Title: **Cultural Agent Model to Predict inHabitant Opinion Reactions (CAMPHOR): Building and Applying a Dynamic Human Terrain Map**

Suggested Topics: **Modeling and Simulation**

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Abstract

One of the strategic goals for the United States armed forces is to win over the hearts and minds of the population in a military theater of operations. Special Operations Forces (SOF) perform missions in part to help win this battle for hearts and minds. In order to be more effective in attaining this goal, SOF team leaders need easy and rapid access to accurate, timely, and detailed intelligence about the effect of mission actions on the opinions of the local population.

In this paper, we describe a methodology and a tool to improve the ability of intelligence officers to support SOF team leaders by providing an accurate and robust computer simulation of cultural dynamics that estimates the effect of SOF actions on local opinion. Social identity theory, theories from cognitive and social psychology, and theories related to social network analysis inform the structure of the model. Data architecture helps users to populate the model even without complete, high-quality data. With both model and data architecture, intelligence officers will be able to efficiently and effectively support SOF operations in pre-deployment, during mission planning, and in the field.

Motivation: Three Levels of SOF Planning Needs

“In accurately defining the contextual and cultural population of the battlespace, it became rapidly apparent that we needed to develop a keen understanding of the cultural intricacies that drive the Iraqi population.”
Major General (MG) Peter W. Chiarelli,
Commander, 1st Cavalry Division, Baghdad, 2004-2005

"…Most human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action."
–Albert Bandura, Social Learning Theory, 1977

One of the strategic goals for the United States armed forces is to win over the *hearts and minds* of the population in a military theater of operations. Special Operations Forces (SOF) perform missions in part to help win this battle for hearts and minds. The mission success in culturally-sensitive environments often hinges on the ability to acquire and apply robust knowledge of socio-cultural phenomena. The human terrain presents challenges of compressed tempo, nonlinear reactions to culturally loaded events (e.g., religious beliefs, customs, and norms), and interactions across complex networks of family, tribe, party, economy, and nation.

Tools such as Pentagon's Human Terrain System (HTS) -- which involves social scientists helping the military understand local culture and politics -- are being designed to better equip the military with cultural knowledge. However, despite recent technological advances in simulations and modeling capabilities, tools that are needed to support the HTS fall short in several respects: (a) Theory – existing tools lack a theoretical foundation for categorizing and describing culturally important behaviors, necessary to make cultural training systems useful across sub-cultures (e.g., Sunni and Shiite) and cultures (e.g., Iraqi and Afhani); (b) Data – users lack tools and methods for capturing cultural behaviors; and (c) Interfaces – the displays and controls do not support crucial behaviors (cues and responses) and contexts that give them meaning.

When planning for counter-insurgency operations in culturally-sensitive environments, the SOF faces the three related problems:

1. The *organizational* problem of improving organizational knowledge and institutional memory related to counterinsurgency and associated environment (e.g., acquiring knowledge of socio-cultural context and transferring it to the newly arrived forces).
2. The *tactical* problem of counterinsurgency planning in a given area (e.g., a village).
3. The *strategic* problem of conducting multiple counterinsurgency missions in a broader theater (e.g., that comprises several villages).

In order to accomplish planning, the SOF team leader needs rapid access to understandable, accurate, and usable intelligence, including intelligence about how different actions may affect the sentiments of the local population. The complexity of cultural dynamics of the local population makes it difficult for intelligence officers to conduct deep and rigorous analysis of the cultural effects of SOF team actions in the field.

Solution: Cultural Agent Model to Predict inHabitant Opinion Reactions

"Culture is the 'human terrain' of warfare. Human terrain is the key terrain."
MG(Ret) Geoffrey Lambert

"…Navigate cultural and *human terrain as easily as*
Marines can now use a map to navigate *physical terrain*."
LtGen James Mattis

To address the above challenges, we have developed a prototype of the Cultural Agent Model to Predict inHabitant Opinion Reactions (CAMPHOR) system that will:

(a) Encode relevant human terrain factors to facilitate mission planning and execution;
(b) Store the acquired socio-cultural knowledge and present it to the human users in a concise and intuitive manner as understandable, accurate, and usable intelligence;
(c) Allow for rapid analysis and prediction of probable effects of culturally-sensitive courses of actions (COA) that may affect the sentiments of the local population; and
(d) Help select the steps necessary to deal appropriately with the insurgencies within the context of their unique cultural environments.

The CAMPHOR will help the SOF mission planners tackle the cultural and social dynamics too complex for the unaided human mind to analyze accurately. The CAMPHOR framework will help predict the range of possible RED and GREEN behaviors within the theater of operations, in order to support the SOF COA planning in culturally-sensitive environments. CAMPHOR will also enable the pre-deployment mission training of rotating SOF and other US military forces. CAMPHOR will fill the cultural knowledge void by gathering ethnographic, economic, and cultural data pertaining to the battlefield to support analysis and decision-making and to provide the SOF commanders with a fully automated comprehensive cultural information research system.

Solution Overview

The CAMPHOR system offers the following functionality (Figure 1):

1. Knowledge Repository, in the form of Human Terrain Maps, for encoding and archiving the socio-cultural artifacts to support counter-insurgency planning in specific localities and support a broader use of socio-cultural Intelligence within the theater of operations.
2. Data Fusion Algorithms for generating the Human Terrain Map (HTM) of a given locality (e.g., a village) from the Intelligence data (e.g., algorithms for automatically reverse-engineering power and communication networks from ISR observations and intercepts).
3. An executable dynamic "cultural map" of the mission environment (i.e., a computer simulation component of the HTM) that will predict how various SOF COA may interact with the local socio-cultural environment (e.g., produce changes in local population opinions), and predict the range of possible RED and GREEN behaviors and probable scenarios that may result from specific COA.
4. User Interface for the rapid data input and the HTM navigation and for presentation of the analysis findings to the SOF team leaders, as well as for compact communication of the critical socio-cultural background information and of the lessons learned.
5. Algorithms for inferring the high payoff COA options and for developing efficient plans.

In a nutshell, CAMPHOR transforms the culturally relevant bits and pieces of information from various sources (e.g., news feeds, historical archives, satellite intercepts of electronic communications, and on-the-ground Intel) into a comprehensive Human Terrain Map that provides automated means for predicting cultural and social dynamics.

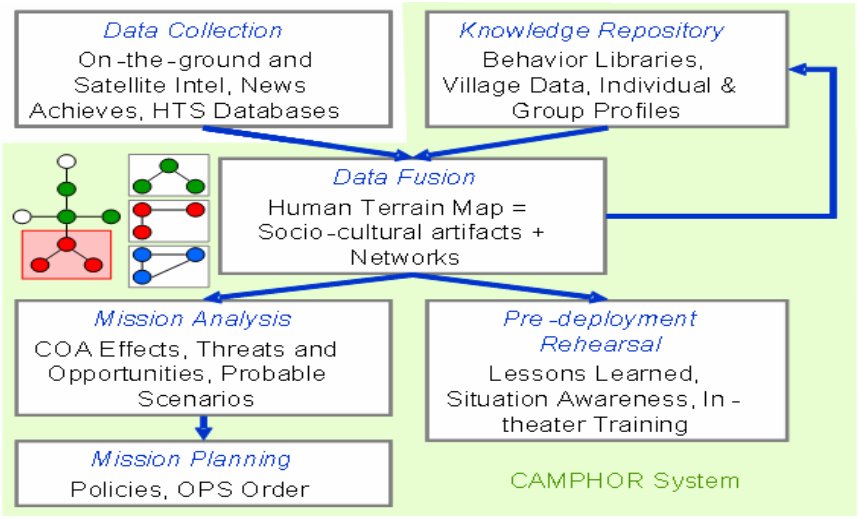

Figure 1. CAMPHOR solution workflow.

