



**HAL**  
open science

## Identifying Emotions in Organizational Settings : towards dealing with morality

Oswaldo Ramon Teran Villegas, Christophe Sibertin-Blanc, Benoit Gaudou

► **To cite this version:**

Oswaldo Ramon Teran Villegas, Christophe Sibertin-Blanc, Benoit Gaudou. Identifying Emotions in Organizational Settings : towards dealing with morality. International Conference on Agents and Artificial Intelligence - ICAART 2014, Mar 2014, Angers, France. pp. 1-9. hal-01151031

**HAL Id: hal-01151031**

**<https://hal.science/hal-01151031>**

Submitted on 12 May 2015

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



## Open Archive TOULOUSE Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author-deposited version published in : <http://oatao.univ-toulouse.fr/>  
Eprints ID : 12981

**To cite this version** : Teran Villegas, Oswaldo Ramon and Sibertin-Blanc, Christophe and Gaudou, Benoit *Identifying Emotions in Organizational Settings : towards dealing with morality*. (2014) In: International Conference on Agents and Artificial Intelligence - ICAART 2014, 6 March 2014 - 8 March 2014 (Angers, France).

Any correspondence concerning this service should be sent to the repository administrator: [staff-oatao@listes-diff.inp-toulouse.fr](mailto:staff-oatao@listes-diff.inp-toulouse.fr)

# IDENTIFYING EMOTION IN ORGANIZATIONAL SETTINGS

## towards dealing with morality

Terán Oswaldo<sup>1,2</sup>, Christophe Sibertin-Blanc<sup>1</sup> and Benoit Gaudou<sup>1</sup>

<sup>1</sup>*IRIT, Université Toulouse 1 – Capitole, 2 rue du doyen Gabriel Marty, Toulouse, France*

<sup>2</sup>*Dpto de Investigación de Operaciones and CESIMO, Universidad de Los Andes, La Hechicera, Mérida, Venezuela*  
{oteran-v, sibertin, benoit.gaudou}@ut-capitole.fr

**Keywords:** modelling morality, OCC emotions, MABS, Systems of Organized Action, SocLab.

**Abstract:** Emotions play an essential role in the behaviour of human beings, either at their sudden occurrence or by the continuous care to prevent the occurrence of unpleasant ones and to search for the occurrence of pleasant ones. Notably, in any system of collective action, they influence the behaviours of the actors with respect to each others. SocLab is a framework devoted to the study of the functioning of social organizations, through the agent-based modelling of their structure and the simulation of the processes by which the actors adjust their behaviours the one to another and so regulate the organization. This position paper shows how SocLab enables to characterize the configurations of an organization that are likely to arouse different kinds of social emotions in the actors, in order to cope with the emotional dimension of their behaviours. The case of a concrete organization is introduced to illustrate this approach and its usefulness for a deeper understanding of the functioning of organizations.

## 1 INTRODUCTION

Social simulation consists in the modelling of social systems and the study of their behaviour by the performance of computer simulations (Axelrod, 1997), including economics, organization, politics, history or social-ecological systems (see for example the JASSS on-line journal). The development of this approach is due to the widening recognition that social systems feature the characteristics of complex systems: they display emergent behaviour not predictable from knowledge of their constituent so that essential phenomena cannot be caught by analytical approaches.

Regarding the simulation of social relationships (Squazzoni, 2012), Sibertin-Blanc et al. (2013a) proposes a formalisation of a well-experienced theory of the sociology of organization, the Sociology of the Organized Action (SOA) (Crozier, 1964; Crozier and Friedberg, 1980) which studies how social organizations (for example a firm, an association, any collective or a political setting) are regularized, as a result of the counterbalancing processes among the power relationships of the social actors. This formalization is implemented in the SocLab environment (El Gemayel, 2013) which enables to define the structure of an organization as an instance of a

generic meta-model, to study its structural properties in an analytical way, to explore the space of its possible configurations (and so to discover its Pareto optima, Nash equilibriums, structural conflicts and so on), and to compute by simulation how it is plausible that each actor behaves with regard to others within this organizational context. As far as one agrees with the fundamentals of SOA, this platform looks like a tool for organizational diagnoses, the analysis of scenarios regarding possible evolutions of an organization or the study of phenomena occurring within virtual organizations featuring particular characteristics.

According to the SOA, the behaviour of each actor is strategic while being framed by a bounded rationality. In this approach, the interaction context defines a *social game*, where each actor adjusts his behaviour with regard to others in order, as a meta-objective, to obtain a satisfying level of capability to reach his goals. The aim of a social game is to find stationary states, i.e., configurations where actors no longer modify their behaviour because each one satisfies himself with the level of capability he obtains from the current state of the game, so that the organization is in a sustainable regularized configuration.

