Chapter 12
Cultural Broker Agents: A Framework for Managing Cultural Misunderstandings

O. González, J.-P. Barthés, and F. Ramos

12.1 Introduction

As an increasing tendency, advances in technology and communications, global partnerships, and expansion of transnational enterprises drive the creation of distributed and multicultural work teams. Such teams highly depend on clear and efficient interpersonal interactions and in a strategy for avoiding misunderstandings deriving from cultural differences.

In such multicultural scenarios, it would be desirable to have a framework to: (i) formalize and measure the culture of users; (ii) define cultural misunderstandings prone to occur; (iii) define proper reactions for each type of cultural conflict; and (iv) timely show explanations and advises to users when potential cultural misunderstandings are detected in their interactions.

This chapter proposes a framework with such capabilities, namely a multi-agent system (MAS), where computer supported interactions are managed by cognitive agents with cultural capabilities called cultural broker agents (CBA). Under this approach, each user is supported by a CBA which formalizes his actions. When users interact, the corresponding CBAs act as intermediaries, capturing information, exchanging messages, and detecting potential cultural misunderstandings based on cultural differences and patterns in interactions.

O. González (✉)
CINVESTAV Unidad Guadalajara
e-mail: oglez@gdl.cinvestav.mx

J.-P. Barthés
Université de Technologie de Compiègne BP 529 F-60205 COMPIEGNE France
e-mail: Jean-Paul.Barthes@utc.fr

F. Ramos
Cinvestav Unidad Guadalajara, Mexico
e-mail: framos@gdl.cinvestav.mx

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Cultural preferences of users are formalized by CBAs as cultural profiles inspired in the theory proposed by Hofstede (1996), who summarizes the culture of individuals as a set of quantitative features.

CBAs formalize interactions by capturing the intention behind each user action. Each time a user interacts with another, the corresponding CBA obtains the illocutionary force, i.e. the intention of the action (Searle 1975). This approach is based on speech act theory (Austin 1975) and the language-action perspective (Winograd and Flores 1987).

Cultural conflicts are defined in different stages of interactions as conditions involving differences in cultural profiles and additional information which vary according to the conflict being defined.

12.2 Models of Culture

Culture is a complex concept with many definitions; none of them completely compatible (Paez et al. 2003). However, most anthropologists agree defining culture as a set of socially acquired patterns for thinking, feeling and acting.

Several researches are aimed at developing measurable models of culture; the most common approach is to decompose culture in a set of cultural dimensions representing the degree of acceptance or rejection for specific behaviors (Hofstede 1996). Depending on the scope of each research, different models base on diverse aspects like: attitudes when interacting with people (Hofstede 1996; Trompenaars 1998), attitudes towards time (Trompenaars 1998; Hall 1989) and the environment (Trompenaars 1998), communication (Hall 1999), corporal language (Hall 1990), or biological needs (Schwartz 2003).

Such models are commonly used in technological developments which require a method for measuring culture. Which model to select depends on the requirements of the application; examples are communication tools (Dutsbar and Hofstede 1999), virtual reality simulations (Llobera et al. 2010), computer supported collaborative work (Kamel and Davison 1998), and design of user interfaces (De Troyer et al. 2006).

We found the model of Hofstede (1996) the most adequate for developing our framework for intercultural collaboration. Hofstede's model is derived from studies on organizational culture, the collection of values and norms that control the way in which people interact in organizations (Hill and Jones 2006).

12.2.1 Hofstede's Cultural Dimensions

Based on data collected from IBM workers in 70 countries, Hofstede identified 4 cultural dimensions affecting interactions in organizations (Hofstede 1996):

- Individualism vs. Collectivism. Degree in which people prefer acting by themselves, or alternatively, as members of a group.

- Power Distance. Degree in which it is accepted in a society that people is treated differently according to social or economical position. A low value reflects a shared belief that people must be treated in the same way.
- Masculinity vs. Feminity. Extent to which a society tends to be more interested in material possessions than in personal relationships and quality of life. Masculine societies value competitiveness, assertiveness, and ambition; feminine societies value family, friendship and quality of life.
- Uncertainty Avoidance. Degree in which a society accepts uncertainty and risk. Societies with high values avoid changing processes and make efforts for reducing ambiguity as much as possible.

In the mid 1980s, Michael Bond (1988) noticed differences of thinking between Eastern and Western cultures and developed a questionnaire about how time is managed when acting and fixing objectives. The questionnaire was applied in 23 countries and the analysis of results led to the addition of a fifth dimension to the model:

- Long Term Orientation vs. Short Term Orientation. How important is in a society the future compared to the importance given to past and present. On the long term oriented pole, people value persistence, perseverance, thrift, and planning. Short term oriented societies give special value to stability, traditions and fulfillment of obligations.

