Influencing Ontology

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1.   Introduction

This extended abstract outlines an ontology for psychological operations (PSYOP) target audience (TA) analysis that can be used for both modeling and simulation of the influence domain and for inter-agent communication. It was devised for use in a multi-agent-based modeling and simulation application designed to support psychological operations campaign analysis and development. (See [1] for an overview of the architecture of this application.)

2.   Psychological Operations

PSYOP is the use of messages to influence the behavior of a group of people, the "target audience." Radio, television, newspapers, pamphlets, leaflets, loud-speaker broadcasts, and word-of-mouth are all forms of communication that can be used to convey a message to a TA. There are three basic elements of TA analysis: accessibility, effectiveness, and susceptibility analysis. A TA is accessible, if it is possible to reach a TA with a message. A TA is effective if it can be influenced to behave in a way that achieves the PSYOP objective. Susceptibility analysis is concerned with determining the nature of the message that would most effectively influence the TA to behave in the desired way.

Our full paper describes a formalization (in the form of an "ontology") of the concepts necessary to provide automated support to these three components of PSYOP target audience analysis. It proposes a representation for the key idea of influence via messaging and formalizes the notion of a message containing a theme that leverages "vulnerabilities" (or sensitivities) of a TA. The ontology captures the essence of what is needed to formalize PSYOP. We need TAs and other actors, influence mechanisms, and ways to represent target audience accessibility, susceptibility, and efficacy.

3.   The Influencing Ontology

An *actor* in the influencing ontology may be a single individual, a group of individuals, or an organization. Individuals are kinds of agents. The actors of the ontology are all thinking agents which means they may act of their own volition (from their desire to act) based on their beliefs, goals, and "policies" (or "values"). They have *states* (properties or attributes) that may change over time, and they behave or do things—perform *actions*—that have effects either on themselves or on other agents over time. A *group* is a collection of individuals that are interdependent. Groups can have states and can perform actions just as individuals can. *Organizations* in the ontology are groups structured by various kinds of relationships, for example, superior/subordinate/peer, patron/client, etc. Both groups and organizations are denoted by constants, following the same orthographic conventions (illustrated below) as for the names of individuals.

The typical form of a statement in the PSYOP (influencing) ontology is expressed in the following schema:

(1)   *(predicate agent [agent$_1$…[agent$_n$]] [object [object$_1$…[object$_n$]]] strength location time)*

where *predicate* specifies a state of the agent or agents referred to in the next argument position(s) of the statement; *agent [agent$_1$…[agent$_n$]]* denote actors of the ontology; object arguments typically denote a linguistic entity of the ontology such as a communication act or message; strength is a floating-point number from the interval [-1.0, 1.0]; location is a reference to the two- or three-dimensional space at which the statement is alleged to hold or to be true; time is the time or temporal interval at which the statement is alleged to hold; square brackets (*[ ]*) indicate optional elements.

A *state* is some attribute of an individual, group, or organization that holds over an extended period of time. Examples are "military power," "economic power," and "economic hardship." States can be unary (i.e., hold of one agent), binary (i.e., holds between two agents), or n-ary (e.g., when it reflects an attitude of one agent towards another agent). "Supports" and "trust," for example, are typically binary predicates: one individual (or group) supports (or support) another individual (or group). Statements expressing state information are expressed using form (1) above. Actor states may be of any practical arity. Unary predicates usually denote attributes. For example,

(2) *(hasMilitaryPower LFLeader 0.3)*

says that an actor (or agent) denoted by the term *LFLeader* has a certain amount of military power. The amount is reflected in the value 0.3, the degree of strength expressed as a floating-point number chosen from the interval [-1.0, 1.0]. Although simple state attributes of an actor, such as "has political power," are of potential value in the social influence domain, binary (or n-ary) predicates that denote a relationship between two (or more) actors are generally of more interest.

Agents have *beliefs*, that is, they subscribe, with varying degrees of confidence, to the truth of the proposition expressed by some statement of the social influence ontology. More formally, object-language instances of the following meta-language schema are well-formed statements of the influence ontology:

(3) *(believes agent (state agent$_1$ [agent$_2$… [agent$_n$]] strength$_1$) strength)*

where *strength* is the measure of the agent's confidence in the truth of the proposition expressed by

(4) *(state agent$_1$ [agent$_2$… [agent$_n$]] strength$_1$)*

A *predicate* may also be used to express a *direct action*, for example, that a group, the LF cadre, is (directly) attacking (or has attacked) another group, the National Guard:

(5) *(attack LFCadre NationalGuard 0.8)*

A predicate may also express an *indirect action*. For instance, an individual may direct a member of his or her organization to do something, for example, prepare a report or make an acquisition. Statements expressing indirect action information are expressed using form (6) below, where *statement* is a well-formed statement of the ontology expressing a state-of-affairs that one agent (the actor) wants another agent (the patient) to bring about or realize in some way or other.

(6) *(indirectAction A B statement)*

A predicate may also express a *goal*, for example, that some individual has as a goal the general alleviation of the economic hardship experienced by a rural population. The actual goal statement is expressed by a statement of the formal language of the ontology. The *rules* of the influence ontology are used to express the dynamics of the ontology, that is, to express the behavior of the elements of the ontology as they move through time.

With this base-level ontology in hand, it is now possible to formalize statements of the PSYOP domain proper: An agent A is *accessible* to an influencing action (or indirect action) by an influencing agent B if it is possible to have true statements of the form *(action A B) or (indirectAction A B statement)*.

An agent A's *effectiveness* with respect to some objective condition C is represented by the extent to which an action J exists such that if A performs the action, then the condition C will be realized (or the probability of it being realized will be greater than if A did not perform the action J.

An agent A is *susceptible* to an influencing action if the agent's beliefs, goals, or policies can be changed (or induced to remain unchanged) in the face of countervailing pressures.

4. References

[1] Haugh, B., et al., "PSYASE: An Environment for Psychological Operations Analysis," Behavior Representation in Modeling and Simulation Conference 2004.

Author Biographies

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