This information is then used to infer mission threats and opportunities and to optimize the selection of COA, in order to achieve superior performance in counter-insurgency operations and “hearts and minds” campaigns (Figure 2).

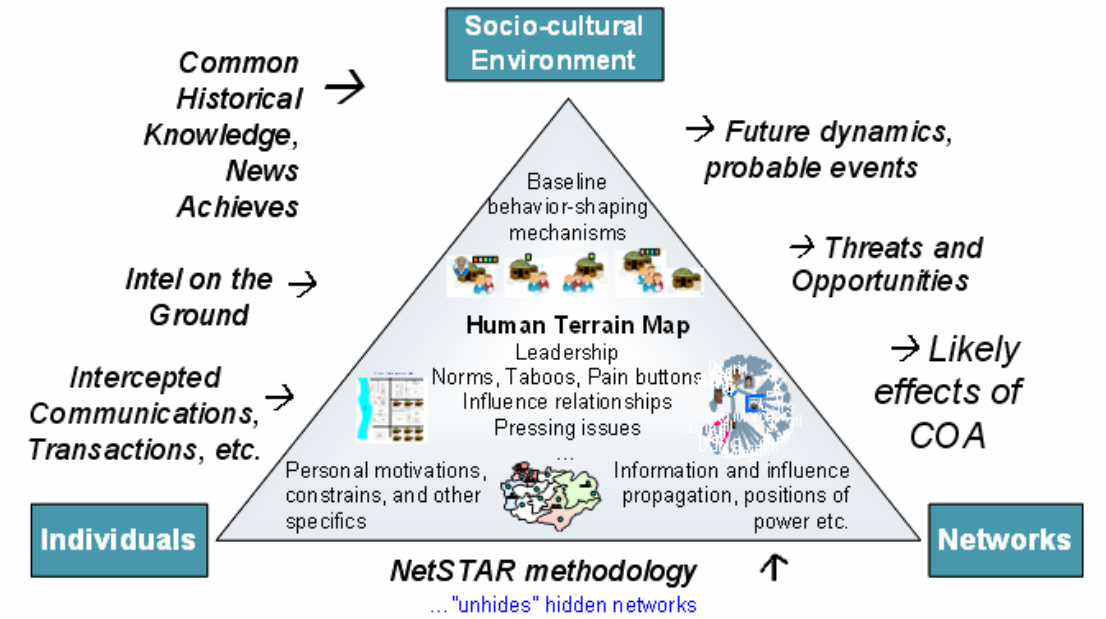

Figure 2. CAMPHOR – the “Big Picture”.

Figure 3 outlines how CAMPHOR builds up a navigation-capable Human Terrain Map. The concomitant automated data fusion methods and algorithms (to be combined with the manual data entry, if desired) are discussed in the following (sub)section (‘Data Sources and Fusion Methods’; also see more details in ‘Human Terrain Map’).

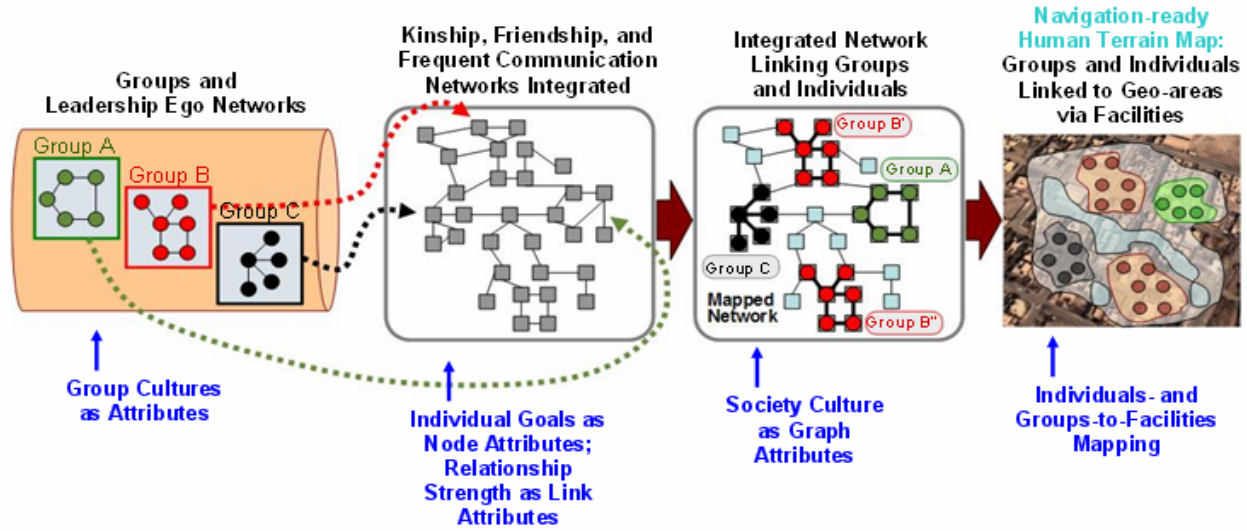

Figure 3. How CAMPHOR constructs navigation-ready Human Terrain Map – an overview.

Figure 4 illustrates the CAMPHOR Concept of Operations.

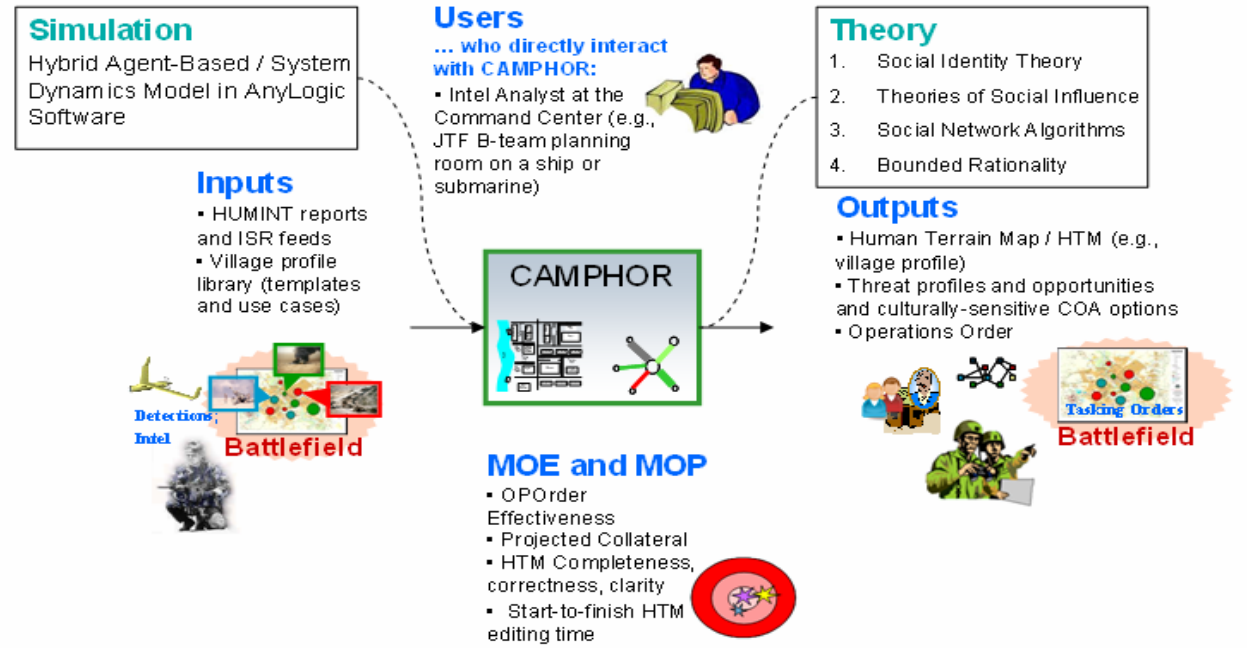

Figure 4. CAMPHOR Concept of Operations.

