

Social Agents for Learning in Virtual Environments

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Abstract. Several serious games have been proposed to practice communication strategies in formal contexts. Intelligent virtual agents (IVA) can be used to show the player the effects of a conversational move. In this paper we discuss the key role of using social context for the virtual agents in these serious games. Social practices are exploited to bundle social interactions into standard packages and as a basis to model the deliberation processes of IVAs. We describe a social practice oriented IVA architecture used in the implementation of a serious game for the practicing of communication in medical interviews.

Keywords: Social practice · IVAs · Serious games · Conversational agents

1 Introduction

In the present day society social skills become more and more important. A growing body of research considers the possession of adequate interpersonal, social and communicative competences as necessary for ensuring social, psychological and occupational well-being [1]. Moreover, the role of social skills as a predictive factor for academic or professional success has been broadly acknowledged. People are more assertive and also in many professional situations traditional power ascribed to roles no longer exists to the same extent. This means that professionals in many occupations have to train their social skills to cope with this new situation. E.g. policemen in the street have to be able to stay calm and quiet down quarrels and fights between groups of people and doctors have to learn to talk to their patients in a respectful and empathetic way.

Several researchers underline the importance of the observational learning for training strategies aimed at social skills acquisition [2,3]. In particular, Bandura [2] hypothesizes that “behavioural, cognitive, and affective learning from

direct experience can be achieved vicariously by observing people’s actions and the consequences for them”. Through “role playing” it is possible to practice the desired behaviours in a controlled setting [1]. However, this approach can be difficult and expensive; often actors are used to train students, but each student can only practice a limited number of times in these realistic settings. Serious games can be exploited as an innovative and valid approach and virtual agents can be used to bring social elements of interactions into simulations [4,5]. The players can interact with the agents to experience the social effects of a conversation [6] and also to better understand how the social structure, the social practice and the social agents involved in a social interaction determine the actual conversation and the utterances that are used [6]. Therefore, virtual conversational agents seem perfect to provide learners with a continuous feedback about the social effects of conversational choices on the interlocutors [7]. However, the most of serious games for communicative skills training use scripted scenarios where the user’s choices are limited according to an instructional design approach so that the scenario will be known after a few runs [7]. Although the efficacy of behavioural approach is proved, a greater degree of freedom during the interaction could support the user in a knowledge construction process according to a constructivist approach. Moreover, despite of an increased attention for the development of “more social” conversational agents [8], having a social identity [9] and being able to recognize the social attitude of their interlocutors [10], to the best of our knowledge, little has been done to put social context at the basis of the deliberation in conversation. Including social context could lead to adding excessive complexity to dialogue management: all the conditions that characterize the state of the conversation, and the effects of the choices on different variables related to the state of the dialogue and the interlocutor must be handled at every dialogue move, complicating the writing of the knowledge base of a conversational agent.

In a previous work [14], we proposed the use of *social practices* [11] as a way to bundle social interactions into standard packages. Social practices are used by people as well to direct and limit the interactions and set expectations. Thus we recognize social chitchat, bad news conversations and formal meeting dialogues. Each come with a set of rules that are usually followed, with actors that play a certain role in them and each have some predefined purpose. While in the previous architecture we focused only on the process of context analysis and choice of the proper social practice, in this work we deeply discuss the role of social practices in the serious games formalization, proposing a new architecture and a prototype of a game designed for medical students aimed at practicing social and communicative skills.

2 Role of Social Context in Serious Games: A Case Study in the Medical Context

Nowadays several serious games have been proposed to practice communication strategies especially in a medical context [7]. These games often exploit intelligent virtual agents to simulate a conversation with virtual patients. In this