Based on an analysis of the answers of its questionnaire, Hofstede computed values for his cultural dimensions describing stereotypes for different countries. Most of the criticisms to Hofstede are focused on the sample he used for obtaining such values. McSweeney (2002) argues that considering groups as big as national populations sharing a common culture is not a valid hypothesis; he also remarks that answers were provided by respondents with similar demographical information, neglecting the diversity of subcultures inside a country. Bryman (1988) states that the number of respondents is not representative for some countries; finally, values obtained by Hofstede are old and ignore global changes of last years.

Despite these criticisms, we consider the theoretical framework, i.e. the proposed dimensions for abstracting culture, represent an adequate model for the scope of our work. According to this, we obtained new values for cultural dimensions for some countries. Like Hofstede, we compute national cultural profiles statistically based on questionnaires; however, we applied them to social network users which provides some remarkable advantages: (i) given the huge amount of social network users, representative samples can be easily obtained from any country; (ii) given the facility for accessing user profiles in social networks, values for more specialized groups can be obtained by segmenting respondents using features like age, sex, religion, or education level; and (iii) responses are constantly generated, which provides fresh values for practical purposes. Figure 12.1 shows new values obtained from a sample of 600 Mexican Facebook users segmented by age and sex.

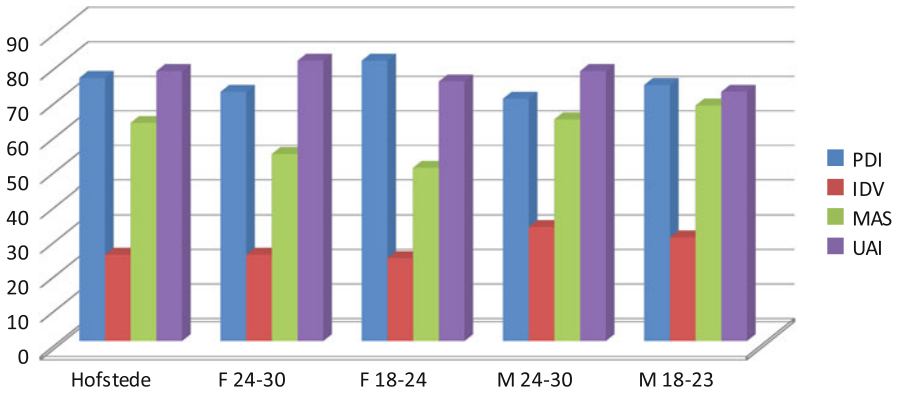

Fig. 12.1 Mexican cultural values segmented by age and sex

12.2.2 Hofstede's Model in Practice

The model of Hofstede has been used mainly for two purposes: (i) for technological developments, where the model has driven the design of some applications; and (ii) as a theoretical framework for analyzing common conflicts when individuals from different cultures interact. The platform proposed is a combination of these two points of view: the model of Hofstede is the foundation for creating cultural profiles for users and theory shows some conflicts which the platform intends to manage.

From the technological point of view, there are some developments influenced by the model. Nazir et al. (2000) developed an agent model for managing intercultural interactions which combines culture, personality and emotions. Personality and culture influence emotional needs of the agent which maintains a long term memory with rigid cultural rules and a short term memory with information about behaviors expected from other agents. When such expectations do not match with events in the environment the agent updates his short term memory in order to adapt.

Rehm et al. (2007) propose a model for deriving the cultural background of a user based on his behaviors and adapt the culture of an embodied conversational agent. Basically, the system classifies the culture of the user into one of eight stereotypes. This is done by capturing movements of the user, analyzing observations, and matching them to one of the cultural stereotypes. The adopted culture affects aspects like spatial extension, speed, and power of movements. Hofstede dimensions are used as an entry point in a Bayesian network while deriving the cultural background of the user, and when assigning behaviors to the agent according to the adopted culture.

Mascarenhas et al. (2009) developed a model of culture based on individualism and power distance values. In this model, goals and emotions of agents are

Table 12.1 Examples of cultural conflicts

1	*Individualism*	*Collectivism*
1.1	Decisions are taken individually	Decisions are taken in group
1.2	Individual points of view must be expressed	Confrontation must be avoided
1.3	Own goals are primordial	Goals of the group are primordial
2	*Low power distance*	*High power distance*
2.1	Subordinates have liberty in their work	Subordinates are told what to do
2.2	Anyone can initiate interactions if necessary	Interactions are supposed to be initiated by superiors only
2.3	Subordinates are consulted	Subordinates are notified
3	*Masculinity*	*Feminity*
3.1	Majority is sufficient	Consensus is desirable
3.2	Success depends on results	Success depends on relationships and teamwork
3.3	Competitiveness is valued	Modesty and cooperation are valued
4	*Low uncertainty avoidance*	*High uncertainty avoidance*
4.1	General aversion against rules	General necessity of rules
4.2	Hard work only if necessary	Hard work is a constant
4.3	Calendars are flexible	Punctuality is essential

influenced by its cultural values. Individualism and power distance values of the agent affect utility of goals according to Hofstede's descriptions about how different values on such dimensions modify behaviors. Emotions are influenced in the same way, by means of an equation based on theory about the influences of individualism and power distance.

