TARDIS - A simulation platform with an affective virtual recruiter for job interviews

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ABSTRACT
The number of young people not in employment, education or training is increasing across Europe. These youngsters often lack self-confidence and the essential social skills needed to seek and secure employment. The TARDIS project aims to build a scenario-based serious-game simulation platform for young people at risk of exclusion to improve their social skills. This paper intends to propose a model for a socio-emotionally realistic virtual agent in the context of job interview simulations. Our model of affect is composed of emotions, moods, social attitudes and personality that intends to create a realistic virtual recruiter.

Categories and Subject Descriptors
I.6.5 [**Computing Methodologies**]: Simulation and Modeling—*Model Development*; J.4 [**Computer Applications**]: Social and Behavioral Sciences

General Terms
Theory

Keywords
Affective model, Emotions, Moods, Social attitudes, Job interview.

1. INTRODUCTION
The number of NEETs[1] is increasing across Europe. According to Eurostat, in march 2012, 5.5 million of European youngster (16 to 25 years old) were unemployed meaning that 22.6% of the youngster global population in European union is unemployed. This unemployment percentage is 10 points superior to the whole population showing that the employment of NEETs is a real problem in Europe.

Current research reveals that NEETs often lack self-confidence and the essential social skills needed to seek and secure employment [5]. To help those young people to access jobs, organisations for youth insertion in the labour market across Europe provide social coaching programmes, in order to help young people acquire and improve their social competencies, especially in the context of job interviews.

In this paper, we present the TARDIS project, funded by FP7, that aims at building a serious game for NEETs and employment/inclusion organisations which supports social training and coaching in the context of job interviews. Youngsters (aged 18 to 25) will be able to explore, practice and improve their social skills in a wide range of possible interview situations. Using serious gaming for job interview simulations shows two advantages: 1) repeatable experience can be modulated to suit the individual needs and; 2) technologies and serious games are intrinsically motivating for the young [19] and shall help to remove the many barriers that real-life situations may pose, in particular the stress associated with engaging in unfamiliar interactions with others.

Many practical applications has shown the interest of serious games in various domains: education [34], therapy [4], autism spectrum [27] in the ECHOES project and crisis management [13]. Some application focus on the decision of employee in a business company [9]. Our goal is to use serious game for empowerment in the labour market through a job interview simulation.

In the TARDIS project, the youngster faces a virtual agent acting as a recruiter. This paper presents an Artificial Intelligence model for such socio-emotionally realistic virtual agents. Our model is used to decide which attitude, emotion and mood should be displayed by the virtual agent. The virtual agent has to control the selection of relevant responses, using an internal representation of the user and the recruiter's mental states.

[1]NEET is a government acronym for young people not in employment, education or training.

It has been proven that the socio-emotional aspect is one of the key feature that distinguishes a machine from a believable agent [25]. Based on that, many tutor applications based on educational agents have been proposed [14, 23, 24]. This research domain, called *Affective Computing* [26], is still in expansion. One core issue in this domain is to build agents that react in a coherent manner: based on the non-verbal inputs (smiles, emotion expressions, body movements), the agent must select relevant verbal and non-verbal responses. The model presented in this paper seeks to take into account all the different dimensions of the socio-affective interaction, in the context of the job interview situation.

Many job interviews focus on the personality of the applicant. This has been encouraged by the fact that some personality traits predict job performance [3]. However, in a face to face job interview, the personality of the applicant is inferred by the recruiter according to the mood, the emotions and the social attitudes expressed by the youngster [12]. Furthermore, it has been proven that visual and vocal perceptions affect interviewers' judgements during an employment interview [8]. Therefore, the affective model of the youngster in our work is composed of emotions, moods and social attitudes to evaluate the quality of the applicant performance. In order to have a realistic simulation, the virtual recruiter must have a credible way to interact with the applicant. The use of affects in the model of our virtual recruiter allows this credibility.

This paper is organised as follows. Section 2 presents existing cognitive architectures in Affective Computing related to our goal and gives the motivation of our work. Section 3 briefly describes the architecture of the TARDIS affective model and its relation to the other project components. Section 4 detailed the affective model of the virtual recruiter and section 5 shows how these values evolve over time and influence the agent's behaviour. Section 6 illustrates the model on a job interview scenario. The last section concludes the paper by presenting the project's next stages.

2. STATE OF THE ART

In [31], a study shows that people who tried to suppress or hide negative emotions during a job interview are considered more competent by evaluators. Thus, emotion regulation is a key element to obtain a job. Emotions expression are regulated by situative norms according to social display rules [10]. Similarly, Tiedens [33] shows that anger and sadness play an important role in the job interview.

