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EmbodiMentor: a science fiction prototype to embody different perspectives using augmented reality

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ABSTRACT
This paper describes the EmbodiMentor, an interaction concept and metaphor that aims to enable users to embody a different person or character's perspective, specify or modify his/her/its emotional elements and conditioning elements, and experience the resulting changes. Its use case scenario is the education and training of foreign languages and intercultural communication skills, were contextualization and first person experiences in common settings are key for practical skill acquisitions. It was born as the micro-science-fiction prototype "*Frances can't sleep. She crawls out of bed and with her EmbodiMentor runs through a range of a client's emotional states, pitching to each one. She then falls asleep.*" The application of the science fiction prototyping concept has been proven a strong approach to develop and investigate innovative applications of emerging technologies.

CCS Concepts
• Human-centered computing → Interaction design → Interaction design process and methods → Interaction design prototyping.

Keywords
EmbodiMentor; Science Fiction Prototyping; Augmented Reality; Virtual Reality

1. INTRODUCTION

"*Frances can't sleep. She crawls out of bed and with her EmbodiMentor runs through a range of a client's emotional states, pitching to each one. She then falls asleep.*"

We created this micro-science-fiction prototype (μSFP) during a hands-on workshop at the recent iLRN 2016 conference [1]. The Science Fiction Prototyping method involves extrapolating current practices, bounded only by imagination, in order to inspire future technological and scientific research, exploring the disruptive or world-changing potential of innovations on several dimension and provides an inspiring way to investigate possible usage and implications in practical daily-life situations (ibid.).

In this μSFP, Frances is an American sales representative who has been preparing an elevator pitch for an overseas client the following day. It has been going well, but she fears being overconfident, due to cultural differences. She can't guess how stressed or relaxed the customer will be. Whether she'll find the client in a business-focused stance or just out of personal dilemmas, whether calm or irritated. Since she is a native English speaker and will be pitching in the client's language, she may not be ready to master the diplomacy required by these nuances using a foreign language. Advanced foreign language education and intercultural interaction training requires contextualization and practical experiences in real settings or in a realistic but also safe environment [15,16].

Rather than running though pre-prepared talking points, this μSFP imagines Frances using a conversation-training avatar to practice her foreign language conversation skills in these various conditions. But not just an avatar with canned responses or behaviors that she knows little about. By bodily entering that avatar, she is presented with the range of emotional and background elements impacting the avatar's conversational stance and behavior. Then, by manipulating them, she in effect specifies the conditions in which the conversation is taking place, from the perspective of her client. This enables her not only to practice but to reflect and build her personal interpretation of the intercultural differences behind the conversation and behavior of others.

In this paper, we provide the background for the EmbodiMentor concept, explaining its relevance and application domain. We then describe our imagined EmbodiMentor and detail how it could be achieved, referencing the literature that supports the various concepts in their current state. We complete with a short reflection on problems and opportunities arising from this concept.

2. BACKGROUND

Science Fiction Prototyping (SFP) was introduced in 2010 by futurist Brian David Johnson as a creative arts way to explore, experience and design the future by emerging in near-future possible technologies based on science facts. The idea is as simple as powerful, following these steps: (i) build a future world based on selected future technologies, (ii) investigate scientific inflections, ramifications on society and humans and their inflection points, and finally (iii) draw conclusions /lessons learned. The realization of such science fiction prototypes can results in narrative stories,

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comics-style stories, videos, multimedia, and virtual world environments. An advanced approach, inspired by agile software development and the application of virtual world environments, has been proposed by Pirker, Gütl & Weghofer in 2014, which applies an iterative design approach based on the above mentioned three steps: (i) design and planning, creative content creation and reuse in 3D environment, flexible settings in a collaborative 3D virtual environment, (ii) experiences of created setting in virtual world, (iii) reflection, (iv) adaptation and enhancement of setting [17]. Micro-SFP or µSFP is a recently emerged concept which combines 3 concepts: science fiction prototyping, micro-fiction (very short stories, some as short as 6 words), and Twitter and texting (160 characters). It tries to keep the length of the story to a minimum but emphasizes one main aspect of the future scenario based on new technologies [18].

The EmbodiMentor µSFP can be seen as extrapolating several current ideas, trends, and practices. Firstly, we extrapolate the current technologies for augmented and virtual reality, from clunky wearable props towards seamless virtual elements that are so much part of our daily lives that we can stumble out of bed in anxiety and a cloudy mind and still use them. Headsets for virtual and augmented reality are becoming available for the consumer market, such as HoloLens, Oculus Rift; 3D screens and projections and even cave-like environments getting more affordable, scenarios and applications are becoming more realistic in virtual settings but also in augmented reality scenes [19,20].