kind of games, it is important to correctly manage the social context in order to obtain a realistic behaviour for the agent and a proper evaluation of the player's abilities. At the same time, it is important to put the students in a complex learning path where the student has to cope with different situations in order to sense others feelings and perspectives, taking active interest in their concerns as well as recognizing one's emotions and their effects. A role play strategy where students experience different roles and scenarios, could lead to a better understanding of the worries of the patients and experiment what are the situations that lead to a greater openness in the conversation. The approach also fosters abstraction and reflection processes thus improving the effectiveness of medical patient dialogue [1]. In addition to the doctor role, players can act as patients and family members, observing from time to time, the reactions of patients in different social situations. As an example, the player can experience the difference in the patient behaviour if he plays the role of the personal doctor of the patient or if he plays the role of a substitute doctor that must gain the patient trustfulness. This implies a modelling of different behaviours and plans of actions for the agent, according to the specific social situation that involve specific social roles, plans, expectations and so on. Let us suppose that the agent acts as a patient usually having a strong headache. In a practice of consultation with his personal doctor, that is already aware of his situation and the symptoms that come with it, the patient's expectation is to quickly obtain the medicine prescription, therefore his plan consists of a sequence of actions related to the conversational protocol that he will soon carry out to obtain the therapeutic treatment. In an unexpected practice of consultation with an unknown doctor the agent expectation is that the doctor properly introduces himself and explains the reason of this substitution. Moreover, the conversation plan changes because the patient must give to the doctor all the required information about his health history. Different situations lead to different goals and plans of actions and also to different reactions of the interlocutor to the same event. As an example, if the substitute of the doctor recommends the patient to further examine his situation by making a CAT scan, the patient is confused and worried. He does not trust this doctor enough to understand that maybe a further check of his health situation can be a good thing. His reaction would certainly have been different if the request had come from his own doctor or if he deliberately went for a visit with an unknown specialist. Therefore in the waiting room he could start a conversation with other patients in order to obtain some useful information and to have some psychological support. As consequence, the virtual agents must be able to adapt itself to the different situations and at the same time the player behaviour must be evaluated according to the different scenarios designed in the game.

3 The SALVE Game

In this section we describe the initial steps in the implementation of a serious game for practicing communication in the medical context. SALVE stands for

“Social Agents for Learning in Virtual Environments” and it is a dialogue-based serious game in which the player can experiment different scenarios and act in different roles. We choose the Italian term “salve” to highlight the importance of social context in communication, because it is an appropriate greeting in various social circumstances. The game allows the player to practice his skills by interacting with a virtual agent. The aim is to offer the player a realistic simulation where he can observe the effects of his conversational choices on the dialogue progress, the reactions of the patients and where he can obtain a final evaluation that summarizes his social, communicative and professional skills. At the beginning of the game the player can select a specific scenario to practice. At the moment we have implemented an “anamnesis scenario” where the player acts as the personal doctor of the virtual agent, but future scenario will allow the player to act as a substitute of the personal doctor, a relative or another patient with similar health problems. Moreover, he can select the skills that he wants to assess during the game. The game offers the possibility to obtain an evaluation of social, emphatic, communicative and professional skills. The core of the game is a social context management according to the social practice theory, that drives the formalization of the agent processes of knowledge representation, understanding and deliberation.

3.1 Social Context Management

We use the theory of social practices in order to support the management of social context in serious games. A social practice refers to a routinized type of behaviour typically and habitually performed in a society. The sociological theory studies the behaviour of groups of people and their interactions according to social practices [11]. In [13], the theory is analyzed from an individual perspective in order to incorporate it into an agent architecture. The aim of the model is to provide a representation scheme that allows the implementation of cognitive agents able to use the social practice as a first-class construct in the agent deliberation process [13]. According to this model a social practice is characterized by a *Physical Context* describing resources, actors and places involved in the practice, and a *Social Context* indicating their social interpretation within the practices: actors will have *Roles*, the involved elements a *Social Interpretation* and proper *Norms* identify the rules that are expected to be followed inside the social practice. The model is also characterized by the *Activities* that an agent can perform in the practice, where the activities have a specific *Meaning* and require some *Competences* from the agent to perform them. The actors build *Plan Patterns* to reach a specific goal in the practice; a *Plan Pattern* is a sequence of expected scenes, where each scene is associated with a subgoal. The achievement of a goal triggers the transition to the next scene. The actors can force the transition to other scenes. In this case there is not a correct observance of the social practice, some goals cannot be fulfilled and this has consequences for the reaction of the interlocutor and on the final scores. (e.g. closing the conversation before properly explaining the proposed treatment).