Several models have been proposed in the domain of affective computing[2] to build credible virtual human based on cognitive models of emotions [22, 14], personality [28] and social relations [21]. However, to our best knowledge, no computational model of social attitude has been proposed. Social attitudes are the expression of the personality of an agent through its behaviour and its emotional expressions, in the context of social norms. For instance, in the context of a job interview, the social attitudes gives the recruiter information about the interviewee's personality and feelings about the job. This information will influence the way of leading the interview for the virtual recruiter and might decide for a *yes* or a *no* at the end. In that sense, it raises questions that are being studied in Theory of Mind [18] and reverse appraisal [12].

In our model, we use an emotion appraisal model based on OCC [22]. As will be shown in section 4, we only consider a limited subset of emotions that are relevant in the context of job interviews and that are compatible with the TARDIS emotion recognition system.

Baron showed the importance of the interviewer's mood during the interview and its impact to the applicant [1]. The evaluation of the applicant is also influenced by interviewer's mood. In the TARDIS project, we aim for the learners to be able to detect these change of moods and to adapt their social attitude accordingly. Therefore, we need an accurate model of mood-behaviour influence. Our model for moods is based on the ALMA model [11]. According to [20], emotions are one of the factor that is able to change moods in human.

For the personality of the virtual recruiter, we rely on the big five model [15] that considers 5 quantitative dimensions (Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism). Indeed, certain connections between 5-factors personality and moods have ever been identified by Mehrabian [16].

In [29], a tutor application about preparing job seekers for an interview situation has been realised. This application has the same goal of TARDIS (help applicant to improve their skills in job interview situation). However, this application proposes a preparation to an interview help by an empathic agent, not a real-time simulation of an interview as in TARDIS.

In the TARDIS project, we require a computational model of social attitudes for the virtual recruiter. This model must encompasses most (if not all) dimensions mentioned above. The next sections present the TARDIS platform and detail the recruiter affective model.

3. ARCHITECTURE OVERVIEW

The TARDIS architecture is composed of four main components. Figure 1 gives an overview of this architecture.

The Social Signal Interpretation (SSI for short). This module provides the affective model with information about the youngster's emotions and social attitude that are detected by the system. For now, the SSI module uses a Kinect[3] and a microphone for perception of attitudes and affects. In future versions, it could integrate eye tracker and other sensors. This module provides the non verbal behaviour analyser tool that supports the parallel and synchronized processing of data from multiple sensor devices. It enables to detect and recognize social cues such as head gaze, voice activity, gestures and postures. Based on these social cues and dynamic Bayesian networks, it computes affects (social attitudes, moods and emotions) and send them as inputs of the affective recruiter.