From the theoretical perspective, there are many examples of cultural conflicts which are analyzed using Hofstede's dimensions. Commonly, such conflicts are related to a dimension and to a context of interaction. Table 12.1 shows some common situations which led to conflicts in intercultural collaboration; these are the kind of conflicts the platform is intended to manage.

12.3 Proposal Overview

Our objective is to provide a multi-agent system for supporting intercultural collaboration and reducing occurrences and impacts of cultural misunderstandings. Our approach bases on cognitive agents with knowledge about the culture of users, which analyze interactions of users searching for the occurrence of potential cultural conflicts. Interactions are formalized according to the language-action perspective (LAP) (Winograd and Flores 1987), whose main foundation is that people act through language. Using LAP, interactions are modeled as conversations which evolve as users perform actions until reaching a final state. The set of possible actions is extracted from speech act theory and the taxonomy proposed by Searle (1975).

12.3.1 Multi-agent System Architecture

The proposed MAS is based on OMAS (Barthès 2011), a platform for developing cognitive agents. Some of the capabilities of OMAS agents which make them suitable for our purposes are:

- Autonomous execution and proactive behavior: OMAS agents execute autonomously in the background and respond to stimulus by means of their skills. Skills are predefined behaviors which can be executed by an agent when it receives a request from other agent or from another element in the environment. They can also display goal-oriented behaviors; an agent possesses a predefined set of goals, and given a scenario they can construct a plan for achieving them, which can involve activities from other agents. Furthermore, an agent can build goals dynamically.
- Structuring and Storing Knowledge: OMAS agents structure their knowledge by means of ontologies, which are formalized with the MOSS knowledge representation language. They include definitions of different ontologies related to their built-in functionalities, and also can be provided with other ontologies required for the specific functionality of each agent.
- Perception of the Environment: OMAS agents can perceive contextual information in order to update their knowledge and adapt their behaviors accordingly. Such perception is represented as incoming messages. As an example, users can interact with personal assistants through a vocal interface, and user utterances are delivered as messages to personal assistants.
- Reasoning Capabilities: cognitive agents possess inference mechanisms which allow them to produce new knowledge by reasoning over their knowledge base. OMAS agents have a persistent store for keeping their knowledge bases and can make inferences over them. In addition, the MOSS formalism allows performing specific queries which can be answered by the same agent or sent to other agents.
- Learning Capabilities: OMAS agents can implement skills for learning from experience. With such skills, OMAS agents can evaluate the results of certain actions, and they can adapt their behaviors in order to improve performance.
- Collaboration: OMAS agents can work together in order to reach common goals. They can send and receive messages, and in this way they share information and make requests for executing skills. In addition, OMAS agents are aware about the existence and the capabilities of other agents, and they can generate plans which involve the execution of skills from several agents.

12.4 Formalizing Culture

This section describes cultural profiles, the means proposed for representing culture of users. Cultural profiles are based on the model proposed by Hofstede, however we decided to represent cultural dimensions using linguistic variables rather than numeric variables. Zadeh (1975) defines linguistic variables as *a formalism for*

dealing with complex and ill-defined systems, whose behavior is strongly influenced by human judgment, perception, or emotions. This definition fits appropriately with the concept of culture: there is no a rigid definition about culture and how to measure it, and the perception about cultural preferences is completely dependent of judgment.

Usage of linguistic variables allows profiling someone with values like *very individualistic* or *more or less risky*, which is more natural than numeric values. Linguistic variables are also convenient when defining cultural differences, using them it is possible to approximate differences in cultural dimensions using fuzzy relations like *greater than* or *approximately equal than*. Finally, usage of linguistic variables allows using fuzzy logic and approximate reasoning for comparing cultural profiles and making inferences from their values.

12.4.1 Linguistic Variables

A commonly used example for illustrating linguistic variables is *age*. While a typical variable for ages holds integer values, a linguistic variable holds text values like *young, quite young, not very young and not very old*, etc.

