Embodied Agents: A New Impetus to Humor Research

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Abstract

In this paper we survey the role of humor in human-to-human interaction with the aim to see whether it is useful for embodied conversational agents to integrate humor capabilities in their internal model of intelligence, emotions and interaction (verbal and nonverbal) capabilities. For that reason we shortly survey the current state of the art of research in embodied conversational agents, affective computing and verbal and nonverbal interaction. We adhere to the 'Computers Are Social Actors' paradigm to assume that human conversational partners of embodied conversational agents assign human properties to these agents, including humor appreciation.

Keywords: Humor, Embodied Conversational Agents, Affective Computing, Nonverbal Communication

1 INTRODUCTION

It is certainly not the case that when we consider research on the role of human characteristics in the user interface of computers no attention has been paid to the role of humor. However, when we compare efforts in this area with efforts and experiments that attempt to demonstrate the positive role of general emotion modeling in the user interface, then we must conclude that the amount of attention is still minimal. As we all know, the computer is sometimes a source of frustration rather than a source of enjoyment. And indeed we see research projects that aim at recognizing a user's frustration [23], rather than his enjoyment. However, rather than detecting frustration, and maybe reacting to it in a humorous way, we would like to prevent frustration by making interaction with a computer more natural and more enjoyable. For that reason we are working on multimodal interaction and embodied conversational agents. In the interaction with embodied conversational agents, verbal and nonverbal communication are equally important. Multimodal emotion display and detection are among our advanced research issues, and investigations in the role of humor in human-computer interaction is one of them.

Our research is on multimodal interaction with and between embodied conversational agents that inhabit virtual worlds. We envision situations where humans talk to embodied conversational agents in the interface, where maybe it is not at all clear what they represent. Are they completely artificial, autonomous, with built-in intelligence, and put in the environment by their owner or designer? Do they represent a human interactor, including aspects of his personality, beliefs and desires? And is this done 'off-line' or even 'on-line', where also the interactor's physical behavior is reflected (not necessarily one-to-one) in the animations of the embodied conversational agent? The user or visitor of an inhabited world may interact with these embodied conversational agents, e.g. to engage in an information service dialogue, a transaction dialogue, to solve a problem cooperatively or to perform a task, or to engage in a virtual meeting. Other obvious applications can be found in the areas of education (including training and simulation), electronic commerce and teleconferencing.

In previous years researchers have discussed the potential role of humor in the interface. However, during these years the potential role of embodied conversational agents was not at all clear, and no attention was paid to their possible role in the interface. Useful observations, also valid when we look at the possible role of embodied conversational agents, were made by Binsted in [6] and Stock in [40]. Binsted discusses how humor can make user interfaces friendlier. That is, humans use humor to ease communication problems. In a similar way humor can be used to solve communication problems that arise with human-computer interaction using natural language interfaces.

Binsted explains that the kinds of humor to be used do not have to be very sophisticated. Suitable humor that can be used is self-deprecating humor. In some cases deprecating the user or a third party can be appropriate, but this type of humor is very risky. Humor can make a computer more human when it fails and can ease the interaction. Inappropriate humor, however, is irritating and humor should be tailored to the user. When a certain user regularly works with a system, the system can adapt the use of humor to the user's taste. She concludes that humor that is sparingly and carefully used can make natural language interfaces much friendlier. However, there are not that many applications. There are exceptions, for example, [25] discusses the use of humor in a natural language robot in the interface, some researchers have been working on adding humor, or rather humorous remarks, to (primitive) embodied agents in the interface or explanation facilities, but these attempts are rather pre-canned and hardly take into account an appraisal of the events that occur or have recently occurred in their world.

About this Paper: In the next section (section 2) we want to look at the role of humor in human-human interaction. We discuss some general issues concerning trust and interpersonal attraction and then, using the CASA paradigm (section 3), start discussing the role of embodied conversational agents in human computer interaction (section 4), including multimodal emotion display, and how we can display appreciation of humor. Section 5 has some observations about feigned and felt emotions when an embodied conversational agent displays them. Section 6 is about the appraisal of events in order to decide that the event is humorous. Section 7 contains the conclusions of this paper.