The SocLab framework has been applied to the study of concrete organizations (see e.g. Sibertin et al., 2006; Adreit et al., 2010; El Gemayel et al.,

2011; Sibertin et al., 2013a) on the basis of sociological inquiries. However in some cases, the simulation algorithm that makes actors to play the social game (Sibertin et al., 2013b) provides results about the behaviour of some actors that do not accurately match the field observations.

This gap between the observed and computed behaviours can be ascribed to the fact that SocLab neglects emotions. However, it is well known that emotions contribute to the regulation of social actors' behaviours together with phenomena such as mimesis (Selten et Ostmann, 2001) or reputation and trust (Giardini et al., 2013). Indeed, social behaviours are not so much driven by abstract reasoning than by complex feelings that are produced by the interaction context and perceived by the partners. Emotions contribute to the regulation of behaviours that emerges in human groups from the mutual adaptation of each one's behaviour to behaviour of others. *"Emotion regulation processes are important as they enlist emotion to support adaptive, organized behavioral strategies"* (Clark, 1992).

Thus, in order to improve the verisimilitude of the actors' behaviours computed by the simulation algorithm, and so the reliability of the provided results, the SocLab platform must cope with social emotions. The first step in this way is to characterize the configurations of an organization that are able to trigger emotions in an actor and to further question simulation results that reveal to be highly prone to launch emotions. Such information could be very useful from a sociological point of view to confirm or not the stability of an organization. In particular, it is likely that an actor with negative emotions which, in addition, is endowed with a significant power, will seek to make the structure of the organization to evolve toward a social game whose rules are more favourable for him.

The further step is to integrate emotions into the algorithm that implements the actors' decision-making processes, so that simulations yield organizational configurations that take into account strategic emotions. To this end, actors must seek not only getting the means to achieve their own goals but also preventing (promoting) of the occurrence of configurations able to arouse negative (positive) emotions.

The remaining of the paper is structured as follows. Emotions are understood in many ways and we first have to define what kinds of emotions we consider and how they are characterized. We refer to this end to the well-known Ortony, Clore and Collins (Ortony et al., 1988) model that is presented in section 2. Section 3 layouts the SocLab modelling of organizations and the actors' decision process in order to introduce the variables which characterize social configurations. Then, we associate to each kind of emotion indexes which values characterize

configurations likely to trigger this emotion in certain actors. The fourth section applies this framework to a concrete system of organized action which is somehow problematic. After a short presentation of this organization and an overview of its SocLab model (all relevant details are given in Terán et al., 2013), we give the values of the indexes for the configuration resulting from simulations and their interpretation in terms of actors' emotion.

## 2 ORTONY THEORY OF EMOTIONS

We use the theory of Ortony, Clore and Collins (Ortony et al., 1988) (OCC) for the characterisation of the various kinds of emotions because: (1) it is well-funded and recognized as a standard in computer science, notably in MABS; and (2) it deals with most social emotions we have to consider.

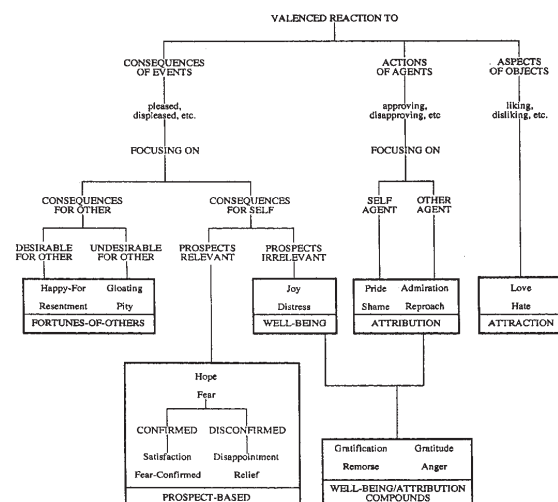


Fig. 1. Ortony et al. (2000, pp 30) classification of emotions.