A linguistic variable is formally defined as a quintuple $L = (\vartheta, T(\vartheta), U, G, M)$, where:

- ϑ is the name of the variable, e.g. *age*;
- $T(\vartheta)$ or the term set, is the collection of possible linguistic values;
- U is the universe of discourse, i.e. the base variable from which linguistic values are defined. For the example of ages, $U = \{0, 1, 2, \ldots, 100\}$;
- G is a syntactic rule generating terms in $T(\vartheta)$, usually given by a context-free grammar;
- M is a semantic rule, which represents the meaning of linguistic values in $T(\vartheta)$. Semantics of a linguistic variable is given by a set of compatibility functions, one for each possible linguistic value X. A compatibility function $c_X : U \rightarrow [0, 1]$ denotes the compatibility of each $u \in U$ with the linguistic value X. For example, some evaluations for the compatibility function associated with the linguistic value *young* would be: $c_{young}(10) = 1, c_{young}(27) = 0.7, c_{young}(35) = 0.2, c_{young}(90) = 0$.

Elements in the term set are either primary terms, like *young, old, middle-aged*, or composite linguistic values composed by primary terms, hedges (*very, more or less, quite*, etc), and connectives (*and, or, not*). In general, system designers heuristically define compatibility functions for primary terms, while values of hedges and connectives are computed with nonlinear operators.

Compatibility functions for linguistic values containing hedges are often approximated using exponential functions (Zadeh 1972). For example the hedge *very*, which has an intensifying effect, is commonly approximated by the square function, while *more or less*, which has the opposite effect, is commonly approximated by the square root function.

$$c_{very\,X}(u) = c_X(u)^2,$$
$$c_{more\ or\ less\ X}(u) = c_X(u)^{1/2}$$

In the case of connectives, compatibility functions are approximated with functions that must satisfy a set of specific axioms (Lee 2005). The most common functions are:

$$c_{not\,X}(u) = 1 - c_X(u),$$
$$c_{X\ and\ Y}(u) = min(c_X(u), c_Y(u)),$$
$$c_{X\ or\ Y}(u) = max(c_X(u), c_Y(u))$$

Note that presented functions are general and apply for any linguistic variable. On the other hand, compatibility functions for primary terms are specific for each linguistic variable and in most cases they are defined and tuned heuristically.

12.4.2 Cultural Profiles

Cultural dimensions measure dichotomies, i.e. the extent in which people prefer one of two possible states. Bounding values represent completely opposite stereotypes, and center values represent balance in preferences.

We define a cultural profile as a set of linguistic variables, each of them modeling a cultural dimension. Such linguistic variables are defined over the universe [0, 100], the domain proposed by Hofstede.

For each linguistic variable v_i in the profile, three primary terms are defined: p_{i1}, p_{i2}, and *neutral*. The terms p_{i1}, and p_{i2} represent both stereotypes, and they are represented as two sigmoid shapes biased to 0 and 100 respectively and symmetric with respect to $x = 50$. *Neutral*, is present in all cultural dimensions and allows profiling individuals whose behaviors are not clearly biased towards a stereotype. The shape of the compatibility function for *neutral* follows a distribution around $x = 50$. The shape of compatibility functions for stereotypes is based on item response theory (Baker and Kim 2004), which is used for analyzing data obtained from measurements of things like abilities, attitudes, and personality traits. In particular, compatibility is characterized using the logistic function, given by:

$$f(u) = 1/(1 + e^{-a(x-b)}), \text{where}$$

- b is the position of the center of the curve, and
- a determines the smoothness of the curve, which is proportional to its maximum slope, i.e. to the slope of the curve in b

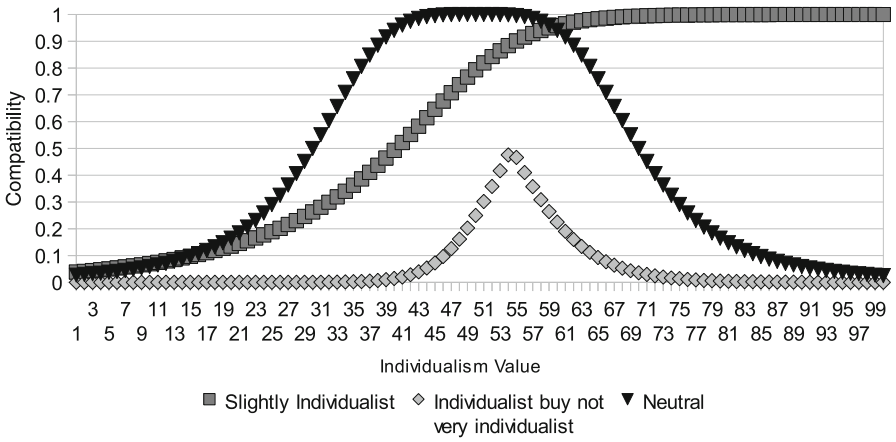

Fig. 12.2 Compatibility functions for collectivism/individualism

Finally, the compatibility function for the linguistic value *neutral* is given by:

$$c_{neutral}(u) = 1/[1 + ((50 - u)/d)^4],$$

where d is proportional to the width of the curve. The set of hedges proposed is $H = \{somewhat, moreorless, very, extremely\}$. Figure 12.2 shows compatibility functions for some linguistic values of the *individualism/collectivism* dimension.