[2]See the Humaine project: `emotion-research.net`

[3]The Kinect is a motions sensing input camera

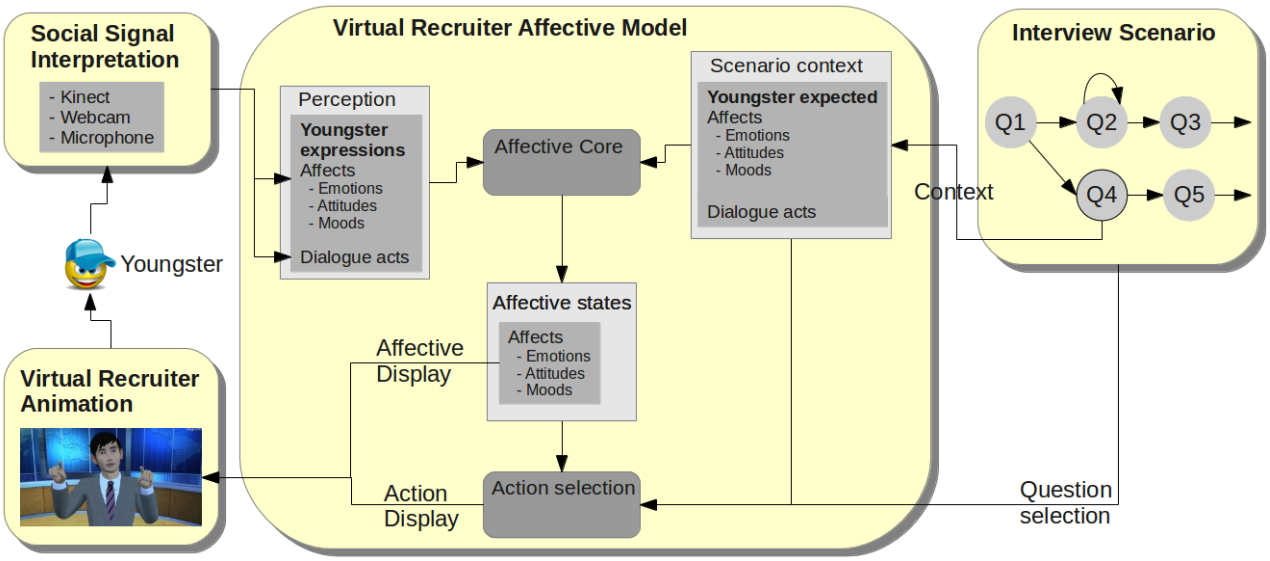

Figure 1: Global architecture

The Interview Scenario. It provides the virtual recruiter the expectation in terms of emotions and attitudes, depending on the interview progress. In the current version of TARDIS, the agent has no understanding of the youngster's actual answers to the questions. It simply follows a predetermined scenario, while focusing on the affective recognition and adaptation. It is well known in the virtual character research community that the definition of context-sensitive interactive scenario often requires expert programmers and results in a hard-to-maintain code. To avoid this, a visual authoring approach for virtual character applications is used. This tool is based on an existing authoring tool, the Visual SceneMaker that allows the scenario to be built by non-experts in computer programming. The scenario will provide a context to the virtual recruiter model: the expectations of the recruiter in term of youngster's affects.

The Virtual Recruiter Affective Model. The affective model detailed in this paper is responsible for determining the agent's internal state (output) depending on the recognized affects and scenario expectations (inputs).

The Virtual Recruiter Animation. The Animation module is responsible for expressing the virtual recruiter's affective state through its behaviour. In order to have realistic behaviours, a new motion capture pipeline was developed to facilitate more efficient processing of the captured data. The expression of affects relies on a model for interpersonal stance based on different time windows. It is integrated with Greta[4]. It uses standards (MPEG-4, BML and FML) to allow the user to define the behaviours by XML like sheets and to be easily adapted with other 3D virtual agent if needed.

[4]GRETA is an Embodied Conversational Agent used in the SEMAINE project.

In order to determine the interesting social cues and affects during a job interview, experiments with users at Mission Locale[5] were done. These experiments consisted in enactments of real job interviews as they are normally conducted in this organism with 10 youngsters. A dialogue model has also been designed on the basis of these enactments. It allowed us to determine the affects that will be integrated in our youngster and recruiter model.

The Affective Model has two main computational functions:

- It will periodically compute the new affective states for the Virtual Recruited Model, based on the perceptions, expectations from the scenario and current affective states. The differences between expected affective states and expressed affective states from the youngster are the key element in the update of the virtual recruiter affective state (see next section).
- It will select actions in the scenario. This part is not presented in this paper.

This paper focus on the details of the recruiter affective model that will be described on the following sections.

4. RECRUITER AFFECTIVE MODEL

Our affective model is based on the youngster detected and expected affects and the internal states of the virtual recruiter. According to Davidson [7], emotion and moods have an important role in influencing human behaviour. Scherer [30] shows the influence of social attitudes on behaviour. We focus on three affective categories: emotions, moods and social attitudes that take values on the $[0, 1]$ interval.

[5]Mission Locale is a French network of organisms that helps youngster in their social course and professional career.

4.1 Youngster detected affects

This module relies on the affective outputs given by the real-time social signal interpretation of the youngster. Affects are given with a level of confidence. These detected youngster affects will be denoted as $E_d(emotion)$ for emotions, $A_d(attitude)$ for attitudes and $M_d(mood)$ for moods ("d" stands for *detected*). Table 1 summarize relevant affects in the context of a job interview. Note that emotions, moods and attitudes are organized as positive and negative. This does not necessarily mean that Distress, Anxiety or Agitation are not good in the context of a job interview, but it depends on the context (given by the scenario's expectations).

We note Ev^+ the set of positive affects (joy, focused, etc) and Ev^- the set of negative ones (distress, anxious, etc).

	Positive	Negative
Emotions	Joy	Distress
		Anger
Moods	Relaxed	Anxious
		Exuberant
		Bored
Attitudes	Focused	Inattentive
	Calm	Agitated
		Aggressive

Table 1: Youngster affects

4.2 Youngster expected affects

These states will be given by the scenario context. Each question in the scenario is marked with expectations about the impact of the question on youngster emotions and attitudes. As our model rely on the comparison of detected affects and expected affects, expected affects stick to the list given by social signal interpretation (table 1). If this list increases in the future, the new affects will be added in the expected list and will be considered by the scenario. Expected emotions and attitudes will be denoted as $E_e(emotion)$ and $A_e(attitude)$ with the same set of emotions and attitudes than for the detected affect ("e" stands for *expected*).

