Propagation of the Effects of Certain Types of Military Psychological Operations in a Networked Population

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Abstract. In modern asymmetric military conflicts, the Armed Forces generally have to intervene in countries where the internal peace is in danger. They must make the local population an ally in order to be able to deploy the necessary military actions with its support. For this purpose, psychological operations (PSYOPs) are used to shape people's behaviors and emotions by the modification of their attitudes in acting on their perceptions. PSYOPs aim at elaborating and spreading a message that must be read, listened to and/or looked at, then understood by the info-targets in order to get from them the desired behavior. A message can generate in the info-targets, reasoned thoughts, spontaneous emotions or reflex behaviors, this effect partly depending on the means of conveyance used to spread this message. In this paper, we focus on psychological operations that generate emotions. We present a method based on the Intergroup Emotion Theory, that determines, from the characteristics of the conveyed message and of the people from the population directly reached by the means of conveyance (*direct info-targets*), the emotion likely to be triggered in them and we simulate the propagation of the effects of such a message on indirect info-targets that are connected to them through the social networks that structure the population.

1 INTRODUCTION

Nowadays, when the Armed Forces have to intervene in the framework of asymmetric conflicts, it is essential for them to make the local population of the concerned country an ally. Operations of influence are then essential and take precedence over combat actions. SICOMORES (SImulation COnstructive et MOdélisation des effets des opérations d'influence dans les REseaux Sociaux) is a system that simulates the effects of some operations of influence (CIMIC, PSYOP and KLE operations) on the population structured within social networks underlied by diverse links (religious link, ethnic link, etc.). PSYOP operations are meant to spread a message that must be read, listened to and/or looked at, then understood by the info-targets [3]. A message can generate in them reasoned thoughts, spontaneous emotions or reflex behaviors. In this paper, we focus on the simulation of the effects of messages likely to trigger emotions, both on the direct info-targets and on the indirect ones due to propagation through the social networks that structure the population.

In section 2, we explain why the system SICOMORES is interesting and useful for the military. In section 3, we describe the state of the art of the systems dealing with the propagation of

sentiments/emotions in a social network, then SICOMORES' theoretical bases are outlined in section 4, followed by the specification of the Human Terrain of the environment in section 5. The characteristics and the modeling of psychological operations, as well as the mechanism of effect generation of emotion-triggering psychological operations are then respectively detailed in section 6 and 7. Section 8 concludes the paper.

2 INTEREST OF THE SYSTEM SICOMORES

A military analyst who is in charge of conceiving psychological messages, is generally a person who knows very well the country to which the recipients belong, its language and the local culture through all its facets. When he intends to reach a given group of people being part of the population and characterized by their social, psychological and/or cultural features (the *direct info-targets*) and to have them feel a specific emotion, he knows how and what to say. He can be efficient without the help of a system. However, a major factor intervenes when a message is spread: the means of conveyance of this message, because it defines the scope of the message, that is the area within which the direct info-targets can be reached. What is to be taken into account is that, within this area, other people than the direct info-targets may be reached. When they get the message, they will have their own reaction, that the analyst has not thought about, but that can be very important and can play a great part. In that case, the system will be able to compute this reaction, because it has the knowledge that describes the characteristics of the Sociocultural Groups of people that were reached by the message in a non intended way. For that purpose, it will use the Intergroup Emotion Theory presented in section 4. What we are underlining is the superiority of the computer over a human being as regards the capacity of storing information such as all the types of people that can be found on a specific area and also its ability to compute an emotion felt by people characterized by social features when they get a given psychological message. There is still another aspect for which the computer will help the analyst. In the country where the conflict takes place, the population is structured within networks based on different links, political, religious, family links, for instance. When a direct info-target is reached by a message, they will probably propagate it, according to some rules we will explain in section 4, to the people they are connected to by the various links (the *indirects info-targets*) and those people will in turn do the same thing with their own connections and so on. Contrary to a human being, the computer can memorize the structure of the networks and then it can determine who will be the indirect info-targets and what will be the effect of the message on them.