Formally, for a given application influenced by n cultural dimensions, culture is modeled as a set:

$$C = \{v_1, v_2, v_3, \ldots, v_n\}$$

Where each v_i is a linguistic variable representing a cultural dimension, defined as:

$$v_i = (\vartheta_i, T(\vartheta_i), U, G_i, M_i), \text{where:}$$

- ϑ_i is the name of the cultural dimension;
- $T(\vartheta_i)$ is the term set, generated by G_i;
- $U = \{0, 1, 2, \ldots, 100\}$;
- $G_i = (W_i, \sum_i, R_i, \sigma_i)$ is a context-free grammar with initial symbol σ_i, where
  - $W_i = p_{i1}, p_{i2}, neutral \cup H$
  - $\sum_i = \{\sigma_i, < expression_i >, < simple\_expression_i >, < connective\_expression_i >\}$
  - R_i is the following set of productions:
    - $\sigma_i ::= < expression_i >$,
    - $< expression_i > ::= < simple\_expression_i > | < connective\_expression_i >$,

- $< connectiveexpression_i >::= not < expression_i > | < expression_i > and < expression_i > | < expression_i > or < expression_i >$,
- $< simple\_expression_i >::= p_{i1}|h_j\, p_{i1}|p_{i2}|h_j\, p_{i2}|neutral|h_j\, neutral$; $h_j \in H$

- M_i is given by the following functions:
  - $c_{p_{i1}}(u) = 1/(1 + e^{-a_i(u-b_i)})$
  - $c_{p_{i2}}(u) = c_{p_{i1}}(100 - u)$
  - $c_{neutral}(u) = 1/[1 + ((50 - u)/d_i)^4]$
  - $c_{very\,X}(u) = c_X(u)^2$
  - $c_{more\ or\ less\,X}(u) = c_X(u)^{1/2}$
  - $c_{somewhat X}(u) = c_X(u)^{1/3}$
  - $c_{extremely X}(u) = c_X(u)^3$
  - $c_{not\,X}(u) = 1 - c_X(u)$
  - $c_{X\ and\ Y}(u) = min(c_X(u), c_Y(u))$
  - $c_{X\ or\ Y}(u) = max(c_X(u), c_Y(u))$

According to this definition, defining a cultural dimension only requires assigning values for parameters a_i, b_i, and d_i, which determine the shape of the compatibility functions.

12.4.3 Values for Culture

The main advantage of modeling cultural profiles as cultural dimensions is that they can be measured for any given user. However, assigning values to cultural profiles is not straightforward and requires a deep understanding of the dimensions in question.

Theories proposing cultural dimensions associate each extreme of dichotomies with typical behaviors. Such behaviors are analyzed in order to develop feasible approaches for measuring cultural dimensions. Hofstede publishes in his website values for his cultural dimensions for 56 different countries and regions (Hofstede, www.geert-hofstede.com). Such values are the result of statistical analysis of tests applied during his research. Another example is the approach adopted by Hall in proxemics theory, providing values for physical distances among humans based on an analysis of perception (sight, hearing, smell, touch, thermoception), categories of interactions, and observation of behaviors of different cultures. Linguistic variables give the opportunity of profiling users heuristically based on the available information. Internally such values are managed as numerical values, for which they are processed by computing their membership functions and applying a defuzzification method.

12.5 Interactions and Conflicts

This section presents the approach adopted for formalizing interactions among users and defining cultural conflicts. Such approach is an extension of the language action perspective (LAP) (Winograd and Flores 1987). The main idea behind LAP is that people act trough language. As consequence of this idea, the LAP is closely related with the speech act theory (Austin 1975). In LAP, interactions are treated as conversations among users, where each turn in the conversation is characterized by an illocutionary act. Each conversation is represented as a state transition network, where user actions trigger transitions until reaching a final state.

We propose extending the model by allowing the specification of cultural conflicts in each state of the conversation. Conflicts are composed by a condition and a reaction. Conditions combine fuzzy and Boolean logic; they express differences of cultural profiles, and comparisons of contextual information. When a new stage is reached in a conversation, the corresponding conditions are evaluated, and if it is the case, the reaction is triggered.

The LAP approach presents some convenient features for our purposes: is intuitive, so common users can define new patterns of interaction; diversity of illocutionary acts allows modeling complex and varied patterns of interaction; and usage of state transition networks allows defining conflicts in any point of an interaction.

