		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .71.

Group \* Q5

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.380 <sup>a</sup>	4	.173
Likelihood Ratio	6.994	4	.136
Linear-by-Linear Association	.567	1	.451
N of Valid Cases	56		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is .71.

Group \* Q3

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.031 <sup>a</sup>	4	.905
Likelihood Ratio	1.047	4	.903
Linear-by-Linear Association	.243	1	.622
N of Valid Cases	56		

a. 5 cells (50.0%) have expected count less than 5. The minimum expected count is 2.14.

Group \* Q6

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.980 <sup>a</sup>	3	.577
Likelihood Ratio	2.241	3	.524
Linear-by-Linear Association	.865	1	.352
N of Valid Cases	56		

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is .36.

# Chapter O

## Participants' Opinion

### First scenario:

The participants' opinion about each character	The participants' opinion about first scenario
Tom - young, strong willed Mum - loving, understanding Dad - difficult, unyielding	One I've only heard of through the news (I don't know anyone who has been in that situation).
mum : simple John: spiteful Tom : young	good but not enough.
Tom is very independent. His mother is so kind. But John is a little stubborn.	I can understand what Tom has done
All seemed reasonable, this is a tricky situation for everyone in some sense.	Sounds plausible
Agreement: didn't understand this character Tom: prick, why did he keep staring at himself John: arsehole Ann: normal	This is a very unlikely scenario to see in a modern European household as we no longer live in the dark ages

*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about first scenario
boring	boring
N/A	N/A
The father is a fool. Who bring his trouble upon everyone else. The mother is meak, to used to taking the father's opinion before anyone else or her own. The son is young and not quite independent yet.	The father should not let his personal matters effect his son. The mother should not have pointed out who the girls father was. It has no relevance and only makes matter difficult. Tom has the right idea. It's more important to be happy yourself, than keeping your family sweet.
Tom is a guy who likes a girl a lot, he is the one who ask approval from his parents (John and Ann ) to marry her, Tom will stand for his decision no matter what parents will say to him Ann is a caring mother that understands her son and think that is her son found the true love than she should be happy and approve his marriage depites her husband's decision. John is a little bit paranoiac man who don't want to approve his son love, because he doesn't understand why his son fell in love in his enemies daughter and will not support Tom, which i very bad and maybe it will reflect on the relationship between his son forever.	I had almost the same situation, and so I can understand , the scenario is typical situation among families and I can say that sometimes parents show their worst side of character in such situations.

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*Appendix O: Participants' Opinion*

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The participants' opinion about each character	The participants' opinion about first scenario
Ann seems reasonable and rational. John seems to be unable to let go of an old grudge for the sake of his son. Tom really should have introduced his love to his family before bringing this up.	I think if John seen how much this girl makes his son happy then he is more likely to get over an old grudge as at the minute he can only think of his dislike for the girl's father but doesn't know the girl. It's unfair on the girl and on Tom.
Tom - he seeked approval but he would not let his father influence his decision. Father - angry but he should really think what would make his son happy. Mother - neutral, wants to make both parties happy.	Difficult, but if the son is happy with this girl then the father and the enemy should put aside their differences.
Tom likes the girl so he cares about his family opinion but it's not like he's going to accept it. His father is strict and thinks this is unacceptable His mother can quite understand her husband but still doesn't want her son to be sad.	Very common scenario in which parents try to influence their children's decisions and enter to their private life
Tom, realises his father's situation but believes that it should be irrelevant when it comes to his life. Ann cares about her sons wish, but believes that her husband will not lose his pride. John may want to digress, bu is too proud.	I think John should sacrifice his pride for his sons happiness.
Ann is an understanding mother and a good wife, she tells her husband when he's in the wrong. John is a hothead who holds a grudge, and cares more about his enemies than his family. Tom takes after his father's anger, and doesn't react appropriately.	Tom doesn't react appropriately, he should be much calmer in the situation. John's reaction is unrealistic. Ann is a very realistic character with appropriate dialogue.