Secondly, we extrapolate current motion-detection technologies as well as object and geometry detection of users' surrounding environments in a similar fashion, so that the term "embodying" acquires a literal meaning. Satisfactory gesture and facial expression detection system are already available on the consumer market, such as Kinect [21,22]. Advances has also been made in emotion detection [23], and even brain signal detection is advancing in directions supporting the proposed idea [24].

Thirdly, we extrapolate the current concept of "embodied empathy for a complex system" as proposed by James Paul Gee [2], where learners at the cutting edge of mastery act and talk as if they are bodily inside their topic, seeking to "to participate in and within a system, all the while seeing and thinking of it as a system and not just local or random events" (ibid).

Fourthly, we envisage the EmbodiMentor as a tool, not a system. A tool employable with other, purpose-specific systems, e.g. conversational applications, games, or even fully immersive simulation platforms. This in turn will require an evolution from the current monolithic state of such platforms into an open world of interconnected immersive software. Some early work towards this has started to appear [3], making this also a not too far-fetched extrapolation.

Lastly, we extrapolate from current techniques and systems for end-user computer programming, which have a long history of enabling children and adults program computational systems without having to master a professional programming language. From programming by demonstration or example to using spreadsheets, from developing games to setting up instruments, it is a field with a large and growing body of literature, know-how, techniques and tools [4]. Our extrapolation in this final element is imagining this body of knowledge being applied to mood, personal stories or personality traits.

3. THE EMBODIMENTOR

3.1 Entering a character's background with the EmbodiMentor

In our µSFP, Frances gets out of bed and prepares to run a conversational application, her artificial intelligence dialogue partner. This might be part of a serious game, part of intercultural training package, or indeed some other training or educational application. But the EmbodiMentor is not part of it: instead, it is one of her personal tools, which she reaches out to (e.g., Fig. 1).

Thanks to interconnection between augmented reality services and other supporting services, she can use it to embody a character and gain insights into that character's perspective. Naturally, scenarios and activities can be replayed, analyzed, adopted and trained multiple times. This interconnection requires the research and development communities on augmented and virtual reality and games/simulations abandon their current monolithic approach to application development. Rather they need to embrace the practices now common in other, longer-developing software systems, where service-oriented architectures and open protocols and data formats are becoming widespread. The new approaches not only rely on advanced technologies and computer science subjects, but in an interdisciplinary way also need to integrate cutting-edge research on foreign language education, and cognitive and social science, in particular intercultural interaction and communication.

Figure 1. The EmodiMentor should be usable as but one of many tools in a user's augmented reality palette

(Image still from the video Lightspin, retrieved from https://lensvid.com/inspiration/lightspin-new-experimental-photography/ on July 18, 2016.)

3.2 Seeing and manipulating moods

Some artistic impressions of mood visualization have come up in recent years. For instance, in Fig. 2, a still from the short movie "Sight", the main character sees another character's mood described as partly anxious, partly impatient and a wee bit unimpressed. But this is shown from an external perspective. Using EmbodiMentor, one could indeed embody the character's perspective and witness reality under that perspective. For instance, instead of just an abstract "anxiousness" meter, that might be associated with a short snippet of life story, running in a loop, imparting concreteness to the meter. If a character is taller or

shorter, Frances may find herself looking down or looking up upon herself. Being visually impaired, biased, prejudiced, could be reflected upon visual elements, upon her own persona or as visual cues alongside mood elements, pictures or short clips, helping Frances consider a wider perspective of the mood and behavior of the character with whom she has been or will be interacting and having a conversation with.

Figure 2. Mood and emotional elements can be part of a character's configuration

(Image still from the video Sight, retrieved from https://www.youtube.com/watch?v=lK_cdkpazjI on July 18, 2016.)

A particularly inspiring artistic approach has come fore in 2015 in the movie Inside Out. In this movie, each character's mood and actions are determined by his/her own emotions, personified as internal characters at a control panel: Joy, Fear, Anger, Disgust and Sadness (Fig. 3). Rather than using it as an explanatory metaphor, we can envisage this approach as a configuration metaphor, by controlling which persona is in control or a similar metaphor. While this is possibly a basic, oversimplified approach, one may propose its evolution into a more complex and scientifically-sound representation of a character using concepts such as the dimensional models of personality traits employed by the American Psychiatric Association for assessment of personality disorders [6].

Figure 3. Inside Out movie's personified emotions at the mind control panel of the movie's main character

(Image retrieved on July 18, 2016 from https://i.ytimg.com/vi/-kArxASiw3Y/maxresdefault.jpg.)