12.5.1 The Language-Action Perspective

The language action perspective is an approach for supporting communication and coordinated action among groups of people. Unlike traditional approaches which give special attention to information processing and data transfer, LAP considers language as the main dimension of cooperative work. LAP bases on the illocutionary force of utterances, i.e. in the action that is actually performed each time we participate in a conversation. For example, by pronouncing an utterance we can promise, request, apologize, declare, make an offer, make a counteroffer, ask, etc.

Under the LAP approach, common patterns of interaction are modeled as conversations for action (CFA). CFAs represent the different paths, in terms of illocutionary acts, that can be followed in a specific kind of interaction. A simple example presented by Winograd (Winograd and Flores 1987) is the CFA where user A makes a request to user B. Figure 12.3, obtained from Winograd and Flores (1987), shows the state transition diagram of such interaction. This pattern of interaction starts when user A makes a request; then user B can accept, decline or make a counter-offer; each of this options provides new possibilities of action for A, then B has new possibilities, and so on until reaching a final state.

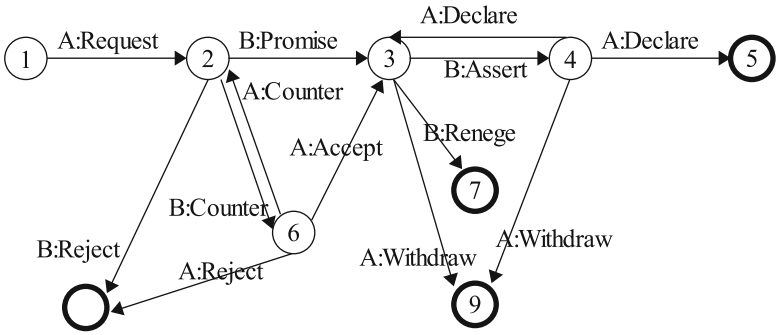

Fig. 12.3 A CFA for a request-promise-response interaction

12.5.2 Defining Cultural Conflicts

We propose extending CFA for defining conflicts prone to occur in interactions. Conflicts are defined by adding *if-then* rules within states of CFAs. Conditions of rules allow taking in account diverse kinds of information like: differences in cultural profiles, personal information about users, and metadata about messages.

Each condition is associated with a reaction. Reactions are tasks performed by cultural broker agents and can be supported by additional staff agents. Therefore they may vary from quite simple behaviors, like showing messages to users, to very complex ones, like executing fuzzy algorithms and updating cultural profiles.

The elements identified for defining cultural conflicts can be divided in four main categories:

- Personal Information. In addition to cultural values, users can be profiled with information like their age, sex, academic degree, position in the organization, etc. The fields to be added depend on the application and comprise all the information that is required for defining the corresponding conflicts. For example, in conflicts related to power distance, it is useful to have information about the position of users in the organization; in conflicts related to *masculinity/femininity*, it is useful to know the sex of users.
- Timing of Interactions. CFA allows modeling interactions as conversations where users interact in turns. Cultural preferences of a user may be reflected in the amount of time he takes for responding when his turn comes. For example, the delay in responses may be useful for defining conflicts related to *individualism*, and the CBA could tune such value accordingly.
- Metadata of Messages. In the CFA model, actions are captured only by their illocutionary forces. However for some conflicts it would be helpful to describe actions with further information. Such kind of information can refer to the

content, or to the nature of the message. Characterizing the content might be done by adding related concepts from an ontology. Characterizing the nature of the message can be done by adding several kinds of information, like the level of priority of the message, the maximum deadline in which a response is expected, or the strength (Searle 1975) of the illocutionary force. For example, for defining conflicts related to the *Long/Short term orientation* dimension, it would be useful to know the time deadline in which a response is expected; or for defining conflicts related to uncertainty avoidance, information about the priority of messages may be required.

- Cultural Differences. For expressing cultural conflicts, it is fundamental to allow the expression of cultural differences. The framework provides two ways for doing so: using assignations on linguistic values directly or using fuzzy relations among them.

The most natural way is by using linguistic values directly, by operating values between two users using Boolean operators. For example, a conflict respecting with *individualism/collectivism* could be defined using *if A is very individualist and B is very collectivist* as part of the condition.

The second possibility is to use fuzzy relations for expressing relative differences in cultural profiles. We use a linguistic variable called *comparison*, which allows defining conflicts using conditions like *if collectivism of B is much greater than collectivism of A*.

The primary terms defined for the variable *comparison* are *higher, lower, and equal*. The membership function of each of these values is a fuzzy set defined over the domain $[0, 100] \times [0, 100]$, i.e. the product of two domains of cultural dimensions (two domains, because *higher, lower*, and *equal* are binary operators).

As mentioned, primary terms may be combined using linguistic hedges; for *greater* and *lower*, allowed hedges are *slightly, more or less, much, extremely*; for *equal*, allowed hedges are *hardly, more or less, almost*.

