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METALOGUE Progress Report

PUBLISHABLE SUMMARY

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SEVENTH FRAMEWORK PROGRAMME

Coordinator: DFKI GmbH

METALOGUE: dialogue system with metacognitive abilities

We live in the world where **multimodal natural language-based dialogue** is increasingly becoming the most attractive human-machine interface and it finds applications staring from information offices, cars to smart houses and smart working environments. Such interfaces offer a mode of interaction that has certain similarities with natural human communication by using a number of input and output modalities which people normally employ in communication, e.g. speech, gesture, facial expressions, pointing devices, etc. Some of these interfaces will advance to the incorporation of multimodality into virtual and augmented reality environments, e.g. using embodied conversational agents.

At the same time, existing dialogue systems, by common agreement, do not yet show interactive behaviour that is natural to its human users, and do not have the flexibility to exploit the full potential of spoken and multimodal interaction. In many instances people refuse to use available multimodal language-based interfaces because they are persived as being too artificial and inconvenient. There are several reason why people can communicate effectively and efficiently and computer systems can not is because, e.g.

1. computer dialogue systems do not have the **rich experience and background knowledge** that humans have
2. people are able to **process** and **perform several actions** (both task-related and communicative ones) **simultaneously** (parallel processing) dialogue systems largely are not (if it happens it mostly happens by accident rather than by design)
3. people are able to monitor, assess and reason about their own and their partner's performance (**metacognitive abilities**) and systems are not.

The goal

Therefore, ***the overall goal of METALOGUE*** is to produce a multimodal dialogue system that is able to implement an interactive behaviour that seems natural to human users and is flexible enough to exploit the full potential of multimodal interaction, as well as to evaluate the developed technologies in multiperspective educational dialogue setting.

The key to achieving the METALOGUE's vision of a future dialogue system is equipping the system with **metacognitive capabilities.** The METALOGUE conversational agent provided with sufficient metacognitive skills will be able to:

1. **adapt** its dialogue behaviour over time according to the interlocutor's knowledge, attitude, and competence, and
2. **predict** other people's knowledge and intentions and show proactive dialogue behaviour,

thus, being more "human" than any know artificial systems.

Therefore, to enable fundamentally deeper understanding of metacognitive processes and nature of the acqisition of such skills, the METALOGUE system will have shared and varied responsibilities of observing, monitoring, experiencing and executing different tasks, by presenting similar materials in multiple contexts enabling self-reflection, by becoming aware of different strategies and how they work.

Education and training as applications

The main METALOGUE application will be **an educational dialogue with a multiperspective support.** The reasons to choose this application area include the following:

- It was proven that having better metacognitive skills can help students learn better and self-regulate their learning *across domains* and *contexts.*
- **The educational dialogue and tutoring interventions** provide useful *constraints* and a dialogue framework. Simply saying, it is feasible to attain the ambitious goal of creating a dialogue system, which looks "human", in such setting.
- **Educational dialogue systems** have potentially a *high economic and social impact*, given the high recognition of lifelong learning as fundamental to Europe's long-term success.

As it has been scientifically proven that, since it significantly influences decision-making process, metacognition is critically important in negotiation, METALOGUE devotes attention to **negotiation** tasks. Also, within METALOGUE we aim for two main types of negotiation tasks, and therefore for two main types of target users:

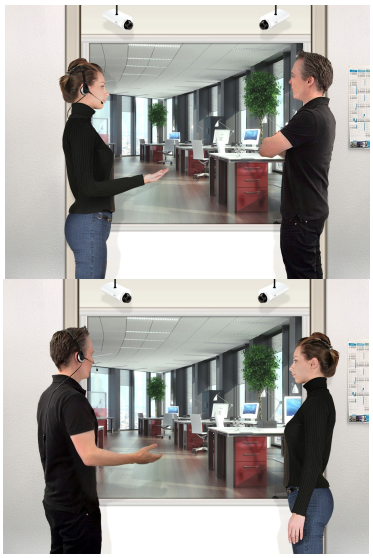
1. The METALOGUE system will be used to **train young entrepreneurs in debating** over policy issues. Use cases will be related to educational scenarios, having as users young trainees related to the Youth Parliament & the Hellenic Parliament Foundation's educational activities and of course their teachers. The project will observe and improve the metacognitive abilities of the trainees, creating societal abilities and skills of the new generation of citizens, introducing them into the modern world issues (rules, obligations, rights, social behaviour and responsibility).
2. The METALOGUE dialogue system will be used by call centre employees (in particular, governmental service providers) to train negotiations with customers. It is designed to deliver a realistic training experience and to make it possible to give quantitative evaluations of how well a given call went. The customer service domain allows room for negotiation and is a prudent choice to test the METALOGUE system.