Following OCC, emotions are linked to events, to actions of people (oneself or other), or to objects. The linked item might be actual or prospective, and an emotion might have a desirable or undesirable character to the extent it might affect the achievement or not of a goal, comply with or violate a moral norm, or be associated with a liked or disliked object. Emotions are then classified in a tree structure (see Fig. 1), as follows: (1) in case the linked element is an event that affects the achievement of a goal, the outcome of the event is appraised either as desirable or as undesirable, and the actor feels either pleased or displeased, correspondingly; (2) in case the linked element is an action that complies or not with a behavioural norm, the actor appraises the action either as praiseworthy or blameworthy, and his reaction will be either approval or disapproval; (3) in

case the linked element is an object, the actor appraises the object either as appealing or unappealing, and so he will either likes or dislikes it. In SocLab only the two first kinds of emotions appear: goal-based (e.g. related with properties of a configuration whose occurrence is an event), and norm-based (e.g. regarding the behavior of one actor toward another one). This will be better explained in section 3.1

### 3 IDENTIFYING EMOTIONS IN SOCLAB

To enable the modelling of social relationships between the actors of organizations, SocLab proposes a meta-model that catches the common concepts and properties of social organizations and is instantiated on specific cases as models of concrete or virtual social organizations or Systems of Organised Action (Crozier, 1964; Crozier and Friedberg, 1980). Accordingly, the model of the structure of an organization is composed of instances of *actors* and *relations* that are linked by the *control* and *depend* associations.

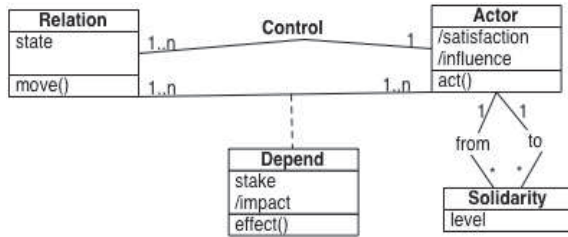


Fig. 2. The core of the meta-model of the structure of Systems of Organized Action

Figure 2 shows the meta-model of organizations' structures, as a UML class diagram. A relation is founded on an organization's resource, or a set of related resources, and it is controlled by a single actor. Resources are material or cognitive (factual or procedural believes or expectations) elements required to achieve some intended actions, so that their availability is necessary for some actors. The *state* attribute of a relation represents the behaviour of the controller actor with regard to the availability of the resource for the ones who needs it. Its range of value SB goes from the least cooperative behaviours of the controller preventing the access to the resource to the most cooperative behaviours favouring this access, while the zero value stands for neutral behaviours.

The *stake* attribute of the dependence of an actor on a relation corresponds to the actor's need of the relation to reach its own goal, on a scale:

$$\text{null} = 0, \text{negligible} = 1, \dots, \text{significant} = 5, \dots, \text{critical} = 10.$$

The *effect function* evaluates how much the state of the relation makes the resource available to the actor, so that  $\text{effect}_r : A \times SB_r \rightarrow [-10, 10]$  has values in:

$$\text{worst access} = -10, \dots, \text{neutral} = 0, \dots, \text{optimal access} = 10.$$

In addition, actors may have solidarities the ones with regard to others, defined by as function  $\text{solidarity}(a, b) \rightarrow [1, -1]$  where negative values corresponds to hostilities and positive values to effective friendships.

Defining the state, or configuration, of an organization as the vector of all relations states, each state of the organization determines on the one hand how much each actor has the means he needs to achieve his goals, defined as:

$$\text{satisfaction}(a, s) = \sum_{c \in A} \sum_{r \in R} \text{solidarity}(a, c) * \text{stake}(c, r) * \text{effect}_r(c, s_r)$$

and on the other hand how much he contributes to the satisfactions of each other actor, defined as:

$$\text{influence}(a, b, s) = \sum_{r \in R; a \text{ controls } r} \sum_{c \in A} \text{solidarity}(b, c) * \text{stake}(c, r) * \text{effect}_r(c, s_r).$$

This interaction context defines a *social game*, where each actor seeks, as a meta-objective, to obtain from others enough satisfaction to reach its goals and, to this end, adjusts the state of the relations he controls. Doing so, it modifies the value of its influence and therefore the satisfaction of actors who depend on the relations it controls.

The aim of a social game is to reach a stationary state: there, actors do no longer change the state of the relations they control, because every one accepts his level of satisfaction provided by the current state of the game, so that the organization is in a *regularised configuration*.

The actors' strategic attitude is framed by a bounded rationality (Simon, 1982). The simulation module of SocLab makes the actors to play the social game (El Gemayel et al., 2011; Sibertin et al., 2013b). The model of the actors' rationality is implemented as a process of trial and error based on a self-learning rules system. Each actor manages a variable that corresponds to his ambition, and the game ends when the satisfaction of every actor exceeds his ambition.

To sum up, each simulation run yields a regularised configuration which associates to each actor numerical values of its satisfaction and its influence, and these values may be used to determine whether this configuration is able to arouse a kind of emotion.