2 THE ROLE OF HUMOR IN INTERPERSONAL INTERACTION

In interpersonal interactions, either at work or at home, humans use humor, humans smile and humans laugh. Humor can be spontaneous, but it can also serve a social role and be used deliberately. A smile can be the effect of appreciating a humorous event, but it can also be used to regulate the conversation. A laugh can be spontaneous but can also mask disagreement or be cynical. Research has shown that laughs are related to topic shifts in a conversation and phases in negotiations or problem solving tasks. In an educational situation humor can be used by the teacher to catch students' attention but also to foster critical thinking. Humor allows criticism to be smoothed, stress can be relieved and students can become more involved in joint classroom activities by the use of humor. Humor can also be the right answer to frustration. In an (E-)commerce situation we have negotiators that use humor to induce trust.

In this section we want to look at the role of humor in human-human interaction. We survey some results from experimental research. Section 2.1 is devoted to three more general issues, not necessarily connected to a particular domain, but playing a role in human-human interaction: trust, interpersonal attraction and humor support in a conversation. More topics could have been chosen, but some of these arise naturally when in section 2.2 we discuss some domains for which we may expect that in the near future embodied conversational agents can play the roles of one or more of the conversational partners in the current real-life situations. The domains we choose are education, information services and commerce, meetings, and negotiations. The role of humor in these domains is discussed by taking examples from the literature.

2.1 GENERAL ISSUES: SUPPORT, TRUST, AND ATTRACTION

In this paper we are not particularly interested in a possible preconceived aim of a conversational partner to create humor during a conversation or discussion. Rather we look at situations where humor occurs spontaneously during an interaction or where it occurs in a supporting role, for example to hide embarrassment, to dominate the discussion or to change the topic. Some of these roles will get more attention in section 2.2. Here we have some remarks on humor to induce trust, interpersonal attraction and how to show appreciation of humor during a conversation.

Humor support, or the reaction to humor is an important aspect of personal interaction. We employ a wide range of humor in our conversations and the given support shows the understanding and appreciation of humor. In [20] it is pointed out that there are many different support strategies. The strategy that can be used in a certain situation is mainly determined by the context of the humorous event. The strategy can include smiles and laughter, the contribution of more humor, echoing the humor, offering sympathy or contradicting self-deprecating humor. There are also situations in which no support is necessary. In order to give full humor support, humor has to be recognized, understood and appreciated. These factors determine our level of agreement on a humorous event and the grade of

how we want to support the humor. This paper is in fact a discussion on the possible role of humor support in the context of the design and implementation of embodied conversational agents

Support may show our involvement in the discussion, our motivation to continue and how much we enjoy the conversation or interaction. Similarity in appreciation also supports interpersonal attraction [8]. This observation is of interest when later we discuss the use of embodied conversational agents in user interfaces. Sense of humor is generally considered a highly valued characteristic of self and others. Nearly everybody claims to have average to above average senses of humor. Perceived similarity in humor appreciation can therefore be an important dimension when designing for interpersonal attraction. In experiments reported by Cann et al. [8] participants had to interact with an unseen stranger. Before the interaction ratings were made of the attitudes of the participants and they were led to believe that the stranger had similar or dissimilar attitudes. The stranger responded either positively or neutrally to a participant's attempt to humor. As a main result it was shown that similarity in humor appreciation was able to negate the negative effects of dissimilarity for other attitudes when looking at interpersonal attraction. In our group we have studied how similarity in attitudes is related to the development of a friendship relationship. The development of a friendship relationship requires time, but especially in the initiation phase the kinds of similarities mentioned above can be exploited. A discussion on friendship in the context of the design and implementation of embodied conversational agents has been presented in [41].

