

HUMAINE

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**Preliminary plans for exemplars:
Communication**

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1. The status of this report

Joint research in HUMAINE aims to produce 'exemplars'. We chose the term exemplars to convey that above all, the systems that we develop should embody sound principles. The systems may be working models or 'in principle' specifications. Embodying sound principles means not only that they should exemplify good ways of addressing individual problems, but also that the set of exemplars taken as a whole defines a rational ways of partitioning the overall problem of developing emotion-sensitive systems. Arriving at a satisfying partition is a major part of the challenge that HUMAINE faces, requiring iteration and consultation between groups dealing with different thematic areas.

The Technical Annex sets process that is designed to meet that challenge. It will begin with production by each thematic group of a review of key concepts, achievements and problems in its thematic area; and drawn from the review, an assessment of the key development goals in the area. This review and assessment will be circulated to the whole network for discussion and comment, aimed both at building understanding of basic issues across areas, and at identifying the choices of goal that would be most likely to let the different groups achieve complementary developments. That consultation phase will provide the basis for deliverables in month 11, which will specify a range of exemplars that deserve serious consideration. A further round of consultation will follow before concrete plans for each workpackage are drawn up and shared at the 18 month plenary meeting.

This report is the review that defines the starting point of the process for work package WP8, whose brief title is 'Emotion in Communication and Persuasion'.

2. Thematic definition of this workpackage

The workpackage is mainly concerned with output in the sense of inducing emotions in the audience, nonetheless forms of multimodal dialogue will also be the subject of this activity. Yet, on the dimension general/specific there is clear consensus that our work cannot be one that accommodates or models all forms of emotional communication. Rather we shall focus on the relevant areas mentioned below:

- General mechanisms and resources for communication and emotions in computational systems;
- Persuasion and emotions;
- Humour and language creativity;
- Deception, lies and emotions;
- Communication technology, perception, music, and emotions.

The Workpackage has a specific computational aspect. Its aims are to help understand some of the critical issues for building persuasive, or otherwise emotion inducing computational systems, develop environments that help experimenting specific concepts, try limited realizations that can be demonstrated as proofs of concepts in view of a novel class of systems.

For doing so it will be required that

- a) human sciences results are taken into consideration, with a clear focus on the theories and models that are better suited for building computational systems
- b) on the computational side, attention is given to principled approaches to construction
- c) HUMAINE efforts are combined with other relevant activities.

A great effort is required for realizing even simple artefacts, and it is a very complex task on the software engineering side to realize integrated systems that comprise components realized independently. So we think that realizations of exemplars should benefit of the work of others at the level of integration of knowledge and critical discussion. We shall aim at developing more than a couple of exemplars instead, each in line with specific interests and experiences of a site and form a working group for continuous discussion of the involved issues.

3. Review of key concepts in the thematic area

Persuasion = the definitions, that historically has been given, can be divided according to what they refer to.

1. Definitions referring to the goal of persuasion: (behaviour, attitude or action inducement)
2. Definitions referring to the functioning of persuasion: (e.g. peripheral vs. central route in the elaboration of a message [Petty & Cacioppo, 86]. Persuasion uses the peripheral route of the receiver).

We converge with the first point of view: persuading a (human or artificial) agent implies planning how to modify its predispositions to certain actions, its/his/her complex of beliefs and judgments (see also the concept of “argumentation”). According to the work developed by linguists, philosophers and cognitive psychologists, persuasion may appeal to both the informational and the emotional route of the recipients [Petty & Cacioppo, 86; Sillince & Minors, 91]. In defining persuasion we differentiate a “large” definition of persuasion (behaviour inducement) from a “narrow” one (action inducement). Another distinction can be made between the weak notion (capturing the idea that persuadee is not already planning to perform the required action/behaviour) and the strong notion (capturing the idea that persuadee has also some *barriers* against the required action/behaviour).

Influence = when loosely speaking about persuasion we are in the field of (social) influence, defined as: “affecting or changing how someone behaves or thinks”.

Argumentation = Argumentation is strictly connected with the concept of rationality. It is a resource for persuasion because:

1. Planning of the message involves some sort of ‘rational’ activity, even when emotion inducement is employed as a means to increase the persuasion strength. On the other side, the way persuasion is performed (items selected, their order of presentation, their ‘surface’ formulation) also depends on the emotional state of the persuader.
2. Argumentation is concerned with the goal of making the receiver believe a certain proposition (influence his mental state) and, apart from coercion, the only way to make someone doing something (persuasion) is to change his beliefs [Castelfranchi, 96].

Persuasion includes a-rational elements as well and so is a “superset” of argumentation. This does not rule out that there is a role for emotion within argumentation [Miceli *et al.*]: through arousal of emotions (see Rhetorics) or through appeal to expected emotions. In classical argumentation, though, these problems are not addressed since emotional argumentation is often considered as some sort of ‘deceptive’ argumentation [Grasso *et al.*, 00].

Coercion = using force to “persuade” someone to do something he is not willing to. Obviously coercion falls out of our definition of persuasion.

Rhetorics = the study of the ways of using language effectively. This area of studies concerns the linguistics means of persuasion (one of the main, but not the only one).

Affective verbal communication = natural language communication finalized either to inform the hearer about an affective state or to induce emotions, affective attitudes, opinions and evaluations.

Affective induction = It consists of the communication process that induces affective states/attitudes in the recipients.

Affective attitudes = They consist of complex mental state such as beliefs, feelings, values, and dispositions to act in certain ways

Evaluative language = Evaluative language is the kind of language that expresses an evaluation/appreciation of the object of the discourse. The evaluations/appreciations reflect the opinions and/or the attitudes of the speakers. Evaluative language is called also subjective language.

Slanting = Slanted writing is the type of writing that springs from our conscious or subconscious choice of words and images. In particular we refer to slanting writing whenever we load our description of a specific situation with *vivid*, *connotative* words and figures of speech. Below are some examples of a denotative (no slant) word and its positive and negative word associates.