*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about first scenario
John - Idiot Ann - normal enough Tom - melodramatic.	badly written but common.
Ann: nice, caring, diplomatic John: blustering, stubborn Tom: young, naive.	That the father should be more considerate of his son's wishes.
Ann seemed like a problem solver, Tom seemed proud, John seemed determined.	It's not an ideal scenario, but I reckon it is the most likely outcome of people in those circumstances.
Ann - Happy for son finding love, pushing him onto his own path Tom - naive about marriage (does he know her that well? have they been dating long?) , not worried about father's approval. John - Expects Tom to do as he says, lets an old grudge potentially ruin their good relationship, doesn't know Kristy but instead see's her for who he knows in her family (negatively)	Tom shouldn't care what his mother or father say (especially as he is 26 and can make his own decisions), it's sad that the father is too self-concerned to go to the wedding but he is at fault and will probably regret the decision, Ann seems like a good mother wanting what's best for her son!
John is a patriarch, who's used to be the one in charge of the family, Tom is young and has his own head, mother wants to keep peace in the family but also wants her son to get happy	this seems like a conflict between a very traditional father and more progressive son and mother
Tom - determined Ann - understanding, forgiving. John - obstinate	John should see if he and George can reach an understanding.
Tom was optimistic and relentless, John was stubborn and negative.	It presented quite a sense of tension and quickly established characters' perspectives on the situation.
John: idiot Ann: lesser idiot Tom: stud	If John truly disliked Kristy's father, he would be pleased his son was sticking it to her.
boring	quite boring
enemies of each other	good scenario
Tom looks independent person Natural parents	Looks natural for old people! But I'm not sure if it be like that now days.

*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about first scenario
Tom informs both his parents but directly tries to influence his father. John has his opinion, is rather stubborn and makes his point which is in some sense understandable.	Uncomfortable situation, no prosperous future.
Tom: strong-willed, independent, a little inconsiderate of his father's feelings Ann: Diplomatic, caring, peace-maker John: Judgemental, obstinate, unwilling to see things from others perspective	It is a likely scenario, commonly played out. The way it is resolved often depends a lot on the closeness of the relationship between parent and child, the strength of the contempt for the enemy, and the willingness to forgive past wrongs.
Tom and John are quick-tempered and selfish. Ann is cautious, however prefers son's wish to the husband's one - sign of independence.	Good beginning, but Tom could have tried to persuade his father instead of giving him an ultimatum. However the scenario is acceptable as John may eventually change his mind
Tom is young and in love. The mother is a peace-maker and the father is old fashioned	this is the plot for a bad film but loosely based on Romeo and Juliet
Mother - subservient John - knows his mind Tom - living in another century	Totally fictitious
The dad is disagrees because of his own experience with the girl's father. The son doesn't care about the agreement of his parents, but would definitely prefer it. The mother tries to facilitates the conversation and helps the son to get the agreement of his father.	I think the father should first look at the relation of his son and the girl (do they really love each other to the point of getting married so quickly? Shouldn't they first experience their relationship further?). The father should definitely not put his own experience with the girl's father at stake.
Tom - seeking approval but prepared to defy Ann - peacekeeper John - stubborn	Shows an example a parent with pre-conceived ideas who are not willing to compromise on the matter - regardless of the happiness of their son. If Tom's father had met the girl and did not think they had enough in common for a long term future then that would have been a different case altogether.

*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about first scenario
	need more in depth analysis and time
Tom: independent, peaceful Mother: peace-maker, loving Father: forthright, opinionated, stubborn	Adult children have their own opinions and lives to lead. It is good when they want the approval of their parents and want to keep them up to date, but it is not essential as they are capable of making their own decisions.
	it takes time but tom can convince his father.
john mean tom passionate Ann peacekeeper,	John is wrong to be angry with his son.
Tom young in love Ann Tom's mum concerned for his happiness John also wants tom's happiness but ready to put it at risk	Writer needs better English rather simplistic
Tom - Ann - open-minded John - old fashioned, stubborn	culture clash
Tom seemed cold and impartial apart from his last words Ann was direct and seemed genuine to be looking for a solution that was best for her son father seemed irrational and determined with his thoughts	I found it difficult to have empathy - not sure if it was the font I associate with cmd or not.
SOUNDS OK	THE WHOLE SCENARIO IS RELETIVELY DEPENDENT ON SITUATION
sss	ss
Tom's father: traditional, controlling Tom: growing in independence!	I can imagine it happening, but I don't feel it is right.
Tom and John are both used to getting their own way, and do not intend to back down. Ann appears to be used to her role as the mediator in their disputes, and in this case considers her son's happiness more important than her husband's 20-year-old grudge.	Tom has given his parents the news and an opportunity to patch up a past dispute, but his father is being stubborn and refusing to budge.