#### 3.1 Indexes of Emotions in SocLab

Table 1 shows the emotions a SocLab actor is likely to feel in a given configuration of the organization.

**Table 1.** Emotions experienced by an actor in SocLab.

		<i>Power (influence) exercised by</i>		
		<i>Self</i>	<i>Other</i>	<i>The Whole organization</i>
<i>Satisfaction Received by</i>	<i>Self</i>	gratificat /remorse	gratitude /Anger	joy/distress
	<i>Other</i>	pride /guilt	admirat/ reproach	If pleased/displeased about ◦ desirable event: happy-for/resentment ◦ undesirable event: gloating/pity
	<i>The Whole</i>	pride/ shame	admirat/ reproach	As above

On one hand, the OCC norm-based emotions are associated with the action done by agents, let us say A, what in SocLab is an individual actor, A itself, another actor, the whole organisation (the whole set of actors, including A) or all others (all actors excluding A). On other hand, the goal-based emotions are based on configurations related with the achievement of a goal. An OCC event is understood in SocLab as a configuration where the actor reaches in some degree its aim. The event is given by the configuration and *properties* of the game, including those of the actors. For clarity we will prefer to talk about the configuration rather than about an event.

The occurrence and intensity of each emotion is identified by an index which is defined on the basis of a proportion, or a percentage. The index is a comparison between what is actually done (e.g., the influence given by the actor) and what could be done (e.g., the potential for giving). Indeed, a social actor “appraises” the situation in the context of the possibilities available for it. The emotional interpretation of the values of each index depends on the very nature of the organization under consideration and of individual traits of the actor A. Globally, considering as an example the Joy/Distress emotions, one could consider that Joy appears above 70% and distress under 50%.

These indexes are not variables used by the agent in its decision making process. They are based on the essential properties of configurations, i.e. what is given (Influence or Inf) from A to B, or in what is received (Satisfaction or Sat) by A from B, where A and B may be: a particular actor, the whole organisation or all the other actors, as shown in Table 1. For instance, we will call  $\min\text{Sat}(A)$  (resp.  $\max\text{Sat}(A)$ ) the minimal (resp. maximal) Satisfaction A can receive from the whole. The same stands for  $\min\text{Inf}(A)$  and  $\max\text{Inf}(A)$ . Similarly,  $\text{Sat}(A, s)$  (resp.  $\text{Inf}(A, s)$ ) stands for the Satisfaction (resp. Influence) of A at configuration s.

### 1. Well-being emotions: Joy/Distress

The OCC model defines joy (distress) as: to be pleased (displeased) about the occurrence of a desirable (undesirable) event, or the (regulated) configuration resulting from such an occurrence. In SocLab, the joy/distress of an actor A is defined as:

$$\text{Joy}(A, s) = (\text{Sat}(A, s) - \min\text{Sat}(A)) / (\max\text{Sat}(A) - \min\text{Sat}(A))$$

### 2. Gratification/Remorse

OCC defines gratification (remorse) as being pleased (displeased) about a desirable (undesirable) event or situation that results from oneself action and thus entails the approving (disapproving) of one's own praiseworthy (blameworthy) action. Thus:

$$\text{Gratif}(A, s) = (\text{Inf}(A, A, s) - \min\text{Inf}(A, A)) / (\max\text{Inf}(A, A) - \min\text{Inf}(A, A))$$

### 3. Pride/Guilt and Pride/Shame

An actor could feel prideful (guilty or shameful) when he approves (disapproves) his praiseworthy (blameworthy) action regarding its effect on another or on the whole. Thus, Pride (Guilt) of A with regard to B is:

$$\text{Pride}(A, B, s) = (\text{Inf}(A, B, s) - \min\text{Inf}(A, B)) / (\max\text{Inf}(A, B) - \min\text{Inf}(A, B))$$

Replacing B by O (all the others) we have the Pride (Shame) of an actor A with regard to all others.