4.3 Internal affective model

The internal affective model contains emotions, moods, personality and attitudes of the virtual recruiter. Personality is static and will not evolve during the simulation but it will influence the dynamics of other affects. We model emotions as a short-term timing affect and mood as a middle-term timing affect.

The affects of the virtual recruiter (i.e. felt emotions, attitude and mood) will be denoted as E_f, A_f and M_f ("f" stands for *felt*). The personality of the virtual recruiter is not dynamic and will be denoted as $P_f(personality)$. Moods are affects with medium term evolution. Our model for moods is based on the ALMA model [11]. Attitudes of the recruiter will be determined by its actual moods and personality and will be initialised by its personality. Table 2 summarize relevant emotions, moods and attitudes for the virtual recruiter.

5. DYNAMICS OF THE AFFECTIVE CORE

	Positive	Negative
Emotions	Joy	Distress
	Relief	Disappointment
	Admiration	Anger
	Hope	Fear
Moods	Relaxed	Hostile
	Exuberant	Bored
		Disdainful
Attitudes	Friendly	Aggressive
	Supportive	
		Dominant
	Attentive	Inattentive
		Gossip

Table 2: Recruiter affects

Our dynamics follow this principle: we compute emotions by comparing youngster detected affects and youngster expected affects. Then, we compute moods on the base of computed virtual recruiter emotions. Finally, considering agent's personality and actual moods, we compute the social attitudes of the virtual recruiter.

5.1 Dynamics of virtual recruiter's emotions

Computation of emotions is based on OCC [22]. In OCC, events of the simulation allow the computation of emotions. Events are perceptions from the virtual agent. In our simulation these events are related to affective expressions of the youngster detected by the virtual recruiter: $E_d(emotion)$, $A_d(attitude)$ and $M_d(mood)$. The perception of events lasts as long as the youngster gives his answer to a question. Lets detail the different computations.

Joy and distress

Following OCC [22], *joy* is the occurrence of a desirable event. In the current version of our model, we do not consider the semantic context of the interaction in the job interview: in a real job interview, negative affects can sometimes be required if for example the recruiter is intentionally provocative to test the applicant reactions and nature. By ignoring the context of the interaction, we simply assumed that youngster's detected positive affects (Ev^+) increase the *joy* of the recruiter whereas detected negative affects (Ev^-) decrease it.

In order to balance between short-time emotions and mid-term moods, we compare all affects to decide the overall expression of the youngster. Let us denote Δ_d the difference between positive detected affects and negative ones.

$$\Delta_d = \sum_{a \in Ev^+} E_d(a) - \sum_{a \in Ev^-} E_d(a)$$

and let us define *norm* the normalization function between 0 and 1:

$$norm(x) = \begin{cases} 1 & \text{if } x > 1 \\ 0 & \text{if } x < 0 \\ x & \text{otherwise} \end{cases}$$

The intensity of *joy* felt by the recruiter is then defined by:

$$E_f(joy) = norm(\Delta_d)$$

Similarly, the *distress* is the occurrence of an undesirable event, *i.e.* negative expressed affects by the youngster:

$$E_f(distress) = norm(-\Delta_d)$$

Hope and fear

Following OCC [22], *hope* is the expectation of a desirable event, and $fear$ corresponds to undesirable events. Similarly to joy and distress, we define Δ_e the difference between positive expected affects and negative ones:

$$\Delta_e = \sum_{a \in Ev^+} E_e(a) - \sum_{a \in Ev^-} E_e(a)$$

The intensity of *hope* and $fear$ is then defined by:

$$E_f(hope) = norm(\Delta_e)$$

$$E_f(fear) = norm(-\Delta_e)$$

Disappointment, admiration, relief and anger

Disappointment happens if a desirable event does not occur, *i.e.* when the agent is in a state such that $E_f(hope) > 0$ and the desirable events (detection of positive emotions) do not occur with an intensity as high as expected. Concretely, if $E_f(hope) > 0$:

$$E_f(disap.) = norm(max_{a \in Ev^+}(E_e(a) - E_d(a)))$$

Note that $E_f(disap.) = 0$ when $E_f(hope) = 0$.

Conversely, admiration occurs when the detected positive emotions are bigger than expected. Concretely, when $E_f(hope) > 0$:

$$E_f(admir.) = norm(max_{a \in Ev^+}(E_d(a) - E_e(a)))$$

Similarly, relief occurs when undesirable events do not occur with the expected intensity: when $E_f(fear) > 0$,

$$E_f(relief) = norm(max_{a \in Ev^-}(E_e(a) - E_d(a)))$$

Finally, anger is triggered by higly detected undesirable events. However, we also use the current agressivity of the recruiter to increase the intensity of the felt anger (the more the recruiter is agressive, the more the recruiter will get angry). Concretely, when $E_f(fear) > 0$,

$$E_f(anger) = norm\Big((1 + A_f(agress.)) \times max_{a \in Ev^-}(E_e(a) - E_d(a))\Big)$$

Based on this emotions (computed through expectations and perceptions of the youngster), the next section presents how we compute the mood of the recruiter.