The membership functions for *greater* and *lower* are based on a threshold function:

$$c_{lower}(x, y) = min(1, [(x - y)/a]^2), x > y$$

$$c_{greater}(x, y) = 1 - min(1, [(x - y)/a]^2), x < y$$

where the parameter a determines the steepness of the threshold.

The membership function for *equal* is based on a function for defining ranges:

$$c_{equal}(x, y) = 1/[1 + ((y - x)/b)^4]$$

where the parameter b determines the shape of the curve.

Figure 12.4 shows the compatibility functions for *greater*, *lower* and *equal*, and illustrates the role of the parameters.

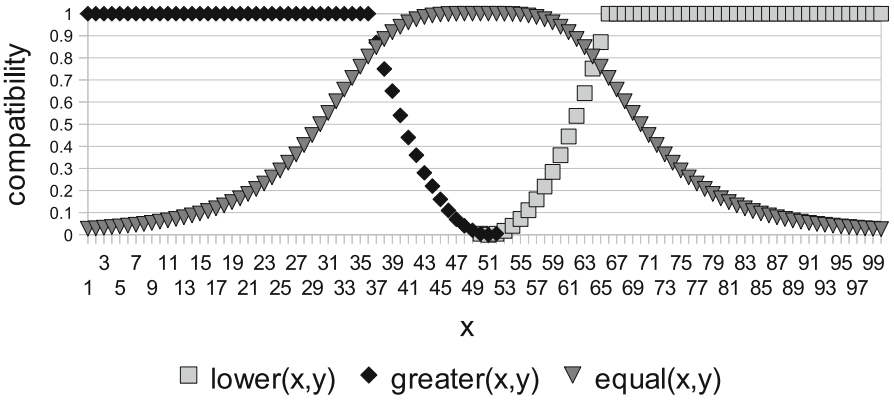

Fig. 12.4 Primary terms for the comparison fuzzy relation

12.5.3 Examples of Cultural Conflicts

Next, we present some illustrative examples of cultural conflict definitions. The examples presented are taken from Table 12.1 and adapted to the CFA showed in Fig. 12.3.

12.5.3.1 Expressing Contradictory Points of View

According to conflict 1.2 (Table 12.1), individualist users express points of view, even if they are contradictory. On the other hand, it is not common for collectivist users to express contradictory points of view in order to avoid confrontations. In the context of the CFA in Fig. 12.3 (supposing B is collectivist), user B could response with a promise, even one that he knows that is hard to fulfill. The consequences of such conflict are considerable when a request has high priority. Such conflict is defined in the knowledge base of the CBA supporting user B, specifically within state 2 of the definition of the CFA. One possible way of defining such conflict is:

if B is highly collectivist and request_priority = "high"

In such case the agent could react, for example by advising the user for responding honestly (i.e. with a counteroffer or a withdraw). Note that the definition of this conflict requires that the user A provides the priority of the request (metadata in messages).

12.5.3.2 Response Time

According to conflict 1.3 (Table 12.1), importance given to own and group goals differs with different degrees of individualism/collectivism. According to this, collectivist users are likely to respond and expect responses more quickly

than individualist users. In the context of the CFA in Fig. 12.3 (supposing B is individualist and A is collectivist), if user B has taken more than a certain time limit for making a promise, it is likely that he will take a long time also for accomplishing the promise. Such conflict is defined in the knowledge base of the CBA supporting user A, specifically within state 3 of the definition of the CFA. One possible definition of such conflict is:

if B is individualist and A is collectivist and
timestamp(transition2)-timestamp(transition1)>limit

In such case the agent could react, for example by advising user A for withdrawing 3. Note that the definition of this conflict requires the usage of transition timestamps.

12.5.3.3 Starting Conversations

According to conflict 2.2 (Table 12.1), in collectivist cultures interactions are supposed to be initiated by superiors only. In the context of the CFA in Fig. 12.3 (supposing power distance of A is much lower than power distance of B), if user A starts an interaction and B is a superior, B may get upset. Such conflict is defined in the knowledge base of the CBA supporting user A, specifically within state 1 of the definition of the CBA. One possible definition of such conflict is

if power_distance of A is much lower than power_distance of B and
superior(B,A)

In such case the agent could react, for example by advising user A for not sending the request at least it is really important. Note that this definition requires that the CBA maintains knowledge about the position of users in the organization (personal information).

12.6 Evaluating Conflicts

As described in the previous section, the condition of a conflict contains two main components: a fuzzy component for expressing cultural differences (in terms of linguistic values), and a non-fuzzy component for describing required additional contextual constraints. The evaluation of contextual constraints is done using Boolean logic over traditional primitive data types. This section focuses on the evaluation of cultural differences.

