

Report from Dagstuhl Seminar 14131

Computational Models of Cultural Behavior for Human-Agent Interaction

Edited by

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Abstract

From March 23 2014 to March 28, the seminar “Computational Models of Cultural Behavior for Human-Agent Interaction” held in Schloss Dagstuhl – Leibniz Center for Informatics. During the seminar, an interdisciplinary group of researchers explored and discussed theories and techniques for computational models of culture as part of virtual human simulations. Culturally-sensitive agents do not only improve the acceptance of man-machine interfaces by adapting their verbal and non-verbal behavior to the user’s assumed cultural background. They also bear enormous potential for a rapidly growing number of ICT-based language and cultural training scenarios that make use of role-play with virtual characters. The seminar brought together researchers with an interdisciplinary background that profited from each other’s perspective and explored challenges for the future.

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Edited in cooperation with Samuel Mascarenhas

1 Executive Summary

Elisabeth André

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The seminar was the first international meeting on computational models of culture. The gathering of a multi-disciplinary team of experts with a background in intelligent virtual agents, human-computer interaction and cultural theories provided us with a lot of inspirations for future research projects. We did not only identify relevant topics for a roadmap on computational models of culture, but also worked out a number of intriguing applications for cultural agents.



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In order to exploit the momentum and enthusiasm generated by the seminar, we discussed some ideas for community building. We plan to organize a follow-up Dagstuhl seminar in about two or three years. However, some participants felt they would not like to wait for such a long time and spontaneously decided to have an additional workshop on Cultural Models for Intelligent Virtual Agents at the Fourteenth International Conference on Intelligent Virtual Agents (IVA 2014) in Boston this year. Furthermore, we discussed the edition of a book and/or a special issue. In addition, we talked about possibilities to share and distribute corpora to support comparative studies of culture-specific behaviors.

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3 Background and Topic of the Seminar

Research on intelligent virtual agents has established itself as a major field of research in computer science with a dedicated annual international conference: the International Conference on Intelligent Virtual Agents (IVA). In the last twenty years, significant advances have been made in enhancing the believability of such agents by endowing them not only with multimodal conversational behaviors, but also tailoring their behavior to emotional and/or personality. However, few researchers have taken up the challenge of modeling the influences culture has on behavior so far even though there is clear empirical evidence that the culture a virtual agent reflects strongly influences how it is accepted by a human user.

For the design of virtual agents, the challenge has been identified, but realizations are often superficial concentrating on avatar appearance for specific cultural groups. De Rosis, Pelachaud and Poggi illustrate this problem with their survey of the Microsoft Agents web site, which shows that the appearances as well as the animations of the characters are almost all based on western cultural norms. They only found four non-western style agents, which moreover exhibited only a reduced set of animations. Agent style can in turn safely be taken as a proxy for agents' implicit rules of behavior linked to culture. Apart from imposing western cultural standards on all users, the danger lies in a very low acceptance of such agents by users with different cultural backgrounds.

The design of agents that reflect a particular cultural background requires computational models that allow the explicit representation of cultural parameters impacting the behavior of the agents in the same way as theories of cognitive appraisal and coping behavior underlie emotional parameters in affective agent architectures. However, research into agent architectures that include cultural factors in the virtual agents' internal knowledge and reasoning is still quite new. Basically, there are two approaches to implement computational models of culture in the Autonomous Agent and Multi-Agent community:

■ Data-driven approaches to computational models of culture

In the data-driven approach, computational models of culture are based on annotated multimodal recordings of existing cultures from which culture-specific behavior profiles are learnt. A prominent example includes the German-Japanese project CUBE-G project funded by the German Science Foundation (DFG) and the Japan Society for the Promotion of Science (JSPS) (<http://www.hcm-lab.de/projects/cube-g/>). In this project, a corpus of multimodal behavior was collected under standardized conditions for three prototypical scenarios in two cultures, Germany and Japan. For this corpus, a statistical analysis was performed highlighting differences between German and Japanese speakers in the use of gestures and postures, communication management, choice of topics etc. The advantage of data-driven computational models of culture lies in their empirical foundation. However, the collection and annotation of cross-cultural corpora is extremely time-consuming and usually requires a multi-national effort. Furthermore, there is the danger that the model derived from the corpora is incomplete resulting into an inconsistent culture-specific behavior of the agents. A third drawback is that the data is hard to generalize to other settings, for lack of a causal model. Finally, it is not obvious how to map statistical behavior data onto computational models even though first attempts have been made in the area of intelligent virtual agents using machine learning approaches.

■ Computational models of culture as extension of agent mind architectures

Another approach to implement computational models of culture is to start from existing multi-agent architectures and extend them to allow for culture-specific adaption of goals, beliefs and plans. One of the earliest and most well-known systems is the Tactical Language

System (<http://www.tacticallanguage.com/>) which has formed the basis of a variety of products for language and culture training by Alelo Inc. Tactical Language is based on architecture for social behavior called Thespian that implements a version of Theory of Mind. This feature is required in cultural agents that model collectivistic cultures where people care a lot about the consequences their actions have on others. More recent systems have been developed within the European projects eCIRCUS (<http://www.e-circus.org/>) and eCUTE (<http://ecute.eu/>) and extended an agent mind architecture called FATiMA by representations of the Hofstede cultural dimension values for the culture of the character, cultural specific symbols, culturally specific goals and needs, and the rituals of the culture. While a more formal approach to cultural models is very well suited for the implementation of synthetic cultures and usually ensures a higher level of consistency than the data-driven approach, it is not grounded in real data and thus may not completely realistically simulate existing cultures. Another limitation is that it is difficult to decide which specific gestures and behaviors to choose for externalizing the goals and needs generated in the agent minds.

In an increasingly globalized world, cultural sensitivity, awareness and understanding has become a major factor of success. As more and more companies do business in other cultures, there is large demand for ICT-based language and culture training systems. Cultural agents have been used as part of social simulations, language and culture training tools.

The seminar has brought together a multi-disciplinary team of experts with a background in intelligent virtual agents, human-computer interaction and cultural theories. In the following, we describe the organization of the seminar, the topics and results of the break out groups as well as plans for future steps.

4 Organization of the Seminar

The seminar was a balanced combination of Pecha Kucha style introductory presentations, seed talks by leading experts, poster and demo sessions and break out groups (see seminar program shown in Figure 1).

Six leading experts were invited to give a seed talk in order to provide us with inspirations for the break out groups. Apart from five colleagues with an academic background, we also invited one representative from industry to convey his perspective on the field.

We had two rounds of break out groups. In the first round of break out groups the focus was on theories, architectures, data, evaluation and applications. In the second round of break out groups we discussed specific applications for cultural agents to concretize our ideas.

A particular highlight of the seminar was the evening program with social activities focusing on the topic of the seminar. We organized a cultural evening where participants presented artifacts from their own culture (stories, songs, dances, food, drinks etc.). In addition, we scheduled an evening where we formed several groups to play cultural games (Banga, Bafa Bafa). These events did not only help break the ice between participants, but also contributed to a better understanding on the role of culture in social interactions and provided us with a lot of inspirations for the implementation of cultural models.

	Monday	Tuesday	Wednesday	Thursday	Friday
Session1	Welcome/Intro (Ruth) 60 second intros (All)	Sarit Kraus: When Is it Beneficial to Develop Culture Sensitive Negotiation Agents?	David Traum: Models of Culture for Virtual Human Conversation	Lewis Johnson: Effective Cultural Models: An Industry Perspective	Wrap-up
	Coffee	Coffee	Coffee	Coffee	Coffee
Session2	Goals (Ruth) Ideas Gathering (All)	Break-out sessions	Justine Cassel: Dyadic Models of Cultural Interaction	Break-out sessions	Informal discussion
12.15	Lunch	Lunch	Lunch	Lunch	Lunch
Session3	Gert Jan Hofstede: Robot and agent culture	Jens Allwood: Cultural perspectives on communication	Social outing	Break-out sessions	DEPART
	Coffee	Coffee	Coffee	Coffee	
Session4	Demos/posters	Break-out sessions	Social outing	Break-out sessions	
18.00	Dinner	Dinner	Dinner	Dinner	
Evening	Cultural Training Games: Barnaga, Bafa Bafa	This is Us: Participants present artefacts from their own culture (stories, songs, dances, food, drinks etc.)	Meal elsewhere	This is Us Again: Spontaneous talks, anecdotes about scientific cultures, examples of cultural misunderstandings etc. Presentation of additional cultural items	

■ **Figure 1** Seminar Program

5 Overview of Talks

5.1 Robot and agent culture

Gert Jan Hofstede (Wageningen University, NL)

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Main reference G. Hofstede, G. J. Hofstede, M. Minkov, “Cultures and Organizations, Software of the Mind,”
Revised and expanded 3rd Edition, ISBN 978-0071664189, McGraw Hill, 2010.