NO SLANT	POSITIVE SLANT	NEGATIVE SLANT
Eats	Dines	Gorges
Doctor	Physician	Quack
Car	Sedan	Jalopy
Old age	Golden years	Decrepitude
Intoxicated	Tiddly	Smashed

Polarity or gradability in the lexicon = The valence of emotion words. It is related to semantic orientation of words (e.g. positive and negative lexicon). Some recent works in NLP show that is possible to partially learn these features from corpora in an automatic way.

Emotion words, affective lexicon = It is important to have lexical resources that contain words referring to emotions (e.g. anger, fear), moods (animosity, affable), emotion-related cognitive states (confusion, dazed), emotional responses (tremble, cry), etc. An affective lexicon is *per se* an important resource for many applications, both based on language recognition and on language production. The potential applications in natural language processing are the basis for those in human-computer interaction.

Computational humour = An emerging computational field in artificial intelligence that deals with building systems capable of inducing amusement and affecting the emotional state of users.

Empathy = The process by which one agent's affective state (the target) modulates in a similar way to that of another agent (the source), drawing on situation or expression. In cognitive empathy the target understands the affective state of the source (a specific variant of the theory of mind) – for example, seeing the source lose its wallet understands that the source is sad, or seeing the source cry understands that it is sad. In affective empathy the target itself feels the affective state of the source; finally in *ideomotoric empathy* the motor action of the target is modulated by that of the source – for example, seeing the source dancing makes the target want to dance too.

Empathic agent = An empathic agent is either able to produce a feeling of empathy in another agent or to itself respond empathically, or both.

Emergent narrative = A participative style of narrative in which the lower-levels of narrative structure emerge from interaction between characters rather than being scripted as part of a pre-defined plot.

Story-telling = A style of narrative in which a particular agent - the story-teller – presents a narrative to one or more agents, usually through verbal and accompanying expressive behaviour.

4. Review of key achievements in the thematic area

Persuasive systems

There are systems that address, more or less directly, the problem of persuasion in human computer interaction. Some of their application scenarios are: preventive medicine, social action and edutainment.

One of the most well known systems that exploited persuasion in communication, focusing mainly on behaviour inducement, is STOP [Reiter *et al.*, 03a; Reiter *et al.*, 03b]. STOP is a generation system employed in a real human setting, with the aim at inducing the user to stop smoking. As pointed out in [Reiter *et al.*, 03a], the authors had hard time in evaluating it in a real context because of the problem of assessing a real change in behaviour and because of the particularly awkward nature of smoking addiction.

Other systems, such as [Zukerman *et al.*, 00], use argumentation strategies in the generation of persuasive messages. Zukerman is concerned with the abstract form of the unfolding of the argument (e.g. *reductio ad absurdum*, *inference to the best explanation*, *reasoning by cases*). In general, though, logical reasoning is just one resource to support persuasion.

Natural argumentation, a growing discipline in AI, is concerned both with the development of natural language-based systems and automated reasoning. It comes closer to persuasion than simple argumentation because it is concerned, for example, with the problem of adequacy - effectiveness - of the message [Fiedler & Horacek, 02]. Even in professional settings, such as juridical argumentation, extra-rational elements play a major role [Lodder, 99]. Recent works have studied applications of natural argumentation [Walton & Reed, 02; Das, 02].

Carofiglio and de Rosis [Carofiglio & de Rosis, 03] focus on emotions as a core element of affective message generation. Their model, since their main concern is dialogical argumentation, uses one persuasive strategy per time.

In general, systems using ECAs address the problem of multimodal persuasion, but more on the interface side than the planning one (in which persuasion plays a major role).

Computational Humour

So far only very limited effort has been put on building computational humour prototypes. Indeed very few working prototypes that process humorous text and/or simulate humour mechanisms exist. Mostly they are concerned with rather simple tasks.

There has been a considerable amount of research on linguistics of humour and on theories of semantics and pragmatics of humour ([Attardo, 94], [Attardo & Raskin, 91], [Giora & Fein 99], Attardo 2002, Giora 2002); however, most of the work has not been formal enough to be used directly for computational humour modelling. An effort toward formalization of forced reinterpretation jokes has been presented by Ritchie (2002).

Within the artificial intelligence community, most writing on humour has been speculative [Minsky, 80; Hofstadter *et al.*, 89]. Minsky made some preliminary remarks about how

humour could be viewed from the artificial intelligence/cognitive science perspective, refining Freud's notion that humour is a way of bypassing our mental "censors" which control inappropriate thoughts and feelings [Freud, 05]. [Utsumi, 96] outlines a logical analysis of irony, but this work has not been implemented. Among other works: De Palma and Weiner [Palma & Weiner, 92] have worked on knowledge representation of riddles, Katz [Katz, 93] attempted to develop a neural model of humour. Ephratt [Ephratt, 90] has constructed a program that parses a limited range of ambiguous sentences and detects alternative humorous readings. A formalization, based on a cognitive approach (the belief-desire-intention model), distinguishing between real and fictional humour has been provided by Mele (2002).

An important attempt to create a computational humour prototype is the work of [Binsted & Ritchie, 97]. They have devised a formal model of the semantic and syntactic regularities underlying some of the simplest types of punning riddles. A punning riddle is a question-answer riddle that uses phonological ambiguity. The three main strategies used to create phonological ambiguity are syllable substitution, word substitution and metathesis.

Finally, Jester [Goldberg *et al.*, 01] is an on-line joke recommending system using collaborative filtering in order to recommend jokes adapted to the user's 'sense of humour'. It does not implement any linguistic technique dealing with humour, rather it uses statistical techniques to recommend jokes based on the user's ratings of a set of sample jokes.

Almost all the approaches try to deal with the incongruity theory at various level of refinement [Köstler, 64; Raskin, 85; Attardo, 94]. The incongruity theory focuses on the element of surprise. It states that humour is created out of a conflict between what is expected and what actually occurs in the joke. This accounts for the most obvious features of a large part of humour phenomena: ambiguity or double meaning.