12.6.1 Defuzzification

Values for cultural dimensions are expressed as linguistic variables either if they are heuristically assigned to the cultural profile of a user or if they are expressed

in conditions. Such linguistic values must be converted to numbers in order to allow computations. This process is called defuzzification and there exist several methods for performing it. The most widely used is by obtaining the *centroid* of the compatibility function:

$$z_X = \left(\sum_{u \in U} c_X(u) \cdot u\right) / \left(\sum_{u \in U} c_X(u)\right)$$

For example, the defuzzification process of the linguistic value *Individualist but not too individualist* with the parameters $a = 0.25, b = 70, c = 10$, is the following:

$$c_{ind}(u) = 1/(1 + e^{-0.25(u-70)})$$

$$c_{very\ ind}(u) = c_{ind}(u)^2$$

$$c_{not\ very\ indi}(u) = 1 - c_{very\ ind}(u)$$

$$c_{ind\ but\ not\ very\ ind}(u) = min(c_{ind}(u), c_{very\ ind}(u))$$

$$z_{ind\ but\ not\ very\ ind} = \sum_{u=0}^{100} c_{ind\ but\ not\ very\ ind}(u) \cdot u / \sum_{u=0}^{100} c_{ind\ but\ not\ very\ ind}(u)$$

$$z_{ind\ but\ not\ very\ ind} = 74.52$$

12.6.2 Evaluating Linguistic Values

This section presents the method for computing the probability of occurrence of a conflict defined with direct assignations of linguistic values. This section is exemplified by evaluating the condition *if B is individualist and A is collectivist*, contained in the conflict about response times presented in Sect. 12.5.3.

The first step is to deffuzify the value of all the linguistic values present in the condition. With the same parameters used above we have:

$$z_{ruleA} = z_{ind} = 15.61$$

$$z_{ruleB} = z_{col} = 84.39$$

Then the actual cultural values of the involved users are defuzzyfied. Suppose that user A is profiled as *Individualist but not very individualist* and user B is profiled as *extremely individualist*.

$$z_{userA} = z_{indbutnotveryind} = 74.52$$

$$z_{userB} = z_{extremelyind} = 87.59$$

Then the average difference of profiles between the condition and the actual cultural profiles of involved users is computed.

$$avg = (|z_{ruleA} - z_{userA}| + |z_{ruleB} - z_{userB}| + \ldots + |z_{rulen} - z_{usern}|)/n$$

For the values given in the example:

$$avg = (58.91 + 3.2)/2 = 31.055$$

Small values for *avg* mean a close correspondence with the rule. Therefore, the smaller the value of *avg*, the bigger the fulfillment of the condition, and therefore the bigger the probability of occurrence of the conflict.

12.6.3 Evaluating Relative Differences

The process for computing the probability of occurrence of a conflict defined using relative differences is similar to the own presented in Sect. 12.6.2. This section is exemplified by evaluating the condition *if power_distance of A is much lower than power_distance of B*, contained in the conflict about starting conversations in Sect. 12.5.3.

The first step is to deffuzify the actual cultural values of the two involved users: z_{userA} and z_{userB}. Suppose that user A is profiled as *very equitative* and user B is profiled as *more or less neutral*.

$$z_{userA} = 13.44$$

$$z_{userB} = 50$$

Then the compatibility function of the involved fuzzy relation is obtained. For the example such relation is *much lower*.

$$c_{lower}(x, y) = min(1, [(x - y)/a]^2); x < y c_{much\ lower}(x, y) = c_{lower}(x, y)^2; x < y$$

Then the function is evaluated for $x = z_{userA}$ and $y = z_{userB}$, assuming $a = 40$:

$$c_{much\ lower}(13.44, 50) = (min(1, [(13.44 - 50)/40]^2))^2 = 0.6979$$

The bigger the value obtained, the bigger the degree of fullfilment of the condition, and therefore the bigger the probability of occurrence of the conflict.

12.7 Conclusions

This chapter presents a framework for managing conflicts in multicultural interactions. The proposal presented represents a first attempt for developing a system intended at reducing the impacts of cultural differences in multicultural collaboration; it is based on constructing quantifiable cultural profiles which are based on strong theoretical basis.

Cultural conflicts are defined based on formalized interactions represented as patterns of actions. The framework provides a flexible and application independent means for defining conflicts in terms of differences in cultural profiles and other kinds of contextual information. Definition and evaluation of cultural differences are based on theories of linguistic variables, fuzzy logic, and approximate reasoning, which improves intuitiveness and simplicity of usage.

The platform consists in a multi-agent system composed of cognitive agents in charge of supporting interactions, maintaining definitions of cultural conflicts, and reacting accordingly as users interact. The framework has been designed based on the theory of Hofstede, respecting to both, its model of culture and the conflicts analyzed under his model.

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