The formalization of the game according to social practices has several advantages. A social practice gives the context to properly interpret the games events and their effect on a set of dimensions of interest. Putting social practice at the base of the agent's deliberation simplifies considerably its formalization, as discussed in [13–15]. In fact, in this way the analysis of an event is correctly managed and differentiated according to the current practice, the current scene inside the practice and finally the game state inside that scene. Among the dimensions of interest, it is possible to consider the agent's emotions and some dimensions related to the player behaviour that can be used to evaluate his final score. The patient's expectations change according to the social situation and the fulfilment or not of these expectations leads to specific emotions. In this sense social practices are useful to define in a simple manner the emotional reactions of the agent. Another advantage concerns the player evaluation, since his behaviour and in particular the observance of social practices allows for an implicit evaluation of social and professional skills, as will be further discussed into the Sects. 3.2 and 4.

3.2 Player Skills Relevant for the Game

The game is aimed at the evaluation of a set of skills that are important for a physician. In the literature several models have been proposed to assess social and communicative skills either in general but also in the specific context of medical consultations [16–18]. For example, a physician must have enough motivation, the ability to give convincing information to the patient, showing empathy and controlling bad emotions. Indeed, these features are fulfilled if the doctor follows the correct practice of consultation. Therefore, starting from a correct model of the social practices involved in the medical context it is possible to assess many of these skills analyzing the observance of the player of the practices. We therefore consider some main skills that correspond to specific scores in the game and that can be chosen by the player at the beginning of the game. The first is the *Social Interpersonal Behaviour*, the ability to assess and follow correctly the different social situations and medical protocols. As an example, consider an anamnesis scenario where the observance of the social practice of consultation with an unknown patient requires a correct greeting and introduction of the doctor, a properly conducted interview to deepen his health history and the current health problem, a proper information giving phase, and a detailed explanation of the therapy. Another important skill is the *Emotion Elicitation*, that we consider as the ability to elicit positive emotions in the patient, avoiding negative ones. According to the specific social situation the actors of a practice have expectations that, if confirmed or not, generate specific emotions. Therefore, the emotional internal state of the agent depends on how the dialogue flow confirms his expectations in a practice. A proper model to formalize the elicitation of emotions in the agent is the OCC model, and in particular the revisited model of Steunebrink et al. [19]. The model summarizes in a hierarchical structure the conditions that elicit emotions and the variables that affect their intensities. The emotion, classified in 22 types, can be a consequence of events, actions of other

agents or aspects or objects that appear in the environment. Another important skill for a physician is showing *Empathy*, the ability to be aware of the needs of the patient, understanding his feelings, concerns and perspectives. Communication events have been classified in [18] according to the expressed empathy. This classification has been made analyzing a set of transcripts of medical consultations, considering the physicians answers to what is called an *Empathic Opportunity* and verbal expressions of emotions by patients that create an opportunity for an *Empathic Response*. An empathetic opportunity can be direct or potential if it is possible to infer an underlying emotion. The empathy skill of the player is therefore evaluated by checking if the player misses the empathetic opportunities in the course of the game or if he uses these opportunities properly. Finally, we consider also the evaluation of *Communicative Skills*, consisting of the ability to listen to the interlocutor, keeping his attention, giving feedbacks, answering in time and choosing appropriate wordings. Another skill that could be considered in future work is the evaluation of a *Self-awareness and regulation skill*, consisting in the ability to properly recognize one’s own attitudes and preferences, select the appropriate skills and manage the internal impulses.

3.3 The SALVE Architecture

Let us consider that the agent has already identified the current social practice [14]. This identification influences the agent’s beliefs and drives the understanding of the dialogue and its conversational choices. This is accomplished by the main module of the architecture, named *Interaction and Representation and Interpretation* (R&I) module (see Fig. 1). The game architecture considers also