How it will work…

Metacognitive skills for where BOTH the system and the user will be of importance in different settings, where they will play different roles in the training environment, for example:

1. The system passively observes tutoring session between a user and a tutor (system in observing mode keeps track of human-human dialogue without interfering in it). The complete discourse is recorded for further analysis.

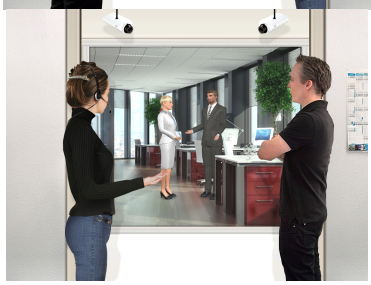
2. The system observing "scripted" tutoring sessions thereby has possibility to intervene, asking relevant questions and influencing the tutoring process by instruct the user to change his behaviour/performance.



3. The system re-plays the user's performance in real time. The user observes his/her own performance. He/she has the opportunity to discuss it with the tutor. The system will additionally allow for re-entering the tutoring session at any point, thus improving the performance as it went wrong.

4. The system actively plays the role of one of the dialogue participants. Human tutor observes, evaluates and guides.

5. The system as a tutor. The system acts as the tutor, guiding multiple users



The METALOGUE system is designed to make use of a wide array of different modalities, such as spoken natural language, facial expressions, body posture and biosensory data. Where appropriate, modalities are designed to be symmetric: a modality available on the input side for user input will also have a counterpart on the output side. That means that the ability to use facial recognition will be complemented by the generation of facial expressions on the virtual characters. This allows for a more natural interaction and is especially useful in multi-party interactions. In such settings, some communication channels may be exclusive to two communication partners (e.g. speech), but other participants can still interact in parallel, e.g., using gestures.

Importantly, the applicability of the METALOGUE system in multi-lingual environments will be demonstrated (English, German, Greek).

Impacts

1. METALOGUE is a significant step in fundamentally deeper understanding of metacognitive processes and nature of the acqisition of such skills, and, on this basis, - in designing computer systems, which behave similar to humans. Thus, METALOGUE will contribute to Europe's scientific leadership in this field.
2. METALOGUE will push forward the technological foundations for designing multimodal dialogue systems employing a spectrum of communication modalities making human-computer interaction more effective and natural.
3. By developing and evaluating educational environment for debate training of young European citizens METALOGUE will contribute towards such European policies as the Strategic framework for European cooperation in education and training ("ET 2020")

4. Advances developed by METALOGUE will become available to European high-tech industry, first of all SMEs, through open-sourcing of major results, therefore inspiring innovation and commercialization of research results.

Progress achieved so far

After the first year, the METALOGUE project made a substantial progress in attaining its overall objectives.

- First of all, the project developed several cognitive models allowing modeling metacognitive processes of humans in the negotiation setting. These models will be used in order to equip the METALOGUE prototype system with metacognitive capabilities.
- The project developed, tested and piloted the methodology of multimodal data collection and processing. Real debate training sessions have been recorded using synchronized set of audio, video (including 3D) and sensor equipment. The data was analyzed and processed to train the METALOGUE system.
- The technical design of the first prototype of the METALOGUE system has been completed. The substantial part of the activities aimed at the implementation of the first prototype suitable for the first round of evaluation has been also accomplished. At the same time, due to the delays with the data collection, which affected the development of the several components of the system, the project reported the delay with the delivery of the first prototype. The release of the first prototype is scheduled for the end of March 2015. The respective deliverables will be delivered by the end of April 2015 (a 4-month delay). The consortium has a clear plan for compensating this delay during the second cycle of the project, therefore the second testing and evaluation pilot will be implemented in accordance with the schedule.
- The principles and settings for the system testing and evaluation have been developed.

The first evaluation of the system involving real users is planned for June 2015.