Specific workshops concerned with Computational Humour have taken place in recent years and have drawn together most of the community active in the field. The proceedings of the most comprehensive events are (Holstijn and Nijholt 1996) and (Stock, Strapparava and Nijholt 2002). Ritchie (2001) has published a survey of the state of the art in the field.

Politeness

A number of research groups have applied the sociolinguistic theories of [Brown & Levinson, 87] to the problem of modelling politeness in a dialogue, e.g. [André *et al.*, 04], [Johnson *et al.*, 04], [Moore *et al.*, 04]. The driving force behind these approaches is to improve the user's affective state by a deliberate use of communication tactics. However, all these approaches are lacking more or less a profound empirical validation. First studies by [Prendinger *et al.*, 03] have shown that a polite agent may decrease user stress. Nevertheless, the relationship between emotional patterns and the threat resulting from the communication tactics applied by a system is still largely unexplored. Another problem lies in the theory itself. For instance, Brown and Levinson start from a fixed ordering of dialogue strategies according to their perceived politeness. There is, however, no doubt that the perceived politeness of any strategy may drastically vary depending on a number of context factors, such as the user's personality, his or her ability to perform a certain task etc. Indeed, a number of studies revealed that autonomy-oriented strategies are not always conceived as more polite than approval-oriented strategies. Current implementations suffer from the fact that the influence of such context factors is still unclear and have to rely on an ad-hoc selection of politeness strategies.

Lies and Deception

The most comprehensive work on lies and emotion was done by Ekman and colleagues (e.g. [Ekman, 92]). He convincingly shows that emotions are the most prominent topic people lie about by trying to conceal their real emotion from others. In the area of human-computer interfaces, especially in the area of embodied conversational agents, sparse work is found on lies and deception. McKenzie et al (2003) describe deceiving agents as training partners for the military domain (check point). But they present no implemented system, just some ideas on the benefits for such a training scenario. Carofiglio, de Rosis, and Castelfranchi [Carofiglio *et al.*, 01] model some deceptive strategies by belief networks that may be incorporated into conversational agents. More literature can be found in the area of multi-agent systems where different strategies of deception and their effects are examined. [Ward & Hexmoor, 03] as well as [Castelfranchi *et al.*, 98] both present multi-agent simulations as test beds for examining the effects, benefits as well as damages, of different forms of deception on the interactions of agents.

Gaze Models

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Some researchers concentrate on gaze models to emulate turn-taking protocols [Beskow, 97; Cassell *et al.*, 94; Cassell *et al.*, 99; Cassell *et al.*, 99b; Thórisson, 02], or to call for the user's attention [Waters *et al.*, 96] to indicate objects of interest in the conversation [Beskow, 97; Lester *et al.*, 00; Thórisson, 97], to simulate the attending behaviors of agents during different activities and for different cognitive actions [Chopra-Khullar & Badler, 99].

Narrative and story-telling

There is currently a growing amount of work in story-telling and narrative, which has become a very active research area. A number of groups have put the user in the authorial position as a means of dealing with the problems of interactive narrative. For example, TEATRIX [Prada *et al.*, 00] is a system that allows children to create fairy stories by interacting with each other and with autonomous characters, based on the taxonomy of Propp [Propp, 28]. Ghostwriter [Robertson, 01] is a further example of an educational virtual environment designed as a preparation activity for children before writing stories. The IDtension [Szilas, 99] system extends the authoring of non linear narratives to the adult author, and the creation of goal trees [Cavazza *et al.*, 01] is one attempt at a formalism for authoring such narratives. Story-telling systems have also been the focus of work, for example Papous [Silva *et al.*, 01] and the Virtual Guide [Ibanez *et al.*, 03], who constructs stories from a definite viewpoint in guiding a user around an area. The issue of interactive narrative poses a number of theoretical problems, and some work has tried to adapt classic Aristotelean theory through the concept of beats, realized in the much-admired Façade system. The theory of emergent narrative [Aylett & Louchart, 03] is a more radical approach to dealing with some of these issues, and its focus on character-interaction stresses the role of affective systems. Finally, narrative work is being carried out using both augmented reality technology [Cavazza *et al.*, 03] and mobile computing [Brunnberg & Hulterström, 03] where it has close links to large-scale computer games.

5. Review of key problems in the thematic area

- Emotions and Natural Language Processing. We want to explore the affective potentiality of natural language generation systems that allow not only to express and communicate emotions but also to induce them in the recipient. The communicative functionalities are related to expression and transmission of affective information. The persuasive ones are referring to the affective induction.
- Verbal language for affective communication. Natural language allows us to represent and describe emotional states in a rather precise way. The affective lexicon can be correlated to a large number of concepts. In this way, the emotional knowledge can be expressed by *emotion* words. Emotions can then be expressed by natural language in different levels. A structured lexical knowledge base is essential for any system using the verbal modality of communication.
- “Communication of emotions” or “emotions in communication”? In the former, the affective meanings are the contents of the message, in the latter they constitute the connotative aspect. The thematic area will give importance to both these levels but put a major emphasis on the second one. A central role will be relative to the *evaluative language*
- Emotions for persuasion. For many human-computer interaction contexts (our main concerns are: monological multi-shot interaction and dialogical interaction) the use of emotions can improve the overall impact of persuasive communication. The induction of an affective attitude (on the part of the user), the indication of a resulting emotional state deriving from an action (appeal to expected emotions), or the displaying of a particular emotion (on the part of the interface) are some of the possible means. Persuasion models for these contexts have to include, at least, an explicit representation of the persuasive intentions of the machine (i.e. the desired behaviours of the audience) and of the affective states (to be inducted, indicated or displayed).
- There are lots of variables influencing persuasive interaction, different from, and possibly related, to emotions (like trust, social relations, perceived reliability and so on). With this respect, two aspects of emotional-persuasion that, once studied and analyzed, can be very fruitful, concern (1) the fundamental role played by social elements in emotional persuasive communication and (2) the function of emotions as trustworthiness enhancers.
 1. Some works provide an insight in the hybrid nature of concept such as: guilt-feeling, pride, and so on (see for example [Miceli, 92; Ortony *et al.*, 88]). But no system has really studied how to use these concepts (the social relations established between the agent interface, the user and, possibly, third parties) to improve the effectiveness of the emotional-interaction (see [Guerini *et al.*, 03] for a preliminary attempt of use).
 2. Another potentially relevant issue for systems is the persuasive function of emotions as trustworthiness enhancers. Emotions are commonly regarded as serving a communicative function, both intra- and inter-individually (e.g., [Clore, 94; Oatley, 92]). A coherent framework that relates characteristics of emotions to their communicative functions is, however, frequently incomplete.