First, the lecture addressed the question “Do we need agents and robots to have culture?” The answer is yes, because they have to mimic human social behaviour, as well as to meet, instruct, and serve people. Second, the lecture gives a broad introduction to culture. People create culture wherever they are together. The deepest level, that of unconscious values, is formed in childhood, and has the most impact on our adult social behaviours. Societies tend to have shared values that remain fairly stable over time, even if individuals and sub-groups differ and practices change continually. A limited set of dimensions of value can be used to compare societal cultures. The dimensions proposed in [1] are used as the main example.

Third, the lecture touches on how societal culture could be modelled. It makes the argument that agents need to have a generic social awareness before they can acquire culture. Such a generic model could be based on the work of various social scientists. The status-power model of Theodore Kemper [3] is taken as an example. On top of such a model, cultural variations can be given to the agents. The model of social importance dynamics [2], itself based on Kemper, is used to show how this could be done.

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- 2 Mascarenhas, S., Prada, R., Paiva, A., & Hofstede, G. J. 2013. Social Importance Dynamics: A Model for Culturally-Adaptive Agents. In Intelligent Virtual Agents (pp. 325-338). Springer Berlin Heidelberg.
- 3 Kemper, T. D. 2011. Status, power and ritual interaction: a relational reading of Durkheim, Goffman, and Collins. Ashgate Publishing, Ltd.

5.2 When Is it Beneficial to Develop Culture Sensitive Negotiation Agents?

Sarit Kraus (Bar-Ilan University – Haifa, IL)

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Joint work of Gal, Ya'akov; Haim, Galit; Rosenfeld, Avi
URL <http://www.cs.biu.ac.il/~sarit/pub.html>

Negotiation and persuasion are tools for social influence that are endemic to human interaction, from personal relationships and business partnerships to political debate. The inclusion of people presents novel problems for the design of automated agents' negotiation and persuasion strategies. People do not adhere to the optimal, monolithic strategies that can be derived analytically. Their negotiation behavior is affected by a multitude of social and psychological factors. In particular, people's cultural background has been shown to affect the way they reach agreements in negotiation and how they fulfill these agreements. We have shown that combining machine learning techniques for opponent modeling with human behavioral models and formal decision making approaches while taking culture into consideration enable agents to interact well with people. I will present a few culture sensitive agents. The KBagent and NegoChat agent negotiate with people in multi-issue negotiation settings. They were evaluated in the US and Israel. Then, we will discuss Colored Trails agents, PURB and PAL, that had been designed for repeated bilateral negotiation when agreements are not enforceable. They were evaluated in Israel, USA and Lebanon. We will also present an equilibrium agent for 3 players CT game that was evaluated in China, Israel and the USA. We will also report experiments on corruption game comparing people behavior in Israel, USA and China. We conclude by discussing the advantages and challenges of developing culture sensitive agents.

PURB models and adapts its behavior to the individual traits exhibited by its negotiation partner. The agent's decision-making model combines a social utility function that represents the behavioral traits of the other participant with a rule-based mechanism that uses the utility function to make decisions in the negotiation process. PURB negotiated with human subjects in the U.S. and Lebanon in situations that varied the dependency relationships between participants at the onset of the negotiation. There was no prior data available about the way people would respond to different negotiation strategies in these two countries. Results showed that people from Lebanon and the USA played differently. In particular, subjects in Lebanon were significantly more reliable than subjects from the USA. PURB was able to adopt a different negotiation strategy to each country. Its average performance across both countries was equal to that of people. However, the agent outperformed people in the United States, because it learned to make offers that were likely to be accepted by people while at the same time being more beneficial to the agent. In contrast, the agent was outperformed by people in Lebanon because it adopted a high reliability measure which allowed people to take advantage of it. The Personality Adaptive Learning (PAL) agent, which negotiates proficiently with people from different cultures; and the Social agent for Advice Provision (SAP) that influences human's decision in settings such as the route selection applications. These agents were evaluated in extensive experiments including people from three countries.

Acknowledgements. Sarit Kraus is also affiliated with UMIACS. This work was supported in part by ERC grant #267523 and the U. S. Army Research Laboratory and the U. S. Army Research Office under Grant number W911NF-08-1-0144.

5.3 On some challenges and features of a theory of intercultural communication

Jens Allwood (University of Göteborg, SE)

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Main reference J. Allwood, “Tvärkulturell Kommunikation,” in J. Allwood (ed.), *Tvärkulturell kommunikation*, Papers in Anthropological Linguistics 12, 1985; english translation available.

URL <http://sskkii.gu.se/jens/publications/docs001-050/041.pdf>

URL <http://sskkii.gu.se/jens/publications/docs001-050/041E.pdf>

Main reference J. Allwood, E. Ahlsén, “Multimodal Intercultural Information and Communication Technology – A framework for designing and evaluating multimodal intercultural communicators,” in M. Kipp et al., eds., *Multimodal Corpora – From Models of Natural Interaction to Systems and Applications*, LNCS, Vol. 5509, pp. 160–175, Springer, 2009.

URL http://dx.doi.org/10.1007/978-3-642-04793-0_10

This talk covered the following topics:

1. The notion of “culture”;
2. Challenges for the notion of culture;
3. Mentalism, cultural variation, cultural change;
4. The strength of the relation between national, region, ethnic, linguistic, political, military culture;
5. The notions of “intercultural communication”, “crosscultural comparison”;
6. Multicultural, intercultural, crosscultural and transcultural;
7. Other influences;
8. Cultural influence on Communication;
9. Understanding of cultural differences;
10. Methods of studying cultural differences and similarities with relevance for communication;

5.4 Models of Culture for Virtual Human Conversation

David Traum (University of Southern California – ICT, US)

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URL <http://people.ict.usc.edu/~traum/Papers/papers.html>

Virtual humans are artificial agents that include both a visual human-like body and intelligent cognition driving action of the body, including engaging in face to face conversation. Culture covers a wide range of common knowledge of behavior and communication that can be used in a number of ways including interpreting the meaning of action, establishing identity, expressing meaning, and inference about the performer. Virtual human behavior will always be interpreted by people from a culture-specific vantage point and viewers will make inferences about cultural aspects of the virtual humans, so whether or not an explicit model of culture is used in the design and behavior of the virtual humans, one will be attributed to them. In this talk, we will present a taxonomy of types of culture models for virtual humans and look at several examples of existing cultural models that have been used, focusing primarily on those we have developed at the Institute for Creative Technologies at University of Southern California, and point out remaining steps for a more full model of culture.

5.5 Cultural Grounding: A Dyadic Model of Culture for Agents

Justine Cassell (Carnegie Mellon University, US)

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Joint work of Cassell, Justine; Papangelis, Alex, Zhao, Ran, Yu, Zhou, Finkelstein, Samantha, Gerritsen, Dave, Vaughn, Callie

URL http://www.justinecassell.com/jc_research.htm

In the field of AI culture has most often been seen as a more or less explicit, internally homogeneous, externally distinctive, collective entity. However, there is data to suggest that culture is – and is better treated in AI as – identity in context – the demonstration in a particular context by a given person of a set of practices that index to members of the same group, and members of other groups, his/her cultural community membership. In this talk I propose the theory of cultural grounding to explain how humans do – and agents can – build a sense of common culture with interlocutors through the deployment of patterns of behavior and practices, with as an ultimate goal, better performance on a collaborative tasks such as peer tutoring.

5.6 Effective Cultural Models: An Industry Perspective

W. Lewis Johnson (Alelo Inc. – Los Angeles, US)

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Computational models of cultural behavior are increasingly finding their way into applications, especially training applications, and are having a significant impact. From an industry perspective, questions that seem problematic for the field in general, such as how to evaluate computational models of culture, are relatively specific and straightforward. A computational model of culture is good if it is fit for purpose, i.e., it can be employed effectively to achieve the desired outcome. In the case of cross-cultural training, the goal is to enable learners to acquire the necessary skills to work successfully with people of other cultural backgrounds.

Focusing on the desired effect is critical when modelling culture, because it determines what aspects of culture to focus on. Without such a focus one can easily come up with a model that is too broad and too shallow to be useful. For example when training people to work in foreign countries it is not sufficient to use general models of the culture of the target country. One must prepare people for the cultural diversity that they will experience, as well as the particular subcultures in which they will work – e.g., business culture, military culture, etc. Thus a situation-specific, idiocultural approach is more useful than an approach that deals with national cultures in general terms.