Friendship and intimacy are closely related. In [18] Hampes discussed the relation between intimacy and humor and in [19] the relation between trust and humor. Trust is an essential aspect of intimacy and the hypothesis that there also exists a correlation between humor and trust was confirmed. There are three key-factors that help us to understand this relationship. The most important factor is the demonstrated relation between humor and extroversion [37]. When we break up extroversion into basic components like warmth, gregariousness, assertiveness and positive emotions it becomes obvious that extroversion involves trust. Another factor, mentioned above, is the fact that humor is closely related to a high self-esteem. People who are proud of who they are, are more likely to trust other persons and to reveal themselves to them. A third factor is that humorous persons are effective in dealing with stress [17]. They are well qualified to deal with the stress or anxieties involved in interpersonal relationships and therefore are more willing to enter relationships. A discussion on trust in the context of the design and implementation of embodied conversational agents has been presented in [4].

2.2 CONVERSATIONS AND GOAL-DIRECTED DIALOGUES

Humor plays a role in daily conversations. People smile and laugh, certainly not necessarily because someone pursues the goal of being funny or tells a joke, but because the conversational partners recognize the possibility to make a funny remark fully deliberately, fully spontaneously, or something in between, taking into account social (display) rules. We will not go deeply into the role of humor in daily conversations, small talk or in entertainment situations. In daily conversations humor very often plays a social role. The role of humor is hardly discussed in Deborah Tannen's well known "That's Not What I Meant!" (about "How Conversational Style Makes or Breaks Relationships"), probably simply because the book is not about conversations going well, but about conversations going wrong. Some issues related to the role of humor have been mentioned in the previous section. It is difficult to design experiments intended to find the role played by humor in human-to-human interactions, when no specific goals are defined. Even experiments related to rather straightforward business-to-consumer relationships are difficult to find. Rather we have to deal in these situations with regulations protecting a customer from humor by a salesman (never use sarcasm, don't make jokes on account of the customer, etc.).

We continue this section by discussing the role that humor plays in some domains of interaction. The discussion is certainly not exhaustive and neither is the choice of domains. It is meant to show the importance of the role of humor and therefore the need to consider the role of humor in situations where we try to replace one or more of the interactors in (multi-party) conversations or dialogues with embodied conversational agents. The examples we mention are task-related. For example, the teacher wants to teach a student, someone wants to get information about theatre performances, I want to buy a pair of shoes. As another example, in a meeting we want to exchange information, solve a problem or negotiate with the other participants. In section 4 of this paper we will mention some examples of conversational situations, (not necessarily commercial) information service situations and business-to-consumer situations that have been modeled using embodied conversational agents (among others, a virtual receptionist, a virtual tourist guide, a car saleswoman, a female bartender). However, the (possible) role of humor in these situations is rather restricted and hardly any comparisons have been made with the real-life situations.

When we look at more goal-directed situations, teaching seems to be one field where the use of humor in the teaching process has received reasonable attention. What is the role of humor as a teaching tool? Many benefits have been mentioned and sometimes made explicit in experiments. Among them are motivating effects on attention, promotion of comprehension and retention of information, more pleasurable learning experience, development of affective feelings toward content, fostering of creative thinking, reducing anxiety, etc. The role of humor during instruction, its social and affective functions for teaching and implications for classroom practice has been discussed in several papers (see Price [34] for an example). Despite the many experiments, it seems to be hard to generalize from the experiments that are conducted [43].

There are more interesting examples of studies about the role of humor in interaction processes. For example, the role of humor and laughter during negation processes is another issue that has received attention. In Adelswärd et al [1] several tape recordings made during international negotiations have been analyzed. One of their research questions concerned the interactional position of laughter: When do we laugh during interaction? Different phases during negotiation can be distinguished. Laughing events turned out to be related to the phase boundaries and also to discourse boundaries (topic shifts). Hence, laughter serves interactional goals. The distinction between unilateral and joint laughter is also important. Mutual laughter often reflects consensus, unilateral laughter often serves the same function as intonation. Moreover, this distinction is related to social issues. Who is dominant in the negotiation, who has the advantage, and for what reasons? Attitudes towards topics discussed are also reflected in the laughing events: which topics are important, sensitive or face threatening?