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From these considerations, we can see how a system like SICOMORES can be precious to the military who use psychological operations, to predict the impact of a message on the whole population.

3 PROPAGATION OF SENTIMENTS OR EMOTIONS IN SOCIAL NETWORKS

To our knowledge, all the works that deal with the propagation of sentiments/emotions in a social network exclusively refer to online virtual communities.

In [14], the authors have developed an agent-based framework to model the emergence of collective emotions. A node is an individual called a Brownian agent which has emotions described by their valence and their arousal that change according to a stochastic dynamics. An individual's next emotional state is determined with a linear sum of psychological factors, including the feedback of the community, and a Gaussian error. In this work, a unique source of nformaton is supported, contrary to [7] where multiple sources of information are taken into account. In [6], the author generates a fully-connected polar social network graph from the sparsely connected social network graph in the context of blogs, where a node represents a blogger and the weight of an edge connecting two bloggers represents the sentiment of trust/distrust between them. The sign and magnitude of this sentiment value is based on the text surrounding the link. The author uses trust propagation models to spread this sentiment from a subset of connected blogs to other blogs to generate the fully connected polar blog graph. In [10], nodes represent posts in a directed graph and edges, hyperlinks connecting posts. Each post is analyzed using sentiment analysis techniques [8] and the goal is to determine how sentiment features of a post affect the sentiment features of connected posts and the structure of the network itself. In [19], the same approach is adopted, but specific questions are answered, like: how to identify features that lead to a sentiment propagation, how does the sentiment propagate, how fast, on the basis of which factors, how are the propagation speed variations connected to real world events, how does the role of the different individuals influence the propagation, etc. ?

4 SICOMORES' THEORETICAL BASES

4.1 Theories of Emotion

The Appraisal Theory of Emotion [13] postulates that, when a human being (or any living organism) lives, imagines or remembers a situation, they experience an emotion that results from the assessment of that situation according to a few cognitive criteria that can be classified into four families and answer specific questions:
- **Relevancy**: Is the situation relevant to me, does it affect my well-being?
- **Implications**: What are the implications of the situation and how do they affect my well-being and my short-term and long-term goals?
- **Coping potential**: To what extent can I face the situation or adjust to its consequences?
- **Normative significance**: What is the significance of the situation as regards my social norms and my personal values?

Scherer's version of the Appraisal Theory includes 16 specific criteria (Stimulus Evaluation Checks – SECs) that belong to the previous families. A combination of values of the criteria determines in a unique way a specific emotion, but the assessment of the different criteria is subjective. Thus, the same situation can trigger different emotions in people with different traits and coming from different cultures. Only the correspondence between a combination of values and a specific emotion is universal (*Universal Contingency Hypothesis*).

According to the Social Identity Approach [17], people categorize the others and themselves into social categories or groups defined by social criteria like age, religion or social status. The people who belong to the same category as an individual are called their **ingroups** and the others are called their **outgroups.**

The Intergroup Emotion Theory [9] is defined in an intergroup context and suggests that the emotional experience of a person as a member of a social group is identical to the experience they live as an individual, as it is described in the Appraisal Theory. The only difference is that the Intergroup Emotion Theory implies the cognitive evaluation of a situation, that concerns the social identity of an individual (traits that connect the person to social groups) instead of involving their personal identity (the aspects that make the person unique). According to Garcia-Prieto and Scherer [5], the criteria that are sensitive to the social identity of a person are the ones that have a social connotation:

• Social goal conduciveness/obstructiveness (*Implications*),
• Agency/responsibility, action target (*Implications*),
• Control, power, adaptability (*Coping potential*),
• External standards (*Normative significance*).

For an individual to feel an intergroup emotion, the situation or the stimulus has to be relevant to the individual's social identity.

	Anger	Guilt
Social goal conduciveness	No	No
Action responsibility	Outgroup	Ingroup
Action target	Ingroup	Outgroup
Coping potential	High	Weak
Normative significance	Open	Immoral/Illegit.