The presentation included examples from cultural awareness training systems that incorporate agents that exhibit culturally accurate behavior in common work contexts.

6 Open Problems

Before the seminar started, a survey was conducted amongst 25 members of the research community to identify the main challenges related to the seminar's topic. In total, the

following four key areas were identified, with their associated questions being tackled by the different work groups at the seminar:

- **Foundations of computational models of culture**
 - How do different disciplines (psychological, anthropological, and sociological) approach and conceptualize culture and how does the disciplinary perspective affect computing models?
 - What are the intersections between culture, personality, gender etc.?
 - How to decrease the risk of cultural stereotyping during model building?
 - How to handle cultural variation and change?
- **Paradigms for cross-cultural data collections**
 - Where can we find solid ground for culture-specific agent behavior?
 - What kind of culture-specific behavioral data should be collected and how should the data be coded?
 - How to separate individual from culture-specific variations in the collected data?
 - How to handle the interdependencies between culture, emotions and personality in data collections?
 - How to create a databank for observation-based studies of cultural differences?
 - How to exchange corpora of culture-specific verbal and non-verbal behaviors?
- **Building computational models of culture**
 - What is the right level of abstraction for representing cultural differences in a computational model?
 - How to operationalize existing cultural theories from the social sciences?
 - How to model the impact of culture on emotion and decision making in social settings, such as negotiation or conflict resolution?
 - How to build dyadic models of cultural interaction between humans and agents?
 - How to tailor multimodal verbal and non-verbal behaviors to an agent's assumed cultural background?
 - How to handle interactions between culture, affect, and cognition, and their impact on individual agent design, multi-agent interactions, and agent-human interactions?
 - How to model the influence of culture on the agent's theory of mind?
 - How to model culture as a plug-in on existing models?
- **Evaluation of computational models of culture**
 - How to evaluate computational models of culture and the agents based on them?
 - How to evaluate the effect of the interaction between the agent's culture and the human's culture?
 - What could be a proper metrics for such assessments?
 - What test base is needed before a simulation can be deemed cross-culturally valid?
 - How to handle the interaction of culture with other individual characteristics, such as emotion and personality in such evaluations?
 - How to address the cultural bias of researchers and scholars in evaluations?

7 Working Groups

The results of the previous survey were presented to the participants at the beginning of the seminar, and the participants were invited to come up with additional ideas for break out groups. In the first round of break out groups the focus was on theories, architectures, data,

evaluation and applications. In the second round of break out groups we discussed specific applications to concretize our ideas.

7.1 Break Out Group 1 – Foundations

Participants: Gert Jan Hofstede, Catholijn Jonker, Toyoaki Nishida, Jens Allwood, Emmanuel Blanchard, Matthias Rauterberg, Colette Faucher, Catherine Pelachaud.

In the beginning, the following themes were identified by this break out group:

- Levels of abstraction and conceptualization
- Social & cultural meaning of the physical world
- Laughter & culture
- What aspects of culture are computable? And in the reverse: which parts of culture cannot or are difficult to be parameterized?

The group decided to take laughter as the leading topic. The main conclusion was that laughter turned out to have an amazing variety of social functions. At the same time biologically laughing is a pretty straightforward adaptation of a sort of startle response, if we leave out the smile that says “I’ll not attack you”. So that response has become mapped onto many social situations. One can laugh:

- Because something is funny (laugh your head off; this tends to be about combining domains that are normally not combined)
- To make a power move at someone (laugh at someone)
- To create good atmosphere (give status to the group that is present; have a laugh)
- To claim status (laugh about one’s own joke)
- To belittle some trouble (laugh away something)

As a consequence, how one would model laughter depends on the ontology of the modelled world. Another conclusion was that all of the functions of laughter are universal, but the frequency and the kind of situations in which they occur vary from one culture to another.

In addition to the topic of laughter, the group also discussed what properties make a “good” model of culture. The following list was proposed:

- Predictability (should be mandatory)
- The ultimate goal is for a theory to be true (maybe can’t be achieved but one should strive towards it) (true = that matches reality) (should be mandatory)
- Consistent (it never contradicts itself) but the culture itself could sometimes be inconsistent
- Exhaustive (all the relevant features are considered)
- The simplest as possible given other characteristics (Occam’s Razor) (useful but not mandatory)
- Perspicuous (easy to see the structure of the theory) (useful but not mandatory)
- Fruitful (useful; it has to bring new things)
- Transformation from theoretical framing (computational model?) to applications should be parameterizable (there was some disagreement)

Although this list is quite demanding, the group agreed that in order to reach a good model there could be intermediate steps.

7.2 Break Out Group 2 – How to build models of cultural agents?

Participants: Jan M. Allbeck, Nadia Berthouze, Timothy Bickmore, Justine Cassell, Dirk Heylen, Kristiina Jokinen, Sarit Kraus, Brigitte Krenn, Bilyana Martinovski, Yukiko I. Nakano, Ana Paiva (Rapporteur), Catherine Pelachaud, David R. Traum.

In this break out group, we first collected a number of research questions that should be studied when building models of cultural agents:

- How to take models of culture and turn them into computational models?
- How to build agents that assess the culture of the user?
- What architectures are currently been used and how can they be turned into culturally adaptive/adaptable ones?
- What methodologies to come up with to build these models?

To build models of cultural agents, we need to decide which kind of agent we would like to model. We identified three kinds of agent:

- Agents that are culturally sensitive (that are aware of cultures of others)
- Agents that portray a “culture”
- Agents that adapt to or co-create a culture that emerges from social interaction with users or other agents

In this break out group, we also discussed the distinction between data-driven and theory-driven methodologies for designing cultural agents. We came to the conclusion that there are no pure data driven approaches because also data driven approaches assume some kind of theory. Furthermore, we discussed to what extent agent systems could be learnt from data and/or from interaction. In this context, we also discussed dialogue phenomena, such as alignment and mirroring, and shared norms that can emerge from interaction with others.

The following features can be influenced by culture: appearance, observable behaviors (action, language and nonverbal behavior), meanings/function/conceptual structure/ontologies (power, status, theory of mind, values, and emotions), context (physical and social environment) and goals. Another view of what elements are influenced by culture is reflected by the following definition:

An agent can be defined as $Agent = (I, Ei, A, u, G, M, H)$ where:

- I – Internal state of the agent;
- A – Actions;
- Ei – Environment representation from the agent’s point of view;
- M – Agent’s model of the other agents (e.g. ToM)
- G – Goals;
- H – History;

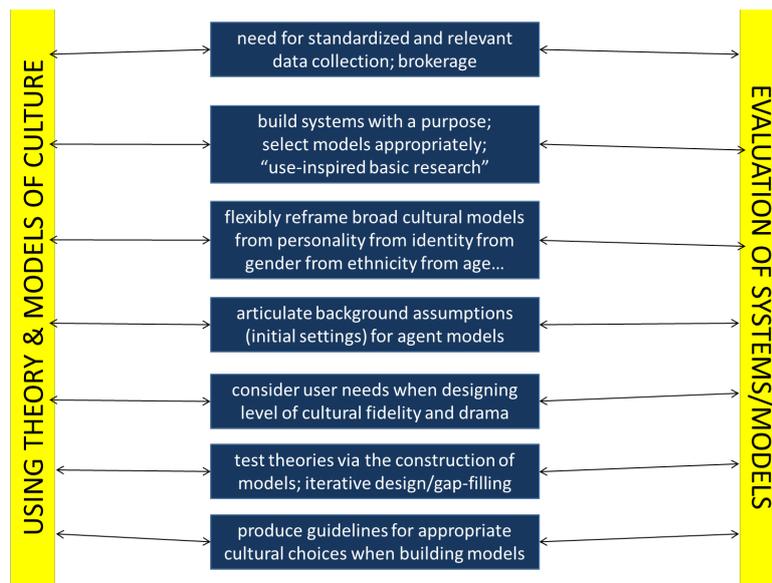
D is a process that takes (I, Ei, A, u, G, M, H) and generates an action.

The final conclusion of this break out group was that most of the features we build into agents should be dependent on “culture”.

7.3 Break Out Group 3 – Evaluation

Participants: Elisabeth André, Ruth Aylett, Lynne Hall, Rüdiger Heimgärtner, Chad Lane (Rapporteur), Matthias Rehm.

In this work group we discussed how to use (and evaluate the use of) theories of culture. The outcome of this break out group was a list of guidelines that are presented in the diagram in Fig. 2.



■ **Figure 2** Guidelines for using and evaluating theories of culture.

