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Title: Planning Small Talk Behavior with Cultural Influences for Multiagent Systems

Authors: Birgit Endrass, Matthias Rehm, Elisabeth André¹>Aalborg University, Niels Jernes Vej 14, DK-9220 Aalborg, Denmark.</sup></p></div><div data-bbox="682 132 826 276" data-label="Image">The image shows the cover of the journal 'COMPUTER SPEECH AND LANGUAGE'. The title is written in red and white text at the top. Below the title is a complex, blue-toned fractal or mandala-like pattern that radiates from a central point, creating a sense of depth and complexity. The overall design is modern and technical, reflecting the journal's focus on computer speech and language processing.</div><div data-bbox="152 325 569 378" data-label="Text"><p>PII: S0885-2308(10)00032-X
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Planning Small Talk Behavior with Cultural Influences for Multiagent Systems

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Abstract

There are several factors that influence communicative behavior, such as gender, personality or culture. As virtual agents interact in a more and more human-like manner, their behavior should be dependent on social factors as well. Culture is a phenomenon that affects one's behavior without one realizing it. Behavior is thus sometimes perceived as inappropriate because there is no awareness of the cultural gap. Thus, we think cultural background should also influence the communication behavior of virtual agents. Behavioral differences are sometimes easy to recognize by humans but still hard to describe formally, to enable integration into a system that automatically generates culture-specific behavior. In our work, we focus on culture-related differences in the domain of casual Small Talk. Our model of culture-related differences in Small Talk behavior is based on findings described in the literature as well as on a video corpus that was recorded in Germany and Japan. In a validation study, we provide initial evidence that our simulation of culture-specific Small Talk with virtual agents is perceived differently by human observers. We thus implemented a system that automatically generates culture-specific Small Talk dialogs for virtual agents.

Key words: Virtual Agents, Culture, Small Talk, Behavior Planning, Language Generation

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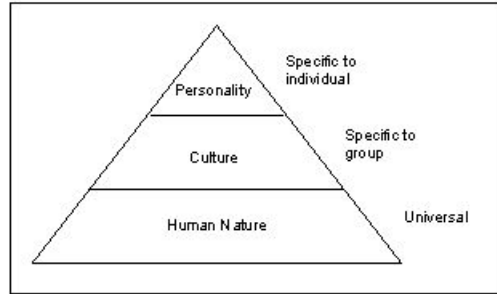


Figure 1: Hofstede's levels of uniqueness in a human's mental program [12]

1. Motivation

Human communication depends on several factors such as personality, emotion or personal relationships. Hofstede [12] refers to this as a mental program, that individualizes every human and affects one's behavior. This so-called "software of the mind" can be categorized into three layers: human nature, culture and personality (see Fig. 1). Since these three levels strongly affect human behavior, we claim that they should also be considered when building believable behavior for virtual agents. So far, enormous efforts have been made in integrating two of the three layers. Through the virtual agents' embodiment, human nature was included in order to simulate believable behavior (verbally and non-verbally). Integrating models of personality was a plausible next step, taking into account that most interactions with virtual agents take place in dyadic conversations and thus a personal layer was considered. However, the third layer (culture) is rather new in the domain of virtual agents and has come into focus only recently. In the following the three layers will be further explained as well as their correlation with virtual agents.

Human nature represents the universal level in one's mental program and contains *physical* and *basic psychological* functions. Virtual agent systems meet people's *physical* nature in more and more sophisticated ways using natural speech and non-verbal behavior such as gestures or body postures. Basic *psychological* functions have been integrated into virtual agent systems as well. The ability to express emotions and act accordingly for example is described in [1] and [10].

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Personality is the level that is specific to the individual and, according to Hofstede [12], contains a unique set of mental programs that characterizes a person. Enhancing the behavior of virtual humans with a personality component has been a vast research field in recent years. Examples can be found in [24] and [17].

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Culture is the middle layer of Hofstede's mental program that determines human behavior. In contrast to personality, culture is specific to the group and the environment, which ranges from the domestic circle, the neighborhood or workplace up to the living community of the country an individual lives in. Culture plays a crucial role in the perception and selection of behaviors, mainly without realizing it. Consequently, behavior is sometimes perceived as inappropriate without it being realized that there is a cultural gap causing the problem. Recently the integration of cultural specific behaviors into multiagent systems has gathered momentum (see [2], [16] or [23]).

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Our aim is to generate culture-specific communication for virtual agents. In our work, we focus on the domain of Small Talk as a type of conversation that occurs in every culture. Small Talk is often used to pass time and avoid silence and does sometimes not serve a certain purpose. In addition to that, it can be used to build trust and rapport between communication partners. According to Reeves and Nass [19] users establish social relations to computer-based systems. Small Talk can be used to influence social relations positively. In [4], Bickmore and Nass use Small Talk to develop trust and rapport toward a virtual agent. In applications where the development of social relations is intended, Small Talk can be a crucial part of the system's social intelligence. Integrating culture as a social factor in the generation of Small Talk for a computer-based system can enhance the development of social relations.

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The contribution of our work is to formalize culture-related differences in Small Talk behavior in a way that allows integration into a program that automatically generates culture-specific dialogs. In our approach, we exemplify culture-related differences in Small Talk for the German and Japanese cultures. Tendencies described in the literature were taken as a basis. As these descriptions are rather broad, we documented the cultural tendencies reported in the literature by analyzing the content of video corpora recording small talk in Japan and in Germany. Integrating our expectations into a

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9 demonstrator with virtual agents, we showed that human subjects perceive
10 a difference between agent dialogs that are in line with their own cultural
11 background and agent dialogs that are not. We take this as a first piece of
12 evidence that our formalization of culture-related differences in Small Talk
13 behavior can enhance the social behavior of virtual agents. We then imple-
14 mented a system that automatically generates culture-specific Small Talk for
15 a multiagent system.
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19 This paper is organized as follows: The next section gives an overview
20 of the related work on Small Talk for virtual agents and approaches that
21 enhance their behavior with a cultural component. Then we describe Small
22 Talk and culture as backgrounds from the social sciences. We go on to intro-
23 duce the basic functions and the structure of Small Talk in section 3, as well
24 as techniques for categorizing topics that might occur in Small Talk. In sec-
25 tion 4, we define culture as a concept and describe different models of culture.
26 As a result of reflecting Small Talk and culture as described in the literature,
27 we summarize the tendencies on culture-related differences in Small Talk be-
28 havior. To ground these tendencies into empirical data, we describe a corpus
29 study in section 5 that helps us to characterize our expectations in a more
30 formal way in order to build a computational model. In section 6, we present
31 a validation study where we evaluated whether subjects perceive a difference
32 between culture-specific dialogs that are in line with observations made for
33 their own cultural background and agent dialogs that are not. Section 7
34 introduces our system architecture including a hierarchical planner that au-
35 tomatically generates culture-specific Small Talk behavior for a multiagent
36 system. In section 8, we discuss our results and describe our future work in
37 this research field.
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45 **2. Related Work**