Particularly lacking is the discussion of the requirements from emotions as a communication system to be reliable [Zahavi, 75, 77a, 77b, 97]). It is assumed that emotions are indeed perceived as relatively reliable indication of one's inner state including attitudes and positions. Hence, in the context of persuasion, emotional communications may moderate the perceived reliability of a given message as a function of the extent to which it is in fit with a message's content. This understudied issues deserves exploration as it can have significant implication for the understanding of the role of emotional signaling in persuasion

Another major problem relies in the gap between the generality of the theoretical models and the specificity of the developed systems: while the former are language and domain independent the latter are far more specific.

Moreover these systems would also pose evaluation problems: there are many different aspects to be evaluated, especially with persuasive system having deep reasoning capabilities [Reiter *et al.*, 03a]. Since this is a new field there are no yet stable evaluation results.

Finally, a number of questions specific to persuasion to be addressed within Humaine:

- whether 'rational' and 'emotional' persuasion may be seen as distinct forms of persuasion.
- how emotional and cognitive factors combine to produce an overall measure of argument strength.
- the difference between various forms of emotional persuasion: for instance, appeal to values and appeal to emotions.
- how affective factors may influence advice-giving dialogs.
- the 'grain size' that is needed to model the addressee of a persuasion message.

It would be good to have a corpus of advice-giving dialogs in order to gain some insight into the above-formulated questions.

- Verbal Humour. Humour performs a particular kind of affective induction, in particular amusement induction. Even if deep modeling of humour in all of its facets is not something for the near future, nonetheless some steps can be followed to achieve results. In the general case, in order to be successfully humorous, a computational system should be able to: recognize situations appropriate for humour; choose a suitable kind of humour for the situation; generate an appropriately humorous output; and, if there is some form of interaction or control, evaluate the feedback. We are concerned with systems that automatically produce humorous output (rather than systems that appreciate humour). Some of the fundamental competencies are within the range of the state of the art of natural language processing.

Humour is the healthy way of creating 'distance' between one's self and the problem, a way of standing back and looking at the problem with perspective. Humour reveals new aspects, disarms and relaxes. It is also infectious, it is an important way to communicate ideas, it helps getting and keeping people's attention and it helps remembering

A number of questions/issues to address within Humaine are specific to computational humour:

- role of humour beside amusement (e.g. humorous advertisement).
- how humour is appreciated by different individuals.
- how to exploit existent NLP techniques: rhymes, wordplays, popular sayings or proverbs, quotations, alliterations, adaptation of existing expressions, adaptation of proverbs, and what resources are necessary
- humour and creative language.
- Emotions and Politeness. We aim at a deeper understanding of the emotional impact of politeness behaviours in man-machine communication. According to Brown and Levinson, politeness strategies are communicative devices for redressing the threats inherent in verbal and nonverbal utterances. Positive politeness aims at protecting the individual's desire to be evaluated positively, for example by expressing admiration for the addressee. Negative politeness accounts for the individual's desire to act free from impositions, for example, by emphasizing that the final decision is up to the addressee.

First studies indicate that the appropriate use of theories of politeness within an educational framework may have a positive influence on the student's emotional state (e.g. see [Johnson *et al.*, 04]). Nevertheless, it is still rather unclear which strategies of politeness to employ in which context. Furthermore, standardized measurements are missing for determining whether the coded strategies actually lead to an improved perception of the learning experience. Finally, cultural aspects have been largely neglected so far.

To capture these aspects, we are collecting and analysing a corpus of human-human interactions. For this purpose a coding theme will be developed that helps annotating the verbal and non-verbal strategies of politeness along with the emotional displays shown (this task has a strong connection with WP5). Because communication is always to a certain degree culture-specific, a replication of this corpus collection in other European countries is planned (e.g. with LIMSI). In collaboration with IRST, we will also investigate the use of humour as a special means to mitigate face threats.

- Lies and Emotion: Work done so far on lies and deception in agents focuses on the effect of false information that is exchanged to achieve a predefined goal. In everyday life this is not the general case in which deception is applied. People tend to lie primarily about their emotions. Thus, endowing a computational system with the ability to detect or show emotions it is inevitable to regard this aspect of human communication giving rise to two main research questions: (i) How to handle false emotional expressions from the user and (ii) How and when to create false ECA emotional expressions (because it is expected). To tackle these questions, we will develop a test bed with a deceiving agent, i.e., with an ECA that exhibits facial and bodily clues to deception. Modeling this agent is based on [Ekman, 92] who precisely describes the clues to deception that can be found in the human face and body.
- Gaze and Facial Expression for Persuasion: Nonverbal behavior and in particular visual behavior is an important feature whose main functions are to help to regulate the flow of conversation, to signal the search for feedback during an interaction, to request information, to express emotion [Argyle & Cook, 76; Knapp & Hall, 97]. But gaze may also be used to influence another person's behavior, or to seek information about the intentions of the other [Beattie, 81, Walker & Trimboli, 83, Webbink, 86]. Humans

are very sensitive to eye behavior and are able to perceive the slightest change in eye direction. So far most of the work related to the creation of ECAs have been oriented toward developing computational model of nonverbal behavior based on their communicative functions. Not much work has been done in modelling nonverbal behavior, and gaze in particular, during persuasion.