7.4 Break Out Group 4 – Applications

Participants: Hirotaka Osawa, Béatrice Hasler, Phaedra Mohammed, Rilla Khaled, Nick Degens (Rapporteur), Felix Kistler, Suleman Shahid, Kobi Gal.

The goal of this work group was to discuss how cultural models can be used in educational or persuasive applications. We argue that instead of trying to create a comprehensive cultural model, we should aim to create a simple cultural model that is sufficient to achieve the goal of the application. Such models could then be expanded upon by other researchers to create more generalizable tools.

By discussing previous research, we were able to identify three important questions that, if answered, will help to determine the requirements for the design of cultural models in the future:

1. *How do we identify the cultural background of application users and manage their opinions of other cultures?*

There are few reasons why it is important that the cultural background of users can be identified before interacting with the application. Firstly, the application may only be intended for a specific group of people, so it is important to ensure that there is an

objective way to classify the user's cultural background. Secondly, the cultural background may significantly influence interpretation of behavior, which may impact the use of the application.

This identification can be quite hard though, because there are no sufficiently rich classification schemes. This is due to the level of aggregation; there is a lot of data on features of national cultures, but this may not be useful if one is interested in different levels of analysis. To deal with this problem, one could generate new features of certain cultures through the use of machine learning or gathering/using data on specific groups. How people perceive other cultures is also important, for instance when your goal is to reduce prejudice. A lack of properly instantiating cultural behavior in the application may lead to the creation of new stereotypes. Even if people are not aware of the relevant culture, they will still have expectations, based on the appearance or behavioral cues of the agent, so these will need to be managed somehow.

2. *How do we integrate and adapt culture in persuasive and educational applications (classifying context, social and cultural elements)?*

It is important to create a strong link between cultural models and the context within an application. This link would need to take the shape of an ontology, involving a classification scheme of a certain context in terms of functional, social and cultural elements. It is important to ensure that there is a difference between the social and the cultural level, as there are universal constants, such as mimicking and synchrony, which can occur in every social context.

There are many advantages to the use of such a classification scheme. Firstly, it would help the agent to take multiple roles in an interaction, e.g. they can be part of an intercultural conflict, or act as a mediator in a conflict. Secondly, it will help autonomous agents to better understand the (social) context without need for human intervention, thus increasing the agency of the agent. Lastly, the content of the tool could be dynamically adjusted based on the cultural background of users.

3. *How do we create engaging applications using cultural differences and interaction modalities?*

To ensure that the interaction of users with applications is engaging, one should determine how game mechanics can be mapped to cultural models. For example, one could add leader boards for cultures that are very competitive. This would lead to a set of guidelines for creating new serious games or gamifying existing games for specific cultures.

With regards to interaction modalities, it is important to ensure that the user is able to act out culturally appropriate behaviors in an intuitive manner. As such, we need a methodology for determining intuitive gestures, and ensure that we are able to link these gestures to cultural differences, for example through the use of a gesture-intention translator.

Conclusion: It is difficult to apply cultural models to applications, so it is important to create models that are simple enough to instantiate, but complex enough to allow for social interaction. These models would need to be generalizable, to ensure that they can be used and expanded upon by other researchers.

While difficult, it is worthwhile to ensure a successful integration, as agents bring many benefits to applications, such as creating a self-contained training tool, or helping the user in an objective manner.

7.5 Break Out Group 5 – Paradigms for Data Collection

Participants: Birgit Endraß, Lewis Johnson, Tomoko Koda, Lydia Lau (Rapporteur), Samuel Mascarenhas, Kasper Rodil.

In this break out group, we concluded that there are two main paradigms for data collection of cultural phenomena: ethnographic and controlled studies. Our conclusion was that the two paradigms can complement each other and can be ideally combined to provide a greater understanding of culture. However, the existing methodologies and validation procedures for each paradigm are quite distinct, as summarized in Figure 3 and Figure 4. In the future, we propose that a bigger effort should be made in facilitating the integration of both paradigms when collecting data.

Type of data	Data development methods	Validation
Field notes	Note taking / communications are being observed within an activity	Correlation of findings from different sources (triangulation)
Observation in naturalistic setting (videos, audio)	Transcription, annotation & commentary	Ditto; subject-matter experts (emic, etc)
Interviews	Skills of the interviewers to elicit responses; sensitive to the environment /context.	Another anthropologist / experienced researcher to review interview protocol.
Questionnaires	Design of the questions, interpretation of replies	Pilot testing questionnaire
User generated digital media (for text, video, discussion forums ...)	Means to identify context; need to understand the activity within which the communication took place; characteristics of participants; tools to filter/focus areas for analysis	Supplement by other data collection methods to gain insight for sensible interpretation

■ **Figure 3** Ethnographic Studies.

Type of data	Data development methods	Validation
Participants’ observation in controlled setting (e.g. videos, audio recording, or other sensor data such as EEG etc.)	Transcription, annotation & commentary (ideally more than one coders, methods appropriate to the sensor data, theory such as speech act)	Inter coder agreement ; Reliability of data; Accuracy rate
Interview/ questionnaires	As in naturalistic setting	As in naturalistic setting
Log data	Coding on log data; correlate the log data with other data; usually involve automatic processing	Validity check on the log data; any other measurements appropriate for the study.

■ **Figure 4** Controlled Studies.

7.6 Second Round Groups

To concretize our ideas, we decided to focus on specific application scenarios of cultural agents in the second round of breakout sessions. Examples included:

- A Training Agent for Oversea Students: We discussed the learning goals of a training agent for graduate students planning to study abroad.
- A Triage Agent: We developed a research and development plan for a culturally-adaptive hospital reception agent.
- An Agent to Encourage Physical Exercise: We discussed the case of a physiotherapist for chronic pain management and discussed how such an agent can be informed by theories and data.
- Teaching Conflict Resolution: We outlined the learning goals for designing an agent who can teach children conflict resolution.
- A Haggling Agent: We recorded videos of role play with seminar participants to illustrate how advice in haggling scenarios can be practiced with a haggling coach.

8 Selected Publications

8.1 Preparing Emotional Agents for Intercultural Communication

Elisabeth André (Universität Augsburg, DE)

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Main reference E. André, “Preparing emotional agents for intercultural communication,” in R. Calvo, S. D’Mello, J. Gratch, A. Kappas, eds., *Handbook on Affective Computing*, Oxford University Press, to appear.

Although many papers emphasize the need to incorporate cultural values and norms into emotional agent architectures, work that actually follows such an integrative approach is rare. To construct anthropomorphic agents that show culture-specific emotional behaviors, researchers must investigate how emotions are conveyed across cultures and how this knowledge can be used to tune emotion recognizers to a particular culture. Models of appraisal and coping have to be enriched by models of culture to simulate how the agent appraises events and actions and manages its emotions depending on its alleged culture. Finally, mechanisms are required to modulate the expressiveness of emotions by cultural traits to convey emotions with right level of intensity and force. Starting from work done in the agent research community, we discuss how existing work on equipping anthropomorphic agents with emotional behaviors can be extended by considering culture-specific variations.

8.2 Werewolves, Cheats, and Cultural Sensitivity

Ruth Aylett (Heriot-Watt University, UK)

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Joint work of Aylett, Ruth; Lim, Mey Yii; Ritter, Christopher; Nazir, Asad; Hall, Lynn; Tazzyman, Sarah; Paiva, Ana; Endraß, Birgit; André, Elisabeth; Hofstede, Gert Jan; Kappas, Arvid

Main reference R. Aylett, M. Y. Lim, L. Hall, B. Endraß, S. Tazzyman, C. Ritter, A. Nazir, A. Paiva, G. J. Hofstede, E. André, A. Kappas, “Werewolves, Cheats, and Cultural Sensitivity,” in Proc. of the 13th Int’l Conf. on Autonomous Agents and Multiagent Systems (AAMAS’14), pp. 1085–1092, IFAAMAS, 2014.

URL <http://aamas2014.lip6.fr/proceedings/aamas/p1085.pdf>

This paper discusses the design and evaluation of the system MIXER (Moderating Interactions for Cross-Cultural Empathic Relationships), which applies a novel approach to the education of children in cultural sensitivity. MIXER incorporates intelligent affective and interactive characters, including a model of a Theory of Mind mechanism, in a simulated virtual world. We discuss the relevant pedagogical approaches, related work, the underlying mind model used for MIXER agents as well as its innovative interaction interface utilising a tablet computer and a pictorial interaction language. We then consider the evaluation of the system, whether this shows it met its pedagogical objectives, and what can be learned from our results.