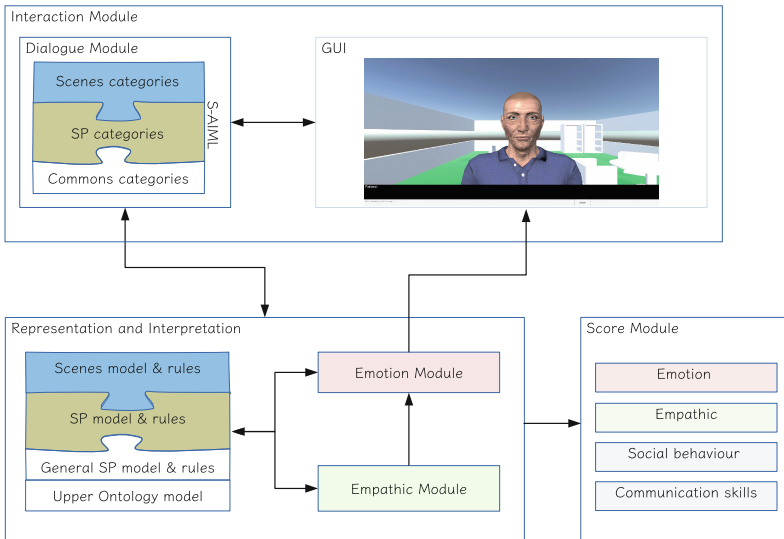


Fig. 1. The SALVE game architecture

a score module used to assess the player abilities. The following sections describe these modules in more detail using the anamnesis practice as example. The practice takes place inside the doctor’s office at a visiting schedule time and involves two actors, assuming respectively the roles of the personal doctor of the patient and the patient itself. In the following sections we refer to a plan associated to this practice aimed to the arrangement of a health care path for the patient. The plan assumes the accomplishment of dialogue activities such as *greetings*, *health problem description* and *therapy acquisition*.

Interaction Module. The interaction module is composed of a graphical interface where an avatar is used to express the emotions and reactions of the patient, and a *dialogue* sub-module that allows the agent to manage the conversation, interpret the utterances of the players and recognize events. The dialogue sub-module is implemented by means of the S-AIML technology [20], an extension of the AIML language [21], that allows to bind the categories to specific practices and their activities. The S-AIML language and its relative processor, are enhancements of the traditional dialogue engine of Alice that allows the chatbot to manage the dialogue according to a specific social practice and to interact with the reasoning module. The language is used to describe possible question-answer modules, called categories, that can be matched during the conversation. The categories can be matched in different practices (*Common Categories*), or can be organized according to the current social practice (*SP Categories*) by means of a *social practice* tag or more specifically according to a scene of the practice (*Scenes Categories*) by means of the (*scene* tag). Moreover it is possible indicate specific preconditions that have to be matched using the (*precondition* tag). The category shown in Fig. 2a allows for an interpretation of a greeting as the accomplishment of the subgoal associated to the *greeting* scene, and as result throws a *GreetingsReceived* event.

```
<scene name="greetings">
  <category>
    <pattern><set>greetings</set></pattern>
    <template>Hello!
    <insert packageName="sp_anamnesi.greetings"
  typeName="GreetingsReceived" />
</template>
</category>
```

(a)

```
<category>
  <pattern>why are you here</pattern>
  <template>
    <insert packageName="sp_anamnesi.health_problem"
  typeName="HealthProblemAsked" />
    I'm experiencing one of my usual
    <getDroolsTemplate />. It's quite strong.
  </template>
</category>
```

(b)

Fig. 2. S-Aiml examples

The category shown in Fig. 2b allows for a transition to the next scene of the practice. When the player asks the agent the reason of the appointment, there is a transition to the *health problem* scene and the querying of the R&I module to get the specific health problem of the scenario. The answer of the agent will be: *I'm experiencing one of my usual headaches. It's quite strong.*

```

rule "GreetingsReceivedInTime"
when
  $startScene:EnterScene(scene.name=="greetings")
  $g:GreetingsReceived(this after[0ms,20000ms] $startScene )
then
  OCCHappenedEvent he=new OCCHappenedEvent();
  don(he,DesirableEvent.class);
  don(he,ProspectedRelevantEvent.class);
  insert(he);
  insert(new ChangeOfSceneFromGoal());
end