*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about first scenario
Tom seemed determined, his dad was stubborn and his mum was passive	Unnecessary conflict, his dad shouldn't interver with his life
John - unreasonable, strict Ann - reasonable, peacemaker Tom - headstrong	Tom is in the right but he would benefit from having a mature discussion with his father to work things out
The mother is more accepting and reasonable, the father seems very unreasonable.	Tom should be able to marry who he likes with the support of his family, regardless.
Tom - Passionate, possibly a bit naive John - Stubborn, grudging old man Ann - Bland.	Meh.
Tom- quite nervous probably, wishes to marry a girl who he wants to spend the rest of her life with. Ann - wants what is best for her son, but seems to switch sides when john appears, siding with her son when previously saying that tom should ascend to his father's wishes.	The scenario is mildly ridiculous in modern society. Reason 1 - Simply because the father doesn't like someone parent does not mean they will dislike her, and if he truly is on good terms with his son why does he not trust him as a judge of character? Reason 2 - In modern society the idea of seeking permission from someone so that you can live with someone you love is silly to say the least.
Mother: encourages her son, tries to persuade the father for the marriage.	Reason 3 - Why does no one think to ask how long this relationship has been going on? If he is supposedly so close with his father why hasn't he mentioned the love of his life or invited her round to dinner or something? Reason 4 - There is no way you could organise a wedding in a month, if you wanted the whole shebang it takes months. Reason 5 - Personally I think the concept of marriage is outdated and the social stigma of couples that aren't married but live together is disgraceful, marriage as an act isn't about ove and never has been, its a legally binding contract that originally was meant to secure a families place in society or improve it, now marriage simply is a backup plan if the relationship goes south then everything is
	split equally between the two partners. Not vivid description of characters. Unreal characters and unreal discussion and reactions.

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The participants' opinion about each character	The participants' opinion about first scenario
Tom looks stubborn in getting married Ann will accept that girl but she is confused about her husband attitude John still remember his old enemy and do not want to forget the past and make his soon happy	I think Tom Should try with his father to attend his wedding. He is his father and is not good make him unhappy about him
Tom - Young and eager, perhaps letting his emotions over ride his logical thought process. Ann - Supportive of her son. John - Narrow minded and petty.	The scenario seems to be rather far-fetched, I don't think any university student would make such a rash decision about his future. Likewise, I don't think most parents would disapprove of their child's spouse on the basis that they dislike the potential spouse's parent(s).
They are not really believable. Tom is the father, Ann the mother, John the son.	Cliche, like coming out of a soap opera. The characters are not believable.
Tom - adamant will get what he wants in the end Ann- A bit naive John- Stubborn and adamant	Tom should marry Kristy, but , try to pursued his father first
John: conservative and selfish Tom: progresist, free minded Ann: rational comprehensive	Illustrate pretty good different personalities developed in a family
young people are very rush able	no opinion
Well, Tom need to be more patient and insistent. Mother is trying to be supportive, but it is really hard to be between son and husband.	I completely support Tom in this situations. His father should forget past problems .
Tom: impolite and irrational Anne: Kind and understanding John: vengeful	no idea
Tom: impulsive, impetuous, undiplomatic, direct John: inflexible, self-absorbed, self-centred, impulsive, dismissive Ann: self-effacing, subservient, weak-willed, kind	The presentation and writing style are quite odd. Especially since "Approval" is presented like another person in the room, someone you can "look at". Also, the way the family behave makes you think they might be Asian, or at least not British, but their names are quite ordinary English names.

*Appendix O: Participants' Opinion*

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The participants' opinion about each character	The participants' opinion about first scenario
Ann - A mother who wants her son to be happy and wants to get her husband to understand and act rationally. John- A stubborn old man Tom - A nice but angry young man	I think its based on what type of reactions occur when different generations come in contact.

**Second scenario:**

The participants' opinion about each character	The participants' opinion about second scenario
Tom - polite, sure of his path Ann - caught in the middle John - authoritarian	Tom handled it better, but he couldn't influence the outcome.
mum : simple John: spiteful Tom : stupid	good
Tom is quite patient. His mother is understanding and nice. But his father is short-tempered and arbitrary.	I support the choice made by Tom and wish his father could forgive and understand him.
See past block.	See past block.
Approval: still don't understand what this characters role is John: still looks at himself, and still behave like a medieval patriarch Ann: behaves reasonably Tom: normal person with a strange urge to get his father's approval	Could have been avoided by not taking his father's opinions into account.
boring	boring
N/A	N/A
The father is a hot-headed fool. The mother is ruled by the father. The son is independent of the two.	It seems to work out better than the last, but he should of confronted his father.
Tom is almost the same as in 1-st scenario, but here he is more polite John is out of control, he doesn't want to listen to his son , he thinks that he can make a future for him and in the end of conversation he tells him to get out from his sight. Ann here is very caring mother as in the 1-st scenario	Its maybe be not very typical situation, but i think it is still quite common situation nowadays.