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47 As we stated above, we aim at correlating the two phenomena of Small
48 Talk and culture and integrate them into a multiagent system. The idea
49 of developing virtual agents that have the ability to use Small Talk is not
50 entirely new. In [6] for example, Cassell et al. describe an embodied conver-
51 sational interface agent (REA) that interacts with a user in the domain of
52 real estate sales. The REA agent is capable of both multimodal input under-
53 standing and output generation and supports social as well as task-oriented
54 dialog. In [4], an advanced version of the REA agent is described where the
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9 social component is enhanced by the agent's capability to engage in Small
10 Talk. Besides accomplishing specific tasks in the real estate domain, the
11 agent uses casual Small Talk to build trust and rapport with the user.
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14 In [3], Bickmore describes an exercise adviser agent that promotes exercise
15 among students in order to evaluate the effectiveness of relational agents in
16 health behavior change. Therefore, the agent needs to be capable of build-
17 ing relationships with people and influencing their exercise behavior. The
18 authors found significantly more laughter in conversations where Small Talk
19 occurred compared to those dialogs where Small Talk was almost absent.
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23 Another purpose of Small Talk in computer-based systems is described by
24 Isbister et al. [15]. A so-called "Helper Agent" virtually joins two users of a
25 chat room in case their conversation stagnates. By introducing typical Small
26 Talk topics the agent can actively help to create interesting and ongoing
27 conversations between human interlocutors. Thereby the agent distinguishes
28 between safe and unsafe topics. The authors state that this division depends
29 on culture. Thus, some topics are safe in one culture and unsafe in another.
30 For their application, however, topics remain limited to those that are either
31 safe or unsafe in all cultures, such as weather and music (safe) or religion
32 and money (unsafe).
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37 Like the ability to engage in Small Talk, the integration of cultural back-
38 ground into the behavior of virtual agents has been focused on recently. In
39 [14], Iacobelli et al. present a virtual peer that models ethnicity through
40 culturally authentic verbal and non-verbal behaviors in order to test ethnic
41 identity and engagement. By changing the verbal and non-verbal behaviors
42 and leaving the appearance constant, the authors tested how subjects assess
43 the ethnicity of a virtual character. Their evaluation suggests that the eth-
44 nicity of a virtual agent can be estimated by adapting verbal and non-verbal
45 behaviors and that children engage with those virtual peers in promising
46 ways for educational applications.
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51 In [13], Huang et al. present a culture adaptive virtual tour guide. The
52 authors take a modularized approach using a generic framework to build
53 agents that display appropriate verbal and non-verbal behaviors. However,
54 they do not explicitly model culture or behavioral differences, but integrate
55 random culture-related behavior such as emblematic gestures in the overall
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9 process of action selection.

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11 Core and colleagues [7] describe a tactical language system where the
12 trainees interact with virtual agents that have a different cultural background
13 than their own. For the training scenario different negotiation styles were
14 implemented: (1) *avoidance*: the negotiator tries to avoid the negotiation
15 which is undesirable in some manner; (2) *integrative*: the negotiation part-
16 ner tries to find a solution for the given problem that is satisfying for all
17 participants and (3) *distributive*: the conversation partner wants to prove his
18 / her point and “win” the negotiation. Although the authors state that there
19 are culture-rated differences in the usage of these strategies they have not
20 identified culture-specific negotiation styles yet, but acknowledge the impor-
21 tance of such a step.
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27 As we stated above, culture is specific to a group whereas personality
28 is specific to an individual. Several approaches have been integrating per-
29 sonality to the internal model of virtual agents. With a group of virtual
30 agents the phenomenon of culture can be simulated. The CUBE-G project
31 [21] for example, investigates culture-adaptive behavior generation for in-
32 teractions with embodied conversational agents which can be employed in
33 edutainment applications for increasing cultural awareness and for learning
34 some of the appropriate behavior routines. For the project, three prototypi-
35 cal interaction scenarios have been taken into account: (1) Meeting someone
36 for the first time; (2) Negotiation; (3) Conversation with an individual with
37 a high social status. The first scenario covers a first time meeting, where
38 getting acquainted with each other and thus leading a Small Talk conversa-
39 tion comes into focus. Verbal behavior differences have not been considered,
40 but attributes of non-verbal behavior as well as communication management
41 behavior have been observed.
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47 Another approach in integrating culture-specific behaviors into a multi-
48 agent system has been taken by Jan et al. [16], who present a model for
49 simulating cultural differences. So far, non-verbal behavior clues have been
50 taken into account, such as differences in proxemics and gaze. In their evalua-
51 tion, the authors show that subjects perceive differences between simulations
52 generated with different parameters and simulations with cultural parame-
53 ters associated with their own culture.
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In [2], Aylett et al. introduce a believable agent-based educational application that was designed to develop inter-cultural empathy in participating users. In the ORIENT application, fantasy characters with their own culture in terms of rituals and symbols were designed. The agent architecture is based on FAtiMA [8], where emotions and personality influence the agents' behavior. To simulate different cultures, this architecture was extended to allow cultural adaptation of the agents. However, in their system only the way actions are interpreted depends on culture. Thus, on the one hand, incoming events are perceived in a culture-specific way (which updates the emotional state of an agent) and on the other hand the triggered reaction is performed according to culture. The work described in this paper focuses on the process of action selection depending on culture. Therefore, stereotypical behavior for certain cultures is simulated to help the user to understand these cultural differences.

Integrating culture into the behavior model of virtual agents has come into focus recently. However, most approaches concentrate on non-verbal behaviors. Our work focuses on culture-related differences in verbal behavior. Small Talk is used in virtual agent applications already to establish social relations. Cultural factors are not considered yet. Our contribution is to formalize culture-related differences in Small Talk behavior in order to build a system that automatically generates dialogs that exemplify these findings. In our work, we concentrate on two national cultures and demonstrate concrete differences in their behavior. To that end a video corpus was recorded in the two cultures of Germany and Japan.

3. Functionality and Structure of Small Talk

In order to formalize Small Talk in a way that allows the generation of different dialogs for different cultural backgrounds, we need to understand and characterize Small Talk first. In this section, we describe Small Talk as it is defined in the social sciences and introduce prototypical sequences and topics for Small Talk conversations.