```

(a)

```

rule "DesirableProspectedEventHappened"
when
  $d:OCCHappenedEvent(this isA ProspectedRelevantEvent,
  this isA DesirableEvent)
  $agent:Emotion(this isA Agent)
then
  $agent.setSatisfaction($agent.getSatisfaction()+1);
end

```

(b)

Fig. 3. Rules examples

Representation and Interpretation. This module organizes the knowledge and the rules required by the agent to correctly interpret the events recognized by the interaction module. Similarly to the previous module, there is a distinction between a more general knowledge and the knowledge specific for the social practices. The general knowledge is related to the agent beliefs and it also includes the formalization of the social practice module, its main components, the rules for starting and closing the practices and to choose and perform a plan pattern. A specific social practice carries implicit knowledge, therefore, depending on the social practice, the agent updates its social interpretation of the elements with which it interacts. The knowledge carried by a practice includes the agent's beliefs and expectations in a practice, the rules for the generation of plans and the analysis of possible norm violations. The rules embedded in a practice are used as a kind of short cuts in the deliberation of the agent. The events, generated by the conversational choices of the player, are analyzed according to the dimensions of interest in the game, in particular according to their influence on the agent emotions or the empathy transmitted by the player. As a specific example, a greeting received in time is interpreted an expected desirable event according to the OCC classification (Fig. 3a) and will elicit positive emotions (Fig. 3b).

Other rules are specific for the assessment of the player's skills, such as the empathy. E.g. a description of the headache by the agent generates an *Empathetic Opportunity* (Fig. 4a). Therefore, if the player underestimates the patient's prob-

```

<category>
  <pattern>How is your pain today</pattern>
  <template>
    It is very strong.
    <insert packageName="empathic"
    typeName="EmpathicOpportunity" />
  </template>
</category>

```

(a)

```

<category>
  <pattern>Don't be exaggerated</pattern>
  <that>It is very strong</that>
  <template>Yes, it's really that bad..
  <insert
  packageName="sp.anamnesi.health_problem"
  typeName="DoctorUnderestimatesPain"/>
  </template>
</category>

```

(b)

```

rule "DoctorUnderestimatesPain"
when
  $e:EmpathicOpportunity()
  DoctorUnderestimatesPain(this after $e)
then
  EmpathicOpportunityTerminator ee=new
  EmpathicOpportunityTerminator();
  insert(ee);
end

```

(c)

```

rule "EmpathicOpportunityMissed"
when
  $p:EmpathicOpportunity()
  EmpathicOpportunityTerminator(this after $p)
  $agent:Agent
then
  $agent.setEmpathicState("empathic
  opportunity missed");
end

```

(d)

Fig. 4. Empathic flow example

lem (Fig. 4b) the *Empathetic Opportunity* is declared terminated (Fig. 4c and d) because the statement of the doctor moves the dialogue away from the expressed emotion.

4 Gaming

In the previous sections we have explained how the conversations with the trainee are managed using social practices. In this section we will discuss how this approach supports the creation of a conversation *game*. In the Communicate! platform [7], that was the primary inspiration for our work, the conversations were pre-designed as a kind of tree structures and trainees have to make a choice at each state for the possible move they make next. In this set up it is easy to associate a score with each possible move in a positive or negative sense. We claim that th predetermined conversations are too limited and showed a way to give the trainee more initiative and freedom in the conversation. However, the consequence of this flexibility is that we cannot associate a score on forehand with every possibde move of the trainee (as they are not all known on forehand). Our approach using social practices and mental states of the agents suggests a scoring approach that is not tied to the actual conversation moves, but rather to the mental states that the agents maintain and the deviations or confirmation of the social practice that is followed. As we have shown, the trainees conversational moves lead to changes in e.g. the emotional state of the patient depending on the specific content of that move. Thus the target of the trainee is to communicate in a way to optimize the score of the patient's mental state. In a naive approach one might than say that a move that makes a patient angry, worried or impatient is bad (leads to a decrease in score). However, it is not always possible to avoid negative emotions in a patient in e.g. the anamnesis scenario. If the doctor finds out that the patient most likely has a brain tumor that causes his frequent headaches he needs to tell this and this might create all kinds of negative emotions in the patient. The training should be geared to how to cope with these emotions and use the conversation to decrease these emotions in some way in the way patient. If a patient is both worried and angry it can be best to first alleviate his worries and after that on his anger, but if they are tackled in the reverse order it might still work in the end. Thus scores should not be given to single states, but rather to sequences of states. E.g. a trainee gets a negative score if the anger of the patient stays above a certain level more than five or ten moves and even gets a very negative score if the patient is still angry at the end of the conversation. So, rather than scoring individual states we can give rules on the sequences of states that appear and their influence on the score. A second issue is that there are several aspects that play a role in the conversation and that the trainee should try to control. We have mentioned empathy with the patient in our context. Because the (felt) empathy is modelled as a separate aspect of the state of the patient it can get a separate score. Having to handle combinations of aspects the trainee now has to try to maximize the scores on all aspects, which often cannot be done at the same time (i.e. in one move). By attaching the scores to rules over state sequences it is now easily possible to

