Adaptive Simulation For Multicultural Dialogue Training

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Abstract

The creation of effective virtual training simulation tools that adapt to trainees' past experiences or preconceptions is extremely challenging. Researchers working on the ImREAL project are aiming at closing the gap between the 'real-world' and the 'virtual-world' by developing a simulated learning environment focusing on simulation systems for interpersonal communication in multicultural environments that responds to users' behavior and adapt accordingly to the user model.
This paper describes the design of an adaptive dialogue simulator that models real world activities in the field of intercultural competence. Real-life experiences are gathered and categorized in micro-activities in order to identify key elements of 'real-world' activities. This enables to crate a simulation environment based on real-life situations that provides new opportunities for assessment, feedback, and learning in general. The aim is to develop a 'self-growing' adaptive simulation which embeds a 'virtual mentor' helping learners reflect on the experience they work through.
The key challenge for the design of the simulation is to develop concepts and innovative services that support the intelligent augmentation of the branching story for experiential learning (simulation environment) with real-world content that is collected, tagged and sorted in an intelligent way by a set of semantic services in a special dedicated real life experiences collection environment.

1. Introduction

Simulations can be very effective training tools if well designed and respecting the individual training and support needs of a certain person. The ImREAL project, an FP7 ICT Research and Development project (www.imreal-project.eu) aims at intelligently bridge the 'real-world' and the 'virtual-world' by developing simulated learning environments focusing on interpersonal communication in multicultural environments that responds to users' behavior and adapt accordingly to the pedagogical model.
One of the core elements of the development process is the design of the simulation environment that a) starts on the modeling of real world activities based on the Activity Theory [3,4,5] b) and includes adaptive dialogues, i.e. adapt according to the user model and real world activities in the field of interpersonal and intercultural competence. Real-world experiences are observed and categorized in micro-activities supporting the identification of the key elements in the real world activity that have to be included in the simulation environment for providing an authentic learning experience. This approach supports the creation of a very authentic simulation environment based on real-life situations and supports the capture of tacit knowledge that is often difficult to verbalise and share with others.
Furthermore the simulation will be augmented by ImREAL services that instantiate real world experiences reported and comment on open social spaces (e.g. storytelling blogs, YouTube, training environment forums and blogs, etc.).
Expected improvements through the augmentation of the simulation environments are the creation of very authentic simulated learning scenarios and to develop a more efficient way to design them. The term "self-growing training scenario" describes the process of improving the feedback to learners by means of harvesting the feedback gained from analysing the users' interactions with the system. In this process the system will constantly adapt to the users' needs and grow to their expectations.

2. Simulation in the ImREAL context

Simulations reproduce the real world by representing selected real life activities, in an often very authentic and immersive way. Simulations facilitate experiential learning, i.e. the significant application of knowledge [1]. According to different authors (Rogers 1969, Knowles 1970, Combs 1982, Rogers & Frieberg (1994), etc.) experiential learning is facilitated when the learner is supported to completely participate in the learning process and has control over the learning scenario and direction; furthermore, learning takes place upon confrontation with practical, social, personal or research questions. And these are the main pedagogical motives for the development of simulation in the ImREAL context.

Simulations can be classified according to their teaching approach, e.g. Alessi and Trollip (1991)[6] classified simulations in two types “for teaching about something”, i.e. physical and process simulations, and “teaching how to do something”, meaning procedural and situational simulations; their educational intention, in the context identifies Prensky (2004) [7] two types in the: “predict” what-if scenarios, “teach” (e.g. models) and entertain”. Furthermore simulations can be classified according to their genres, e.g. Aldrich (2005) [8,9] identifies "branching stories”, “interactive spreadsheets”, “virtual labs” and “game-based models".

2.1 Real world and simulation model

In the scope of ImREAL Role-based branching simulations will be developed that allows the learners to take on different roles based on the re-creation of the real-world event according to the pre-defined activity model. The simulation in ImREAL will involve constructivist elements with co-learners and domain experts co-creating the learning environment by tagging, commenting, adding further options and reporting on their concrete experiences in the training domain.

The structure of a branching story conceived for experiential learning (simulation environment) will be enriched and updated with new real-life content that is collected, tagged and sorted in an intelligent way by a set of semantic services in a special dedicated real life experiences collection environment. Additionally the “Intelligent environment” suggests the appropriate add-in place within the branching story. These suggestions will then just have to be accepted or rejected by a human expert. Also, while interacting with the branching story, the user is allowed to add some options in natural language that will also be initially sorted by the intelligent services. The last step of the foreseen development will be to implement intelligent functionalities that allow the system to react in real time to free inputs from the user.