Small Talk is often thought of as neutral, non-task-oriented conversation about safe topics, where no specific goals need to be achieved. But besides being a simple chat, Small Talk can serve different purposes, such as establishing social relations, getting acquainted with a conversation partner or avoiding undesirable silence. Although the rules of Small Talk seem to be

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9 loose, there are certain structures that explain the flow of an average Small
10 Talk conversation. In [25], Schneider describes a sequence that exemplifies
11 the prototypical structure of Small Talk. This sequence of utterances is char-
12 acterized as follows:
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- 14 1. Question
 - 15 2. Answer
 - 16 3. Reverse Question / understanding / acknowledgment / evaluation
 - 17 4. Zero or more idle-moves
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21 where step three and four can be performed several times. According to
22 [25], this sequence can be used to discuss a topic within a Small Talk con-
23 versation. It can then be restarted for every new topic. Of course, this is
24 only one sequence that describes the prototypical flow of discussing a topic
25 and not necessarily every Small Talk conversation has to follow this line.
26 However, it can be used for our purposes in building a computational model
27 of Small Talk for a system using virtual agents. In our work, we use this
28 sequence as a basis to describe the prototypical flow of a Small Talk conver-
29 sation.
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33 Besides defining a prototypical sequence within a Small Talk conversa-
34 tion, possible topics need to be constrained. Obviously, not every topic is
35 appropriate in an everyday Small Talk conversation. So-called *unsafe top-*
36 *ics* such as death, serious illness, religion or sex are avoided. According to
37 Kellermann and Palomares [18], the choice of topics in everyday conversation
38 depends on the personal relation between the interlocutors. Consequently,
39 topics that are likely to be discussed in a casual Small Talk situation are
40 predictable.
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44 In [25], Schneider categorizes topics that might occur in Small Talk con-
45 versations into three groups, while the choice of topics depends on the social
46 context:
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- 48 1. The **immediate situation** holds topics that are elements of the so-
49 called *frame* of the situation. In order to explain the idea of a frame,
50 the author of [25] uses a Small Talk situation that takes place at a
51 party. Possible topics within a party frame could be the atmosphere,
52 drinks, music, participants or food.
- 53 2. The **external situation** (later referred to as social topics) or “su-
54 persituation” describes all topics that hold the larger context of the
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9 immediate situation. This category is the least limited of the three.
10 Topics within this category could be the latest news, politics, sports,
11 movies or celebrities.
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- 13 3. For the **communication situation** (later referred to as private topics)
14 interlocutors are seen as a subset of the immediate situation. Thus, top-
15 ics concentrate on the conversation partners e.g. their hobbies, family
16 or career.
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19 According to [25], a typical Small Talk conversation begins with the in-
20 terlocutors' immediate situation (e.g. the location of the conversation or the
21 weather). Successively, topics can either shift to the external situation (e.g.
22 economy or news) or to the communication situation (e.g. hobbies or career).
23 Whether the conversation addresses social or private topics is dependent on
24 the social surrounding. While shifting to social topics is more common in
25 a social context, such as a party situation, shifting to private topics is typ-
26 ical for a conversation between strangers that want to avoid silence. As a
27 result, topic selection in Small Talk depends on the conversation partners,
28 their personal relation and social context.
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32 33 4. Defining culture and cultural differences

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35 In the previous section, we discussed the sequence of a prototypical Small
36 Talk conversation as well as an approach that categorizes topics that might
37 occur during Small Talk. So far, the influence of cultural background has
38 not been taken into account. Since the observations described above have
39 been made for Western cultures they do not necessarily hold true for other
40 cultural groups as well. Do topics in Asian Small Talk conversations, for
41 example, shift to the communication situation when silence is tried to be
42 avoided just as described for Western cultures? In addition, the prototypical
43 structure of Small Talk described above does not give any information about
44 the ordering of different topics. Does one topic have to be finished before
45 another one starts? How are topics reintroduced? In this section, we address
46 these questions and summarize tendencies in culture-related differences in
47 Small Talk behavior as described in the literature.
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53 Our objective is to build a multiagent system where the style of casual
54 Small Talk varies with culture. Therefore, we need to define culture and
55 behavioral differences between cultures. Although culture is an abstract con-
56 cept that describes tendencies of behavior rather than fixed rules, there are
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9 approaches that define culture in a dimensional manner or categorize cultural
10 groups and define most likely behaviors for these groups.
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13 Culture can be seen as a concept, where dichotomies are defined and
14 differences in behaviors are explained accordingly. Hall [11], for example,
15 distinguishes so called *high* and *low contact* cultures, that depict behav-
16 ioral differences in proxemics and haptics. Following Hall's definition, Ting-
17 Toomey [26] characterizes the varieties of these cultural groups in more detail.
18 According to her, features of high-contact cultures include direct facing, fre-
19 quent direct eye contact, close interaction and a rather loud voice, whereas
20 features of low-contact cultures include indirect facing, wider space, little or
21 no touching, indirect glances and a soft or moderate voice.
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24 Another dichotomy analyzed by Ting-Toomey [26] is the division into
25 *monochronic* and *polychronic* cultures. One behavioral pattern described for
26 monochronic cultures is that members tend to do one thing at a time. Most
27 Western cultures find themselves in the monochronic group. Controversially,
28 most Asian cultures belong to the polychronic group and prototypically tend
29 to do several things at a time. Generalizing these behavioral patterns, West-
30 ern cultures tend to finish one thing before starting another, while it is more
31 common in Asian cultures to switch back and forth between tasks. Regard-
32 ing the domain of Small Talk, we derive from the tendencies described above
33 that topics are rather discussed after one another in monochronic cultures
34 and thus in a more sequential manner than in polychronic cultures, where
35 we anticipate switching back and forth between topics as more natural. Con-
36 cluding this idea, we formulate a first tendency on culture-related difference
37 in Small Talk behavior that distinguishes Asian and Western cultures:
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43 **Tendency 1:** Topics are more likely to be discussed one after the other
44 (more sequentially) in Western Small Talk conversations than in Asian ones.
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47 In [11], Hall describes another distinction of cultures and divides them
48 into *high* and *low-context* cultures. Regarding verbal communication, in so-
49 called high-context communication little information is explicitly encoded
50 and the conversation relies mainly on physical context. Besides verbal ut-
51 terances, meaning is transported through context or non-verbal clues. Thus,
52 interlocutors are expected to "read between the lines" in order to decode
53 the whole meaning of a verbal message. In contrast, low-context commu-
54 nication explicitly encodes information. The speaker is thus expected to
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construct clear messages that can be understood easily without the need to decode other aspects of communication. Most Western cultures are low-context cultures whereas most Asian cultures are high-context cultures. According to [5], low-context cultures tend to use many question-answer pairs, whereas high-context cultures develop information from the context. Thus, the structure of Small Talk as described in section 3 should be more common in Western Small Talk situations than in Asian ones.