Describing and explaining the occurrence of humor in small task-oriented meetings is the topic of a research study conducted by Consalvo [9]. The study gives good insight in humor's important role within management meetings. A humorous event was defined as the situation in which at least one of the participants laughed. An interesting and unforeseen finding was the patterned occurrence of laughter associated with the different phases of the meeting. The opening phase is characterized by its stiffness and serious tone and the atmosphere of distrust. Humor in this phase is infrequent. This is in contrast with the second, transitional phase that lasts only a couple of minutes and the humorous interactions are frequent and for the first time during the meeting all participants laugh. Their laughter conveys the agreement that the problem can be solved and the commitment of the individual participants. The last phase, the problem-solving phase contains a lot more humorous events than the opening phase, but still less than the transitional phase. Humor echoes the progression of a meeting and can be both constructive or destructive. It can be an important tool for management and leadership, because appropriate humor can smoothen the task-oriented processes through cultivating an environment where freedom and flexibility will flourish.

Any reader will know about other examples of interactions that involve the role of humor. What about a tourist guide, explaining the history of a cathedral, a bartender that soothes a tense situation, or a car saleswoman who knows how to handle sexual harassment by using humor?

3 COMPUTERS AS SOCIAL ACTORS

In the research on the 'computers are social actors' (CASA) paradigm (see e.g. Reeves & Nass [35]) it has been convincingly demonstrated that people interact with computers as if they were social actors. Due to the way we can let a computer interact, people may find the computer polite, dominant, extrovert, introvert, or whatever attitudes or personality (traits) we can display in a computer. Moreover, they react to these attitudes and traits as if a human being displayed them. As an example, consider the situation where a person interacts with the computer in order to perform a certain task. When, after completing the task, the person is asked by the same computer about its (i.e., the computer's) behavior, the user is much more positive than when asked this question while sitting behind an other computer. From these CASA experiments we conclude that it is possible, at least in principle, to design systems that are perceived as social actors and that can display characteristics that elicit positive feelings about an interaction, even though the interaction is not considered as perfect from the user's point of view.

As mentioned above, humor plays an important role in interpersonal interactions. And so do smiles. We will return to the role of smiles later. Will humor in the interface have similar effects as in interpersonal interactions? In [28], experiments are reported that have been performed to examine the effects of humor in task-oriented computer-mediated communication and in human-computer interaction. It was shown that humor could have many positive effects. For example, participants who had received jokes during the interaction rated a system as more likable and competent. They smiled and laughed more, they responded in a more sociable manner and reported greater

cooperation. The study provides strong evidence that humor should be incorporated in computer mediated communication and human-computer interaction systems.

4. EMBODIED CONVERSATIONAL AGENTS

4.1 DEVELOPMENTS IN EMBODIED CONVERSATIONAL AGENTS

In our research on natural interactivity between humans and computers we adhere to the CASA paradigm. Embodied conversational agents (ECAs) have become a well-established research area. Embodied agents are agents that are visible in the interface as animated cartoon characters or animated objects resembling human beings. Sometimes they just consist of an animated talking face, displaying facial expressions and, when using speech synthesis, having lip synchronization. These agents are used to inform and explain or even to demonstrate products or sequences of activities in educational, e-commerce or entertainment settings. Experiments have shown that ECAs can increase the motivation of a student or a user interacting with the system. In [24] Lester et al. showed that a display of involvement by an embodied conversational agent motivates a student in doing (and continuing) his or her learning task. Some examples of embodied conversational agents are shown in Figure 1. From left to right we see: Jennifer James, a car saleswoman who attempts to build relationships of affection, trust and loyalty with her customers, Karin, informing about theatre performances and selling tickets, Layla, a virtual receptionist, Carmen, a mother undergoing therapy, and Steve, educating a student.

Figure 1: Examples of 2D and 3D embodied agents

Current research deals with improving intelligent behavior of these ECAs, but also with adding emotional behavior and personality. Improving intelligent behavior requires using techniques from artificial intelligence, in particular natural language processing. Domain knowledge and reasoning capabilities have to be modeled. Agent models have been developed that allow separation between the beliefs, desires and intentions of an agent. For systems consisting of multiple agents formal communication languages have been developed that allow the transfer of information from one agent to another. Together with dialogue modeling techniques rudimentary natural language interaction with such agents is becoming possible. Speech input remains difficult to realize, speech output can be of acceptable quality.