The CAMPHOR inputs include: (1) Assumptions about the local environment (e.g., material conditions); (2) Culturally-relevant up-to-date intelligence; (3) Mission planning needs (objectives and success criteria); (4) Candidate actions; (5) Contextual Intel – recent events in the village. The CAMPHOR outputs include: (A) Human Terrain Map (groups, networks, behavior envelops); (B) Probable events (threats and opportunities) for each COA; and (C) Mission Plans (e.g., OPS Order) composed from high-value COA selections.

Data Sources and Fusion Methods

“The information we desire the most about the enemy-his real fighting power and his intentions-lie in the psychological and human dimensions rather than the physical...”
-- Dr. Ahmed S. Hashim
U.S. Naval War College

The doctrinal military decision-making process (MDMP) (Wade, 2005) through which the U.S. Army conducts its operations relies on the intelligence preparation of the battlefield (IPB). The IPB templates, databases, and other products lay out information about the adversary and other key groups in the area of operations. The IPB products include information about group’s size and location, its leaders, and linkages among key individuals. The information from the IPB about will serve as the good initial starting point input into the CAMPHOR system.

Currently, only a limited set of tools is available to intelligence operators to analyze, correlate and visualize the data, e.g., StarLight (http://starlight.pnl.gov/) and AnalystNotebook (http://www.i2.co.uk/Products/ Analysts_Notebook/default.asp). These tools are often combined with technologies for data mining and automated entity and link discovery from text sources (Miller et al., 2000; Grishman, 2003; Stolfo et al., 2003) or with manual HUMINT data. They rely on domain understanding (Krebs, 2001; Sageman, 2004) or applied social network analyses (Van Meeter, 2001; Dombroski, Fischbeck, and Carley, 2003; Skillicorn, 2004). However, these tools merely present and visualize the networks formed by observations and *do not solve the network identification problem* of “cleaning uncertain observations”, especially in the presence of missing, irrelevant, deceptive, and mislabeled attributes and links. As a result, current approaches to analyzing networks are manual and prone to errors.

CAMPHOR, however, seeks to automate the reverse engineering of linkage information (see Figure 5 for the problem outline) and other essential socio-cultural factors for the key groups in a given area, based on the data feeds from various information sources (from open-source socio-cultural information to focused ISR observations of select individuals and organizations).

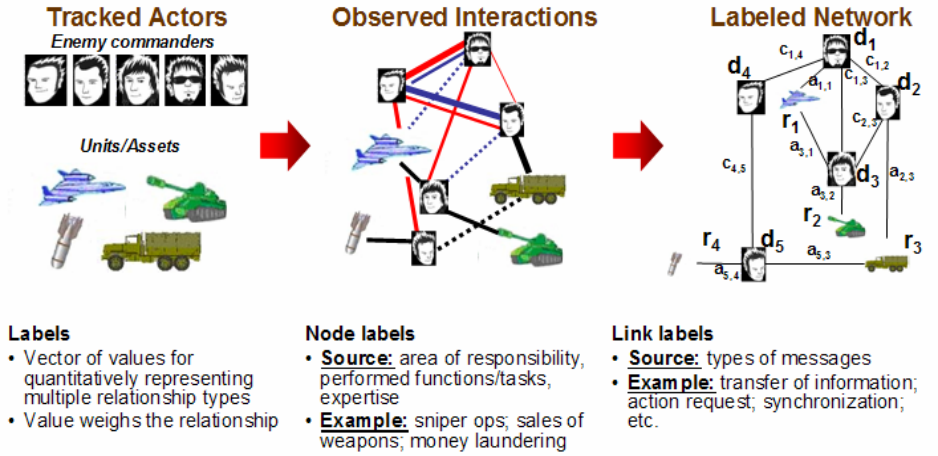

Figure 5. Network identification problem setup.

Although human actions leave in the information space detectable events whose dynamic evolution creates patterns of the potential activities that may be related, linked, and tracked over time (Pattipati et al., 2004), the socio-cultural data is often very sparse, creating a challenge to connect relatively few relevant events embedded within massive amounts of data. To extract critical information from the ISR data, CAMPHOR customizes algorithms originally developed by APTIMA and successfully validated under the DARPA NetSTAR (Identification of Network, Structure, Tasks, Activities, & Roles from observations) project (contract HR0011-06-C-0047, DARPA, 1/27/06 – 7/27/06; DARPA TPOC Alex Kott: Alexander.Kott@darpa.mil). NetSTAR uses variants of Hidden Markov Models and Markov Random Fields, to reverse-engineer communication and other networks that link individuals from multi-source uncertain ISR data based on probabilistic attributed network pattern matching principles (Levchuk et al., 2007). Experiments have shown that NetSTAR provides reliable state prediction of the organizational network under high levels of missing data, sensor errors, and deceptive or irrelevant observations (Figure 6 below; see also Levchuk et al., 2006; 2007). NetSTAR is capable of inferring the principles and goals under which the groups of interest operate.

Equipped with NetSTAR algorithms, CAMPHOR aims for seamless integration of data from disparate sources. Ultimately, the CAMPHOR system will draw on the data streams from international and domestic sources; press and news services; analyses from regional and technical experts, and so on. In the future, CAMPHOR may interact with centralized socio-cultural knowledge databases, such as those presently developed under the Pentagon's Human Terrain System initiative.