3. The training scenario

The training scenario embeds the “self-growing adaptive simulation for training” in interpersonal communication in a multicultural environment and provides a fruitful setting to gradually improve the simulation scenario with the provided user feedback and inputs to reflect the user experience in both the simulated world and the real world. The system will take input like semantic annotations from users to adapt the presentation of learning content accordingly and therefore adapt to the expectations of the learners. The training area will be used to augment the virtual training simulator.

The training scenario is the “buddy programme” (Erasmus) at the University of Erlangen-Nuremberg that brings together students from one European country with exchange students from abroad. Students supporting foreign students as well as their tutors are trained in the fields of intercultural competence and interpersonal communication.

This field of application provides a suitable intercultural and interpersonal communication as integral part of the everyday work, thus allowing the integration of real and virtual world.

Key concept in the ImREAL process is the services supported development of the simulation environment according to the real world activities. Three main phases can be identified in this process:

- In the initial phase of the simulation design real world activities will be identified by means of observation (6 to 10 users). Different tools and methods such as videos, interviews and diaries, and storytelling are used for the observation and the detailing the real world activities. Through these methods a very high level of granularity of the activity will be achieved, which is extremely important in order to identify which aspects are important to be captured from the real world in the simulator. The aim of this observation and reporting phase is to derive a

bootstrap activity model. “Intelligent ImREAL service supports the development of the simulation branching story by identifying the activities and key aspects for training (e.g. non-verbal communication as important abstract tool at all phases of the activity process)

- In a second phase and after the first simulation development process according to the real world model, the simulation environment will be enriched through the user interaction, i.e. each user (learners, trainers and experts) interaction. Different tools for adding and commenting are embedded in the simulation environment. The “Intelligent environment” suggests the appropriate add-in place within the branching story. These suggestions will then just have to be accepted or rejected by a human expert. While interacting with the branching story, the user is allowed to add some options in natural language that will also be initially sorted by the intelligent services.
- In the third phase the simulation will be constantly updated according to the semantic user model being developed in the context of the ImREAL project. The user model supports adaptive content creation, i.e. augmenting the simulation environment with real world experiences provided by domain-experts, peers and retrieved from different types of open social spaces. The last step of the foreseen development will be to implement intelligent functionalities that allow the system to react in real time to free inputs from the user.

3.1 Embedding the simulation in the training environment.

The simulation is part of an overall online training scenario. The buddy training program foresees four e-Learning modules on key topics of interpersonal and inter-cultural communication. These modules are supported by four real world simulations (as above described) that make it possible to apply and test acquired knowledge under authentic “work” situations. The Training environment will be enriched through the real world experiences, which are triggered by the user model. The real world experiences are integrated in the training concept by semantic tagging and the competence ontology.