Despite improvements we cannot expect that in the near future these agents can match human capabilities. In [3] the notion of ‘believability’ was introduced in this field of research. Believability is present in an ECA when despite a lack of realism communication using a multiple of modalities leads to a suspension of disbelief by the human conversational partner. ‘Trust’ in an embodied conversational agent is a related issue. Do we trust an agent that plays the role of a doctor or a salesperson? The role of small talk for, among others, inducing trust in an embodied real estate agent is discussed in [4]. It is an example of sometimes subtle capabilities that help to improve the believability of an embodied agent. Clearly, humor is very much related to many of the natural interaction issues mentioned above: emotions, personality, attraction, and trust. Until now we have not seen much research going on into embodied agents that interpret or generate humor in the interface. Nevertheless we see attempts to maintain an emotional state and generate facial expressions and other display of emotions from such an emotional state. This may cause an agent to smile at an appropriate moment.

4.2 NONVERBAL AND AFFECTIVE INTERACTION IN EMBODIED AGENTS

An embodied agent has a face. It may have a body, arms, hands and legs. We can give it rudimentary intelligence and capabilities to have verbal and nonverbal interaction. Nonverbal signals come from facial expressions, gaze behavior, eyebrow movements, gestures, body posture, and head and body movements. Nonverbal signals can also be made available in the voice of an ECA. Communicative behavior is dependent on the personality that has been modeled in an ECA.

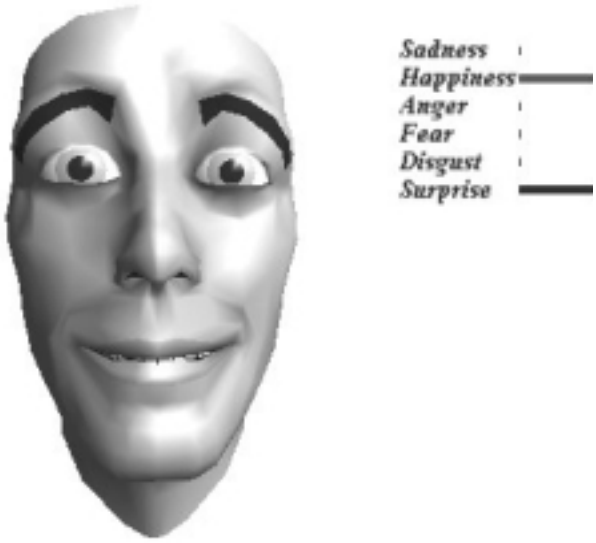

Figure 2: Blending of happiness and surprise

In previous years we have seen the emergence of affective computing. Although many research results on modeling of affect are available, it is certainly not the case that a comprehensive theory of affect modeling is available. Reasons to include emotion modeling in intelligent systems are, among others, to enable decision-making in situations where it is difficult, if not impossible, to make rational decisions, to afford recognition of a user's emotions in order to give better and more natural feedback, and to provide display of emotions. Especially when the interface includes an embodied conversational agent, it seems rather obvious that the user expects a display of emotions and some recognition of emotions by the embodied agent. On the other hand, in order to improve the interaction performance of embodied agents they should integrate and use multimodal information obtained from their human conversational partner. Although measurement techniques and technology are becoming available to detect multimodal displayed emotions in human interactants (cameras, microphones, eye and head trackers, expression glasses, face sensors, movement sensors, pressure sensitive devices, haptic devices and physiological sensors) here we will not discuss the display of humor emotions, e.g. enjoyment, by the human interactant (and preferably be perceived by an ECA). Obviously, although useful, we would rather have an ECA understand why the events that take place generate enjoyment by its conversational partner and why the ECA itself should display enjoyment because of its appreciation of the humorous situation. Display of enjoyment should follow from some emotional state that has been computed from sensory inputs of a human interactant, but in the first place from an appraisal of the events that happen or have happened simultaneously or very recently. A usual standpoint is that of appraisal theory, the evaluation of situations and categorizing arising affective states.