3.3 Interacting with the characters

Once a character has been configured or edited, the conversation can be a plain simulation/game interaction. However, the EmbodiMentor can continue to be active, by providing the learner with cues to help her (Frances, in our μSFP) understand the development of the conversation. This could look like the cues in Fig. 2, and could be helpful for learning intercultural differences and communication. One may look no further than idioms, which are a common source of puzzling for non-native speakers. EmbodiMentor could be active while the conversation is ongoing and provide cues about idioms, enabling the learner to stop and review their meaning, possibly in connection with the characters' attitude and mood (Fig. 4).

Seen from a broader perspective, the EmbodiMentor could act in support of not understanding or misunderstanding conversations. In any dialogue, participants' backgrounds can lead them to "*make different assumptions about one another's actions, construct different interpretations of discourse objects, or produce utterances that are either too specific or too vague for others to interpret as intended*" [7], which can be heightened by differences in native languages and indeed intercultural differences in general. For instance, interpersonal relationship patterns can vary significantly between East Asian speakers and North American speakers, and consequently communication patterns are also starkly different [8].

This support can be not only the possibility of showing interpretation cues, but actually enabling the learner to stop the dialogue and embody the character at that point, witnessing and exploring that character's perspective. We imagine being able to rewind and replay the conversation, but from within the characters' internal perspective, this time with our own image being overlaid with our artificial intelligence dialogue partner's perspectives and interpretations being overlaid on our previous conversational interchange.

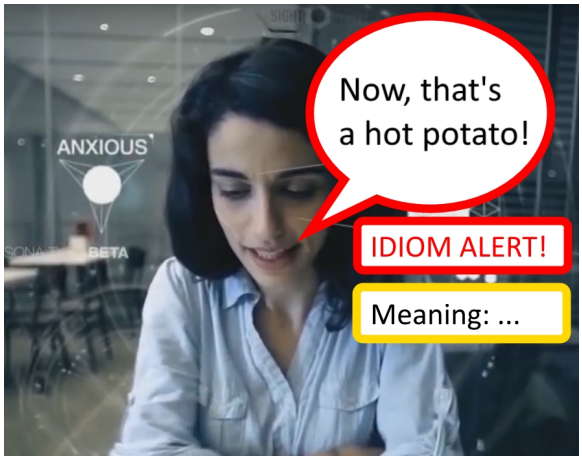

Figure 4. Mood and emotional elements can be part of a character's configuration

(Edited version of Figure 2.)

4. PROBLEMS AND OPPORTUNITIES

While the realization of the EmbodiMentor appears to be an exciting prospect, it is still, as presented, only a piece of technology. It is enabler of various interactions, but what our μSFP does not address is the educational or training perspective behind it.

Enabling the learner to explore behind-the-scenes into the emotional state of a conversational character implies that the learner takes an adequate reflective stance, hence the pedagogical framework or approach must enable, encourage, and support it. There have been efforts to develop adequate theoretical ground for reflective conversations, but the complexity of the problem remain taxing. Particularly since it requires combining learning theory and communication theory, across multiple dimensions: the intercultural and communication practice dimensions mentioned earlier in this paper, but also others such as identity development, group actions, and others [9].

Moreover, the use of the EmbodiMentor requires not only for the learner to adopt a reflective stance, it requires she/he then acts upon that reflection to modify the mood and background of the artificial intelligence conversation partner. That is, the theoretical framework behind its use requires not only a reflective stance, but also a decisive departure from instructional teaching approaches, towards the constructivist paradigm. Indeed, it calls upon for the learner to create his/her own learning situations, putting theory into practice by generating hypothetical scenarios [10]. This reification of the learners' knowledge as a "test of reality", as a concretization of the abstract, in Wilensky's terms [11], is the core of Papert & Harel's constructionism proposal [12]. This theoretical background is being used in language learning, by resorting to artifact-building tasks (dictionaries, shared storytelling) as mediators reifying knowledge for leaners [13]. The EmbodiMentor, if we envision it as a shareable tool, one that allows multiuser participation and sharing of its artifacts, i.e., sharing of its mood and background setup of the conversation partners, may just become a strong enabler of constructionist pedagogy in the learning of language and intercultural communication – and that in itself is and enticing prospect. Still, a challenge of constructionism in formal educational settings is the issue of uneven achievement. Albeit some measures to overcome it have been researched and proposed in other domains such as technological literacy [14], expanding its use towards a novel interaction mode and domain will require significant research and exploration to become feasible.

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