Similarly, the Pride (Shame) of A with regard to the whole organization is defined as:

$$\text{Pride}(A, W, s) = (\text{Inf}(A, s) - \min\text{Inf}(A)) / (\max\text{Inf}(A) - \min\text{Inf}(A))$$

### 4. Gratitude/Anger

The OCC model defines gratitude (anger) as to be pleased (displeased) about the consequences for oneself of another's praiseworthy (blameworthy) action. Thus gratitude (anger) is similar to gratification (remorse), but it regards what is given by the other instead of what is given by oneself. We define the Gratitude (Anger) of A towards B as:

$$\text{Gratitude}(A, B, s) = (\text{Inf}(B, A, s) - \min\text{Inf}(B, A)) / (\max\text{Inf}(B, A) - \min\text{Inf}(B, A))$$

### 5. Admiration/Reproach

Admiration (reproach) is related to approving (disapproving) some other's praiseworthy (blameworthy) action, evaluated wrt the consequences for another actor B, for all others, or for the whole organization. More precisely, Actor A evaluates the influence given by actor B considering its consequences for C, in accordance to the solidarity A feels towards C. This can happen either because A perceives the consequence for C of B's action, or the feeling of B towards C (sharing of emotions). Thus, the Admiration (Reproach) of A towards B, given the A's solidarity towards C, is:

$$Admiration(A,B,C,s) = Gratitude(C,B,s) * Solidarity(A,C)$$

The sign of Solidarity(A, C) determines whether A feels Admiration (positive) or Reproach (negative) towards B.

### 6. Happy-for/resentment, and Gloating/pity

These emotions appear when the actor perceives what is happening for another particular actor as a consequence of a configuration resulting from collective action. Example: an actor B is getting a low capacity while it is giving a lot; this means that he is collaborative and expects the others to be so towards him, and the low collaboration from others toward him is unjust. Under this situation, if an actor A has negative (positive) solidarity towards actor B, then A feels pleased (displeased) by what is happening to B, and so A would feel gloating (pity) in the following proportion:

$$Pity(A, B, W, s) = Abs[Joy(B, W, s) - Pride(B, W, s)] / Joy(B, W, s) * Sol(A, B);$$

Notice that (Joy(B, W, s) - Pride(B, W, s)) is negative (undesirable). Pity (gloating) occurs if solidarity is positive (negative). When (Joy(B, W, s) - Pride(B, W, s)) is positive (desirable), the same equation defines Happy-for/resentment.

## 4 THE CASE

The model of a concrete team is introduced to exemplify how emotions and morality can be identified in SocLab, and to illustrate how such identification can help in auditing organisations or designing policies for promoting collaboration. The team is in charge of designing a methodology for Institutional Planning in the Public Sector (we will call it Team for Designing a Planning-Methodology, or TDPM). The model has been developed in interaction with persons who are or have been involved in the TDPM team, with whom also the simulation results have been shared and discussed (a precise description of the TDPM's model is given in (Terán et al., 2013)).

TDPM is part of a Public Foundation entrusted with the investigation and development of socially pertinent free technologies, which in turn is part of the Ministry for Science and Technology of a LatinAmerican country. That Public Foundation has four departmental units for its basic activities, and a Management Unit. The basic units are:

- **Pertinence Unit:** advises other units about the relevance of technologies.
- **Development Unit:** produces the tools for the methodologies.
- **Research Unit:** designs free technologies methodologies, organisational forms and tools.

- **Technological Spreading Unit:** spreads the use of the methodology.

### 4.1 The TDPM team

The TDPM's model includes seven actors coming from all the five units of the Public Foundation (an actor can correspond to several similar concrete member of an organization): two actors from the Research Unit, two actors from the Development Unit, and one from each of the three other units. The work process the TDPM follows the cycle shown in Fig. 3. Each actors of the team has some duty and controls some relations, as explained below:

- Director. It controls the relations: *controlWork* and *materialSupport*. The first one consists in work report and evaluation mechanisms, and the second one on all material assistance.
- researcherS. It designs the planning methodology, and specifies the requirements of the tools. It controls the relation *researchMethS*.
- researcherO. It operatively helps the ResearcherS. It controls the relation *researchMethO*.
- developerS. It develops software tools, and so controls the relation *develTools*.
- developerO. It helps the developerS actor operatively, developing particular functionalities of the software, controlling the relation *develToolO*.
- pertAdviserS. It is responsible for advising the rest of the team about the social pertinence of the methodology, controlling the relation *pertinence*.
- techSpreaderO. It is responsible for technological spread, for promoting the use of the methodology, controlling the relation *techSpread*.

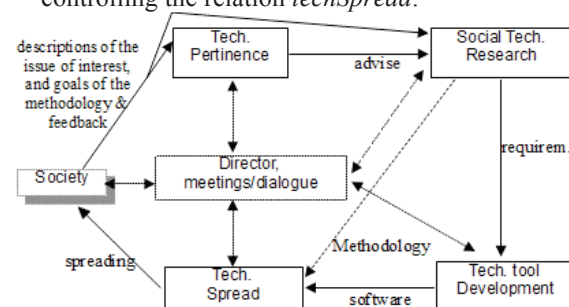


Fig. 3. Activities of the team developing the planning methodology. It completes a cycle begging by identifying requirements of the society, and finishing with spreading the product (methodology) into the society.