As we stated above, the choice of topics occurring in casual Small Talk can be culture-dependent. According to Isbister et al. [15], the categorization into safe and unsafe topics varies with cultural background. Consequently, a topic (such as talking about family members) can be considered as safe in one culture and as unsafe in another. If the distinction into safe and unsafe topics varies with culture, we expect that the overall choice of topic categories is also dependent on culture. Following Hall's categorization, Ting-Toomey [26] describes people belonging to high-context cultures as having a lower "public self" than people belonging to low-context cultures. A typical behavioral pattern for members of high-context cultures is not to reveal too much information during a first-time meeting. Bringing together Small Talk as a typical conversation for a first-time meeting and the categorization of topics described in section 3 (immediate situation, social topics, private topics), we expect private topics to be more common in low-context cultures than in high-context cultures. We therefore formulate the second tendency on culture-related differences in Small Talk behavior for Asian and Western cultures (topic categories are used as defined in section 3):

Tendency 2: Less private topics occur in Asian Small Talk conversations than in Western ones.

In summary, the choice of topics as well as their sequence within a dialog vary across cultures. In a simulated Small Talk dialog cultural background should be taken into account as well. However, the tendencies described above are rather broad and too abstract for integration into a system that automatically generates culture-specific Small Talk behavior. On the one hand, we need to find empirical evidence that the tendencies described in the literature are valid for concrete human cultures rather than for cultural groups and, on the other hand, concrete data that describe behavioral differences in statistical manners are essential to build a computational model.

5. Empirical corpus study

As we stated above, our aim is to build a multiagent system that generates Small Talk dialogs with culture as a parameter. In section 4, we introduced tendencies formulating differences in Small Talk behavior between Western and Asian cultures. However, to integrate these ideas into a system, we need more concrete data. In addition, the distinction between Western and Asian cultures is too broad for our purposes. To exemplify culture-specific differences in verbal behavior, we recorded and analyzed a corpus in the two national cultures of Germany and Japan, that was created within the CUBE-G project [22]. For the acquisition of this corpus, three prototypical interaction scenarios were videotaped: A first-time meeting, a negotiation and a conversation with a person with a higher social status than one's own.

Since we were interested in Small Talk behavior, we only considered videos for our analysis that took place in the first interaction scenario. For our video corpus, we recorded more than 20 interactions in each culture. Every scenario was recorded with one student interaction partner and one professional actor. Each of the students was told that they would have to solve a task with another student and therefore the two of them had to get acquainted with one another. While having a Small Talk conversation to get to know each other, the video taping had already started. Actors were told to be as passive as possible and to allow the participant to lead the conversation. Only if communication seemed to stagnate, actors should get more active. Participants did not know that they were interacting with actors. In this vein, we were able to ensure high control over the recordings. On the one hand we could assure that participants did not know each other in advance. On the other hand we were able to assure that each Small Talk scenario lasted for around 5 minutes. To allow all gender combinations, we had to hire four actors for this scenario: one female and one male actor from both participating cultures. It should be noted that dyads were held in each person's mother tongue and thus Japanese subjects interacted with Japanese actors and German subjects with German actors. The same two interlocutors participated in the second scenario, a negotiation. For the third scenario, the student subject interacted with another actor who played the role of our business partner who was interested in the results of the recordings. For this role, a female and a male actor were hired in both cultures. In total, around 20 hours of video material were collected for more than 40 subjects. Further

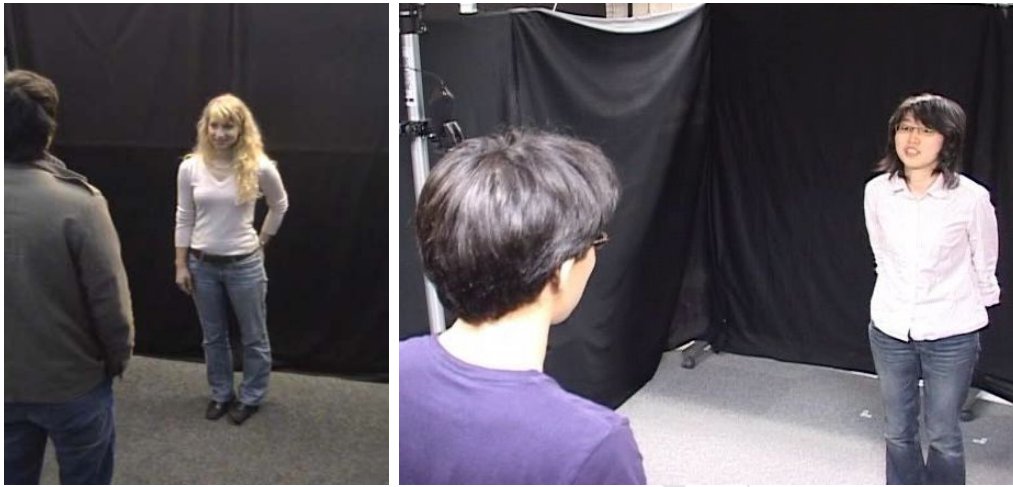


Figure 2: Female subject interacting with a male actor in the Small Talk scenario of the CUBE-G corpus (left: Germany; right: Japan)

information on the video recordings can be found in [20].

To avoid gender effects, we took into account only videos with mixed gender combinations for our analysis (either subject male and actor female or vice versa). Figure 2 shows two examples within the Small Talk scenario in the two cultures of Germany and Japan. For our model, eight videos displaying Small Talk dialogs were analyzed, four for each culture. These were the first four videos in mixed gender combination that were translated by our Japanese project partner. In our future work, we aim to translate and transcribe all of the videos for further analysis.

As we stated earlier, we expect topics to be discussed in a more sequential manner in Western Small Talk conversations than in Asian ones (see Tendency 1, section 4). In our corpus, we therefore assume that topics are reintroduced and discussed several times in Asian conversations, whereas this behavior should not occur as often in Western dialogs. To analyze conversations, we counted the amount of topics that arise in each Small Talk dialog as well as the shifts between topics. If, for example, a pair of communication partners talked about their studies first, then switched to talk about soccer and then talked about a movie they had seen in the cinema, this would mean that they discussed three topics (studies, soccer, movie) and had two

	Germany	Japan
Topics (in all videos)	26	26
Topic Shifts (in all videos)	38	46
Topics (average per conversation)	6.5	6.5
Topic Shifts (average per conversation)	9.5	11.5

Table 1: Comparison of number of topics with topic shifts in German and Japanese Small Talk conversations from our video corpus

topic shifts between them (studies - soccer, soccer - movie). In another conversation, interlocutors might talk about their studies in the beginning as well, then switch to soccer and finally come back to talk about their studies again. For our analysis this would compute to two topics (studies, soccer) and two topic shifts between them (studies - soccer, soccer - studies). In a conversation where studies are discussed and the conversation is concluded with soccer, this would add up to two topics (studies, soccer) and one shift (studies - soccer). Note that the same amount of topics does not necessarily mean the same amount of topic shifts and vice versa. In that manner, we were able to compare conversations in terms of how many topics occurred in a conversation in relation to the sequence of their occurrence or reappearance respectively.