- How ECA design can affect a user: What is the best graphical representation to create an affective link with the user? This topic influence the way a character shows emotions in order to be persuasive. For ex., the cartoon characters facilitate the establishment of a playful relationship with the user and allow to "play" with the form and the proportions of the characters to create emotions. According to the target audience, a character like Mickey can be made an accomplice with soft rounded forms, or it can appear more aggressive like Pokemon [Montigneaux, 02].
- Narrative and story-telling: Narrative structures and the story-telling process provide major mechanisms of persuasion and communication. They support affective involvement through the identification with the characters and their dilemmas and conflicts and offer a spectrum of approaches from the didactic to the free-wheeling fantastical. Key problems lie in the necessary integration of many lower-level components already discussed in this section, not to mention action-selection mechanisms (WP7) and expressive behaviour (WP6). A major issue is that of reconciling narrative structure with user interactive freedom (the 'narrative paradox'), which impacts the role of author and story management approaches. Further questions are raised by the use of augmented reality and mobile computing technologies which abandon old interaction technologies of mouse and keyboard for the decoding of user behaviour and affective state through sensors.

6. Assessment of the key development goals in the thematic area

- **Persuasion**

ITC-IRST, Univ. Bari. Developments of industrial concern: Cantoche

The theme of persuasion will be expanded along two dimensions:

1. the study of its mechanisms (both in monological and dialogical situations) and the role of emotions. For example:
 - a. Integrate models of emotion manipulation with models of beliefs and goal induction. The artificial intelligence approach will emphasize BDI&E (belief-desire-intention-emotions) agents and the theory of how intentions and commitments are produced in these agents.
 - b. Furnish models of measurement of the strength of persuasive strategies, and other related concepts such as: argumentation strength [Sillince & Minors, 91], probative weight [Walton, 00], dialectical relevance [Walton, 99] and impact [Zukerman *et al.*, 99; Zukerman, 01].

The limits of applying a purely logical reasoning in simulating how an interlocutor may be induced to believe a given fact or to hold a given intention has been discussed from various viewpoints: we need, on one side, considering uncertainty and ‘ignorance’ in various aspects of the process and, on the other side, introducing more refined argumentation schemes (see, for instance, the series of CMNA Workshops [[http1](#); [http2](#)]). Researches focused, in particular, on how attempting to simulate natural argumentation and persuasion requires defining new methods for representing knowledge, for reasoning on it and for generating natural language monologs or dialogs.

Persuasion strategies may have various degrees of strength, depending on the goal which motivates the persuasion process, on the plan of the persuader and on the characteristics of the recipient. Various methods have been proposed for representing uncertainty in this domain: see, for instance, BIAS [Zukerman *et al.*, 99; Zukerman, 01], [Carofiglio, 04]. In both the cited examples, once a model has been built it may be employed to reason about the effect of available evidence on the claim. It may be employed, as well, in a sort of hypothetical reasoning, to plan which data combinations might produce a desired impact on the claim: in this hypothetical reasoning, the possible emotional impact of a message on the persuadee may be evaluated by integrating cognitive emotion activation models with persuasion and argumentation models [Carofiglio & de Rosis, 03]. Here, a clear link with WP7 exists.

- c. Represent in a unique formalism/framework different persuasive strategies. Starting from a reflection about the continuum which characterizes the various (emotional and non emotional) persuasion modes, we will propose a framework which tries to unify the various items of this continuum (see for

example [Guerini *et al.*, 03]. We will then investigate various (emotional and non emotional) persuasion and argumentation strategies, (like those in Walton and Toulmin [Prakken *et al.*, 03; Toulmin, 58]) and will propose a method to formalise them by representing the various sources of uncertainty and incomplete knowledge they may include. We will also investigate related aspects (critical questions, counter-arguments and so on), as well as information about the user attitudes (a user image model) to indicate the ‘best’ argumentation move the system can make, in a given situation.

2. working at one exemplar, including the building of two prototypes (for monological and dialogical scenarios) to test the developed models

Participants tools and characters are being prepared by Cantoche (also in connection to WP9) in order to test the emotions by writing scripts and animate virtual characters. These tools will be provided in September 2004. They are meant to be helpful for the interface of the prototype for the Persuasion exemplar.

Cantoche will also elaborate on the feedback from customers about using embodied agents for e-commerce or other kinds of application. They will focus in particular on persuasion.

- **Persuading gaze and appearance**
Univ. Paris 8

The eye gaze during conversation plays an important role in regulating the communication.

It may have several functions in social interaction [Argyle & Cook, 76; Kendon, 67; Ellsworth & Ludwig, 72; Kendon & Cook, 72]. These studies try to give an answer to issues like: Do people gaze more at the other while talking or while listening? Is the eye gaze used to regulate the flow of the conversation and the exchange of speaking turns? In previous work a gaze model based was developed on the communicative functions model proposed by Poggi *et al.* [Poggi *et al.*, 00]. This model predicts what should be the value of gaze in order to have a given meaning in a given conversational context. We wish to investigate the effects of gaze and facial expression on the persuasiveness of an agent on a human viewer, particularly in terms of influencing the users’ emotional state. Avenues of investigation include the effects of eye contact, gaze direction, facial expression and blinking on the persuasive abilities of an agent. There may be many subtleties worthy of consideration; in terms of gaze direction for example, torso orientation and context may be important factors for persuasiveness. It has been reported in [BFB80] that people talking on television were regarded as being less reliable and expert when addressing a camera directly than when seen in profile, despite the fact that intuition may suggest that a direct camera view would connote directness of approach and qualities of authority and reliability.