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The participants' opinion about each character	The participants' opinion about second scenario
Again, Ann is very reasonable and rational. John should not dismiss his wife in such a manner like he is superior to him. Nor should he hold believe that because he has fathered his son that he now controls Tom. Tom has stood up for what he believes in, in a very polite way. I would say that has quite a bit of courage.	Unfortunately I do not understand where the father gets to think he is so superior to his 26 year old son and his wife. The son is now a fully fledged adult and has been for some time and has the right to make his own decisions. And as much as children love their parents there is a time where they must 'fly from the nest' and at this point parents shouldn't come into their lives to this extent.
Tom - polite, really wanted his father's approval. Father - would not change his decision. Mother - on her son's side	Tom's father is self-centred. He cannot put his past aside to see his son happily married.
Tom is very polite and wants his family permission but he's not going to rely on it. His father is very angry and thinks this is unacceptable. His way too cruel towards his son His mother again is the middle person who wants to understand both of them but understands her sons sight more.	Common scenario where family relations are teared down due to families mixing with their children opinions
John is angry, and stubborn. Tm is scared b in love. Ann is too intimidated to speak up to John.	I feel that John feels he is the only one in the house that deserves an opinion.
Ann is a good mother and wife, telling her husband when he is in the wrong, though she is not firm enough. John is outrageously hot-headed and does not place family values very highly. He does not treat his wife or his son properly. Tom is a good character, he does things appropriately but takes action and makes a stand for what he thinks is right when needed.	Much more realistic than the first one. Tom does things appropriately but John is far too aggressive.



*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about second scenario
John - idiot in general Tom - idiot for bothering to ask Ann - idiot for putting up with that oaf.	sounds a bit cheesy.
Tom: young, strong-willed, naive Ann: caring, concerned John: stubborn, mean	Tom's initial request from his mother was somewhat a sign of weakness. John's reaction was too much and out of context. The situation went very bad...
.	.
Ann, good mother, wants what's best for son John - self obsessed, hindering son's life Tom - would like blessing from father but father won't give it, doesn't hold him back from marriage	Parents have every right to give opinion on children's weddings, but the only person they should worry about is the bride to be, parents should not have this sense of power in determining a child's future, as a child in a mental 'parent' cage will never understand or live life the way they want
John and Ann are the same as in the scenario before, Tom in here is more polite and respectful towards his parents and the family rules and traditions	it seems to be a happier family than in scenario 1 as the son is really concerned about getting the approval
John - obstinate, pig headed Ann - open minded, forgiving, reasonable Tom - focused, scared	Tom should commit to a plan of action, then later seek approval.
Tom was much more pleading in the second scenario, John actually appeared slightly less hostile but scarcely. Ann appeared quite tense, stuck in the middle of the conflict.	Good use of FAtiMA, characters were built quickly and effectively in the situation.
John: old fashioned Ann: pushover Tom: a bit thick	I wouldn't ask my parents for permission to marry, definitely not if I was 26. I would let them know, but not ask.
idiots	totally shocking
n/a	good
*	*

*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about second scenario
Tom tries to avoid conflict by letting his mother ask instead of him. Mother doesn't really spend a lot of effort to convince the father. Father is absolutely stubborn and won't change his opinion.	Uncomfortable situation. 2 vs. 1 situation (Tom, mother vs. father) but mother is very neutral. Future trouble in family can be foreseen.
John: Uncompromising and obstinate Tom: Considerate, diplomatic Ann: Peacemaker, diplomatic	Also realistic. In this case the relationship between father and son is likely to be irrevocably changed for the worse.
Tom is now rather considerate than selfish. John - same, but less angry. Ann should not have said "insanity".	Better scenario - at least less opposed by John
Tom is still bold but polite. The mother is even more of a facilitator and the father is even more boorish and old fashioned	it is the storyline to a Bollywood film
Mother the peacemaker Tom - independent	Discussion fairly realistic, outcome questionable.
Same as before	Same as before
Same as previous screen Tom - seeking approval but willing to defy Ann - peacekeeper John - stubborn (but a little more willing to listen this time).	Tom went about this in a more sensible fashion and so there was less tension in the conversation itself but the outcome was still the same.
-	as said before
as before	as before
.	.
john bully, controlling Ann peacekeeper Tom passionate, scared of dad	Tom should have spoken to his father himself, although this appears to be partly due to fear. I do not agree with this kind of parenting.
as before except john more intransigent	as before
Tom - restrained, polite Ann - John - angry, old fashioned	unreasonable father
Tom- worried Ann- caring and aware father- direct and suspicious	all characters are more aware of the fathers reaction will be...