Interestingly, our analysis showed that in both cultures the exact same number of topics was discussed. Thus, in the four German videos we found 26 topics as well as in the four Japanese videos (see Table 1). Regarding shifts between topics, we found 38 topic shifts in German conversations and 46 topic shifts in Japanese conversations (whereas all videos were approximately 5 minutes long). Although these results are not significant, they are in line with tendencies described in the literature. In addition, these findings give a clearer insight into how many topics and topic shifts we should integrate into our computational model for virtual agents.

Regarding the second tendency (see Tendency 2, section 4), we expect to observe fewer private topics in Asian Small Talk conversations than in Western ones. Analyzing the same eight videos that were mentioned above, we needed to divide the topics that occurred in the videos into categories. Following [25], we distinguish three groups: topics covering the immediate, external and communication situation (see section 3). Considering the ex-

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perimental setting at a university with student-subjects, we chose to classify topics as follows:

1. **Immediate situation:** Participants talk about the experimental setting, the task or reasons why they participated.
2. **External situation** (*social sphere*): Subjects talk about studies and university (supersituation for recordings at a university), friends / people they know or public topics such as sports, music or movies.
3. **Communication situation** (*private sphere*): Students talk about topics concerning themselves such as their origins, hobbies, favorite music, going out at night, personal habits or even their health.

Comparing German and Japanese Small Talk conversations, we found out that the Japanese participants discussed significantly more topics referring to the immediate situation than the German subjects (using t-test with $p=0.03$). In most Japanese conversations, participants discussed the experimental setting while this was not common in German conversations. Furthermore, German subjects talked significantly more about social topics than about topics discussing information about the immediate situation (t-test with $p=0.03$). This strengthens the impression that talking about the immediate situation, such as the experimental setting is not very common in German Small Talk conversations. Participants preferred talking about social topics such as their studies or friends. We made similar observations for private topics in comparison with the immediate situation. In German conversations, participants talked significantly more about private topics than about the immediate situation (t-test with $p=0.04$). In that vein, topics such as hobbies or favorite clubs or bars were a lot more common than talking about the setting or task subjects had to solve. In contrast, the Japanese dialogs did not show any significant results comparing the different topic categories. This suggests that all three groups of topics occur similarly and there is no clear tendency toward social or private topics as observed for German conversations.

Table 2 shows the percentaged distribution of the topic categories discussed in our corpus in the two cultures. Again, these findings are in line with tendencies described in the literature. As we stated earlier, we expected to find fewer private topics in Asian Small Talk conversations compared with Western ones. For example, in one German Small Talk conversation, participants talked about their studies, their origins (places of birth) and places

	Germany	Japan
Immediate situation	14 %	29 %
Social sphere	43 %	50 %
Private sphere	43 %	21 %

Table 2: Selection of topic categories in German and Japanese Small Talk conversations

they visited during their travels. In comparison, in one of the Japanese dialogs subjects discussed the experimental setting, the task that they had to face later as well as their studies.

We are aware that our empirical study is limited by a very small pool of participants. However, observations made for the two cultures are in line with tendencies described in the literature. We therefore use these preliminary findings to formulate characteristics on culture-specific Small Talk for virtual agents.

6. Validation with virtual agents

Before integrating our findings into a system architecture, we wanted to validate whether the findings in culture-specific behavior also apply to virtual humans. Thus, we decided to investigate in a pilot study whether human subjects perceive a difference between virtual agent dialogs that vary with culture as a parameter.

For this validation study, we used the scenario designed for the CUBE-G project [21]. In a Virtual Beergarden the agents have the ability to wander around and to communicate with each other. The application was constructed to serve as a training scenario where the user can learn more about culture-specific differences in non-verbal behavior. To that end culture-specific virtual agents were created. Figure 3 shows two examples from the Virtual Beergarden (left: German agents; right: Japanese agents). The characters' appearance (skin, hair or shape of the face) as well as their non-verbal behavior were adapted to their cultural and ethnic background [23]. Differences in non-verbal behavior may manifest themselves in obvious ways, for example in culture-specific gestures (such as a bow for the Japanese greeting) or typical body postures for a given culture (see Figure 3). To show culture-related differences in non-verbal behavior in a more subtle way, dif-



Figure 3: Culture-specific agents in the Virtual Beergarden application (left: Germany; right: Japan)

ferent styles of performing an action were modeled. For instance, the speed, rhythm or spatial extent of a gesture may be varied. For our pilot study, we used the German agents in order to find out if German subjects prefer them performing Small Talk in a German style as derived from the literature review and the corpus analysis.

Our main interest lies in a different topic selection in the two cultures of Germany and Japan. We therefore scripted different Small Talk dialogs for the two cultures that contained different topics depending on the simulated culture. For the pilot study, dialogs were scripted by hand; later scripts will be computer-generated. In total, three conversations were recorded for each culture. Topics within the dialogs were chosen taking into account findings from literature as well as from our corpus study.

As described earlier, Japanese subjects in our empirical study raised significantly more topics covering the immediate situation than the German subjects. Accordingly, the simulated dialogs reflecting typical Japanese Small Talk behavior contained more topics that deal with the immediate situation as well. As an indication of how many topics from each category should be chosen for each dialog, we used the findings from our corpus study summarized in Table 2, section 5. Thus, we decided to integrate half private and half social topics into the German Small Talk dialogs and one third private topics, one third social topics and one third topics covering the immediate situation into the Japanese Small Talk conversations.

Agent	Utterance	Topic	Category
A	"Have you known Ana for a long time?"	friends	social
B	"No. Not too long. I met her last term at university."	friends	social
A	"Oh, so you are studying? In which semester are you?"	studies B	private
B	"I am in my third year."	studies B	private
B	"Are you studying as well?"	studies A	private
A	"Yes, I am studying sports."	studies A	private
B	"So I guess you watched the beginning of the Olympic Games in Beijing on TV last week?"	social event	social
A	"Sure! And Germany has already won a medal."	social event	social

Table 3: Example for a German Small Talk dialog from our pilot study

Table 3 and Table 4 show two example dialogs from our pilot study. Please note that agent dialogs were held in German for German subjects. Table 3 and Table 4 thus show translated dialogs. Before observing the agent videos, subjects were told that the two agents were just introduced to each other by a common friend called Ana in the Virtual Bergarden.