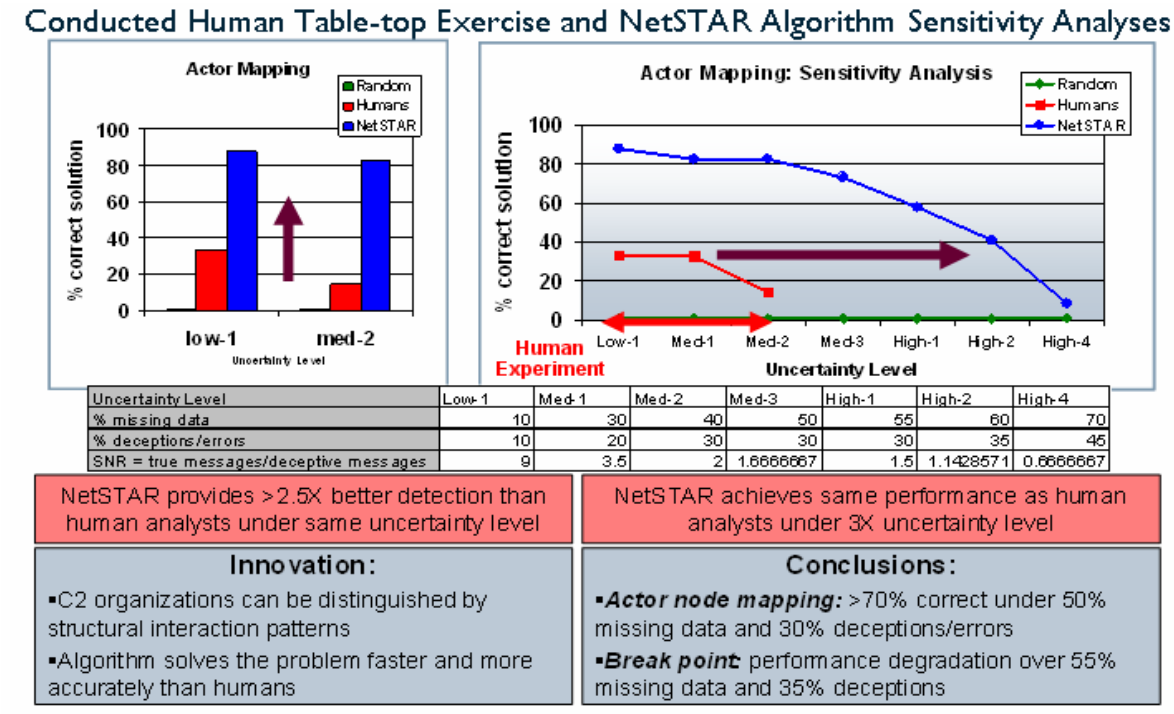

Figure 6. NetSTAR algorithm validation results.

Human Terrain Map

> “Cultural awareness will not necessarily always enable us to predict what the enemy and noncombatants will do, but it will help us better understand what motivates them … and how we can either elicit the support of the population or at least diminish their support to the enemy.”
> Major General Benjamin C. Freakley, Commanding General, CJTF-76, Afghanistan, 2006

The key component of CAMPHOR is the Human Terrain Map (HTM), which formally organizes the relevant socio-cultural knowledge of the psychological and human dimensions of the theater of operations. The “human terrain” (McFate and Jackson, 2005) defines the socio-cultural, anthropologic, and ethnographic information about human population and society in a given area. The CAMPHOR HTM framework: (1) helps profile the local population and capture culturally important behaviors; (2) focuses the Intelligence gathering; (3) helps fuse the socio-cultural information to build a comprehensive knowledge base; (4) guides and automates the analysis of how various COA may impact the population; (5) predicts the range of possible RED and GREEN behaviors and probable scenarios; (6) articulates the critical socio-cultural background information and lessons learned; and (7) facilitates pre-deployment mission training and rehearsal.

In a strict mathematical sense, the CAMPHOR HTM is a multilayered multi-attribute graph (Figure 7) that encodes the relationships between groups and key individuals, and is linked to the IPB-like documents, namely -- the socio-cultural terrain briefs or SCTB (Figure 8).

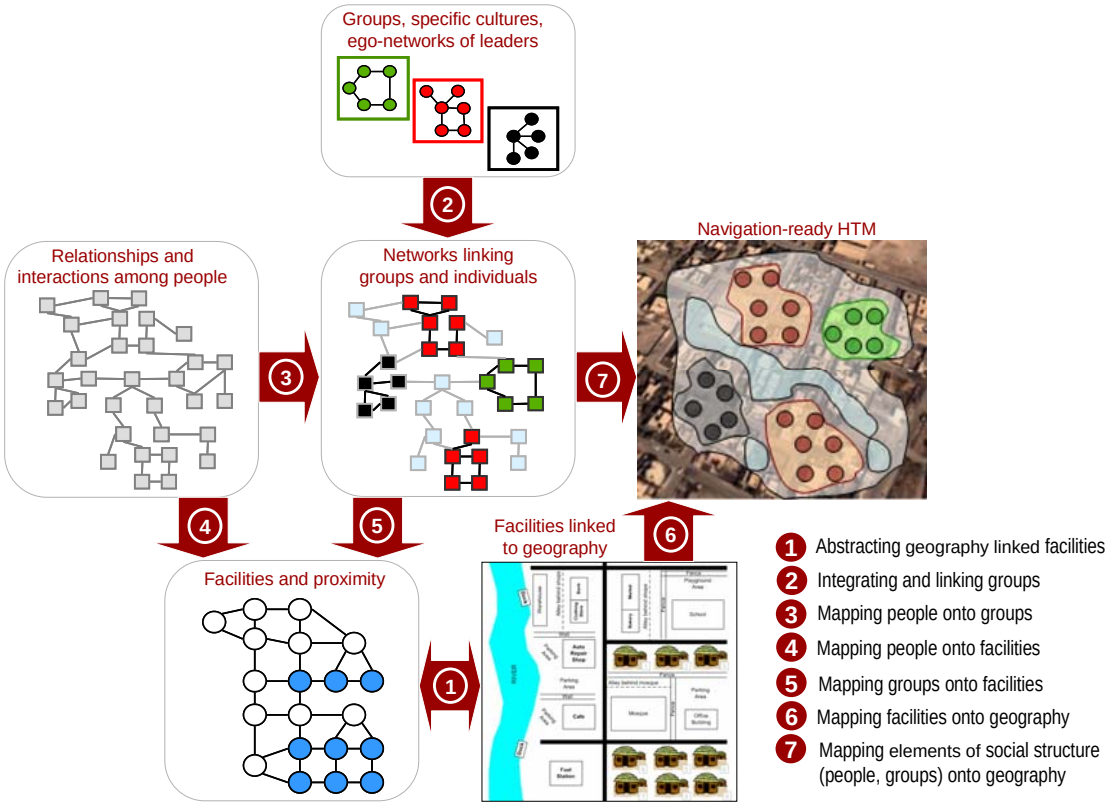

Figure 7. CAMPHOR “under-the-hood” HTM construction process – an overview.