*Appendix O: Participants' Opinion*

The participants' opinion about each character	The participants' opinion about second scenario
IN THIS OCCATION THEY ARE OK	NORMAL
aaa	aaa
Mother: trying to please, but rational Father: Angry, controlling, irrational Tom: polite, but intimidated	As before.
John: Very overbearing. Considers himself very much the man of the family, and expects to be obeyed without question regardless of personal desires. Tom: Starting to become more independent, but still rather cowed by his father. Ann: Tries to influence John, but often fails. Resigned to a peacekeeping role.	Tom and Ann's tactic of letting Ann build up gradually to the revelation that George is Kristy's father appears to have got John suspicious enough that he is much more angry when he finds out. How much of that is due solely to the scenario and how much to the characters themselves is hard to tell - the balance of dominance between John and Tom seems much less level in this scenario.
Tom is trying to please his family but knows he will do as he pleases whether that means pleasing them or not	As toms mum put it 'insanity'
john is being very immature and selfish Ann tries hard to be the reasonable one but gives in too easily to john tom is being mature about approaching his parents to talk	tom is acting as a very considerate and mature son in even asking for his parents permission. he is totally in the right to marry whoever he wishes, its his life.
Father very dismissive. Mother more accepting and reasonable.	Tom should have the support of his family.
See from previous scenario.	Meh 2.0
Tom - Nervous about disobeying his father, but resolute that he loves Kristy Ann - Seems more amiable to the idea of tom marrying someone else than in the previous scene. John - A douche bag living with a cultural output that is disgraceful. A father should be supportive of his son and give advice freely, he should not try and control his sons life like a tyrant, arranging a marriage without his sons consent is immoral and I am surprised that he	This reads like something directly out of Romeo and Juliette without the flowery language. Everything I said about Scenario 1 applies here. Like I said I think arrange marriage is immoral, every person should be allowed to live their own life as they choose. We no longer live in the middle of a desert squatting in tents, society has moved on and so should we.
were on good terms before this conversation.,.	236

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The participants' opinion about each character	The participants' opinion about second scenario
Mother: quite supportive father: stubborn Son: quite respectful	Again this is not a discussion that would ever happen in real life
Tom was polite son in his discussion Ann tried to make both happy John was	Tom does not have any choice in his decision. I agree with him to get married with Kristy.
Tom - Appears more level-headed this time, does his best to get approval but ultimately fails and follows his heart. He still may be letting his emotions run riot though. Ann - Submissive and intimidated, does her best for her son but ultimately John seems to have control of her. John - Arrogant and obnoxious, selfish and power-hungry. Obviously thinks he is in charge of all his family matters and that his word is final. Too proud to back down and support his son.	John's behaviour is outrageous, he is acting like a child and throwing his toys out of the pram because his son has fell for a rival's daughter. The scenario is very alien to me although I can imagine in other parts of the world it is very common place.
Same as previous	Same as previous, very bad.
Tom - Adamant to get what he wants, but will not walk all over his father to get it Ann- Positive thinking mother John- Stubborn dad stuck in traditions of the past	Tom should marry Kristy, With or without his fathers approval
Tom: patient but solid in his decision John: worse than the previous case Ann: comprehensive	This was worse than the previous one
no description	no opinion
Tom is very concerning about approval, but not so much to cancel marriage, mostly because wants this is tradition and he wants to make his parents happy about himself.	Well done, Tom. If it is his real desire he must do this, even his parents disagree.

*Appendix O: Participants' Opinion*

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The participants' opinion about each character	The participants' opinion about second scenario
Tom: polite Anne: kind and helpful John: vengeful and irrational	no idea
Tom: reasonable, assertive, respectful John: inflexible, overbearing, old-fashioned, vengeful Ann: Shy, self-effacing, weak-willed	It seems more realistic than the first and people seem a bit more reasonable and polite. It still does not sound like a British family to me, unless they are of South Asian or possibly Chinese background.
Ann- a reluctant mediator Tom - an obedient son romance gets him. John - typical head of the family the alpha male	too distractive not enough argument and too stubborn a father.

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