5.2 Virtual recruiter moods

The computation of moods is based on emotions following the ALMA [11]: the mood is a point in the PAD (Pleasure, Arousal, Dominance) space proposed by Mehrabian [17]. Based on these models, we propose a mapping of OCC emotions into PAD space that will be used to compute virtual recruiter moods.

In the context of a job interview, the recruiter is always in a dominant position considering its status. As a consequence, the D parameter of the PAD space is never negative changing the mapping of emotions and mood as shown in table 3. According to the intensity of the emotion, the arousal can be positive or negative for some emotions and it will trigger different moods. For example, if a joy is intensive (positive arousal), it will lead to an exuberant mood. But, if the joy intensity is weak, the agent will just become relaxed. However, some emotions have always big intensity: anger will always have a positive arousal. In the same way, a disappointment can imply disdainful attitude if the dominance is important and bored attitude for a low dominance.

Emotion	P	A	D	Mood
Joy	+	+/-	+	Exuberant, Relaxed
Distress	-	+/-	0/+	Hostile, Disdainful, Bored
Hope	+	+/-	0	Exuberant, Relaxed
Fear	-	+	0	Hostile
Relief	+	-	+	Relaxed
Disappointment	-	+/-	0/+	Hostile, Disdainful, Bored
Admiration	+	+	0	Exuberant
Anger	-	+	+	Hostile

Table 3: Mapping of emotions into PAD space and corresponding moods

We can notice that, usually, emotions *Admiration*, *Disappointment*, *Distress*, *Fear* and *Hope* are associated to a negative dominance. However, as we presented above, the context of a job interview confers the virtual recruiter a dominant status and we consider that these emotions will tend to a low dominance which is still positive.

As proposed by [11], mood is initialised with the personality of the virtual recruiter. The personality is defined using the OCEAN model and we transform this into affective values and then into a point in the PAD space following the proposition of [21]. Then, all along the simulation, felt emotions modify the initial agent's mood by attracting the 3D PAD point to the new PAD center of the future mood. The new PAD center is computed according to emotions felt during a certain period thanks to the PAD mapping given in table 3.

In the context of our job interview simulation, the period is determined by the number of cycle question/answer. Each answer slightly influences recruiter's mood. The basis for calibration is as follows: after 5 cycles of a specific emotion (anger for example), the virtual recruiter will be in the corresponding mood (hostile).

5.3 Virtual recruiter attitudes

[32] has shown the relation between attitudes and personality and [35] exhibits some relations between moods and attitudes. Based on that, our computation of attitudes relies on two main parameters: the actual mood of the virtual recruiter (which evolves during the simulation according to new emotions) and the initial personality of the virtual recruiter (which will remain in the same state during the simulation). In order to analyse the mood and personality, we compare them to a threshold θ, which was set to 0.5 in our experiments in the next section.

The intensity of $friendly$ attitude ($A_f(friendly)$) is defined in our model as the combination of the personality trait *agreableness* (A) and the degree of *exuberant* mood:

If $(P_f(A) > \theta) \vee (M_f(exub.) > \theta)$, then:

$$A_f(friendly) = max(M_f(exub.), P_f(A))$$

The intensity $A_f(aggressive)$ depends on *agreeableness*, *neuroticism* (N) and the *hostile* mood:

If $\Big((P_f(A) < \theta) \wedge P_f(N) > \theta\Big) \vee (M_f(hostile) > \theta)$, then:

$$A_f(aggr.) = max(M_f(hostile), P_f(N), 1 - P_f(A))$$

The intensity $A_f(dominant)$ is based on *extraversion* (E), *neuroticism* and the *hostile* mood:

If $\Big((P_f(E) > \theta) \wedge P_f(N) > \theta\Big) \vee (M_f(hostile) > \theta)$, then:

$$A_f(dominant) = max(M_f(hostile), P_f(N), P_f(E))$$

The intensity $A_f(supportive)$ is based on *agreeableness*, *extraversion* and the *relaxed* mood of the agent:

If $\Big((P_f(E) > \theta) \wedge P_f(A) > \theta\Big) \vee (M_f(relax) > \theta)$, then:

$$A_f(compr.) = max(M_f(relax), P_f(A), P_f(E))$$

The intensity $A_f(inattentive)$ is based on *conscientiousness* and the $disdainful$ mood:

If $(P_f(C) < \theta) \vee (M_f(disd.) > \theta)$, then:

$$A_f(inatt.) = max(M_f(disd.), 1 - P_f(C))$$

Similarly, the intensity $A_f(attentive)$ depends on *conscientiousness* and *relaxed*:

If $(P_f(C) > \theta) \vee (M_f(relax) > \theta)$, then:

$$A_f(att.) = max(M_f(relax), P_f(C))$$

Last, $A_f(gossip)$ is based on *extraversion* and the *exuberant* attitude:

If $(P_f(E) > \theta) \vee (M_f(exub.) > \theta)$, then:

$$A_f(gossip) = max(M_f(exub.), P_f(E))$$

The way we compute attitudes follow this principle: an agent can adopt an attitude according to its personality or according to its actual mood. For example, someone who is not aggressive due to his personality can become aggressive if its mood is very hostile. The mood compensate the personality and vice versa.

6. SIMULATION

This section details a concrete scenario inspired by video of job interview taken with the Tardis users (Figure 2).

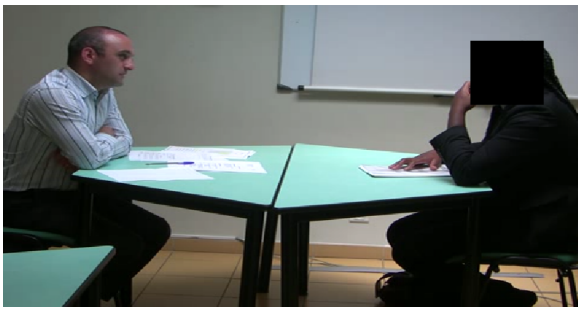

Figure 2: Screen-shot of a video of a job interview with users.

The scenario is a succession of 6 questions/answers during the job interview for a bus driver position. At the beginning of the interview, the recruiter asks the youngster to talk about himself and his professional career. The youngster has no experience in this domain. Quickly, he seems to be stressed and does not find relevant arguments. The succession of questions/answers is described in Figure 3.

In this scenario, the youngster is often in difficulty during the interview. He expresses many hesitations and negative affects that we annotate with socio-cognitive specialists. With these data, we want to see if our model can answer in a realistic way to youngster reactions. At the beginning of the simulation, the recruiter is relaxed. Our first simulation consider the youngster affective reactions.

For each question the recruiter has expectations about the youngster and considers the affective answer of the virtual recruiter: Expected affective answer for question 3 is $[Joy = 0.5, Anxious = 0.8, Agitated = 0.7, Focus = 1]$. Affective answer to question 3 is quite positive: $[Anxious = 0.6, Agitated = 0, Focus = 1, Calm = 0.7]$. The recruiter was expected negative affect (agitated), for this reason, he was feeling fear. Since its fear is not confirmed, he is relieved $[Relief = 0.7]$ but a bit disappointed $[Disappointment = 0.5]$ because he was expecting joy. The emotional answer of the recruiter is coherent with the video expectations.

At each question, every emotion will give new influence to the PAD center according to emotions triggered influencing the recruiter's mood. Figure 4 shows this evolution. In

Q1 - Recruiter: What is the customer looking for when he takes the bus?
A1 - Youngster: Feeling uncomfortable, doesn't find many relevant arguments.
Q2 - Recruiter: What about the journey? Could it be long?
A2 - Youngster: Comfortable, he is flexible about commuting and work hours.
Q3 - Recruiter: How do you see your career in 10 years?
A3 - Youngster: Feeling a little bit more at ease, he indicates an anticipation of his evolution in the company but remains vague. He doesn't know enough about career advancement.
Q4 - Recruiter: Do you have plans to evolve in this activity?
A4 - Youngster: As he ignores the professional perspectives, he simply answers: "Being responsible".
Q5 - Recruiter: Let's consider a practical case, how do you manage a complicated situation? Find one and explain me your solution.
A5 - Youngster: Has trouble to find relevant arguments. Many hesitations.
Q6 - Recruiter: Can you list your main qualities and drawbacks?
A6 - Youngster: He whispers, not convincing and uncomfortable.

Figure 3: Questions/answers from the video

this figure the mood of the recruiter moves between slightly relaxed to slightly exuberant but its level of pleasure depends of the applicant answers. We can see the correlation between good answers and pleasure increase and bad answers and pleasure decrease. Its main attitude during all the interview is attentive.