Table 1. Examples of Emotion Definitions with Social Cognitive Criteria

4.2 Frijda's Laws of Emotion

An emotion is generally defined as "a subjective response to events that are important to the individual" [4]. Emotions are best characterized by two main dimensions: *arousal* and *valence*. The dimensions of valence ranges from highly positive to highly negative, whereas the arousal can be interpreted as the intensity. For Frijda, an emotional event generates a memory relative to the emotion felt by an individual during this event/situation, but here the situation itself is much less important than the emotion and the target of the emotion.

According to the *Law of habituation* [4], if one has often experienced an emotion towards someone during repeated

emotional events, then the next time an analogous emotion will occur, it will be less intense. It is the "repeated exposure to the emotional event" that accounts for habituation (*Law of Conservation of Emotional Momentum*). However, the *Law of Hedonic Asymmetry*, which highlights the different adaptation to pleasure or pain, states that the intensity of intense negative emotions seem not to diminish. The *Law of Comparative Feeling* expresses another interesting fact: "The intensity of an emotion felt during an event depends on the relationship between the event and some frame of reference against which the event is evaluated". The frame of reference is often the current situation, but it can also be an expectation, which is the case for relief and disappointment.

4.3 Propagation of Emotional Information in Social Contexts

According to [11], people are most willing to communicate social anecdotes that arise emotions and, as Rimé [12] reported, "The communicability of emotional social information is situated as some emotions are better able to increase communicability than others, and this varies with the identity of the audience". Several emotions selectively increase the communicability of social information: for instance, surprise and sadness only increase the communicability with friends (or ingroups), fear only with strangers (or outgroups). Guilt and shame are emotions that people keep to themselves and generally don't communicate.

4.4 Maslow's Pyramid and its Limitations

Maslow created a hierarchy of the human beings' needs, where the fundamental needs of a person (*physiological needs*: to eat, to drink, to sleep, etc., *security need*, *social needs*) are to be satisfied before the higher level ones (*need of esteem*, *need of self-accomplishment*). The fact that Maslow's pyramid was designed for Western countries has been underlined in several works, e.g. [15], where the author explains that both the hierarchy of priorities between the different needs and the needs themselves may differ between cultures. For instance, in an Asian country, interpersonal relationships and social interactions are more valued, on average, than self-accomplishment needs.

5 MODELING THE HUMAN TERRAIN IN SICOMORES

The Human Terrain consists of Social Agents. A Social Agent can be an individual who is part of one or several Sociocultural Groups (network(s)). A Social Agent can also be a Sociocultural Group like a Community Council, a religious network, an ethnic group, an NGO, a volunteer association, a group of interests, etc. Individuals and Sociocultural Groups are part of the population. The other Social Agents are local authorities, ONU Agencies, etc. Individuals are modeled as intelligent agents, Sociocultural Groups as groups of agents, whereas the other social agents are modeled as global social entities.

5.1 Individuals

Each individual is described by a set of attributes:
- *Social features*: age, gender, language, social status, religion, ethnicity, location, professional status, media (through which they can be reached: tracts, posters, newspaper ads,

loudspeakers, radio, television, SMS and phone calls) and social goals.
- *Cultural features*: values, norms, artifacts, rituals, institutions, symbols.
- *Psychological features*: interests, vulnerabilities, types of needs, satisfaction degrees (in [-10, 10]) for each type of needs (according to Maslow's terminology). We will explain these notions in detail in the next section.

Cultural and some social and psychological features can be "factorized" in the description of Sociocultural Group(s) to which the individuals are linked.
Political, religious and other types of Sociocultural Group leaders are represented as particular individuals.

5.2 Sociocultural Groups

A sociocultural Group is a group of people recognized as such by its members and also by the other people, and is described by attributes specifying Social (including social goals), Cultural (Values, Norms, Artifacts, Rituals, Institutions and Symbols) and/or Psychological features. Let us specify the previous notions:

A *social goal* is any desired social reward (a positive outcome provided by and revered by a society) that one works toward, i.e. getting an education, obtaining a good job, getting married and having children, buying a nice car, even buying an Ipod can be considered a pop-culturally social goal.