In the German Small Talk dialog, half of the conversation covers social topics and the other half private topics. In that vein, in Table 3 the agents talk about their common friend Ana, the Olympic Games (both social topics) and the studies of the two of them (private topics for both). As mentioned above, in the Japanese Small Talk dialogs every category should be covered by one third. In Table 4, the agents thus talk about the beer garden location (immediate situation), the weather (social topic), and their hobbies (private topic).

The aim of this pilot was to verify whether subjects perceive a difference between the agent dialogs and if there is a preference for communication styles that are in line with findings made for the subject's cultural background. Our pilot study was held in Germany with German subjects and we

Agent	Utterance	Topic	Category
A	"This beergarden is really lovely."	location	immediate situation
B	"Yes. And because of the trees there is a nice shade."	location	immediate situation
A	"Oh yeah. It is exceptionally hot this summer. "	weather	social
B	"True, the weather is really good this year. And it has hardly rained at all."	weather	social
A	"Like that I can go running quite often."	hobbies	private
B	"Oh, you are running?"	hobbies	private
A	"Yes. I run twice a week."	hobbies	private

Table 4: Example for a Japanese Small Talk dialog from our pilot study

thus expect participants to rate the German Small Talk versions as more appropriate. Both Small Talk versions (German and Japanese) were displayed with the Western-style characters to assure that subjects did not assume a cultural background different from their own. The agent dialogs were held in German to avoid effects due to the language barrier. In addition, the beergarden setting would not lead to a different cultural assumption, as this is a normal setting for a Small Talk conversation for German subjects.

As we focused on videos from our corpus study where mixed gender combinations were recorded, we decided to show videos with mixed genders in the agent conversations as well. Thus, we were able to avoid interfering effects aroused by different gender combinations.

Apart from the choice of topics, no other aspects of culture-specific Small Talk behavior were taken into account. To avoid user preferences evoked by differences in non-verbal behavior, agents in the Small Talk conversations did not exhibit any gestures or culture-specific postures. Instead they displayed a neutral posture (standing straight with arms hanging down both sides of their body, see Figure 4). Another analysis of the video corpus revealed that there are culture-related differences in communication management behavior [9]. As we wanted to focus on topic selection, the Small Talk dialogs in our study did not use differences in pauses in speech for example, but showed



Figure 4: Screenshot of validation study, showing a pair of videos displayed by Western-style agents

only very brief pauses to simulate breathing between sentences.

Furthermore, in none of the scripted dialogs were topics reintroduced, neither in the German nor in the Japanese version. Topics were rather ordered sequentially, which was assumed to be preferred for subjects with a German background (see section 4). By simulating only differences in one aspect of communication (topic selection), we avoided interfering effects elicited by other aspects of communication, such as non-verbal behaviors or communication management behaviors. Figure 4 shows one of the dialog pairs within our pilot study as well as the questions that subjects were asked to estimate.

Subjects watched the three pairs of videos in alternating order and were asked to judge

1. which one is more appropriate,
2. which one is more interesting,
3. which conversation they would prefer to join,
4. which pair of agents gets along with each other better and
5. which topics occurring in the dialogs were more appropriate for the situation.

	German version	Japanese version
Video more appropriate	25	8
More interesting	28	5
Rather like to join	26	7
Agents getting along better	26	7
Topics more appropriate	25	8

Table 5: Overview of user ratings in the preliminary evaluation study

As we mentioned earlier, we used Western-style characters and invited German subjects. We thus expected participants to perceive the German version as more appropriate and interesting. In addition, we assumed that subjects would rate agents in the German version as getting along with each other better because of the choice of more private topics.

In our pilot study, 11 subjects participated: 5 male and 6 female. All subjects were between 21 and 33 years old. As every subject watched 3 pairs of videos, we obtained a data set containing 33 judgments.

Table 5 shows an overview of the subjects' estimations. Although differences were subtle and participants did not know that the study was about topic selection, the results revealed significant preferences for the German Small Talk versions. Thus, German subjects preferred dialogs where topics were more private and did not refer to the immediate situation. Using the two-sided t-test for statistical analysis, we achieved significance for all five questions with $p < 0.001$.

Interestingly, subjects explained their decisions using expressions such as "constrained", "superficial", "firm" or "distant" for videos displaying the Japanese Small Talk versions, while they commented on videos showing the German versions with expressions such as "more private" or "real interest in the conversation partner".

Although the number of subjects in our pilot study is very small, we have initial evidence that observers perceive a difference between culture-specific dialogs. The results of our validation study show that German subjects preferred dialogs that are in line with observations made for their own cultural background. We thus claim that integrating culture-related differences in

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9 Small Talk behavior of virtual agents can enhance the observer's perception of
10 their dialogs. We therefore integrated our findings into a system architecture
11 that automatically generates culture-specific Small Talk behavior for virtual
12 agents. This system architecture is described in the following section.
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15 **7. System architecture**

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18 Regarding our validation study (see section 6) we have initial evidence
19 that culture-specific differences in Small Talk behavior performed by virtual
20 agents do have an impact on human users. These effects motivate the inte-
21 gration of different topic selection and sequencing into a system that auto-
22 matically generates Small Talk for virtual agents with culture as a parameter.
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26 According to [24], AI-based approaches, and plan-based approaches in
27 particular, are becoming more and more popular to control the behavior of
28 synthetic characters. Using a planner for behavior generation, a complex
29 goal (e.g. getting acquainted with another agent) can be broken down into
30 smaller subgoals and actions (greet the conversation partner, have casual
31 Small Talk). Depending on character-specific attributes (personality, cul-
32 ture) actions could be performed in different ways, or the selection of actions
33 to archive a goal could be varied.
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38 To integrate our findings in culture-related differences in Small Talk into
39 a behavior planning component, a planner needs to satisfy the following
40 demands:
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- 42 1. Topics for discussion need to be enhanced with an attribute (identifying
43 them as private, social or immediate);
- 44 2. Selection of topics according to cultural background of interlocutors;
- 45 3. Sequence of discussing a topic can be reordered.
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49 For the realization of our system we use the Simple Hierarchical Ordered
50 Planner (JSHOP2), developed at the University of Maryland [28].
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53 Figure 5 presents an overview of our systems architecture. An instance
54 of the planner generates a fixed dialog structure depending on the cultural
55 background of the participating interlocutors. The dialog structure with
56 abstract actions (e.g. question, answer, ...) is passed to the core system,
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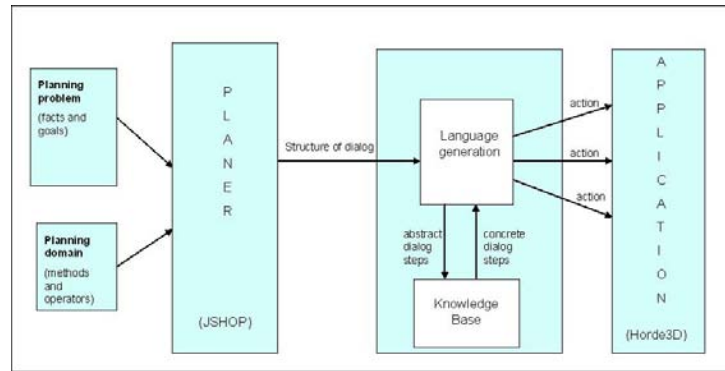