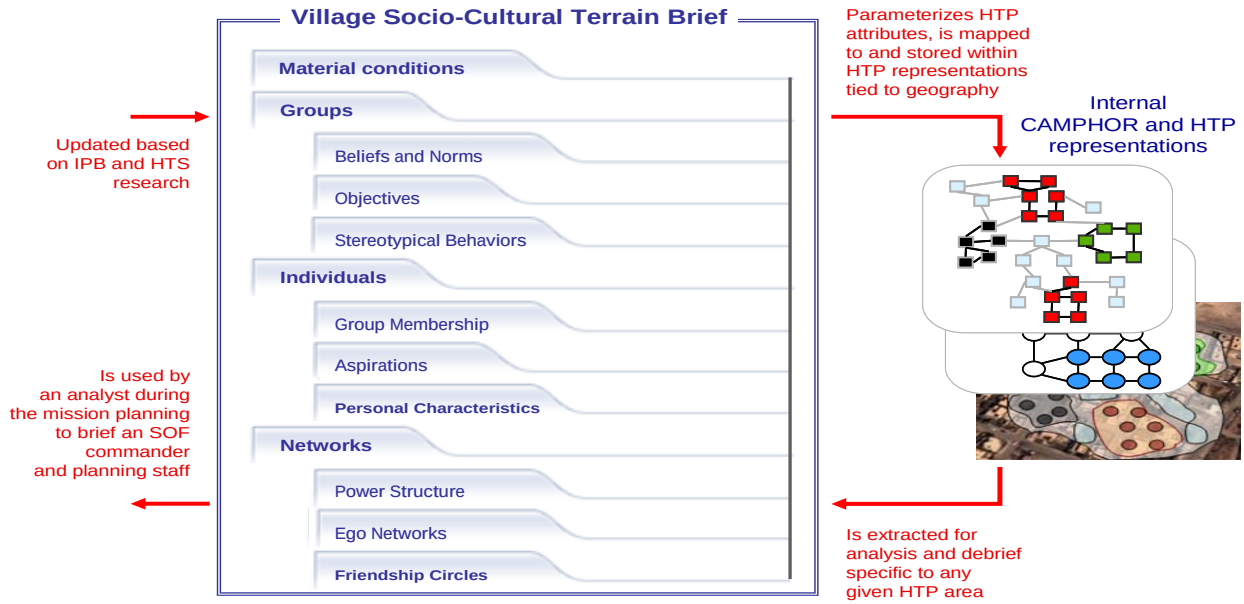

Figure 8. CAMPHOR socio-cultural terrain brief (SCTB) – an overview.

Figure 9 illustrates the elements of a Socio-cultural Terrain Brief (see Use Cases below for more details).

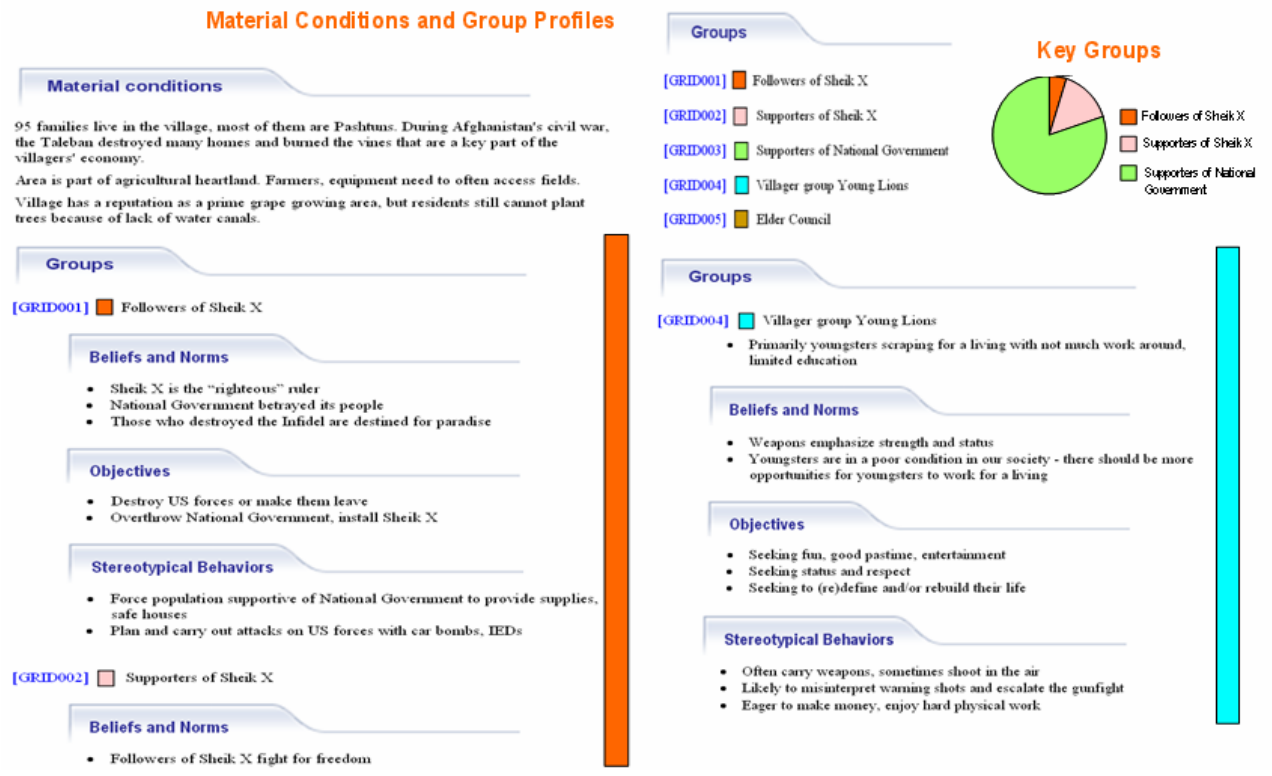

Figure 9. Material conditions and group profiles from a socio-cultural terrain brief — an illustration.

The CAMPHOR users will be receiving a focused SCTB (Figure 9) about any geographic area they choose (from within the area for which the HTM has been constructed and populated). The HTP navigation exploits the reverse mapping between geography and groups and/or individuals. The attributes of the HTP represent the group-specific cultures -- relatively stable but with the potential to change over time -- the top-most HTP attributes represent the culture shared across a society. The individual attributes encode individual differences; the degree to which individuals adopt and practice culturally shared attitudes; and their unique goals and significant behavior tendencies.

The CAMPHOR Human Terrain Map, and its socio-cultural terrain brief (from Figure 8; see also the detailed illustrations of SCTB in the Use Case example below), encodes the following information about human population in the area of operations:

1. Social and material conditions, i.e., the basic demographics data (e.g., the approximate number of families or households in a village); the key elements of the local economy; and other relevant material conditions under which social arrangements develop.
2. Group composition and profiles, i.e., the key influential groups; the cultural artifacts (e.g., values, norms, objectives, beliefs) that shape the group behavior. At the societal level, culture artifacts involve mainstream average tendencies, while at the individual level they represent the level of individual’s participation in shared values, beliefs, and behavior tendencies. The balance between the within-group culture variance and the between-group culture variance is an indicator of stability within a given society (or group). The cultural artifacts help infer the competing agendas, balance of power, opportunities exploitable from group’s viewpoint, and risks of cultural confrontation that pit alternative value systems against each other.
    - Beliefs, values, and norms, i.e., the culturally shared traditions; assumptions of what constitutes “good” vs. “bad” behavior, “desirable” vs. “undesirable” practices, “fair” vs. “unfair” actions; expectations about other groups; etc..
    - Objectives, i.e., the commonly-shared objectives and needs of group participants.
    - Stereotypical behaviors, i.e., the “trade-mark” individual and collective actions, repeatable behavior patterns likely to occur in the future.
3. Individual profiles, i.e., individuals of interest in a village, their group identities (when known) and individual-level cultural artifacts (e.g., values, goals, aspirations).
    - Group identities, i.e., the groups that this individual belongs to or identifies with.
    - Aspirations and goals, i.e., known individual goals (e.g., when he or she is studying to become a doctor; is generally looking for opportunities to make a living; desires to send his/her children to school; is in need of a specific medical treatment; etc.).
    - Personal characteristics, i.e., factors that shape the behavior of a given individual.
        - “Trade-mark” behavior traits, i.e., unique personal behavior traits (if any); known repeatable (fixed) action patterns.
        - Cognitive characteristics, e.g., education, risk-aversiveness, etc. that can be used to predict decision-making trends and capabilities.