To investigate the possibilities of engaging the user through emotional interaction, we will be working with WP8 on developing an initial showcase to engage the user emotionally through multimodal interaction. GAMBLE features a small game of dice where one of the game partners is substituted by the Greta Agent (developed by Catherine Pelachaud and colleagues). This game can only be won by deceiving the other players and by detecting such attempts from the other players.

- **Politeness**

Univ. Augsburg

See exemplar

- **Humour and creative language**

ITC-IRST

See exemplar

- The role of emotions in persuasion, emotions as trustworthiness enhancers. Experiments of applied role of humour in product promotion and negotiation.

Univ. Haifa

- **Lie, deception**

Univ. Augsburg

See exemplar

- **Storytelling**

Univ. Salford

- **Music**

QUB

7. Relation to other workpackages

Main relations foreseen are the following:

WP3 Theories and & Models, WP4 Signs of Emotions, WP7 Emotion in cognition and action (e.g. how persuasion use/induce cognitive elements in bringing about an action on the part of persuadee).

WP6: emotions in interaction (e.g. how to use ECAs in persuasive interactions).

We intend also to coordinate our efforts with WP5 Data and databases, WP6 Interaction.

Finally we intend to discuss themes and be actively involved in WP9 Usability and WP10 Ethics. The latter seems particularly relevant for the specific content of WP8 (the possibly controversial uses of persuasion in human-computer interaction). Note that the ethical problems do not concern only emotional-persuasion, but persuasion *per se*.

Needs (theory)

Some of the needs for results to be achieved in Humaine outside of this workpackage and that should be beneficial for WP8 are the following:

- Personality studies. It is clear that personality is a key factor in emotional behaviour. In humour we can mention the work of Ruch [Ruch, 96] and the analysis of humorous impact on different personalities.
- A theory of expectation. Some researchers consider surprise as a form of emotion *per se*; in many situations, it is combined with other factors. A broken expectation often plays a key role in emotion and communication.
- A theory of how trust evolves dynamically.
- Theories of mass communication and emotions. We believe we should look into theories of mass communication: in fact we are trying to model a dynamic process that is similar to mass communication. In building intelligent computer-based systems, we intend to do this flexibly, taking into account the individual addressee of the communication and the context. Klaus Scherer has confirmed the relevance of this direction.
- Effect of emotion in reasoning style and decision-making. This is a theme that has been studied largely in cognitive economics, and we think it would be very important that it is systematized so that some results can be adopted in WP 8.

8. Preliminary ideas about possible exemplars

A. Exemplar 1

Creative Humour Test Bed

Humour.

Humour is a cultural universal and a ubiquitous, intriguing, phenomenon. The many attempts to define and characterize humour in its generality have defied success. Ironically, while most people intuitively know what humour is, they have problems in defining or explaining its nature and attributes.

Psychologists have typically differentiated between two facets of research: (a) *humour appreciation* (the ability to understand and enjoy humorous messages), and (b) *humour creativity and production* (the ability to communicate humorously in context). These two dimensions may be distinct and require quite different capacities.

Applied Goal.

An environment for humorous creativity, in which the user is able to manipulate and play with the creative and affective potentialities of natural language, can be useful for many applied fields. Users can select or compose linguistic units (e.g. such as single words, syntagms, assertions, questions, short sentences, etc.), and subsequently modify and expand them according to computational humour techniques. The possibility to create a user model (i.e. a model of the receiver of the message) that includes his/her cognitive and affective state allows correlating the linguistic units with that model. Thus the resulting messages become more adaptable and appropriate to the mental state of the final addressee and capable of influencing him or her. For example, this tool could be useful for the creation of advertisements, slogans, headlines and personalized banners for e-commerce.

The actual cooperative creative process can be iterative. For example, if the user is a copywriter, his/her need could first select a set of linguistic elements and then evaluate them according to his/her own taste, in order to perform a further selection or to invent a new set. Ideas first selected by the user are then elaborated creatively by the system, with additional incremental adjusting by the two partners.

Similarly, such a tool could be effectively employed for supporting creative writing and development of intelligent tutoring (or edutainment) systems. Emotions generated by computational humour can provide a good support for promoting memorization and attention.

The goal is to provide an environment that makes it possible to explore suggestions provided by the system. The choice could be left to the creative user, and the material can be the basis for exploring new possibilities from which to draw one's inspiration, and can be calibrated so as to maximize the emotional effects she wants to achieve.

Possible use of the creative environment.

Generally, the computational tools for aided creativity are mostly employed in image processing (e.g. in architecture or in computer graphics), but there is an increasing interest in developing similar systems centred on verbal language. In particular investigations on *aided creative writing* show the analogy with aided design. A possible applied scenario is a system for the creation of humorous advertisements. An important reason for choosing the advertisement domain is the fact that it is sufficiently simple (generally ads are constituted of short expressions) and, at the same time, they have a sufficiently rich semantic content. To create a humorous advertisement, it is necessary to have knowledge of the product to advertise and of the potential consumers.

Possible examples generated by the humorous creative environment can be:

“Thirst come, thirst served” [advertisement for a soft drink], “Come join us at Growman’s mortuary—where thousands are dying to get in....” [advertisement for a mortuary], “A chat has nine lives” [advertisement for a chat].

The system can get in input information about the item to advertise, characteristics of possible recipients and some formal constraints about the sentence to be generated. The output will be constituted by one or more “humorous headlines”. The representation of the recipient’s characteristics will influence the selection of the most appropriate humorous strategies.

Methodology.

Developing the test bed will consist to:

- Study humour models and emotions.
- Integrate knowledge on emotions, language and humour and the reasoning mechanisms.
- Realize automatic humorous and emotional natural language production
- Test the results with groups of users, taking into account personality studies and the specific humour appreciation patterns.