8.3 The Impact of Linguistic and Cultural Congruity on Persuasion by Conversational Agents

Timothy Bickmore (Northeastern University, US)

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Joint work of Langxuan, Yin; Bickmore, Timothy; Cortés, Dharma;

Main reference L. Yin, T. W. Bickmore, D. E. Cortés, “The Impact of Linguistic and Cultural Congruity on Persuasion by Conversational Agents,” in Proc. of the 10th Int’l Conf. on Intelligent Virtual Agents (IVA’10), LNCS, Vol. 6356, pp. 343–349, Springer, 2010.

URL http://dx.doi.org/10.1007/978-3-642-15892-6_36

We present an empirical study on the impact of linguistic and cultural tailoring of a conversational agent on its ability to change user attitudes. We designed two bilingual (English and Spanish) conversational agents to resemble members of two distinct cultures (Anglo-American and Latino) and conducted the study with participants from the two corresponding populations. Our results show that cultural tailoring and participants’ personality traits have a significant interaction effect on the agent’s persuasiveness and perceived trustworthiness.

8.4 Designing Culturally-Aware Tutoring Systems with MAUOC, The More Advanced Upper Ontology Of Culture.

Emmanuel G. Blanchard (IDÛ Interactive Inc. – Montréal, CA)

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Joint work of Blanchard, Emmanuel G; Riichiro Mizoguchi

Main reference E. G. Blanchard, R. Mizoguchi, “Designing Culturally-Aware Tutoring Systems with MAUOC, The More Advanced Upper Ontology Of Culture,” *Research and Practice in Technology Enhanced Learning*, 9(1):41–69, 2014.

URL <http://www.apsce.net/uploaded/filemanager/f0135fcd-8156-48b3-82f1-b9c06b88b4d8.pdf>

TEL systems are reaching societies where they were almost completely unavailable previously. This makes the importance of culture in TEL systems more salient as they need to accommodate an expanding cultural-geographical user base. Indeed it is known that culture has a huge impact on educational expectations and norms, and the way people efficiently learn. However, culture remains a difficult concept to integrate into the already complex TEL microcosm, and the design and development of theory-grounded Culturally-Aware Tutoring Systems (CATS) thus requires guidance. The More Advanced Upper Ontology of Culture (MAUOC) is introduced in this paper as a way to address the cultural gap. It concentrates and structures in one place the many scientific-grade notions needed to get a coherent view of the cultural domain while translating them into a common ground. As such, it offers theory-grounded guidelines for culture integration in TEL.

8.5 ‘What I see is not what you get’: Why culture-specific behaviours for virtual characters should be user-tested across cultures

Nick Degens (Wageningen University, NL)

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Joint work of Degens, Nick; Hofstede, Gert Jan; Beulens, Adrie; Endraß, Birgit; André, Elisabeth

Main reference N. Degens, G. J. Hofstede, A. Beulens, B. Endraß, E. André, “‘What I see is not what you get’: Why culture-specific behaviours for virtual characters should be user-tested across cultures,” to appear.

URL <http://www.nickdegens.nl/research/publications/>

Integrating culture into the behavioural models of virtual characters requires knowledge from very different disciplines such as cross-cultural psychology and computer science. If culture-related behavioural differences are simulated with a virtual character system, users might not necessarily understand the intent of the designer. This is, in part, due to the influence of culture on not only users, but also designers. To gain a greater understanding of the instantiation of culture in the behaviour of virtual characters, and on this potential mismatch between designer and user, we have conducted two experiments. In these experiments we tried to simulate one dimension of culture (Masculinity vs. Femininity) in the behaviour of virtual characters. We created four scenarios in the first experiment, and six in the second. In each of these scenarios the same two characters interact with each other. The verbal and nonverbal behaviour of these characters differ depending on their cultural scripts. In two user perception studies, we investigated how these differences are judged by human participants with different cultural backgrounds. Besides expected differences between participants from Masculine and Feminine countries, we found significant differences in perception between participants from Individualistic and Collectivistic countries. We also found that the user’s

interpretation of the character's motivation had a significant influence on the perception of the scenarios. Based on our findings, we give recommendations for researchers that aim to design culture-specific behaviours for virtual characters.

8.6 Cultural Diversity for Virtual Characters

Birgit Endraß (Universität Augsburg, DE)

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Main reference B. Endraß, "Cultural Diversity for Virtual Characters – Investigating Behavioral Aspects across Cultures," ISBN 978-3-658-04909-6, Springer, 2014.

URL <http://dx.doi.org/10.1007/978-3-658-04910-2>

In human conversation, meaning is transported through several channels such as verbal and nonverbal behavior. Certain of these behavioral aspects are culturally dependent. Mutual understanding or acceptance is thus, amongst others, dependent on the cultural background of the interlocutors. When designing virtual character behavior, culture should be considered as it may improve the character's acceptance by users of certain cultural backgrounds.

In this dissertation, the simulation of culture with virtual characters is investigated. Thereby the focus lies on the generation of different culture-related behaviors by integrating culture as a parameter into the behavioral models of virtual characters, rather than simulating obvious differences such as outer appearance or language.

In the scope of this dissertation, aspects of verbal behavior, communication management and nonverbal behavior were explored and exemplified for the German and Japanese cultures. These aspects are of special interest, since they are dependent on culture, and address different modalities of a virtual character's behavior. For the integration of culture into computational models, a hybrid approach was developed that combines the advantages of a model-based approach and a corpus-driven approach. The hybrid approach enables us to model the causality of culture and corresponding behavior in a generalizable manner while concrete behaviors can be extracted from empirical data.

For the generation of culture-specific behaviors, methodologies from Artificial Intelligence were applied, in particular distributed behavior planning and Bayesian networks, and simulated in a 3D virtual environment. To evaluate the culture-related behaviors, perception studies were conducted in both targeted cultures. Results indicate that human observers tend to prefer character behavior that was designed to resemble their own cultural background. For the behavioral aspects where our hypotheses were confirmed, we consider their attention when designing virtual character behavior as promising. We aim on contributing to the field of intelligent virtual agents by providing our findings that can help improve a character's acceptance by users of certain cultural backgrounds.

However, the integration of cultural background into the behavioral models of virtual characters can not only enhance their acceptance, but also be used for cultural training in virtual environments, for the localization of computer games, or for cultural heritage by preserving and transferring culture-specific behaviors. Although the workflow has been applied to two national cultures, it is of a general nature and can serve as a guidance for other culture-specific generation approaches.

8.7 Modeling Psychological Theories of Emotion and Social Identity for Helping the Conception of Psychological Messages: the System PSYMDEV

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Joint work of Faucher, Colette; Machtoune, Malika

Main reference C. Faucher, M. Machtoune, “Modeling Psychological Theories of Emotion and Social Identity for Helping the Conception of Psychological Messages: the System PSYMDEV,” Poster Presentation, in Preliminary Proc. of the 23rd Conf. on Behavior Representation in Modeling and Simulation (BRIMS’14), 2 pp., 2014.

URL http://cc.ist.psu.edu/BRIMS/archives/2014/Faucher_BRIMS2014.pdf

In asymmetric conflicts, the Armed Forces generally have to intervene in countries where the internal peace is in danger. They must make the local population an ally in order for them to be able to deploy the necessary military actions with its support. For this purpose, psychological operations (PSYOPS) are used to shape people’s behaviors and feelings by spreading out messages thanks to different media (tracts, loudspeakers, video clips, etc.). In this paper, we present PSYMDEV (PSYchological Message DEViser), a system that helps the military analyst to construct messages that trigger specific emotions in members of the population selected by social criteria like age or political opinion and called the info-targets. Given such a sociocultural group and a feeling that the latter must feel, the system provides a twofold-situation that consists of, on the one hand, a categorization-situation meant to induce a positive or negative initial state of mind in the info-targets depending on the type of emotion to be triggered through a psychological mechanism inspired by theories stemming from Social Psychology and an action-situation aiming at effectively triggering the specific feeling through a psychological process explained by the Intergroup Emotion Theory, an extension of the Appraisal Theory of Emotions. These situations are illustrated by means of images or a film or some auditive elements, thanks to adapted media generally used by the military like tracts or video clips, for example. Therefore, the twofold-situation gives birth to a psychological message intended to trigger an emotion.

8.8 The Effects of Culturally Congruent Educational Technologies on Student Achievement

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Joint work of Finkelstein, Samantha; Yarzebinski, Evelyn; Vaughn, Callie; Ogan, Amy; Cassell, Justine

Main reference S. Finkelstein, E. Yarzebinski, C. Vaughn, A. Ogan, J. Cassell, “The Effects of Culturally Congruent Educational Technologies on Student Achievement,” in Proc. of the 16th Int’l Conf. on Artificial Intelligence in Education (AIED’13), LNCS, Vol. 7926, pp. 493–502, Springer, 2013.