A *norm* [20] is "a group-held belief about how members should behave in a given context. Sociologists describe norms as informal understandings that govern individuals' behavior in society, while psychologists have adopted a more general definition, recognizing smaller group units, like a team or an office, may also endorse norms separate or in addition to cultural or societal expectations. The psychological definition emphasizes social norms' behavioral component, stating norms have two dimensions: how much behavior is exhibited and how much the group approves of that behavior".

A *cultural artifact* is "an item that, when found, reveals valuable information about the society that made or used it. What is qualified as a cultural artifact? Burial coins, painted pottery, telephones or anything else that evidences the social, political, economic or religious organization of the people whom they belong to can be considered cultural artifacts" [21].

A culture's *values* are "its ideas about what is good, right, fair, and just. For example, American sociologist Robert K. Merton suggested that the most important values in American society are wealth, success, power, and prestige" [24].

A ritual "is a sequence of activities involving gestures, words, and objects, performed in a sequestered place, and performed according to set sequence". Rituals may be prescribed by the traditions of a community, including a religious community. Rituals are characterized by formalism, traditionalism, invariance, rule-governance, sacral symbolism and performance.
Rituals of various kinds are a feature of almost all known human societies, past or present. "They include not only the various worship rites and sacraments of organized religions and

cults, but also the rites of passage of certain societies, atonement and purification rites, oaths of allegiance, dedication ceremonies, coronations and presidential inaugurations, marriages and funerals and son on. Many activities that are ostensibly performed for concrete purposes, such as jury trials, execution of criminals, and scientific symposia, are loaded with purely symbolic actions prescribed by regulations or tradition, and thus partly ritualistic in nature. Even common actions like hand-shaking and saying hello may be termed rituals" [22].

Cultural *institutions* are "elements within a culture/subculture that are perceived to be important to, or traditionally valued among its members for their own identity. Examples of cultural institutions in modern Western society are museums, churches, schools, work and the print media. "Education" is a "social" institution, "post-secondary education" is a cultural institution, "high-school" is an instantiation of the institution within America [23]".

To the human mind, *symbols* are "cultural representations of reality". Every culture has its own set of symbols associated with different experiences and perceptions. Thus, as a representation, a symbol's meaning is neither instinctive nor automatic. The culture's members must interpret and over time reinterpret the symbol. Symbols occur in different forms: verbal or nonverbal, written or unwritten. They can be anything that conveys a meaning, such as words on the page, drawings, pictures, and gestures.

We intend the notion of *vulnerabilities*, as people's weaknesses regarding different aspects:
- *Commerce/Economy*: financial situation, commerce, industry, etc.
- *Resources*: food, arms, money, oil, etc.
- *Critical needs*: hunger, thirst, care, rest, security, etc.
- *Infrastructures*: health, communications, energy, water, transport, etc.
- *Emotional aspects*: frustration, isolation, fear, anger, etc.
- *Organisational aspects*: alliances, loss of an expert, international dissents, structural weaknesses, limitations, etc.

For each Sociocultural Group is defined a particular Maslow's-like pyramid with specific types of needs to which is associated a given respective importance.
For a given Sociocultural Group, to each specific value of the attributes mentioning Cultural features, social goals and types of need is associated the quantified (between 0 and 10) importance/typicality of that particular element for the Sociocultural Group.
The different Sociocultural Groups are organized within a hierarchy of power. Sociocultural Groups are networks, as long as their members interact with each other.
Various links may connect the members of a Sociocultural Group (e.g. religious link or family link). Some Sociocultural Groups are temporary, for example the group of people working on a Civil-Military project or the group of people gathered together at a periodic market.