4. Networks, i.e., the social connections (e.g., work relationships, frequent face-to-face communications, propinquity/friendship and kinship relations, supply chains, etc.) that link people in a village, as well as connections between various groups and between individuals and groups.
   - Power structure., i.e., the subordination relationships (e.g., superior-subordinate work relationships; teacher-follower relationships; etc.); the pressure points and channels of influence that can be exploited to shape human behavior.
   - Ego networks, i.e., the circle of people that a given person interacts with frequently (e.g., near-daily).
   - Kinship and friendship circles, e.g., relatives and friends.
   - “Etc.”: Other types of relationships may be encoded in CAMPHOR in the future.

Predicting behaviors

The HTM and its culture-specific attributes facilitate predictions of behavior trends of organizations, groups, and individuals in response to specific stimuli (e.g., COA) or situations. Figure 10 below outlines the method by which these predictions are carried out (based on the “difference engine” and “general problem solver” principles combined with bounded rationality principles; e.g., see Minsky 1985; Kahnemann 2002; Smith 2002).

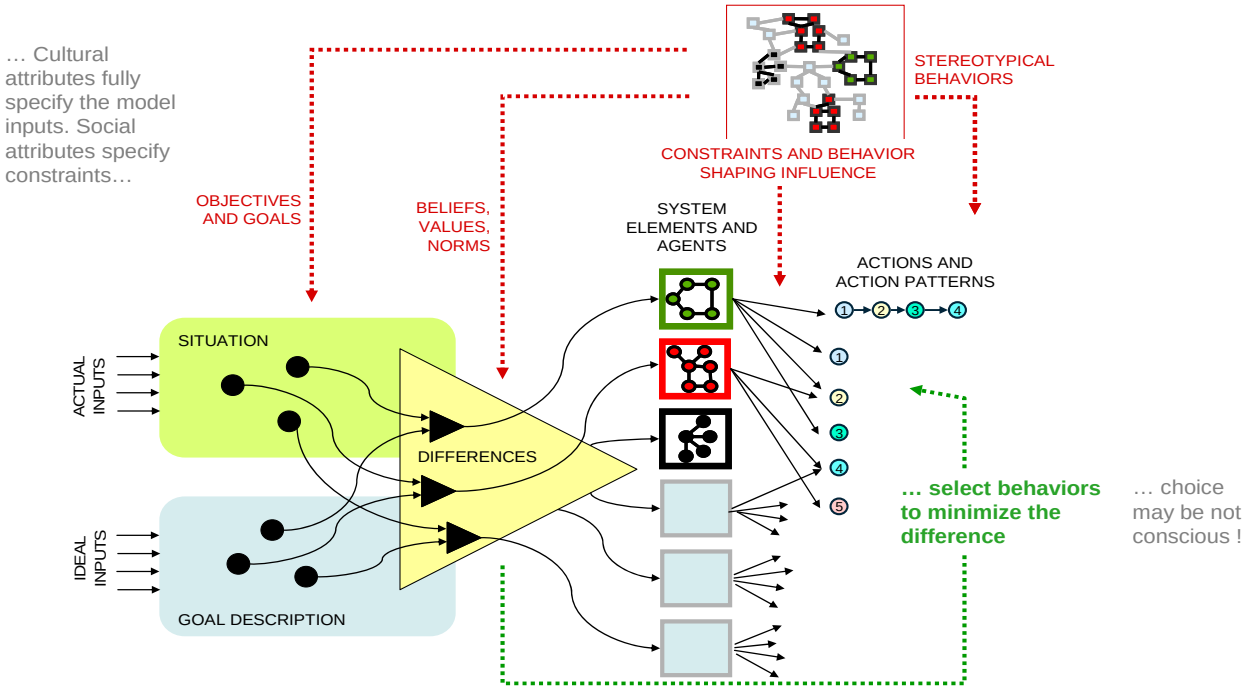

Figure 10. CAMPHOR predictions of behavior trends – an overview.

Figure 11 illustrates the inputs into CAMPHOR for a hypothetical Iraqi Insurgency Scenario.

PROTOTYPICAL ACTIONS OF DIFFERENT GROUPS FROM HISTORICAL DATA

action_name	action_type	action_name	action_type	action_name	action_type
General Military Action	Physical Oriented	Grenade Attack	Military Oriented	Patrol an Area	Military Oriented
Targeted Military Action	Symbolic Oriented	IED Attack	Military Oriented	Rally Support for Leader	Other
Call for support	Symbolic Oriented	Sniper Attack	Military Oriented	Dismantle an Organization	Symbolic Oriented
Suicide Bombing	Boundary Oriented	Seizing Property	Physical Oriented	Looting	Physical Oriented
Call For Change In Leadership	Physical Oriented	Establishing a Base	Boundary Oriented	Lifts Sanctions	Economic Oriented
Civil Disturbance	Physical Oriented	Changing Laws	Other	Protestors Killed	Population Oriented
Provide Material Support	Economic Oriented	Returning from Abroad	Population Oriented	Create a New Holiday	Symbolic Oriented
Government Named	Diplomatic Oriented	Making Arrests	Population Oriented	Individual Killed	Military Oriented
Ambush	Military Oriented	Public Works Projects	Physical Oriented	Create an Organization	Other
Car Bomb (Non-suicide)	Symbolic Oriented	Sabotage Economic Assets	Economic Oriented	Car/Truck Bombing (Suicide)	Military Oriented
Coordinated Suicide Bombings	Diplomatic Oriented	Hold Elections	Diplomatic Oriented	Coordinate Activities	Other
Change in Location	Boundary Oriented	Set up a Tribunal	Other	Cessation of Hostilities	Military Oriented

GOALS OF DIFFERENT GROUPS FROM INTEL

goal_name	goal_type
Stabilize Security	Physical
Create Islamic State	Social
Increase Shi'a Political Power	Social
Increase Sunni Political Power	Social
Increase Kurdish Political Power	Social
Drive Coalition Forces out of Iraq	Military
Create a Democratic Iraq	Social
Protect Iraq Oil Infrastructure	Economic
Increase Hakim's Political Power	Social
Increase Sadr's Political Power	Social
Re-install Ba'athist Regime	Social
Protect Iraqi Borders	Military
Weaken Iraq	Land
Increase Chalabi's Political Power	Social
Increase Assyrian Political Power	Social
Increase Turkomen Political Power	Social
Prevent Kurdish Independence	Diplomatic
Improve Humanitarian Conditions	Physical

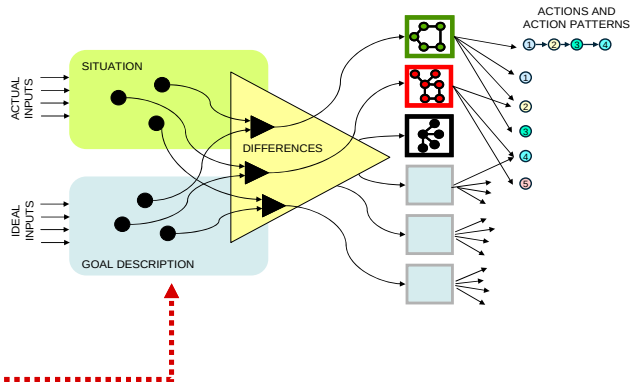

Figure 11. Iraqi Insurgency Scenario goals and actions (derived from Intel and historical data) as inputs into CAMPHOR – a hypothetical example.