The two following attitudes are found:

- some actors of the team are highly *engaged*, creative, and thus their work is key for the team;
- other members of the team are weakly engaged, *distanced*, and their work is little productive and slightly supports the TDPM's aims.

In the TDPM team, the actors `pertAdviserS`, `researcherS` and `developerS` reveal to be highly engaged; while the other four actors are distanced at different degrees.

## 4.2 Results

Table 2 shows the distribution of influences and satisfactions at the regularised configuration resulting from simulations. Table 3 gives the intensities of Joy, Pride, Gratification and Gratitude felt by the actors at this configuration. For Gratitude particular cases are presented, indicating towards whom the actor feels such an emotion. The other emotions, namely `Admiration/Reproach`, `Happy-for/Resentment` and `Gloating/Pity`, do not appear in the present model because there are not significant solidarities between actors.

From Table 3 we see that all actors have a good level of Joy and Gratification. In particular, `researchO` has the minimal value of Joy, while `pertAdviserS` has the maximal one.

An interesting result appears when we compare the values of Pride to the Whole (`Pride_W`) and Pride to others (`Pride_O`). Pride to the whole is high for all actors but in some cases Pride to others is low. This means that some actors give a lot to themselves but little to others. The worst case is that of `techSpreaderO`, followed by `developerO` (0.29 and 36.3, respectively). The `techSpreaderO` case is critical and should strongly affect the performance of the team. Also the Director is not very much engaged (`Pride_O` is only 52.7%), somewhat affecting the performance of the team.

This case illustrates how the level of moral emotions is correlated with the level of engagement of the actors, and could help in defining policies to improve actors' engagement and so the organisation's performances. In particular, actions aiming at favouring (in some actors) pride to all the others could be beneficial. Afterwards, those policies can be improved from careful feedback about the generated changes in the actors' engagement and emotions. In the long term, the promotion of appropriate emotions would be aimed at establishing desirable organisational norms.

## 5 RELATED WORK

Different formalizations of OCC can be found in the literature, see for instance Steunebrink *et al.* (2012) or Adams (2010). These formalizations represent formal descriptions of the qualitative aspects of emotions (or conditions to happen), which indicates when an emotion is triggered. On the other hand,

quantitative aspects of emotions (e.g., emotion intensity) addressed in the present paper has received scarce treatment. One work in this area is offered by Steunebrink *et al.* (2008).

OCC does not specify in detail how to deal with the quantitative aspect of emotions, apart from mentioning some variables on which emotions depend, and giving some hints about how to manage the quantitative aspect of emotions, by using the variables *potential*, *threshold* and *intensity*. Intensity is defined as the difference between potential and threshold (see Steunebrink *et al.*; 2008, p. 3). For instance, the potential (and thus the intensity) of some emotions related with the action of agents is affected by the variables degree of praiseworthiness (blameworthiness), degree of desirability and degree of effort. In particular, the effect of these variables can be considered linear: potential is a weighted sum of the named variables. In general, in OCC, potential is defined in terms of the *Central Intensity Variables* and the *Local Variables*.

Similarly, only hints are given in OCC about how to define the qualitative value of the threshold of emotions: they might be determined in terms of *Global Variables* which are related with the "mood" (a kind of disposition) of the individual; e.g., if the individual general feeling or "mood" becomes more agreeable than in a previous state, then the threshold of negative emotions would be increased in relation to the values at that previous state. Among the OCC Global Variables, we have: sense of reality, and the subjective importance of a situation.

Alike OCC, Steunebrink *et al.* (2008) does not study the variables affecting the intensity of emotions, but instead concentrates on the integration of qualitative aspects into the logical formalization of OCC. For this, they need to describe not only the initial value of an emotion, but also how its value changes over time, decreasing until disappearing or being negligible, what is represented via an inverse sigmoid function

## 5.2 Our Approach

In SocLab the interest is in the regularized configuration resulting from simulation, where certain properties occurs according to the state of each relation and the values of each actor's Influence (what is given) and Satisfaction (what is got). In this sense, we can say that the resulting intensities of the emotions are regulated emotional states, which can be related with *measures of central tendency* (e.g., means, medians, or modes). Thus, the interest is not in simulating the dynamics of emotions as in Steunebrink *et al.*



(2008); *i.e.*, the aim is not to simulate the conditions in which emotions occur, or their initial and subsequent values over time.