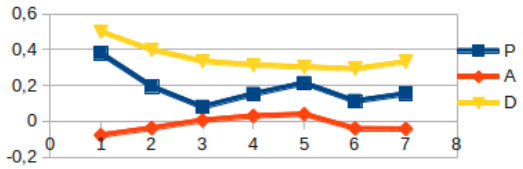

Figure 4: PAD evolution for a relaxed youngster

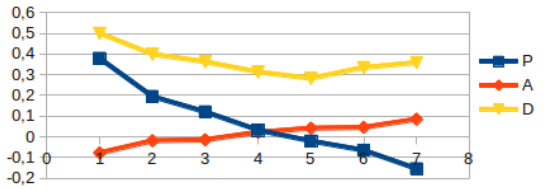

Figure 5: PAD evolution for an aggressive youngster

In order to see another reaction of our virtual recruiter, we consider the same scenario with an aggressive youngster. Reaction will be different for the recruiter and will lead to the PAD evolution exposed in Figure 5. Because of the aggressivity of the youngster, the pleasure decrease more and the intensity of emotions is more important (in particular because of anger emotion). Recruiter's mood will tend to be hostile and as a consequence, its attitude will then become aggressive.

This example shows that our agent is able to interact in a realistic emotional way in a job interview situation because emotions, moods and attitudes triggered are coherent with socio-cognitive specialists annotations. Next step will be to test this evolution based on Social Signal Interpretation in real time and to evaluate it.

7. CONCLUSION

In this paper, we have presented the general architecture of a serious game for job interviews and youngster inclusion in the labour market. We have focused on an affective model for a virtual recruiter in job interview simulations. This model is based on emotions, moods and attitudes in both inputs (recognized affects) and outputs (expressed affects). We illustrated on a scripted example scenario the results of our model and we showed that we could achieve variability in the agent's attitude. This work is fully integrated in the TARDIS platform and has been used in user experimentations in Mission Locale. The results of these experimentations, and thus the validation of our model's credibility, will be published later on.

At the moment, our model considers exact inputs from perception. One core issue that has to be dealt with is the imprecisions and errors in the social signal interpretation. We are currently considering how our model can be extended to consider probabilistic or fuzzy theories. The recruiter shall adapt its questions, its vocabulary and its level of politeness according to its social attitudes towards the youngster. Previous work [6] has proved that the language level could be adapted using a simple affective model. The next important step in our research is to build an affective representation of the interaction from the recruiter's point of view, allowing the recruiter to reason about the actual and potential behaviour of the applicant (theory of mind [2]). With such a representation, virtual recruiter action selection can consider its internal affective states, scenario, strategic intentions and goals allowing a more accurate decision process.

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8. REFERENCES

[1] R A Baron. Interviewer's Moods and Reactions to Job Applicants: The Influence of Affective States on Applied Social Judgments. *Journal of Applied Social Psychology*, 17(10):911–926, 1987.
[2] Simon Baron-Cohen. *Mindblindness*. MIT Press, Cambridge, Massachusetts, 1995.
[3] M.R. Barrick and M.K. Mount. The big five personality dimensions and job performance: A MetaAnalysis. *Personnel psychology*, 44(1):1–26, 1991.
[4] Clint Bowers. Serious games for therapy. *Journal of CyberTherapy and Rehabilitation*, 4(4), 2011.
[5] John Bynner and Samantha Parsons. Social Exclusion and the Transition from School to Work: The Case of

Young People Not in Education, Employment, or Training (NEET). *Journal of Vocational Behavior*, 60(2):289–309, April 2002.

[6] Sabrina Campano and Nicolas Sabouret. A socio-emotional model of impoliteness for Non-Player Characters. *Affective Computing and Intelligent*, pages 1123–1124, 2009.

[7] Richard J Davidson. On Emotion, Mood, and Related Affective Constructs. In Paul Ekman and Richard J Davidson, editors, *The Nature of Emotion Fundamental Questions*, chapter 2. Oxford University Press, 1994.

[8] Timothy DeGroot and Stephan J Motowidlo. Why visual and vocal interview cues can affect interviewers' judgments and predict job performance. *Journal of Applied Psychology*, 84(6):986–993, 1999.

[9] Heiko Duin, Manuel Oliveira, and Ali Saffarpour. A Simulation Model for Virtual Manufacturing Environments for Serious Games. In *Proceedings of the 13th International Conference on Concurrent Engineering ICE 2007*, pages 4–6, 2007.

[10] P Ekman and W V Friesen. *Unmasking the face: A guide to recognizing emotions from facial clues*. Number 1968. Prentice Hall, 1975.

[11] Patrick Gebhard. ALMA - A Layered Model of Affect. *Artificial Intelligence*, pages 0–7, 2005.

[12] Shlomo Hareli and Ursula Hess. What emotional reactions can tell us about the nature of others: An appraisal perspective on person perception. *Cognition & Emotion*, 24(1):128–140, 2010.