show that some orders of conversational moves lead to better scores than other ones without limiting the conversation to some predetermined order(s). So, we get more flexibility and more accurate scoring of the trainee's performance. The social practice is used for the scoring as this practice gives a context in which the interaction takes place and it therefore also indicates the expected (range of) mental states of the participants during the conversation. Thus we can use these mental states as a kind of target values for the trainee to achieve. Thus scores become relative to a social practice rather than some absolute values, which makes the scoring more realistic. E.g. a patient should never be angry in a regular check-up meeting with his doctor, but he can be expected to become angry in a bad news conversation. Thus the patient becoming angry is not always bad, but is bad in certain contexts.

5 Conclusion

In this work we analyse the importance of a social context management in serious games, proposing an architecture for social agents modelling based on the social practice theory. The architecture puts social practice at the heart of the deliberative process of an agent, allowing for a more accurate interpretation of user sentences. According to the specific social practice, the choices of the player have a different effect on the agent's state and on his final score. It is important to highlight that the changes are not only on single question answer exchanges, but the activation of a social practice determines meaningful changes also on the entire dialogue path. It determines the activation of both knowledge and plans, and the correct understanding of the player sentences by means of the activation of a subset of S-AIML categories. Without a social practice approach there is a need to encode a lot of social and communication rules and heuristics into the game characters, while with the proposed approach the knowledge becomes modularized and efficiently used. Nevertheless, social practice is not a rigid structure; the agent acts according to its expectations into the practice, but his choices are consequence of a constant analysis of the dialogue state. We discussed about some preliminary steps in the implementation of what we called SALVE game. Future work will regard the development of other scenarios and the setting of specific trials to prove the educational effectiveness of the game.

References

1. Segrin, C., Givertz, M.: Methods of social skills training and development. In: Greene, J.O., Buresono, B.R. (eds.) *Handbook of Communication and Social Interaction Skills*. Lawrence Erlbaum Associates Inc., Mahwah (2003)
2. Bandura, A.: Social cognitive theory of personality. In: *Theory and Research, Handbook of Personality*, pp. 154–196 (1999)
3. Hodgson, R.: Review of T. L. Rosenthal, and B. J. Zimmerman 'Social Learning and Cognition'. *Behav. Psychother.* **10**, 124 (1982)
4. Swartout, W., Artstein, R., Forbell, E., Foutz, S., Lane, H.C., Lange, B., Morie, J., Noren, D., Rizzo, S., Traum, D.: Virtual humans for learning. *AI Mag.* **34**(4), 13–30 (2013)