**Table 2.** The exerted influence (in columns) and obtained satisfaction (in lines) by the actors of the TDPM team at the configuration resulting from simulations. The last column shows the percentage of satisfaction each actor receives from all actors in relation to what it can get. Similarly, the last two lines show the actual percentage of influence each actor gives to the Whole and to all the Others, in relation to what it can give.

	Director	researcherS	researcherO	developerS	developerO	perAdviserS	techSpreaderO	Satisfaction	%SatiWhole
Director	29.8	15	0.8	15	0	6.9	-5.9	61.5	89.7
researcherS	2.3	40	1.5	7.2	-0.8	6.9	-5.9	51.1	86
researcherO	-0.4	-4	14.8	0.9	-0.2	0	0	11.1	71
developerS	-1.8	25	1.5	36	-2.3	0	0	58	85
developerO	-2.7	4	0.3	18	19	0	0	38	89
perAdviserS	2.7	20	0	18	-0.4	24.3	-4.9	59.5	90
techSpreaderO	-0.6	0	0	0	0	0	45	43.9	72
Influence	29.2	100	18.8	95.1	15.4	38.1	28	46.3	
% Inf. To Whole	78.9	100	95.6	100	93.1	99.5	100		
%Inf. To Others	52.8	100	59.2	100	36.3	99.3	0.3		

**Table 3.** Intensity of emotions felt by the actors of the TDPM team in the configuration described in Table 2. For Gratitude only examples are given.

	Joy	Gratif	Pride O	Pride W	Gratitude	Towards
Director	89.7	97.68	52.7	78.9	20.5	techSpreaderO
researcherS	85.5	100	100.0	100	99	techSpread.
researcherO	71.3	97	59.2	95.6	99.3	perAdviserS
developerS	84.7	95	100.0	100	100	researchS
developerO	89.4	94.8	36.3	93.1	95	developerS
perAdviserS	90.2	99.6	99.29	99.5	52	director
techSpreaderO	72	99.6	0.29	99.5	-	developerO

In this sense, we take a different approach from that of Steunebrink *et al.* (2008). The determination of emotions rests in relational properties of the actors, associated with the actors' aims and morality; that is, emotions are defined in terms of what an actor gives and what an actor receives. It is supposed that the conditions for the emotion are fulfilled at the regulated state, and so we do not need to test them. However, the intensity of an emotion is not necessarily positive, as it might also be either null or negative. As emotions of interest in SocLab are defined in pairs (*e.g.*, pride vs. shame), if the intensity is positive, then the positive component happens, otherwise the negative component is the case.

Thus, the paper focuses in determining the intensity of each emotion, which for simplicity here is assumed to be equal to its potential (the threshold is 0). However, alike OCC and Steunebrink *et al.* (2008), we do not concentrate on specifying either the variables determining the intensity or the vari-

ables indicating the threshold of the emotions. For instance, for the case of Pride and Gratification, the emotion intensity results from evaluating what the actor is given to itself or to others, in relation to what it can give. This might be seen as a consequence or as measure of the actor's morality. On the other hand, the index of Joy focuses on what the actor is receiving, in comparison to what it can receive, what measures the degree of achievement of the actor goals.

It is important to notice the introduction of the notion of solidarity, which is missing in Steunebrink *et al.* as in OCC. This allows differentiating a diversity of relationships between an actor and the others. For instance, Admiration of actor A towards actor B might happen not only because the action of B is of direct interest for A, but also because it is of interest for an actor C to whom A feels solidarity. This permits to considerably increase the richness of the described social relationships.

## 6 CONCLUSION

The paper shows how emotions can be identified in SocLab models of organizations by the definition of indexes that evaluate the potential arousal of moral emotions such as pride and guilt. Considering a concrete organization, it has illustrated how the knowledge of the actors' emotional states improves the understanding of the functioning of an organization.

Considering the fact that social actors try to prevent bad emotions and reach good ones, this opens the way for the simulation algorithm to cope with the emotions of actors. In the case study, the indexes show low levels of moral emotions for some actors, and thus, e.g., help in a diagnosis of the organization in order to design policies to improve the level of engagement of those lowly engaged actors. These policies would promote desirable norms of behaviour, taking into account moral emotions as incentive/punishment in settling and strengthen those norms, in order to increase collaboration in the organization. This issue will be addressed in further research.

## ACKNOWLEDGMENTS

This work has been supported by the French ANR project EMOTES "Emotions in social interaction: Theoretical and Empirical Studies", contract No. ANR-11-EMCO 004 03.