Figure 5: General system architecture

where the language is generated. Concrete actions (verbal and non-verbal) are triggered and sent to the application, which displays the behavior using a graphics engine developed at the University of Augsburg [27]. The systems' components are described in further detail below.

7.1. Behavior planning

As input, the planner expects a *planning problem* (state of the world and tasks to solve) and a *planning domain* (rules and actions for planning). Regarding dialog-generation for virtual agents, the planning problem defines the agents with their attributes, topics and an overall goal. An example can be seen in Figure 6. Two agents (A and B) with their characteristics (such as personality or culture), predefined topics (with categorization as described in section 3) as well as the overall goal (generating a conversation between A and B) are defined here.

The planning domain contains rules with information about the conversational style, as well as operators that represent the abstract dialog utterances (such as “greeting”, “question”, “answer”). Within the planning domain, rules were defined that integrate our findings in culture-specific Small Talk. Figure 7 for example represents a strategy for agents with a Japanese background. The rule applies if the agent is interested in the given topic and it is neither private nor has been brought up by this agent before. As a consequence to that method, the interlocutor performs an answer but does not ask back about the same topic immediately, which would be the strategy for a German agent.

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9 (defproblem problem SmallTalk
10     (agent A) (agent B)
11     (personality A introvert) (personality B extrovert)
12     (culture A Japan) (culture B Japan)
13     (interest A movies)
14
15
16     (topic Beergarden-location immediate)
17     (topic movies social)
18     (topic living-situation private)
19
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21     ((conversation A B)))

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Figure 6: Example definition of agents and topics within the planning problem

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24 (:method (SmallTalk ?A ?B)
25 ...
26 case_Japan
27     ((agent ?A) (agent ?B) (interest ?A ?topic) (culture ?A Japan)
28     (not(topic ?topic private)) (not(talkedabout ?topic)))
29
30
31     ((!ask ?A ?topic) (!answer ?B ?topic) (SmallTalk ?x ?y))
32 ... )

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Figure 7: Example of a dialog rule within the planning domain

To integrate the first tendency (see section 4) that was validated for the two cultures of Germany and Japan into a demonstrator, we used the typical Small Talk sequence described in section 3 as a baseline for each topic. Following that idea, for each predefined topic the four utterances can be performed: (1) question, (2) answer, (3) reverse-question and (4) reverse-answer. As predicted in the literature and confirmed by our corpus analysis, it is more likely that members of Western culture will adhere to that sequence, while for Asian conversations it is more common to switch back and forth between different topics. Hence, in a Japanese conversation a topic might be dropped before the sequence is finished and resumed at a later point in time, while the sequence is strictly followed in a prototypical German dialog. In our system, the rules apply for each agent separately. Consequently, in a conversation with one German and one Japanese agent, the former will follow the prototypical sequence while the latter will give more freedom to the flow of the conversation.

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11 The second tendency described in section 4 suggests that less private
12 topics occur in Asian Small Talk conversations. This was confirmed by our
13 corpus analysis, which also revealed that there are fewer topics covering the
14 immediate situation in German dialogs than in Japanese ones. To integrate
15 this idea into the behavior planning component, topics were tagged accord-
16 ing to the categorization described in section 3: (1) immediate situation, (2)
17 social sphere and (3) private sphere. Depending on the interlocutor’s cultural
18 background the planner will tend to choose social and private topics to be
19 brought up by German agents, while topics covering the immediate situation
20 or the social sphere are the most common ones for Japanese agents. In prin-
21 cipal, every topic can be chosen for every agent, as it is possible to talk about
22 every topic in each culture. But the threshold for introducing a topic un-
23 likely for one’s cultural background is increased and thus hardly ever reached.
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28 As described in this section, the structure of the dialog is generated for
29 the given agents regarding their cultural background. This dialog-structure
30 contains a sequence of abstract actions, such as “greeting”, “question(topic)”
31 or “answer(topic)”. That interaction plan is sent to the behavior generator
32 for further processing.
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35 *7.2. Behavior generation*

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37 The behavior generator connects the hierarchical planner with the mul-
38 ti-agent application. In addition, it contains a knowledge base where verbal
39 utterances for the abstract actions are stored as well as non-verbal behav-
40 iors. A core function of this component is to keep track of the dialog and
41 handle the right timing. As we showed in [9], timing is a crucial task in
42 culture-specific communication. The usage of pauses in speech for example
43 differs with cultural background. We showed that users who observe vir-
44 tual agents showing culture-specific pause behavior perceive differences and
45 judge behavior which is in line with their own cultural background as more
46 appropriate.
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50 *7.3. Application*

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52 As we stated above, we use the Virtual Beergarden which represents a
53 meeting place where virtual agents interact, to display our findings in culture-
54 related Small Talk behavior (see section 6). Actions (verbal and non-verbal)
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9 that are triggered by the behavior generation component are sent to the ap-
10 plication, where they are displayed using body postures, gestures and natural
11 language.
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13 14 *7.4. Example dialogs*

15 In this chapter, we demonstrate two example dialogs that were gener-
16 ated by our system. In the current implementation, 2 topics are provided
17 for each category including sentences that represent the utterances for our
18 prototypical sequence. This amount of topics is sufficient to demonstrate the
19 generation of prototypical culture-related differences in Small Talk. Addi-
20 tional topics can easily be added to create more variation in the dialogs.
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22 In order to exemplify our findings in culture-specific differences in casual
23 Small Talk conversations, we present one German and one Japanese dialog
24 that was generated as described above. Table 6 serves as an example to high-
25 light prototypical German behavior. In the example dialog, two topics are
26 discussed, the living situation of the interlocutors and a movie that is cur-
27 rently showing. This choice of topics is prototypical for a German Small Talk
28 conversation, as a private topic (living situation) and a social topic (movies)
29 occur. In addition, the sequence of the dialog is related to a prototypical
30 German style, as each topic is finished before the next topic is introduced.
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32 In comparison, Table 7 presents a prototypical Japanese Small Talk con-
33 versation generated by our system. Just as in the German version, the dialog
34 contains one social topic (a movie currently showing). But instead of rais-
35 ing a private topic, a topic covering the immediate situation is discussed
36 (the beer garden location). The flow of conversation also differs from the
37 German version. In the prototypical Japanese dialog, the first topic is not
38 finished completely by its first occurrence, but is reintroduced after another
39 topic showed up. In that vein, the beer garden location is discussed in the
40 beginning of the conversation as well as after talking about the movie.
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48 **8. Conclusion and future work**