The group objectives and/or individual goals define the “desired” situation, various aspects of which (e.g., subgoals) “arise” different elements of the social system (e.g., individuals, groups, information pathways, social pressure) that then act (i.e., select and perform actions) to change the state of the world they control or influence in a way that tends to diminish the difference that aroused it. In essence, those behaviors and interactions that benefit the objectives/goals tend to be preserved and/or reinforced, while other behaviors and interactions that adversely affect objectives/goals tend to be avoided and/or reduced. This tendency is mediated by bounded rationality (e.g., “satisficing” rather than optimizing; oscillating between reactive and proactive decision-making; shifting between risk-taking and risk-avoidance) that affects human choices.

Remarkably, the corresponding behaviors by various groups and individuals need not be conscious or directed; very often, such behaviors are “self-organizing” and emerge from the interactions among the many “agencies” that become engaged in pursuit of the concomitant (sub)goals (Smith,

2002, Nobel Price lecture). As will be shown in the Use Case examples below, these principles may be systematically used during the SOF mission planning to discover/select COA that would promote objectives/goals of certain groups and stimulate behaviors that promote the success of the SOF mission. The CAMPHOR will help the SOF mission planners in predicting the cultural and social dynamics that are too complex for unaided human mind to analyze accurately -- especially when dealing with non-commensurate and counteracting objective systems and social pressures.

The objectives/goals indicate person or group’s predisposition to choose prototypical actions (or to acquire/learn/try new actions); while social networks constrain and shape behaviours (e.g., by restricting access to information and mobilizable social capital; mediating supply chains and options for rapid dissemination of outputs; fostering human interactions and material or emotional support). The individual resources impact the attractiveness of actions, while the network structures mediate the cost/benefit of rapidly acquiring resources, and thus impact the CAMPHOR predictions. Networks exhibit emergent properties of structure and composition by “rewarding” certain behaviors that are compatible with their ecology (and by “sanctioning” behaviors that are mismatched with the ecology of the concomitant cultures).

CAMPHOR Applications and Hypothetical Use Case

Example applications may include the tactical problem of planning a counterinsurgency mission in an area, the strategic problem of conducting multiple counterinsurgency missions in an area, or the organizational problem of improving organizational knowledge related to counterinsurgency and its ethnographic roots.

Hypothetical Use Case: Waging a Counter-IED Campaign

One hypothetical example of a use case may be as follows.

***Objective*:** The foreign country is occupied with the US troops, whose goals include providing security to people, supporting civilian reconstruction, and combating insurgents. There is a village near a US Army fire base (FB) where several IED attacks have recently occurred. US forces have been interacting with the village for months, but recently troops are suffering from repeated attacks with improvised explosive devices and, occasionally, vehicle-based bombs. Most of the villagers support the pro-US government, but there is a powerful local leader, Sheik X, whose followers commit the anti-US attacks. Some of the villagers willingly support Sheik X, but many are coerced into sheltering the insurgents. Special operations forces (SOF) in the area need to support efforts to end Sheik X’s attacks on US forces.

***Time Frame*:** US presence in the village has gone on for many months. The IED attacks have become very intense over the past month. Mission planning is expected to recur over time as the situation changes. The anti-IED campaign may last months; even if Sheik X’s forces are stopped, the village must be made resilient to further insurgency operations.

***Stakeholders*:** The direct users of CAMPHOR on the SOF side will involve the top few officers and enlisted men of a SOF team. In addition, the counterinsurgency operation will involve forces from the US Army (whose forces routinely patrol the village) and the forces of the local government’s army and police.

***Product without CAMPHOR*:** The OPORDER without CAMPHOR will simply include socio-cultural information in the Enemy, Civil Considerations, CCIR, and ROE sections. Below is an example of what the summaries of these sections may look like:

- Enemy: Followers of Sheik X trying to attack US forces with car bombs, IEDs.
- Civil Considerations
  - 80% of AO population support National Government. 20% support Sheik X.
  - Supportive population forced to provide support, safe houses.
  - Area is part of agricultural heartland. Farmers, equipment need access to fields. Limit collateral damage to fields.
- CCIR (Intel)
  - IR: Attempts to use FB access road.
  - PIR: Types of IEDs, car bombs, recent cell phone traffic
- ROE: Weapons. Hold. Deadly force OK if weapons ID'd or fired upon. Warning shots first if commands not obeyed, then deadly force.

Process with CAMPHOR

In this scenario, there is substantial background knowledge about the area of operations due to past military involvement in the village. Thus it is likely that the Intel analyst can populate CAMPHOR with a decent amount of both template-based generic cultural/demographic knowledge and some customized information about key stakeholders. Figure 12 below shows what this information may look like in CAMPHOR, as it describes the characteristics of the most important political groups in the village, reflecting past intelligence collected about followers of Sheik X, the National Government and other groups.

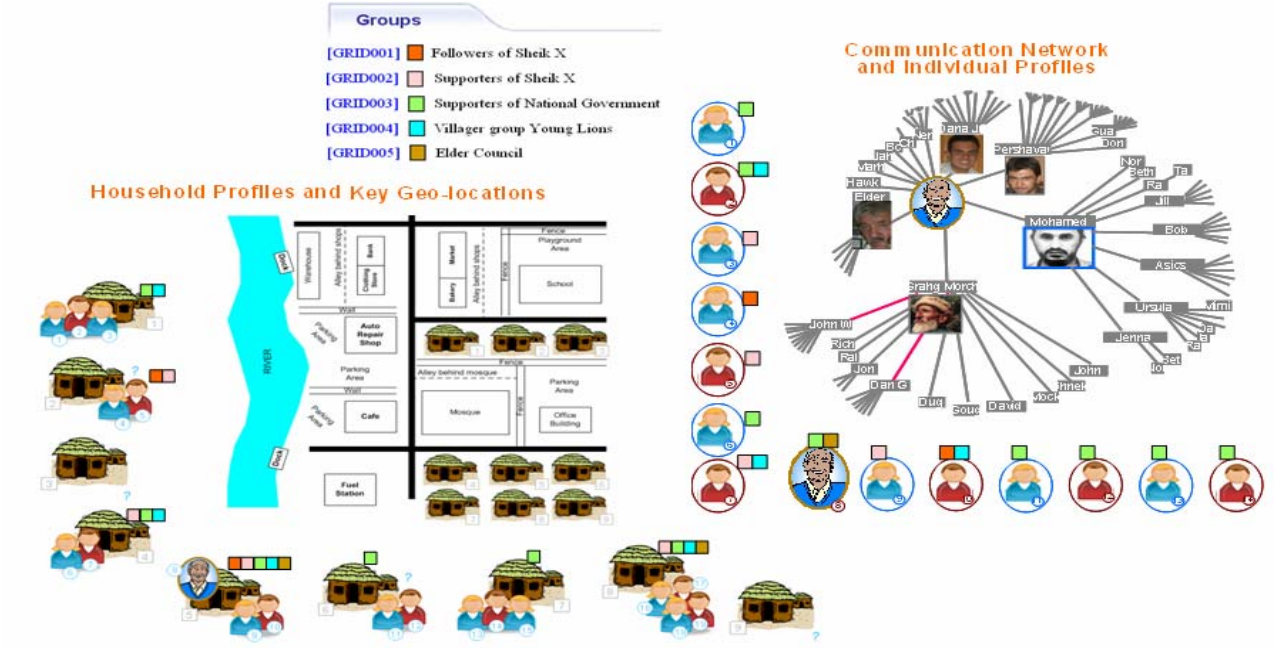

Figure 12. Elements of a SCTB – facilities, networks, and individual profiles – an illustration.