In our past work, computational humour was limited to a typology based on semantic opposition. More extended humour capabilities will be achieved, introducing a multiplicity of strategies, related to various types of humour. Each strategy will also be associated to different categories of recipients. The association will be performed considering the humour appreciation characteristic of the class of recipients taken into account. Indeed, the effect of a humorous message can be very different, according to personality traits, beliefs, age, and cultural level of the target. It is particularly important to be able to induce surprise, which is present in almost all humorous strategies, and to insert it in a positive context, so as to generate amusement instead of dismay or disappointment. In order to create and regulate the surprise, it is necessary to contradict expectations and beliefs of the recipient. For this reason, it is clear that the implementation of such functionalities implies dealing with some aspects of emotions, beliefs, commonsense and stereotyped knowledge.

Prototype.

The system will be developed mainly at IRST.

It will consist of :

- 1) a number of linguistic, common sense and emotion-related resources, adapted for the needs.
- 2) A set of strategies and algorithms for producing humour effects
- 3) A generator of expressions in English
- 4) Possibly, a subsystem for multimedia effects (e.g. ECA's, kinetic typography)

If possible it will be combined with other constructive work, for instance by Univ. Augsburg` on politeness, or by Univ. of Paris 8 on ECA's.

It will also include experimental studies on the value of humour in negotiation and advertisement by University of Haifa.

We shall define a methodology and a plan of evaluation of the results of the environment for practical finalities, and incremental evaluation of the progress.

B. Exemplar 2**Persuasion Models Test Bed****Persuasion.**

Persuasion is a pervading phenomenon in human communication. It has been defined in many different, formal, ways, from action to behaviour inducement. While lots of theory have been proposed to explain different aspects of persuasion, only few have hardly tried to categorize all of its facets in a comprehensive and, most of all, computational way.

The goal of this exemplar is to develop and test theories about persuasion, both in monological and dialogical interactions, that are not purely based on "rational" argumentation. These theories will lead to the development of two separate prototypes (one for the monological, the other for dialogical, interaction).

Applied Goal.

An environment for persuasive interaction, in which an interface is able to interact in a richer and more natural way with users, can be useful for many applied fields, especially those in which the interface will have contextual goal to pursue or will have to induce a particular behaviour on the part of the user. Some scenarios are dynamic advertisement, preventive medicine, social action and edutainment. In all these scenarios the "argumentative way" is not

enough. For intention and behaviour adoption what often really matters is not only the content but the overall impact of the communication. Within this prospect persuasion allow bring forth those elements (like, for example, the emotional ones), necessary for an effective interaction.

Obviously the persuasive interaction can be either monological or dialogical depending on the scenario. In our view, the models used to account for these different interactions will be tightly interconnected, sharing large parts of theory.

In dynamic advertisement the interaction is likely to be monological, while in educational environments it is more realistic to have it dialogical. Moreover a dialogical dimension can be reached not only between the system and the user, but also within the system itself, like with counselling agents that play different persuasive roles, in order to make the user experience even more compelling.

Possible use of persuasive models.

Generally, tools with persuasive aims have only hardwired persuasive features or, on the contrary, deep reasoning capabilities, but these are mainly argumentative and context dependent. However, there is an increasing interest in developing similar systems with deep reasoning capabilities on persuasive elements.

Methodology.

Developing the test bed will consent to:

- Study persuasion models and emotions.
- Integrate knowledge on emotions, language and persuasion within reasoning mechanisms (both for monological and dialogical settings).
- Realize automatic persuasive and emotional multimodal messages.
- Test the results with groups of users, taking into account personality studies.

Extended persuasive capabilities will be achieved, introducing a multiplicity of strategies, related to various types of monological and dialogical interaction.

Prototypes.

The prototypes will be developed mainly:

1. at IRST (for the monological setting)
2. at Univ. of Bari (for the dialogical setting),

with possible contributions by Univ. of Augsburg and others. If possible some components will be shared, certainly implementation of strategies will benefit from common research and discussions. And of course the realization of the prototypes will benefit of the wider work by different partners within the workpackage.

The prototypes will consist of :

- 1) a number of scenario related resources, adapted for the needs.

- 2) A set of strategies and algorithms for producing persuasive effects.
- 3) a subsystem for multimodal interactions (e.g. ECA's, kinetic typography)

The goal of the prototypes is to analyse how the framework described in the previous sections may be employed to generate arguments in natural language (studying, for example in the monological setting, the uses of Rhetorical Relations in the building of complex persuasive messages [Guerini *et al.*, 04]) and to simulate (in the dialogical setting) undermining of the argument which supports a given conclusion, in a persuasion dialog. For instance, some exceptions may be introduced which, in a way, delete or reduce the impact of the strategy [Carofiglio, 04].

Our exemplar will show how the knowledge representation framework that we propose is able to deal with uncertainty aspects of this reasoning process. It may be enriched to include other sources of knowledge which enable generating natural language dialogs. The persuasion component will be seen as part of an affective decision-support system. Models for representing 'induction of emotions' in the addressee (at which we will work in the scope of WP7) will be integrated in the dialog simulation exemplar, as well as a linguistic emotion recognition component at which we will work in the scope of WP4. This integration of components will simulate situations of 'emotional contagion and manipulation' in persuasion dialogs and will provide opportunities for feedback and mutual feeding between the various Workpackages of Humaine.

C. Exemplar 3

An integrated Model of Emotion and Politeness

Brown and Levinson's [Brown & Levinson, 87] theory on politeness propagates some "traffic rules" of social interaction that are inherent in every communication. Basing a model for human-ECA interaction on this theory brings neglected aspects like the interplay of verbal and non-verbal behaviour and the role of emotions into the foreground.

We will design and implement a conversational model that integrates a social theory of politeness with a cognitive theory of emotions. To test our model, we will provide an interface to a concrete animated agent (e.g. the Greta Agent developed by Catherine Pelachaud) that is able to vary its communication tactics based upon the emotional state of the user.