49 Our objective was to build a multiagent system where the style of casual
50 Small Talk is planned according to the cultural background of the interlocu-
51 tors. Inspired by different definitions of culture and corresponding stereotyp-
52 ical behavior found in the literature, we summarized the following tendencies
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Agent	Action	Example utterance	Topic	Category
A	greeting	"Hello!"		
B	greeting	"Nice to meet you!"		
A	question	"Do you live in this area?"	living situation	private
B	answer	"Oh yes, I moved here because of my studies."	living situation	private
B	reverse question	"How about you? Do you live nearby too?"	living situation	private
A	answer	"No, I am here to visit my uncle."	living situation	private
B	question	"Have you heard about that new alien movie on cinema?"	movies	social
A	answer	"Yes I heard about it, but haven't seen it yet."	movies	social
A	reverse question	"And you? Have you already seen it?"	movies	social
B	answer	"I saw it yesterday. It was really scary."	movies	social

Table 6: Example for a stereotypical German Small Talk dialog

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Agent	Action	Example utterance	Topic	Category
A	greeting	"Hello!"		
B	greeting	"Nice to meet you!"		
A	question	"Do you like this Beergarden?"	Beergarden location	immediate situation
B	answer	"Oh yes, I think this place is especially nice."	Beergarden location	immediate situation
A	question	"Have you heard about that alien movie on at the cinema?"	movies	social
B	answer	"Yes I heard about it, but haven't seen it yet."	movies	social
B	reverse question	"How about you? Do you like this location?"	Beergarden location	immediate situation
A	answer	"Oh yes, I come here very often."	Beergarden location	immediate situation
B	reverse question	"And that movie? Have you already seen it?"	movies	social
A	answer	"I saw it yesterday. It was really scary."	movies	social

Table 7: Example for a stereotypical Japanese Small Talk dialog

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9 about culture-specific differences in Small Talk behavior distinguishing Asian
10 and Western cultures:

- 11 • **Tendency 1:** Topics are discussed in a more sequential manner in
12 Western Small Talk conversations than in Asian ones.
- 13 • **Tendency 2:** Less private topics occur in Asian Small Talk conversa-
14 tions than in Western ones.
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20 Since these tendencies are rather broad and not concrete enough to build
21 a computational model of stereotypical behavior, the CUBE-G video corpus
22 recorded in the two cultures of Germany and Japan was analyzed. Both ten-
23 dencies were confirmed by the empirical corpus study and a deeper insight
24 into culture-related differences in Small Talk behavior was gained.
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27 In order to verify if these findings are valid for Small Talk dialogs dis-
28 played by virtual agents and whether human subjects perceive a difference be-
29 tween the agent conversations, we performed a preliminary validation study.
30 Scripted dialogs exemplifying our findings were rated by German subjects.
31 Although the number of subjects is very limited, the analysis indicates that
32 subjects prefer the choice of topics that is in line with observations made for
33 their own cultural background.
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37 Reflecting on the results from the empirical study (videos with human
38 participants) and the validation study (videos with virtual agents judged by
39 human observers), we built a system that automatically generates Small Talk
40 behavior taking into account the cultural background of the interlocutors. To
41 this end, we used a hierarchical ordered planner to generate a dialog struc-
42 ture and a multiagent application that displays the communication.
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45 The work presented in this article is part of a larger research endeavor
46 that aims at enculturating interactive systems acknowledging the fact that
47 the user's cultural profile provides heuristics of behavior and interpretation
48 that influence the interactions with human and artificial interlocutors. Small
49 Talk as a specific kind of verbal behavior that is relevant for first or casual
50 encounters is thus only one aspect of this endeavor but an important one as
51 the first impression of an agent can determine the user's (un)willingness to
52 continue the interaction. Other aspects include non-verbal behaviors such as
53 gestural expressivity or emotional facial displays, cognitive abilities such as
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9 the appraisal of incoming data, or the appearance of the agent in terms of
10 its skin color or dress. Research in this area is in its infancy and one of the
11 current challenges is to determine the importance of the different influencing
12 factors on the user-agent interaction and to integrate relevant factors into a
13 single model.
14

15 The challenge arises from the ill-defined nature of the domain which makes
16 it difficult to reliably specify the links between cultural profiles and individual
17 behavior traits. The literature on cultures is often of a very general nature,
18 stating for example that Southern Europeans use gestures more frequently
19 than Northern Europeans, but lacking information about contexts and sit-
20 uations in which this effect occurs. Thus, much more specific information
21 is necessary to build a reliable model of cultural influence on behavior. In
22 this article, we exemplified how a standardized observational study in specific
23 contexts can shed light on these links and how a ‘general’ theory of culture
24 like Hall’s [11] can be exploited in order to model the behavioral differences
25 based on this empirical information.
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31 As a next step, we plan to integrate culture-specific semantics of commu-
32 nication management behavior, such as giving feedback or using silence as a
33 means of communication. Additionally, we aim to adapt the conversational
34 style to the cultural background and thus use more question answer pairs
35 in the Western dialogs than in the Asian ones in order to simulate another
36 effect of the classification into low and high context cultures.
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38 Taking into account other concepts of culture, we intend to integrate
39 Hall’s [11] division into high and low contact cultures. This dichotomy pro-
40 vides information about the spatial behavior of different cultures. Thus,
41 besides simulating *what* people talk about in Small Talk situations we can
42 also demonstrate *how* they express their culture non-verbally.
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45 So far we have tested the impact of different Small Talk styles on Ger-
46 man users in our validation study. After having implemented a system that
47 automatically generates culture-specific Small Talk dialogs, we are planning
48 a larger evaluation study with both German and Japanese subjects.
49

50 In the longer term, we are aiming to develop a distributed system that
51 plans Small Talk with culture as a parameter. Thus, agents will be able to
52 react in a culture-specific manner dynamically. In the current version, the
53 system architecture generates a fixed dialog. By distributing this approach,
54 we will be able to integrate the users and allow our agents to react to the
55 user-input in real time.
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