5. Babu, S.V., Suma, E., Hodges, L.F., Barnes, T.: Learning cultural conversational protocols with immersive interactive virtual humans. *Int. J. Virtual Reality* **10**, 25–35 (2011)
6. Fairclough, N.: *Analysing Discourse: Textual Analysis for Social Research*. Psychology Press, Abingdon-on-Thames (2003)
7. Jeuring, J., Grosfeld, F., Heeren, B., Hulsbergen, M., IJntema, R., Jonker, V., Mastenbroek, N., Van Der Smagt, M., Wijmans, F., Wolters, M., Van Zeijts, H.: Demo: communicate! - a serious game for communication skills. In: *Proceedings EC-TEL 2015: 10th European Conference on Technology Enhanced Learning* (2015)
8. Klüwer, T.: “I like your shirt” - dialogue acts for enabling social talk in conversational agents. In: Vilhjálmsson, H.H., Kopp, S., Marsella, S., Thórisson, K.R. (eds.) *IVA 2011. LNCS (LNAI)*, vol. 6895, pp. 14–27. Springer, Heidelberg (2011). doi:[10.1007/978-3-642-23974-8_2](https://doi.org/10.1007/978-3-642-23974-8_2)
9. Cassell, J.: Social practice: becoming enculturated in human-computer interaction. In: Stephanidis, C. (ed.) *UAHCI 2009. LNCS*, vol. 5616, pp. 303–313. Springer, Heidelberg (2009). doi:[10.1007/978-3-642-02713-0_32](https://doi.org/10.1007/978-3-642-02713-0_32)
10. Carofiglio, V., De Carolis, B., Mazzotta, I., Novielli, N., Pizzutilo, S.: Towards a socially intelligent ECA. *IxD&A* **5**, 99–106 (2009)
11. Reckwitz, A.: Toward a theory of social practices a development in culturalist theorizing. *Eur. J. Soc. Theory* **5**(2), 243–263 (2002)
12. Minsky, M.: A framework for representing knowledge. In: *Computation & Intelligence*, pp. 163–189. American Association for Artificial Intelligence (1995)
13. Dignum, V., Dignum, F.: Contextualized planning using social practices. In: Ghose, A., Oren, N., Telang, P., Thangarajah, J. (eds.) *COIN 2014. LNCS (LNAI)*, vol. 9372, pp. 36–52. Springer, Heidelberg (2015). doi:[10.1007/978-3-319-25420-3_3](https://doi.org/10.1007/978-3-319-25420-3_3)
14. Augello, A., Gentile, M., Dignum, F.: Social practices for social driven conversations in serious games. In: De Gloria, A., Veltkamp, R. (eds.) *GALA 2015. LNCS*, vol. 9599, pp. 100–110. Springer, Heidelberg (2016). doi:[10.1007/978-3-319-40216-1_11](https://doi.org/10.1007/978-3-319-40216-1_11)
15. Augello, A., Gentile, M., Weideveld, L., Dignum, F.: Dialogues as social practices for serious games. In: *Proceedings of the 22nd European Conference on Artificial Intelligence, ECAI 2016* (2016, to appear)
16. Elksnin, L.K., Elksnin, N.: Teaching social skills to students with learning and behavior problems. *Interv. Sch. Clinic* **33**(3), 131–140 (1998)
17. Street Jr., R.L.: Interpersonal communication skills in health care contexts. In: Greene, J.O., Burleson, B.R. (eds.) *Handbook of Communication and Social Interaction Skills*, pp. 909–933. Lawrence Erlbaum, Mahwah (2003)
18. Suchman, A.L., Markakis, K., Beckman, H.B., Frankel, R.: A model of empathic communication in the medical interview. *JAMA* **277**(8), 678–682 (1997)
19. Steunebrink, B.R., Dastani, M.M., Meyer, J.-J.C.: The OCC model revisited. In: Reichardt, D. (ed.) *Proceedings of the 4th Workshop on Emotion and Computing - Current Research and Future Impact*. Paderborn, Germany (2009)
20. Augello, A., Gentile, M., Weideveld, L., Dignum, F.: A model of a social chatbot. In: Pietro, G., Gallo, L., Howlett, R.J., Jain, L.C. (eds.) *Intelligent Interactive Multimedia Systems and Services 2016. SIST*, vol. 55, pp. 637–647. Springer, Heidelberg (2016). doi:[10.1007/978-3-319-39345-2_57](https://doi.org/10.1007/978-3-319-39345-2_57). ISBN 978-3-319-39345-2
21. Marietto, M.D.G.B., de Aguiar, R.V., Barbosa, G.D.O., Botelho, W.T., Pimentel, E., Frana, R.D.S., da Silva, V.L.: Artificial intelligence markup language, a brief tutorial. arXiv preprint (2013). [arXiv:1307.3091](https://arxiv.org/abs/1307.3091)