URL http://dx.doi.org/10.1007/978-3-642-39112-5_50

Dialectal differences are one explanation for the systematically reduced test scores of children of color compared to their Euro-American peers. In this work, we explore the relationship between academic performance and dialect differences exhibited in a learning environment by assessing 3rd grade students’ science performance after interacting with a “distant peer” technology that employed one of three dialect use patterns. We found that our participants, all native speakers of African American Vernacular English (AAVE), demonstrated the strongest science performance when the technology used AAVE features consistently throughout the

interaction. These results call for a re-examination of the cultural assumptions underlying the design of educational technologies, with a specific emphasis on the way in which we present information to culturally-underrepresented groups.

8.9 Reflections on a Model of Culturally Influenced Human-Computer Interaction to Cover Cultural Contexts in HCI Design

Rüdiger Heimgärtner (IUIIC – Undorf, DE)

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Main reference R. Heimgärtner, “Reflections on a Model of Culturally Influenced Human-Computer Interaction to Cover Cultural Contexts in HCI Design,” *International Journal of Human-Computer Interaction*, Special Issue on Reframing HCI Through Local and Indigenous Perspectives, 29(4):205–219, 2013.
URL <http://dx.doi.org/10.1080/10447318.2013.765761>

This article presents an approach covering cultural contexts in human-computer interaction (HCI) design using a model of culturally influenced HCI. Cultural influence on HCI is described using cultural variables for user interface design. Assumptions regarding the influence of culture on HCI, considering the path of the information processing and the interaction style between Chinese and German users are explained on the basis of cultural models. Subsequent indicators represent the relationship between culture and HCI (culturally imprinted by the user). Correlations adopted theoretically between cultural dimensions and variables for HCI design are investigated. These correlations represent first relevant constituents of a model for culturally influenced HCI. Considerations applying such a model and evidence for the proper application of the method are presented. The proposed analysis of the context of users in general is presented, and some challenges evolving from the intercultural HCI design process from local and indigenous perspectives are addressed. The descriptive intercultural model for HCI design serves to inspire HCI engineers in the requirement analysis phase as well as HCI designers in the design phase. Finally, some implications for practitioners are shown, including HCI style scores, to prognosticate the effort and the expenditure for taking into account the cultural context in intercultural user interface design.

8.10 Intercultural User Interface Design

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Main reference R. Heimgärtner, “Intercultural User Interface Design,” in K. Blashki and P. Isaias, eds., *Emerging Research and Trends in Interactivity and the Human-Computer Interface*, pp. 1–33, IGI Global, 2014.
URL <http://dx.doi.org/10.4018/978-1-4666-4623-0.ch001>

This chapter starts with an introduction illuminating the theoretical background necessary for taking culture into account in Human Computer Interaction (HCI) design. Definitions of concepts used are provided followed by a historical overview on taking culture into account in HCI design. Subsequently, a glimpse of the current state of research in culture-centered HCI design is derived from secondary literature providing the gist of the structures, processes, methods, models, and theoretic approaches concerning the relationship between culture and HCI design. Controversies and challenges are also mentioned. A short discussion of results from empirical studies and design recommendations for culture-centered HCI design lead to implications and trends in future intercultural user interface design research.

8.11 Cultural Differences in Human-Computer Interaction – Towards Culturally Adaptive Human-Machine Interaction

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Main reference R. Heimgärtner, “Cultural Differences in Human-Computer Interaction. Towards Culturally Adaptive Human-Machine Interaction,” ISBN 978-3-486-71989-5, De Gruyter, 2012.

URL <http://www.degruyter.com/view/product/232226>

The work makes a contribution to the investigation of cultural factors in Human-Machine Interaction (HMI). Cultural influences can be described by intercultural variables which are imprinted differently depending on the respective specific culture and provide concrete design tasks for the design of HMI. Different cultural models are presented. Assumptions are derived from them regarding the influence of culture on HMI. These assumptions encompass differences about information processing and interaction style between Chinese and German users.

Cultural differences in Human-Computer Interaction (HCI) and culturally adaptive systems are not separable from each other because of safety issues. On the one hand, the regulation of cultural differences in HCI represents the first step towards developing culturally adaptive systems. On the other hand, the results of the cultural differences only become applicable in HCI by culturally adaptive systems in areas relevant to safety. E.g. a cultural customization is only automatically possible for driver navigation systems during the journey. Technical products like the driver navigations systems treated as examples in this dissertation are becoming more complex in functionality and interaction possibilities. Additionally, due to the expansion of global markets, products and systems need development for possible worldwide usage. One possible method of coping with intercultural complexity is to apply adaptive systems.

The concept of cross-cultural adaptive HMI is discussed and the influence of culture on driver navigation systems and cases of cross-cultural adaptability in driver navigation systems are presented. Thereby, the reasons, advantages and problems of using adaptability will be addressed. An important prerequisite for cultural adaptability is to classify the user quantitatively by the system according to culturally influenced interaction patterns. This work concentrates on describing a method to obtain quantitatively discriminating cultural interaction indicators and their values for cross-cultural Human-Computer Interaction design as preparatory work for culturally adaptive navigation and multi-media systems.

The method has been implemented in a tool for intercultural HCI analysis. Two empirical studies have been carried out providing HCI analysis during several test sessions. Test persons of different cultures did several tasks using this test tool. A first offline pre-study indicated interesting results and provided new insights that have subsequently been verified by two online studies. These studies revealed differences in human-computer interaction that depend on the cultural background of the users (e.g., attitude, preference, skill, etc.) and proved that the test tool was working properly. Furthermore, doing those empirical studies, the cultural differences in HCI have been found quantitatively, which fulfills a prerequisite for automatic cultural adaptability. Cultural dimensions are related to culturally different conceptions held by human beings about space, time and communication, which have implications for their expectations (e.g., number and order of information units).

Several cultural interaction indicators exhibiting informational characteristics are presented which taken together describe an interaction pattern of the user with the system. Additional qualitative studies confirmed the necessity of the quantitative studies as well as

confirming the truth of the results in this study. The results are presented and discussed to demonstrate the difficulties, but also the importance of understanding cultural differences in HCI to clear the way for cultural adaptability. Moreover, theoretically postulated correlations between cultural dimensions and variables for HMI design have been analyzed using statistical methods. Based on the results, a model with cultural variables for intercultural HMI design has been developed from which a usability metric trace model containing quantitative cultural interaction indicators was derived and empirically verified. This model served to adapt rules that have been implemented in a demonstrator to prove that cultural adaptability works in reality and not only statistically.

The basic postulated principle of culturally adaptive human-machine interaction (CAHMI) can be improved upon empirically as found in the results of this work. The user interface can be adapted automatically according to the culturally influenced interaction patterns of the user. From this, also with regard to driver navigation systems, several recommendations for the design of ‘intercultural user interfaces’ are derived and culturally adaptive interface agent architecture as well as a generic adaptability framework is suggested.

8.12 Robotic Rabbit Companions: amusing or a nuisance?

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Joint work of Heylen, D.; van Dijk, E.; Nijholt, A.

Main reference D. Heylen, B. van Dijk, A. Nijholt, “Robotic Rabbit Companions: amusing or a nuisance?,” *Journal on Multimodal User Interfaces*, 5(1-2):53-59, 2012; available also at EEMCS.

URL <http://dx.doi.org/10.1007/s12193-011-0083-3>

URL <http://eprints.eemcs.utwente.nl/21166/>

Most of the studies in human-robot interaction involve controlled experiments in a laboratory and only a limited number of studies have put robotic companions into people’s home. Introducing robots into a real-life environment does not only pose many technical challenges but also raises several methodological issues. And even though there might be a gain in ecological validity of the findings, there are other drawbacks that limit the validity of the results. In this paper we reflect on some of these issues based on the experience we gained in the SERA project where a robotic companion was put in the homes of a few people for ten days. We try to draw some general lessons from this experience.

8.13 Modelling Trade and Trust Across Cultures

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Joint work of Hofstede, Gert Jan; Jonker, Catholijn; Meijer, Sebastiaan; Verwaart, Tim

Main reference G. J. Hofstede, C. M. Jonker, S. Meijer, T. Verwaart, “Modelling Trade and Trust Across Cultures,” in *Proc. of the 4th Int’l Conf. on Trust Management (iTrust’06)*, LNCS, Vol. 3986, pp. 120-134, Springer, 2006.