6 PSYOP CHARACTERISTICS AND MODELING IN SICOMORES

For a PSYOP, a group of individuals called the direct *info-targets* is defined by means of social and/or psychological criteria which allows to find out their membership Sociocultural Group(s) and assign them cultural features and social goals. A message is then spread out to them on a specific area, depending on the scope of the means of conveyance the Forces are using and the individuals' receptivity to this means (e.g. individuals must have a radio to be reached by a message broadcasted on the radio). After the message has reached the direct info-targets, the latter will propagate to the *indirect info-targets* the content of the message. Given that SICOMORES is meant to simualte the propagation of PSYOP effects through the population structured within Sociocultural Networks, the user of the system must provide some general information concerning the PSYOP that is the input: date, effect desired by the military, direct info-targets, used mean of conveyance, means of conveyance scope, theme of the message (religious, political, etc.). Moreover, given that we don't use image recognition, nor spoken language or text semantic analysis, we expect the user to directly give some characteristics of the information conveyed by the message whatever its form (video clip, radio or television program, speech, image, text) and we assume that it is the description of an action or an event such that the agent and the target of the action are Social Agents. This action/event gives rise to a situation described as follows:

- *Relevancy:* list of the Sociocultural Groups to which the situation is relevant.

- *Goal facilitation/obstruction*: set of tuples (Social goal, "favored", concerned Sociocultural Group) or (Social goal, "obstructed", concerned Sociocultural Group).

- *Causal Agent, Action Target*: Social Agent who performs the action that gives rise to the situation and Social Agent who is the target of the action.

- *Coping potential*: set of tuples (Sociocultural Group or leader, value in {low, medium, high}). The Coping Potential of each Sociocultural Group is globally assessed by the user.

- *Sociocultural Elements*: set of tuples (Sociocultural Group, "flouted" or "accentuated" or "obstructed" or "favored", sociocultural characteristic) (see next section).

- *Need Satusfaction or Dissatisfaction*: set of tuples (type of needs, Sociocultural Group or leader, positive or negatve satisfaction degree). The types of needs are by default "Physiological Needs", "Security need", "Social Needs", "Need of Esteem", "Need of Self-Accomplishment" [15], but may be replaced by other types of needs specific to a given culture. The satisfation degree ranges between 0 and 10.

To provide these pieces of knowledge, the user is guided. For each Sociocultural Group concerned by the situation, they can display the name of its possible leader and all the social, cultural and psychological characteristics of the group as well as the hierarchy of power. The information provided by the user will

help the system assess the cognitive criteria mentioned in the section presenting the Intergroup Emotion Theory in order to determine the emotion triggered by the given message.

7 Effect Generation of a PSYOP

7.1 General Scheme

A direct info-target receives a message and feels an emotion related to the information conveyed by this message, according to the iNtergroup Emotion Theory. Their well-being may also be affected by the action/event described by this message, the notion of well-being representing the satisfaction/ dissatisfaction of the info-targets' needs. The direct info-targets then propagates the information to the indirect info-targets who, in turn, propagate it. An Info-target decides to propagate an information only if they judge it interesting enough. In that case, the choice of the people to whom it is propagated depends on that emotion generated in the emitter in accordance with what was mentioned in section III concerning the type of people to whom emotional information is propagated. It is the information that each info-target receives that determines their own emotion and well-being, not the emotion of the emitter of the information. It is important to notice that all the individuals who are members of the same Sociocultural Group experience the same emotions (as we will see later, their intensity may vary though) and feel the same well-being.

We will first explain how he arousal of an emotion determined by the Intergroup Emotion Theory is computed, then adjusted due to prior experiences and the strength of the concerned message. We will then show how the well-being of an info-target is computed. The notions of interest of an information and unexpectedness of a situation will be defined and quantified.

Finally, we will specify the conditions under which the propagation of a message stops.

7.2 Computation of the Arousal of an Emotion Determined According to the Intergroup Emotion Theory

Let Sc be the Sociocultural Group of an ndividual who must assess a situation.

As we saw in section 5.2, a Sociocultural Group in SICOMORES is defined, among other characteristics, by social goals, values, norms, artifacts, rituals, institutions and symbols and each value for these characteristics is weighted by its importance/typicality for the group.