4.3 DISPLAYING HUMOR APPRECIATION IN THE FACE AND IN THE VOICE

In [10], when discussing the display of emotions in speech, Roddy Cowie mentioned, "*A major topic is raised here for want of a better place. It is humour. Humour appears to have strong links to both control and emotional mixture. It may express anger or bleakness or happiness, and our explorations suggest that it is very often used as the preferred way of signalling these emotions without violating display rules. A useful way of making the point is in terms of artificial agents. If they are going to show emotion, we surely hope that they would show a little humour too*." Facial expressions and speech are the primary sources for obtaining information of the affective state of an interactant. So, we conclude that an embodied conversational agent first of all needs to display emotions and humor appreciation through facial expressions and the voice.

In speech, emotion (or emotion changes) can be detected by looking at deviations from personal, habitual vocal settings of a speaker because of emotional arousal. Cues come from loudness, pitch, vibrato, precision of articulation, etc. See e.g. [22] for observations, including a discussion of cues that are related to detecting enjoyment in the voice. The vocalization of laughter is another interesting issue for embodied conversational agents.

To describe emotions and their visible facial actions, facial (movement) coding systems have been introduced. In these systems facial units have been selected to make up configurations of muscle groups associated with particular

emotions. The timing of facial actions has also been described. Using these systems, the relation between emotions and facial movements can be studied. For example, it can be described how emotion representations can be mapped on the contraction levels of facial muscle configurations. Modalities in the face that show affect also include movements of lips, eyebrows, color changes in the face, eye movement and blinking rate. Cues combine into expressions of anger, into smiles, grimaces or frowns, into yawns, jaw-droop, etc. Happiness, for example, may show in increasing blinking rate. Obviously, when using a talking face, a designer can deliberately put emphasis on particular facial actions during interaction. In Figure 2 we display a face from our own research that uses a fuzzy-rule based system to map an emotional state on muscle contraction values [7].

Smiles and laughs are the usual responses to humor. As mentioned in previous sections, laughs and smiles also serve social and (discourse) interactional goals. In [14] eighteen different smiles are distinguished. A smile can be a greeting; it can mean incredulity, affection, embarrassment or discomfort, to mention a few. Smiling does not always accompany positive feelings. That makes it important to be able to display the right kinds of smiles at the right time on the face of an embodied conversational agent. Frank and Ekman [16] discuss the 'enjoyment' smile, the particular type of smile that accompanies happiness, pleasure, or enjoyment. The facial movements that are involved in this smile are involuntary, they originate from other parts in the brain than the voluntary movements and have a different manifestation. Morphological and dynamic markers have been found to distinguish enjoyment smiles from others. The main, best validated marker is known as the Duchenne marker or Duchenne's smile, the presence of *orbicular oculi* action (the muscle surrounding the eyes) in conjunction with zygomatic major action (muscles on both sides of the face that pull up the mouth corners). The Duchenne smile can reliably be identified visually. Although some people can produce it consciously, it probably is the best facial cue for deciding enjoyment and therefore an embodied conversational agent should show it in the case of sharing humorous events with its human partner. For a survey of hypotheses and empirical findings regarding the involvement of muscles in the laughter facial expression see [38]. Laughter also involves changes in posture and body movements. Again, we need to distinguish between different types of laughter (spontaneous, social, suppressed).