URL http://dx.doi.org/10.1007/11755593_10

Misunderstandings arise in international trade due to difference in cultural background of trade partners. Trust and the role it plays in trade are influenced by culture. Considering that trade always involves working on the relationship with the trade partner, understanding

the behaviour of the other is of the essence. This paper proposes to involve cultural dimensions in the modelling of trust in trade situations. A case study is presented to show a conceptualisation of trust with respect to the cultural dimension of performance orientation versus cooperation orientation.

8.14 Game Design Strategies for Collectivist Persuasion

Rilla Khaled (University of Malta, MT)

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Joint work of Khaled, Rilla; Barr, Pippin; Biddle, Robert; Fischer, Ronald; Noble, James

Main reference R. Khaled, P. Barr, R. Biddle, R. Fischer, J. Noble, “Game design strategies for collectivist persuasion,” in Proc. of the 2009 ACM SIGGRAPH Symp. on Video Games (Sandbox’09), pp. 31–38, ACM.

URL <http://dx.doi.org/10.1145/1581073.1581078>

A fundamental feature of serious games is persuasion, an attempt to influence behaviors, feelings, or thoughts. Much of the existing research on serious games and, more generally, on persuasive technology (PT), does not address the important links between persuasion and culture. It has tended to originate from Western, individualist cultures, and has focused on how to design for these audiences. In this paper, we describe the design of one of two versions of a serious game we developed about quitting smoking titled *Smoke?* which is targeted at collectivist players. We show how the design was informed by persuasive strategies we identified from the crosscultural psychology literature, intended for use in games for players of collectivist cultures: HARMONY, GROUP OPINION, MONITORING, DISESTABLISHING, and TEAM PERFORMANCE. We then discuss the results of a quantitative investigation of the effects of both game versions on both individualist and collectivist players.

8.15 Traveller: An Interactive Cultural Training System controlled by User-Defined Body Gestures

Felix Kistler (Universität Augsburg, DE)

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Joint work of Kistler, Felix; André, Elisabeth; Mascarenhas, Samuel; Silva, André; Paiva, Ana; Degens, Nick; Hofstede, Gert Jan; Krumhuber, Eva; Kappas, Arvid; Aylett, Ruth

Main reference F. Kistler, E. André, S. Mascarenhas, A. Silva, A. Paiva, N. Degens, G. J. Hofstede, E. Krumhuber, A. Kappas, R. Aylett, “Traveller: An interactive cultural training system controlled by user-defined body gestures,” in Proc. of the 14th IFIP TC 13 Int’l Conf. on Human-Computer Interaction (INTERACT’13), LNCS, Vol. 8120, pp. 697–704, Springer, 2013.

URL http://dx.doi.org/10.1007/978-3-642-40498-6_63

In this paper, we describe a cultural training system based on an interactive storytelling approach and a culturally-adaptive agent architecture, for which a user-defined gesture set was created. 251 full body gestures by 22 users were analyzed to find intuitive gestures for the in-game actions in our system. After the analysis we integrated the gestures in our application using our framework for full body gesture recognition. We further integrated a second interaction type which applies a graphical interface controlled with freehand swiping gestures.

8.16 Pros and Cons of Displaying Self-Adaptors: Importance of Considering Users' Social Skills

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Main reference T. Koda, H. Higashino, "Pros and Cons of Displaying Self-Adaptors: Importance of Considering Users' Social Skills," Workshop on Cultural Characters in games and learning (CCGL'13), 2013.

Joint work of Hiroshi Higashino

URL <http://www.is.oit.ac.jp/~koda/hiserver01/profile-e.html>

Self-adaptors are bodily behaviors that often involve self-touch. Our continuous evaluation of the interaction between an agent that exhibits self-adaptors and without indicated that there is a dichotomy on the impression on the agent between users with high social skills and those with low skills. People with high social skills feel more friendliness toward an agent that exhibits self-adaptors than those with low social skills. The result suggests the need to tailor non-verbal behavior of virtual agents according to user's social skills.

8.17 Socio-emotional effects of synthetic language varieties

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Research on intelligent agents has demonstrated that the degree an artificial entity resembles a human correlates with the likelihood that the entity will evoke social and psychological processes in humans. On the other hand, language attitude studies based on natural voices have provided evidence that human listeners socially assess and evaluate their communication partners according to the language variety used. Taking the two findings together, we hypothesize that synthetically generated language varieties have social effects similar to those reported from language attitude studies on natural speech.

As a starting point for assessing the socio-emotional effects of synthetic language varieties in ECAs, the design and realization of a set of synthetic voices was presented representing standard and dialectal varieties of Austrian German. The respective voices can be accessed online via http://vsds.ofai.at/vsds_synthesize.cgi. See also [4]. Moreover, an approach to employing techniques from statistical machine translation was introduced, in order to transform textual input representing the standard variety into representations suitable as input to a dialectal text-to-speech system. See http://varieties.ofai.at/test_translate.shtml for an online demonstration of such a translation system and <http://varieties.ofai.at/publications.shtml> for related references.

[3] and [2] to appear provide evidence that socio-emotional effects of natural language varieties transfer to synthetic varieties. In addition, it could be shown that not only the particular variety has effects on the socio-emotional evaluation and appreciation of the respective speaker, but also features relating to the voice quality of the synthesized speech bring about attributions of different social aspects and stereotypes.

[1] investigate the effects of a virtual character's bodily expressivity and the language variety it speaks on its perceived personality. Clear evidence was found that synthesized language variety, and gestural expressivity influence the human perception of an agent's

extroversion. Whereby Viennese and Austrian standard language are perceived as more extrovert than the German standard.

Summing up, language variety, voice quality and gestural expressivity together strongly influence the attitudes of listeners towards artificial speakers, thus highlighting the importance of an accurate design of voice, language variety and body behaviour for the development of artificial agents. Moreover, agent designers may directly profit from existing results of language attitude studies on natural speech, which is an important factor, given the growing availability of synthetic voices representing different language varieties.

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8.18 Promoting Metacognition in Immersive Cultural Learning Environments

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Metacognition, defined as active control over cognitive processes during learning, is a critical component in the development of intercultural competence. Progression through stages of intercultural development requires self-assessment, self-monitoring, predictive, planning, and reflection skills. Modern virtual learning environments now provide a level of immersion that enable meaningful practice of cultural skills, both in terms of visual and experiential fidelity. This paper discusses their potential role in intercultural training, and the use of intelligent tutoring and experience manipulation techniques to support metacognitive and intercultural development. Techniques for adapting the behaviors of virtual humans to promote cultural learning are discussed along with the role of explicit feedback. The paper concludes with several suggestions for future research, including the use of existing intercultural development metrics for evaluating learning in immersive environments and on the balance between implicit and explicit feedback to establish optimal conditions for acquiring intercultural competence.

8.19 Reciprocal adaptation in intercultural interaction contexts

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Adaptation is a major process in evolution and it has been studied mainly in biology and zoology. In [1], Gumperz introduced the term reciprocal adaptation into the field of sociolinguistics of interpersonal communication as a procedure used by anthropology scholars in gathering data from unwritten languages. As “each participant gradually learns to adapt and to enter into the other’s frame of reference... what others had seen as primitivity or failure to conform to pre-existing standards of rationality or efficiency now became evidence for the existence and functioning of cultural differences” [1]. Reciprocal adaptation and accommodation are studied as interhuman spoken language interaction phenomena [2], [3], [4]. However, the majority of previous intercultural communication studies are actually cross-cultural communication studies i.e., they do not study how people from different cultures communicate with each other but rather compare how people from different cultures reason within their own cultures and on the basis of this comparison draw expectations and assumptions on how they would communicate when they meet (e.g. [5], [6]). These expectations and assumptions are then used in intercultural communication training and education. Such approaches have come a long way but there are still issues left unexplained. Part of the reason for this is that they have taken language, communicative processes and contextual factors insufficiently into account. In effect, there is a need of consideration of communicative changes in intercultural interlingual interactions.

Reciprocal adaptation is a mechanism which changes patterns of communication in the process of communication on cognitive and linguistic levels but also on emotional and behaviour levels. Speakers adapt to each other with respect to posture, gaze, proximity, orientation, lexical choices, tone of voice, emotion expression, etc. But how do intra-cultural communication patterns change when people meet in intercultural contexts as they adapt to each other’s culture-based communicative patterns? [7] found that international student groups who are trained in intercultural communication based on results from cross-cultural studies perform worse with regard to creativity in comparison to a group of international student who are not intercultural communication trained. In addition, linguistic adaptation of human agents to Virtual Humans is found also in spoken human-computer dialogues [8], which indicates that successful human-computer interaction benefits from a design based on reciprocity i.e. design of dialogue systems, which learn during and through interaction based on the principles of imitation and adaptation. Preliminary studies suggest that expectations of adaptation during face-to-face intercultural communication are sustained but the degree of the effect is not yet clear. For instance, interactive studies on intercultural communication which involve Chinese speakers have focused on differences in communication [9] rather than on the actual process and communicative relatedness between speakers. However, [10] found that when Spanish and Chinese meet for a job interview role-play, Spanish use among other features, less gestures and shorter mutual gaze whereas Chinese use more gestures and longer mutual gaze than in identical intra-cultural contexts. Qui and Wang [11] also notice reciprocal adaptation during Swedish-Chinese business negotiation role-play in English. These results indicate that we need to rethink major assumptions and methods of intercultural communication study and co-design of interactive e-learning technology.