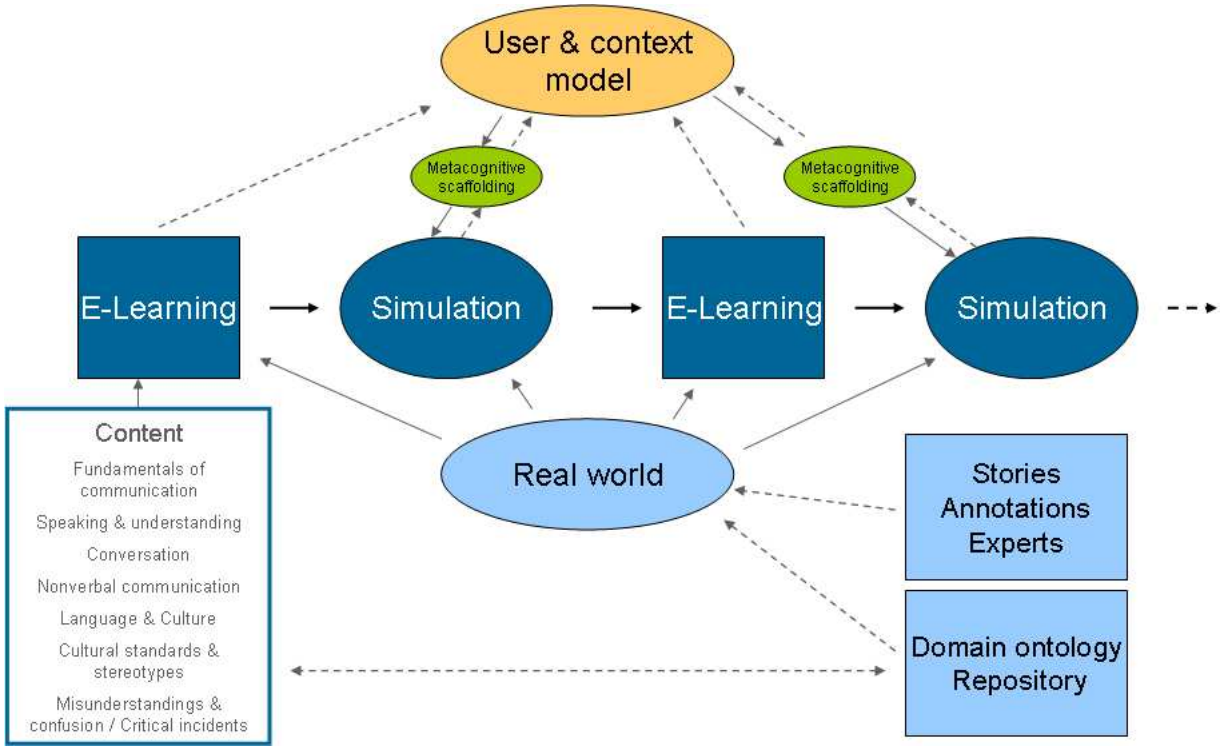

Figure 1*The buddy program training concept and ImREAL services (user and real world model, metacognitive support based on micro-adaptivity.*

3. The simulator

The simulator we are building upon to implement the previously described scenarios is a web application that starts with the structure of a branching story: in each step users interact with the system choosing between a set of possibilities. The choice they make determine the next step; thus users go through different paths and get different feedbacks about their interaction according to the sequence of choices they made. This structure is particularly indicated to simulate dialogues. During the interaction, when the user makes a choice at a certain step, the next step can be pre-determined (according to the previous choice), but it can also be extracted randomly between a set of possible next steps (that can come logically after the previous choice): the preferred behaviour of the system at each step can be set while creating the branching story. This means that in the same branching story we can have both pre-determined sequences and random nodes.
Within the frame of the ImREAL project, we are planning to extend our system by adding more functions that make it highly adaptable, specifically:

- user adaptability: in a given step, the system tries to offer selected user-specific content (questions, answers, possible choices) according to user profile and preferences as well as user interaction up to that step (considering the sequence of his choices up to that moment)
- user-added extra-content: in a given step, when having to chose among some options, users have the possibility to add extra options using natural language in a specific field, e.g. to share their past experience. Provided information is stored (and does not influence the system immediately) and can be used to extend system contents
- improve and personalize user feedback (based on user profile and interaction with the simulation) exploiting intelligent semantic services
- interpreting natural language: semantic analysis of user-generated content and user responses in natural language. If this is true, in the previous case (user-added extra-content) the system is able to respond to user interaction in natural language is a way very similar to a human being
- semi-automatic content augmentation based on intelligent semantic services to update and enrich existing content of the simulator

What is of particular interest in this context is the possibility to add a so-called “Content Repository” that allows to better match Storytelling and experience collection with the simulation guaranteeing at the same time that the contents of the simulation are never obsolete as would be a static screenshot of reality taken at a certain moment in time. The Content Repository contains user-generated content describing past experiences; this can be e.g. in form of a story or of a structured interview. But it could also be a sort of blog or interactive system where experience based discussions happen and user content is continuously updated and commented. The Repository is analyzed and filtered by a Semantic Engine that selects the content based on its ontology (as configured by the human operator) and suggests matches with the content structure that already exists. This means that suggestions are done automatically as to where the new content might be added to enrich the base of the simulation. The operator building the story, a domain expert, must then approve the result of the filtering before the new content can be added to the content available for the simulation.

4. Future work

In the scope of ImREAL the described self-growing adaptive simulation environment is being developed. The key focus lays on aligning real and simulated world in a pedagogical meaningful way and the creation of personalised and contextualised simulated learning experiences that allow for the integration of real and virtual world. At the end of the first conceptualisation phase, the project members are preparing the development of the ImREAL services in an iterative user and research-centred approach. As soon as the first development phase is finished extensive user-trials will be

initiated aiming at constantly evaluating the development progress from a pedagogical and technological point of view.

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