Let FlValues, FlNorms, FlArtifacts, FlRituals, FlInstitutions and FlSymbols be the respective sets of the values of the attributes Values, Norms, Artifacts, Rituals, Institutions, Symbols for the group Sc, that represent cultural elements **flouted** in the situation. Let $imp(fv_1)$, …, $imp(fv_{Card(FlValues)})$ be the respective importance of the values fv_1,…, $fv_{card(FlValues)}$ of FlValues.

We define analogous notations for FlNorms, …, FlSymbols.

Let FrGoals be the values of the attribute Social Goals, that represent goals **favored** in the situation. Let $imp(fsg_1)$,…, $imp(fsg_{card(FrGoals)})$ be respective importance of the values fsg_1,…, $fsg_{card(FrGoals)}$ of FrGoals.

Let ObGoals be the values of the attribute Social Goals, that represent goals **obstructed** in the situation. Let $imp(osg_1)$,…, $imp(osg_{card(ObGoals)})$ be the respective importance of the values osg_1, …, $osg_{card(ObGoals)}$ of ObGoals.

Let AcValues be the values of the attribute Values, that represent cultural values **accentuated** in the situation. Let $imp(av_1)$,…, $imp(av_{card(AcValues)})$ be the respective importance of the values av_1,…, $av_{card(AcValues)}$ de AcValues.

- ***If the valence of the emotion is negative***, the factors influencing its arousal are the importance of the breakings, if the emotion is mainly caused by a lack of respect towards some sociocultural elements, and the social goals that are obstructed. In case of incompatibility of the situation with sociocultural characteristics and/or the obstruction of social goals of the info-targets' Sociocultural Group, the arousal of the emotion is more or less intense depending on the importance of the concerned characteristics. For instance, if the situation goes against an important moral value, the emotion will be more intense than if another characteristic is involved.

We define the emotion Arousal Increase Factor AIF (with the previous notations, AIFNorms, …, AIFObGoals being defined in an analogous way as AIFValues):

$$AIF = (AIFValues + AIFNorms + AIFArtif. + AIFRituals + AIFInstit. + AIFSymb. + AIFObGoals / 70 \quad (1)$$

$$AIFValues = \sum_{i=1}^{card(FlValues)} imp(fv_i) \Big/ card(FlValues) \quad (2)$$

- ***If the valence of the emotion is positive***, the factors influencing its arousal are the respective importance of the social goals that are satisfied and the respective importance of the cultural values that are accentuated in the situation.

$$AIF = (AIFFrGoals + AIFAcValues) / 20 \quad (3)$$

$$AIFFrGoals = \sum_{i=1}^{card(FrGoals)} imp(fsg_i) \Big/ card(FrGoals) \quad (4)$$

$$AIFAcValues = \sum_{i=1}^{card(AcValues)} imp(av_i) \Big/ card(AcValues) \quad (5)$$

In both cases (negative or positive emotion), the arousal of the emotion is then defined as follows (it varies between 0 and 1):

$$A = (AIF + 1) \times 0.5 \quad (6)$$

7.3 Adjustment of the Arousal of an Emotion Due to Prior Experiences

7.3.1 Emotional Memory Databases

To every Sociocultural Group is associated a database of emotional memories. Each emotional memory is defined by a tuple (emotion, arousal, target of the emotion). Let's underline the fact that an emotional memory is the trace of a

dated emotion towards a Social Agent, like Frijda's emotional event. The situation deriving from a PSYOP message, that has caused the occurrence of the corresponding emotion is not stored. Every time a new PSYOP triggers a new emotion, the corresponding emotional memory is stored in the Sociocultural Group's memory database.

7.3.2 Taking into Account of Frijda's Laws

After the determination of an emotion triggered by a psychological message, its arousal is computed as shown in section 7.2 and then adjuted by taking into account Frijda's Laws.

• **Law of Habituation and Law of Hedonic Asymmetry:** If a positive emotion or a negative emotion the arousal of which is higher than a given threshold occurs repeatedly towards a Social Agent, the absolute value of the arousal of this emotion decreases each time, which is not the case for very negative emotions the arousal of which does not change. The decreasing factor is set to a value α (to be adjusted during experimentation).