## REFERENCES

- Adam Carole, 2007. *Emotions: From Psychological Theories to Logical Formalization and Implementation in a BDI agent*. Ph.D. Thesis, Université de Toulouse, Toulouse, France. 216 p.
- Andreit, F., Roggero, P., Sibertin-Blanc, C. and Vautier, C., 2011. Using SocLab for a Rigorous Assessment of the Social Feasibility of Agricultural Policies. *International Journal of Agricultural and Environmental Information Systems* 2(2), p. 1-20.
- Axelrod, R., 1997. Advancing the Art of Simulation in the Social Sciences. In R. Conte, R. Hegselmann and P. Terna (Eds), *Simulating Social Phenomena* (pp. 21-40). *Lecture Notes in Economics and Mathematical System*. Springer-Verlag.
- Clark M, 1992. *Emotion and social behavior* (Ed), Sage Publications.
- Clore, Gerald L. and A. Ortony, 2000. Cognition in emotion: Always, sometimes, or never. In *Cognitive neuroscience of emotion*, edited by Richard D. Lane, and Lynn Nadel, 24-61. New York: Oxford University Press.
- Crozier, M., 1964. *The Bureaucratic Phenomenon*. Chicago: University of Chicago Press.
- Crozier M. and E. Friedberg, 1980. *Actors and Systems: The Politics of Collective Action*. The University of Chicago Press.
- El-Gemayel, J., Chapron, P., Sibertin-Blanc, C (2011). Impact of Tenacity upon the Behaviors of Social Actors. *Advances in Practical Multi-Agent Systems*, Quan Bai and Naoki Fukuta (Eds), Studies in Computational Intelligence 325, p. 287-306, Springer.
- El-Gemayel J., 2013. *Modèles de la rationalité des acteurs sociaux*. PhD of the Toulouse University, France.
- Giardini F., R. Conte, and M. Paolucci, 2013. Reputation. Chapitre 15 In *Simulating Social Complexity - A Handbook*, Bruce Edmonds and Ruth Meyer Editors. Springer.
- Ortony, A., Clore, G., and A. Collins, 1988. *The cognitive structure of emotions*. New York: Cambridge University Press.
- Selten, R., Ostmann, A, 2001. Imitation Equilibrium. *Homo Oeconomicus* 43, 111-149
- Sibertin-Blanc, C., Amblard, F. and Mailliard, M. (2006). A coordination framework based on the Sociology of Organized Action. In *Coordination, Organizations, Institutions and Norms in Multi-Agent Systems*, O. Boissier, J. Padget, V. Dignum and G. Lindemann (Eds), LNAI, 3913, 3-17. Springer.
- Sibertin-Blanc, C. Roggero, F. Adreit, B. Baldet, P. Chapron, J. El Gemayel, M. Mailliard, and S. Sandri, 2013a SocLab: A Framework for the Modeling, Simulation and Analysis of Power in Social Organizations, *Journal of Artificial Societies and Social Simulation (JASSS)*, 16(4). <http://jasss.soc.surrey.ac.uk/>
- Sibertin-Blanc, C. and El Gemayel J. 2013b. Boundedly Rational Agents Playing the Social Actors Game - How to reach cooperation. *Proceeding of IEEE Intelligent Agent Technology*, V. Raghavan (Ed.), 17-20 nov. 2013, Atlanta.
- Simon, H. A., 1982. *Models of bounded rationality: Behavioral economics and business organization*. The MIT Press.
- Squazzoni, F., 2012. *Agent-Based Computational Sociology*, Wiley
- Staller A. and P. Petta, 2001. Introducing Emotions into the Computational Study of Social Norms: A First Evaluation, *Journal of Artificial Societies and Social Simulation* vol. 4, no. 1.
- Steunebrink, B.R., Dastani, M.M. & Meyer, J.-J.Ch., 2008. A Formal Model of Emotions: Integrating Qualitative and Quantitative Aspects. In G. Mali, C.D. Spyropoulos, N. Fakotakis & N. Avouris (Eds.), *Proceedings of ECAI'08*, pp. 256-260. IOS Press.
- Steunebrink, B.R., Dastani, M.M. & Meyer, J.-J.Ch., 2012. A Formal Model of Emotion Triggers: An Approach for BDI Agents. *Synthese*, 185(1):83-129, Springer.
- Terán, O., and Sibertin-Blanc C., 2013. Social Model of a Team Developing a Planning-Methodology. *OpenAbm* <http://www.openabm.org/model/3983/version/1/view>