5. FEIGNED OR FELT?

In applications using embodied conversational agents we have to decide which smiles and laughs to use while interacting with a human conversational partner. When a virtual teacher smiles, should it be a Duchenne smile? Is the embodied agent 'really' amused or does it only display a polite smile because it does not really like the joke made by its human conversational partner. Or should it not laugh or smile at all because of this politically incorrect joke? As mentioned by Cowie [10]: *"People respond negatively to displays of emotion that are perceived as simulated, and that is a real issue for agents that are intended to convey emotion."* Will our attempts to introduce believability not be hampered by the impossibility to convey emotions in a believable way? Maybe we accept poor quality speech synthesis, maybe we accept poor quality facial expression (compared with human speech and human facial expressions), but will we accept the same for emotion display, in particular display related to an appreciation of a humorous event conveyed through these channels? Note, that when we talk about a humorous event, we include events that appear in a story being told by a virtual agent in interaction with a human conversational partner, events that are interpreted from a sequence of utterances in a dialogue, events that are visualized in a virtual environment, or events that need interpretation of integrated virtual and real-life interactions. These are interesting issues, but in our view not different from other observations on believability of embodied agents. In some situations, assuming that quality allows it, a synthesized voice or face may express acted pleasure (or anger), in other situations genuine pleasure (or anger). Whether it sounds or looks sincere depends on being able to suspend disbelief in the human partner of the agent. Interesting in this respect is the work of Marquis and Elliott [26] who discuss research on embodied poker-playing agents (with a human partner) that can display, based on the OCC model deliberately display false emotions in the face and in the voice.

6. APPRAISAL OF HUMOROUS EVENTS

It is clear from the observations we made in the previous sections that there is a need for models that allow generation, prediction, detection and interpretation of humorous events. There is also a need to be able to generate, display and interpret smiles and laughs in a context that is not necessarily found humorous by an embodied conversational agent, but that nevertheless may lead to smiles and laughs, for example to keep a conversation going.

We think that it seems to be quite natural to make a step from event appraisal theories for emotion to appraisal theories for humorous events, in order to obtain embodied conversational agents that smile or laugh at the right moment, making them more believable. Some of these theories have been designed with computation in mind. How can we elicit and display emotions using a computational model? One rather mature theory for calculating cognitive aspects of emotions is the OCC model [31], a framework of 22 distinct emotion types. In later years [32] it was suggested to collapse this scheme to five distinct positive and five distinct negative affective reactions, under the assumption that this should be sufficient for building believable affective agents ("*with the potential for a rich and varied emotional life*"). In several (mostly, stripped-down) versions, the model has been used. E.g., in the OZ-project [36], which is concerned with the development of a theatre world inhabited by emotional agents. In the Carmen project [27] event appraisal is used to recognize and process feelings of guilt and anger in a setting where an embodied conversational agent talks with a mother of children with leukemia.

We think it is useful to review existing theories and observations concerning the appraisal of (humorous) situations (available as events, in conversation, in verbal descriptions or stories) in terms of possible agent models that include explicit modules for beliefs, desires, intentions and emotions. For example, it would be worthwhile to investigate how such a model can include reasoning mechanisms about situations where there is the feeling that the situation is normal, while at the same time there is a violation of a certain commitment of the agent about how things ought to be. With this view in mind it seems useful to look at the violation theory discussed in [42], attempts to define degrees of incongruity [12], attempts to define humor in terms of violations of Grice's conversational maxims [2], proposals to define and explain humor or laughter in terms of perceptual, affective, and response patterns [39], but also 'measures' made possible by a Situational Humor Response Questionnaire (measures the propensity to laugh in a variety of verbally described situations). Annotated verbally described situations could be the basis for (supervised) learning of humorous situations similar as our model of agent emotions learning discussed in [33].

7. CONCLUSIONS

In this paper we were able to touch upon the state of the art of embodied conversational agents, humorous interfaces and affective computing. We think that from our observations it may become clear that current research on affective computing, research on generating and interpreting facial expressions and research on embodied (and intelligent) agents can and should be combined with humor research. This is for the benefit of humor research and results can help to design new and interesting applications in human-computer interaction using embodied agents.

Acknowledgements. This paper was written while we took part in the HAHAcronym project (Humorous Agent for Humorous Acronyms). This is a European IST programme (IST-2000-30039) on Future and Emerging Technologies, done jointly with Istituto Trentino di Cultura (ITC-IRST) in Trento, Italy. Part of the material in this paper was taken from a deliverable we wrote for that project [29]. I am grateful to Matthijs Mulder for his help in finding relevant literature and to Lynn Packwood for proofreading the paper.

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