• **Law of Comparative Feeling:** If several (at least 2) consecutive emotional memories of the same valence have occurred towards a Social Agent and a new emotion towards the same Social Agent appears with the opposite valence, then the absolute value of the arousal of the latter is increased. The increasing factor is set to a value β (to be adjusted during experimentation).

An emotional event which triggers an emotion with an absolute value of its arousal lower than a certain threshold, will not be stored in the concerned Social Agent's memory database.

7.4 Adjustment of the Arousal of an Emotion Due to the Strength of a Psychological Message

The arousal of an emotion computed in both previous steps, is then adjusted again by taking into account the strength of the message. The strength of the message to be propagated (SMP) depends on the previous strength of the message (SM), the credibility of the emitter and a Boolean, EQTL, equal to 1, if the theme of the message is identical to the type of link that connects the emitter of the message and the receiver, to 0 otherwise. The credibility of any Social Agent to the eyes of each Sociocultural Group or leader is predefined (between 0 and 1). It is equal to 1, if the sender and the receiver belong to the same Cultural Group. Initially, the strength of the message propagated by the direct info-targets is equal to 1, otherwise it ranges between 0 and 1.

$$SMP = (EQTL + (1 - EQTL) \times 0.8) \times Credibility \times SM \quad (7)$$

Then the final value of the arousal of the emotion is:

$$A_f = A \times \alpha \times SMP \quad \text{or}$$
$$A_f = A \times \beta \times SMP \quad \text{or} \quad (8)$$
$$A_f = A \times SMP$$

7.5 Interest of an Information

Following the Simplicity Theory [1], the interest of an individual in an information is the interest in the event/situation that the information describes or implies and is quantified as the sum of its *unexpectedness* and the arousal of the emotion it causes in this individual:

$$I = U + A_f \quad (9)$$

We define a situation caused by a PSYOP as *unexpected*, if some elements of the situation do not correspond to the sociocultural characteristics of the people involved in it. These elements are:

- the norms and rituals characterizing the people's Sociocultural Group(s),
- the fact that the situation does not respect the hierarchy of power between the Sociocultural Groups in the concerned society.

Let PowerHierarchy be equal to 10, if the hierarchy of power is respected and 0, otherwise. The Unexpectedness is defined between 0 and 10 as follows:

$$U = (AIFNorms + AIFRituals + 10 - PowerHierarchy) / 30 \quad (10)$$

7.6 Degree of Well-being Generated by a Message

With the same notations as in the previous sections, let $imp_{N1},\ldots,$ imp_{Nn} be the respective importance of the different types of needs (in [0,1]) defined for a Sociocultural Group Sc and $d_{s1},\ldots,$ d_{sn} their respective satisfaction degrees for the group Sc in the concerned situation, the global degree of well-being of Sc's members in the situation is computed as follows (in [-10, 10]):

$$\sum_{i=1}^{n} imp_{Ni} \times d_{si} \Big/ 10 \times n \quad (11)$$

7.7 End of the Propagation of a Message

Three conditions can cause the partial end of the propagation process:
- the individual who just received the message does not have enough interest about it to transmit it (the interest falls below a certain threshold),
- the strength of the message to be propagated falls below a given threshold,
- if an ndividual is connected to another one in a temporary network and the link is not activated during the propagation, then the propagation stops along this branch.

The complete end occurs if it has been a long time (higher than a given threshold) since the message was spread by the Armed Forces.

The different thresholds are to be defined during the experimentation.

8 CONCLUSION AND FUTUR WORK

We have presented some aspects of SICOMORES, a decision support system intended to simulate the effects of influence operations on the population structured in sociocultural networks, in the framework of asymmetric conflicts. We have focused of the description of a method meant to determine the effects of an emotion-triggering Psychological Operation on the population, based on theoretical works stemming from the Psychology of Emotion and from Social Psychology.

The next step of our work will be to validate our model. A realistic population will be generated using an algorithm that takes into account the sociocultural characteristics of the concerned country [2] and the sociocultural data will be extracted from [18]. The future interface will allow to display "maps of emotion" and well-being indicators for each Sociocultural Group.

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