Methodology:

Developing the model will involve the following sub tasks:

- Collecting and analyzing a multimodal corpus of human-human interactions
- Formulation of multimodal communication tactics based on the corpus analysis
- Application of the resulting conversational model to a concrete agent
- Empirical study that compares the user's affective response to the polite and non-polite version of the agent

Prototype:

The prototype will be developed mainly at UA, if possible combining with other constructive work by IRST, Univ. of Bari, and by Paris 8.

The prototype will include:

- ⌘ A repertoire of multimodal communication tactics
- ⌘ A conversational module that adapts communication tactics to the emotional state of a user
- ⌘ Interface to a concrete animated agent (e.g. the Greta Agent)
- ⌘ An experimental environment for the support of Wizard of Oz Experiments

D. Exemplar 4

False emotions in true lies

In human-human communication, emotions are the number-one topic that people lie about and studies show that up to 30% of social interaction longer than 10 minutes contain such deceptions [DePaulo *et al.*, 96]. Endowing technical systems like embodied conversational agents with the ability to detect, represent, generate and/or show emotions, it is thus indispensable to investigate the crucial questions how to handle false emotional expressions from the user and how and when to create false emotional expressions in the ECA.

As a first showcase we are developing the system GAMBLE (Greta's Affective MoBiLe dicing intEraction). This is a small game of dice where one of the game partners is substituted by the Greta Agent (developed by Catherine Pelachaud and colleagues (see also WP6)). To win this game of dice it is necessary to deceive the other players and to detect such attempts by the other players. Because it is unknown if and how users react to deceiving ECAs, this showcase will allow us to investigate in a principled way (i) if users react at all to clues that are described in the literature to indicate a lie when an ECA shows these clues, and (ii) if this is the case, how they react to and interpret these clues, e.g., as a malfunction of the system, as an affront, or as a useful feature that makes the interaction more engaging, (iii) techniques to detect false emotional expressions from the user like speech analysis (strong connection with WP4), and (iv) how to handle such false expressions, i.e., how to react to them.

Methodology

Developing the test bed will include the following subtask:

- Implementing a distributed multi-party interaction system
- Integrating knowledge about clues to detection with the animation of an interface agent
- Implementing reasoning mechanisms for the application domain
- User evaluations to tackle the above mentioned research questions

Prototype

The prototype will include

- An extendable platform to test different number and kinds of agents as well as different numbers of users
- A set of strategies to produce deceptions in appropriate situations
- A set of strategies to decide on non-verbal means of deception.

E. Exemplar 5

A mobile persuasive story-telling guide

We seek to move away from the concept of a guide that has it reciting facts about places or events to that of a 'guide with attitude' that tries to persuade the user through a story-telling approach towards its own world-view of such places and events.

We would achieve this through the development of a synthetic personality with its own attitudes and affective engagement with the guide domain. An affective model and expressive behaviour is here seen as a key to the development of such a personality, in the sense of what constitutes the distinguishing features of a particular person, the externally evident aspects of the character or behaviour of a person.

Applied goal

An augmented mobile environment consisting of 2 virtual agents possessing contrasting personalities, having different perspectives about the surrounding environment. The user will be able to hear different versions of the same event or places depending on the profile of the virtual story-teller. Context aware presentation and a multi-modal interfaces will be explored. The agent is expected to be proactive and have the ability to express its internal state as well as emotional state through animated character behaviours or other means of expression.

The goal is to investigate the impact of perceived personality and expressive behaviour on the knowledge a user acquires from the guide both on retention and on the position adopted by the user, that is, the extent to which they are persuaded of the guide's world view.

Possible use of the creative environment

Generally, this application can be used to enhance tourists' experience during a visit. They will be able to hear about the same historical events or places narrated as different stories depending on the virtual guide's point of view. This feature is also useful for educational purposes as children would be more open-minded if they have the opportunity to explore a situation from different perspectives.

Methodology

Developing the test bed will include:

- Study of models of emotion and personality
- Integration of knowledge on emotions, personality, language and persuasion within reasoning mechanisms

- Formulation of multimodal communication techniques
- Integrating the resulting agent model into mobile technologies
- User evaluation

Prototype

The prototype will be developed at USAL, if possible combining with other constructive work by IRST and KTH.

It will consist of:

- ∞ Different personality models for the agents
- ∞ Algorithms for producing different emotional effects for the different personality
- ∞ A multimodal interaction interfaces

F. Exemplar 6

A participative emergent narrative

Interactive narrative approaches have to deal with a narrative paradox in which the structures required for satisfying narrative appear to conflict with the interactional freedom of the user. Emergent narrative tackles this problem by decomposing narrative hierarchically and maintaining a hypothetical plot at the highest level of abstraction which adapts to the lower-level actions of interacting characters. It also takes the stance of the participant and metrics related to engagement and involvement rather than tidiness of narrative structure and draws on lessons from improvisational and interactive theatre and role-playing games. It deals with the persuasive elements in interaction which support the ‘willing suspension of disbelief’ by a participating user .

Applied goal

The construction of a graphical interactive narrative in which actions emerges from the interaction between characters within a more abstract narrative framework adapting to those interactions. Story management will be incorporated both as a top-level mechanism modeling exogenous variables and by distribution within the architecture of synthetic characters. Affective state will be used as one of the metrics of engagement.

Methodology

Developing the test bed will include:

- Development of dramatic metrics measuring engagement of characters
- Integration of knowledge on emotions, personality, language, dramatic impact and persuasion within character action-selection mechanisms
- Formulation of test scenarios
- User evaluation

Prototype

The prototype will be developed at USAL, if possible combining with other constructive work by IRST and KTH and drawing on WP6 and WP7.

9. Conclusions and Way Forward

At this phase just a limited effort has been put at factorizing common parts or discussing points worth integrating into larger scenarios. We are not emphasizing software integration as this would be too costly with the limited resources we have and would go to the detriment of building instead advanced and well founded prototypes that build on interesting research.

The current state is satisfactory. We assume that we shall need one specific WP meeting to advance in this direction so that we shall be able to present a final version of the exemplars.

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