[13] Hazaël Jones, Julien Saunier, and Domitile Lourdeaux. Fuzzy Rules for Events Perception and Emotions in an Agent Architecture. In *7th Conference of the European Society for Fuzzy Logic and Technology and Rencontres Francophones sur la Logique Floue et ses Applications (Eusflat-LFA 2011 joint Conference), Aix-Les-Bains, France, 18/07/11-22/07/11*, pages 657–664. Joint Eusflat-LFA, July 2011.

[14] Stacy Marsella, Jonathan Gratch, and J Rickel. Expressive behaviors for virtual worlds. *Lifelike Characters Tools Affective Functions and Applications*, pages 317–360, 2003.

[15] R. R McCrae and O. P John. An introduction to the five-factor model and its applications. *Journal of Personality*, 60:175–215, 1992.

[16] Albert Mehrabian. Analysis of the big-five personality factors in terms of the pad temperament model. *Australian Journal of Psychology*, 48(2):86–92, 1996.

[17] Albert Mehrabian. Pleasure-arousal-dominance: A general framework for describing and measuring individual Differences in Temperament. *Current Psychology*, 14(4):261, 1996.

[18] A N Meltzoff. Understanding the Intentions of Others: Re-Enactment of Intended Acts by 18-Month-Old Children. *Developmental Psychology*, 31(5):838–850, 1995.

[19] Alice Mitchell and Carol Savill-Smith. The use of computer and video games for learning: A review of the literature, 2004.

[20] Paula P. Morris, William N.; Schnurr. *Mood: The frame of mind*. New York, NY, USA, springer-v edition, 1989.

[21] Magalie Ochs, Nicolas Sabouret, and Vincent Corruble. Simulation of the Dynamics of Non-Player Characters' Emotions and Social Relations in Games. *IEEE Transactions on Computational Intelligence and AI in Games*, 1:4:281–297, 2010.

[22] Andrew Ortony, Gerald L Clore, and Allan Collins. *The Cognitive Structure of Emotions*. Cambridge University Press, July 1988.

[23] A. Paiva, J. Dias, D. Sobral, R. Aylett, P. Sobreperez, S. Woods, C. Zoll, and L. Hall. Caring for agents and agents that care: Building empathic relations with synthetic agents. In *Proceedings of the Third International Joint Conference on Autonomous Agents and Multiagent Systems-Volume 1*, pages 194–201, Washington, DC, USA, 2004. IEEE Computer Society.

[24] L Pareto, DL Schwartz, and Lars Svensson. Learning by guiding a teachable agent to play an educational game. *in Education Building Learning*, pages 1–3, 2009.

[25] Lynellen D S Perry. Emotionware. *Crossroads*, 3(1):5–6, September 1996.

[26] R W Picard. Affective Computing. *Emotion*, TR 221(321):97–97, 1995.

[27] K Porayska-Pomsta, C Frauenberger, H Pain, G Rajendran, T Smith, R Menzies, M E Foster, A Alcorn, S Wass, S Bernadini, K Avramides, W Keay-Bright, J Chen, A Waller, K Guldberg, J Good, and O Lemon. Developing technology for autism: an interdisciplinary approach. *Personal and Ubiquitous Computing*, 2011.

[28] Helmut Prendinger and Mitsuru Ishizuka. Social role awareness in animated agents. *Proceedings of the fifth international conference on Autonomous agents AGENTS 01*, pages 270–277, 2001.

[29] Helmut Prendinger and Mitsuru Ishizuka. the Empathic Companion: a Character-Based Interface That Addresses Users' Affective States. *Applied Artificial Intelligence*, 19(3-4):267–285, March 2005.

[30] K. R. Scherer. What are emotions? And how can they be measured? *Social Science Information*, 44(4):695–729, December 2005.

[31] Monika Sieverding. 'Be Cool!': Emotional costs of hiding feelings in a job interview. *International Journal of Selection and Assessment*, 17(4), 2009.

[32] Mark Snyder. The influence of individuals on situations: Implications for understanding the links between personality and social behavior. *Journal of Personality*, 51(3):497–516, 1983.

[33] L Z Tiedens. Anger and advancement versus sadness and subjugation: The effect of negative emotion expressions on social status conferral. *Journal of personality and social psychology*, 80(1):86—-94, 2001.

[34] Mary Ulicsak. Games in Education : Serious Games. *Context*, 10(6/7/2011):89, 2010.

[35] Duane T Wegener, Richard E Petty, and David J Klein. Effects of mood on high elaboration attitude change: The mediating role of likelihood judgments. *European Journal of Social Psychology*, 24(1):25–43, 1994.