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8.20 Personality differences in the multimodal perception and expression of cultural attitudes and emotions

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Joint work of Clavel, C.; Rilliard, A.; Shochi, T.; Martin, J. C.

Main reference C. Clavel, A. Rilliard, T. Shochi, J.-C. Martin, “Personality differences in the multimodal perception and expression of cultural attitudes and emotions,” in *Proc. of the 3rd Int’l Conf. on Affective Computing and Intelligent Interaction (ACII’09)*, pp. 1–6, IEEE, 2009.

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Individual differences have been reported in the literature on nonverbal communication. Recent development in the collection and evaluation of audiovisual databases of social behaviors brings new insight on these matters by exploring other types of social behaviors and other approaches to individual differences. This presentation summarizes two experimental studies about personality differences in the audiovisual perception and expression of social affects. We conclude on the potential of such audiovisual database and experimental approaches for the design of personalized affective computing systems.

8.21 Social Importance Dynamics: A Model for Culturally-Adaptive Agents

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Joint work of Mascarenhas, Samuel; Prada, Rui; Paiva, Ana; Hofstede, Gert Jan

Main reference S. Mascarenhas, R. Prada, A. Paiva, G. J. Hofstede, “Social Importance Dynamics: A Model for Culturally-Adaptive Agents,” in Proc. of the 13th Int’l Conf. on Intelligent Virtual Agents (IVA’13), LNCS, Vol. 8108, pp. 325–338, Springer, 2013.

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The unwritten rules of human cultures greatly affect social behaviour and as such should be considered in the development of socially intelligent agents. So far, there has been a large focus on modeling cultural aspects related to non-verbal behaviour such as gaze or body posture. However, culture also dictates how we perceive and treat others from a relational perspective. Namely, what do we expect from others in different social situations and how much are we willing to do for others as well. In this article we present a culturally configurable model of such social dynamics. The aim is to facilitate the creation of agents with distinct cultural behaviour, which emerges from different parametrisations of the proposed model. The practical application of the model was tested in the development of an agent-based application for intercultural training, in which the model is responsible for driving the socio-cultural behaviour of the virtual agents.

8.22 Dynamic Cultural Contextualisation of Educational Content in Intelligent Learning Environments using ICON

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Joint work of Mohammed, Phaedra; Mohan, Permanand

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Research into culturally-aware Intelligent Learning Environments (ILEs) has been motivated by interest in improving the achievements, participation and motivation of underrepresented student groups, increasing the acceptance and use of ILEs through cultural-awareness, and reducing student misinterpretations of ILEs driven by lack of culturally-aware designs. Cultural awareness, when applied to ILEs, contours the overall appearance, behaviour, and content used in these systems through the use of culturally-relevant student data and information. However in most cases, these adaptations are system-initiated with little to no consideration given to student-initiated control over the extent of cultural-awareness being used in the learning experience. In addition, many ILEs use cultural granularity at a national or country level which may over generalise the cultural backgrounds of students and fail to capture differences between subcultures in a society that are relevant to the student. As such, this talk examines some of the issues relevant to these challenges through the development of the ICON (Instructional Cultural cONtextualisation) system. The talk discusses the computational approaches used in ICON for modelling the diversity of students across cultures, the necessary semantic representation formalisms for culture, and the production of run-time, dynamic ILE adaptations that reflect and respond to these subtle but important differences within cultures.

8.23 Towards Computational Model of Cultural Awareness in Communication

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Classical approaches to culture have been analytic in the sense that they rely on observations, conceptualizations, investigations, arguments, criticisms, and so on. In contrast, modern computational approaches draw on synthetic methodologies that use cultural models to simulate cultural phenomena to see their consequences under various conditions. The unique feature of the intelligent virtual agent technology is that it allows ordinary people to experience, by participation, with cultural encounters in artificial situations designed for specific purposes such as learning. These synthetic approaches bring about excellent new opportunities, as the users can gain as much direct experiences as she or he like under varieties of specified settings by changing parameter values or even by replacing models. For example, our research group leverages this characteristic to permit the user to experience with culture-depending queuing behaviors and real-time collaborations [5, 3].

A synthetic approach to culture employs a method for building conversational agents that can actively and proficiently participate in natural conversations among people. A data-intensive approach to conversational systems [4] exploits abundant data obtained from measuring conversation to enrich both interactional and transactional aspects of conversational agents. A computational model of cultural awareness and evolution in communication is a central issue for building conversational agents aware of cultural aspects in communication that can not only adapt to the cultural background of partners but also take an active role in building, extending and diffusing new cultural traits.

Provided that culture is a collective mental programming of the mind following [2], cultural difference is everywhere depending on the degree of the individual differences of mental software that may arise not only by national culture but also by educational background, business practice, or even by age. We would like our conversational agent not only to sense and adapt cultural differences but also to make an active participation such as inventing, revising and disseminating a new communication practice.

A computational theory of culture might involve such issues as:

1. Theory of communication. I suspect that a joint activity theory [1] might serve as a good start point. We need to build on it a computational theory of how cultural aspects manifest in a communication ladder.
2. Theory of cultural signals. The space of cultural signals may be captured by a parametric model, such as the one proposed in [2]. In addition, semiotics is needed to specify how signals are associated with intended meaning.
3. Theory of cultural cognition. It should entail how cultural signals are explicitly or implicitly encoded in communication and how people may realize and adopt them. I suspect that cultural signals are implemented as a redundancy in behaviors so participants can easily notice them; should they understand the meaning and like them, they start to spend a certain amount of cost to employ them. People may know the meaning by being told or guess it by themselves, each may correspond to the theory theory and the simulation theory in theory of mind, respectively.
4. Theory of cultural creation and diffusion. Creation might sometimes carefully designed, but sometimes caused by contingent events.

5. Computational theory of empathic agents. In order for a conversational agent to actively participate in cultural evolution, it need to be empathic, not only be able to sense cultural signals but also appraise them to feel other participants' emotions as well as express its own empathy to allow the partners to feel the agent's emotion.

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8.24 Emotional Cyborg: Complementing Emotional Labor using Human-agent Interaction

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The author proposes the notion of an emotional cyborg as a new application proposal in the human-agent interaction (HAI) field. The author summarized what kind of human processes maintain emotional labor and how such kind of social labor is supported by HAI technologies. The author implemented AgencyGlass, a prototype application, as a tool for realizing an emotional cyborg. The device is attached on a user's face and displays the user's eye gestures. The author implemented a prototype application for supplementing emotional labor with AgencyGlass and presented this as a video.

8.25 Computational modelling of culture and affect

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Joint work of Aylett, Ruth; Paiva, Ana

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This article discusses work on implementing emotional and cultural models into synthetic graphical characters. An architecture, FAtiMA, implemented first in the antibullying application FearNot! and then extended as FAtiMA-PSI in the cultural-sensitivity application

ORIENT, is discussed. We discuss the modelling relationships between culture, social interaction, and cognitive appraisal. Integrating a lower level homeostatically based model is also considered as a means of handling some of the limitations of a purely symbolic approach. Evaluation to date is summarised and future directions discussed.

8.26 Child-robot interaction across Cultures

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This study investigates how children from two different cultural backgrounds (Pakistani, Dutch) and two different age groups (8 and 12 year olds) experience interacting with a social robot (iCat) during collaborative game play. We propose a new method to evaluate children's interaction with such a robot, by asking whether playing a game with a state-of-the-art social robot like the iCat is more similar to playing this game alone or with a friend. A combination of self-report scores, perception test results and behavioral analyses indicate that Child-Robot Interaction in game playing situations is highly appreciated by children, although more by Pakistani and younger children than by Dutch and older children. Results also suggest that children enjoyed playing with the robot more than playing alone, but enjoyed playing with a friend even more. In a similar vein, we found that children were more expressive in their non-verbal behavior when playing with the robot than when they were playing alone, but less expressive than when playing with a friend. Our results not only stress the importance of using new benchmarks for evaluating Child-Robot Interaction but also highlight the significance of cultural differences for the design of social robots.

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