Each group also has a cognitive, cultural, and communication profile. The CAMPHOR may inform its users about local customs and stereotypical responses to various events, allow exploring the social networks, and analyzing existing groups and their relationships (Figure 12).

Predicting effects and scenarios

CAMPHOR uses its HTM (as in Figure 12) -- together with the candidate COA by the SOF and US forces -- to construct a dynamic executable model of the mission environment and its socio-cultural terrain. This model is a hybrid model that includes agent-based, system dynamics, and social network components. Figure 13 illustrates the process of building a model in CAMPHOR, while analyzing options for COA, directed at different groups.

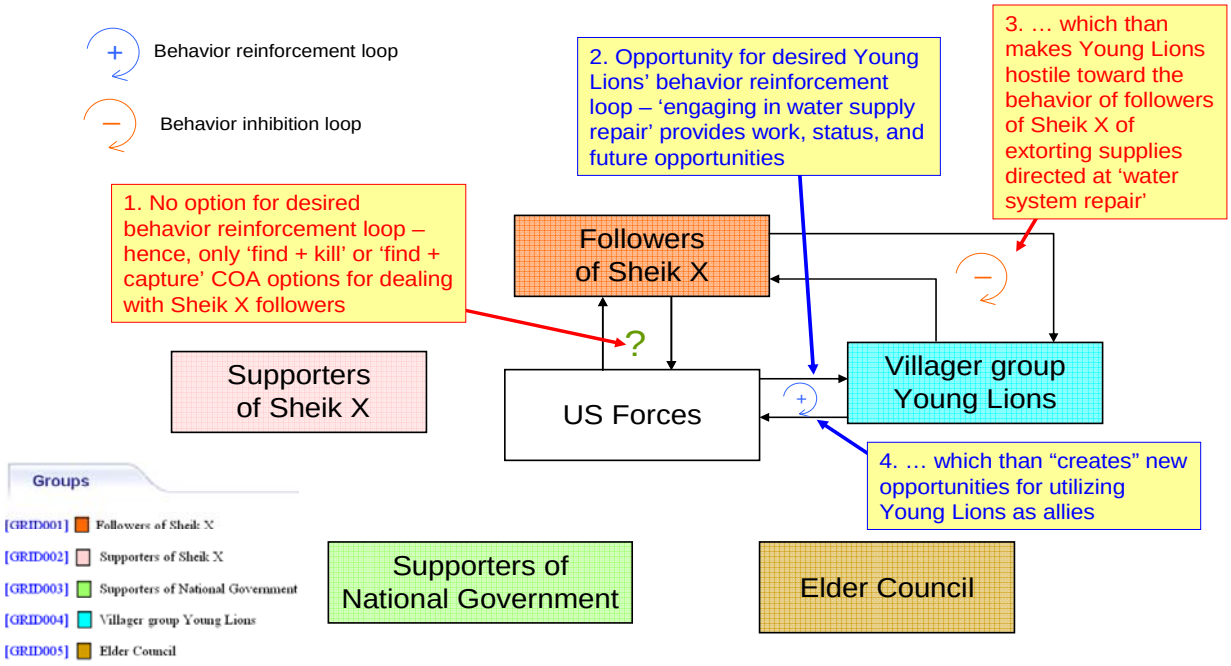

Figure 13. Applying CAMPHOR to discover and help explore positive and negative feedback loops in an ethnographic landscape – an illustration.

Figure 13 shows the five most powerful groups in the village: the US forces, followers of Sheik X, the Young Lions, supporters of Sheik X, supporters of the National Government, and the Elder Council. The user can propose COAs toward one or more of these group actors and see what outcomes (both socio-cultural and behavioral) are likely. Initially, the user explores direct COAs against followers of Sheik X (shown in box 1). Unfortunately, US forces can only try to capture or kill Sheik X's forces as they seem to have a fanatical devotion to combating the US and are not prone to bribery or cooperation of any sort with the US.

Therefore, the user looks at possible COAs aimed at the Young Lions, a group of poor and idle youth who interact with Sheik X's follower (shown in box 2). A potential set of COAs for the Young Lions is to address their poverty and boredom by engaging them in civilian infrastructure

development for the village. CAMPHOR can estimate that, although the US is doing a “good deed” for the Lions, and there is an opportunity for them to grow friendlier to the US this way, they are unlikely to really change their opinions towards US forces as a direct result of this assistance. The US forces are initially perceived as “the outsider” or “the occupier” by most of the village, so this opinion is unlikely to change due to direct social influence attempts on the part of the US. However, CAMPHOR can make an educated guess that Sheik X’s followers, who regularly extort from villagers, will extort infrastructure supplies from the Young Lions. This is likely to negatively influence the Young Lions opinions of Sheik X (he is stealing from them) and, ironically make them more amenable to future cooperation with US forces (on the principle of “the enemy of my enemy is my friend”).

The CAMPHOR dynamic model of the socio-cultural terrain enables Intelligence Analysts to conduct on-the-fly assessment of COA effectiveness for the mission at hand (the richness of available data determines the uncertainty and the breadth and focus of the predictions envelop for the COA testing). The CAMPHOR dynamic model addresses the following facets of human individual and group behavior:

1. *Cognitive processes* of people who perceive events, judge their meaning, memorize past events, and (possibly) learn from their experiences.
2. *Cultural processes* of people who possess and change their opinions, relationships, and affiliations with different identity groups. E.g., dynamic shifts in allegiances to specific social and cultural identities could manifest that terrorist groups seek affiliation with the jihad and intend to commit atrocities against western nations (Sageman, 2004).
3. *Communication processes* people use to spread information about events. Theories of social influence (Friedkin, 1999; Milgram, 1974) suggest that the network structure is important in determining how communication changes people’s opinions. Social network analysis (Wasserman & Faust, 1999) identifies the frequency of communication as the key observable variable that mediates the social influence.
4. *Event characterization* (e.g., social event characterization scheme) related to observable activities and artifacts encountered in the physical world (e.g., marriage exposes people to new kinship and friendship networks, which may inspire affiliation with jihad).

CAMPHOR outputs and consequences - illustration

The CAMPHOR model can be systematically applied to analyze ethnographic landscape (e.g., captured in Figures 12 and 13) and assist the mission planning. The use of CAMPHOR to systematically explore the socio-cultural phenomena and the associated structure of a human terrain landscape may change the mission plan captured in the concomitant Operations Order (as illustrated in Figure 14 below) from (a) applying deadly force toward insurgents, to (b) a non-kinetic strategy, i.e., affiliating with a specific group of young villagers, promoting their status by involving them into repairing critical infrastructure (e.g., water system), and reducing inflow of insurgents and promoting stability through non-kinetic means.

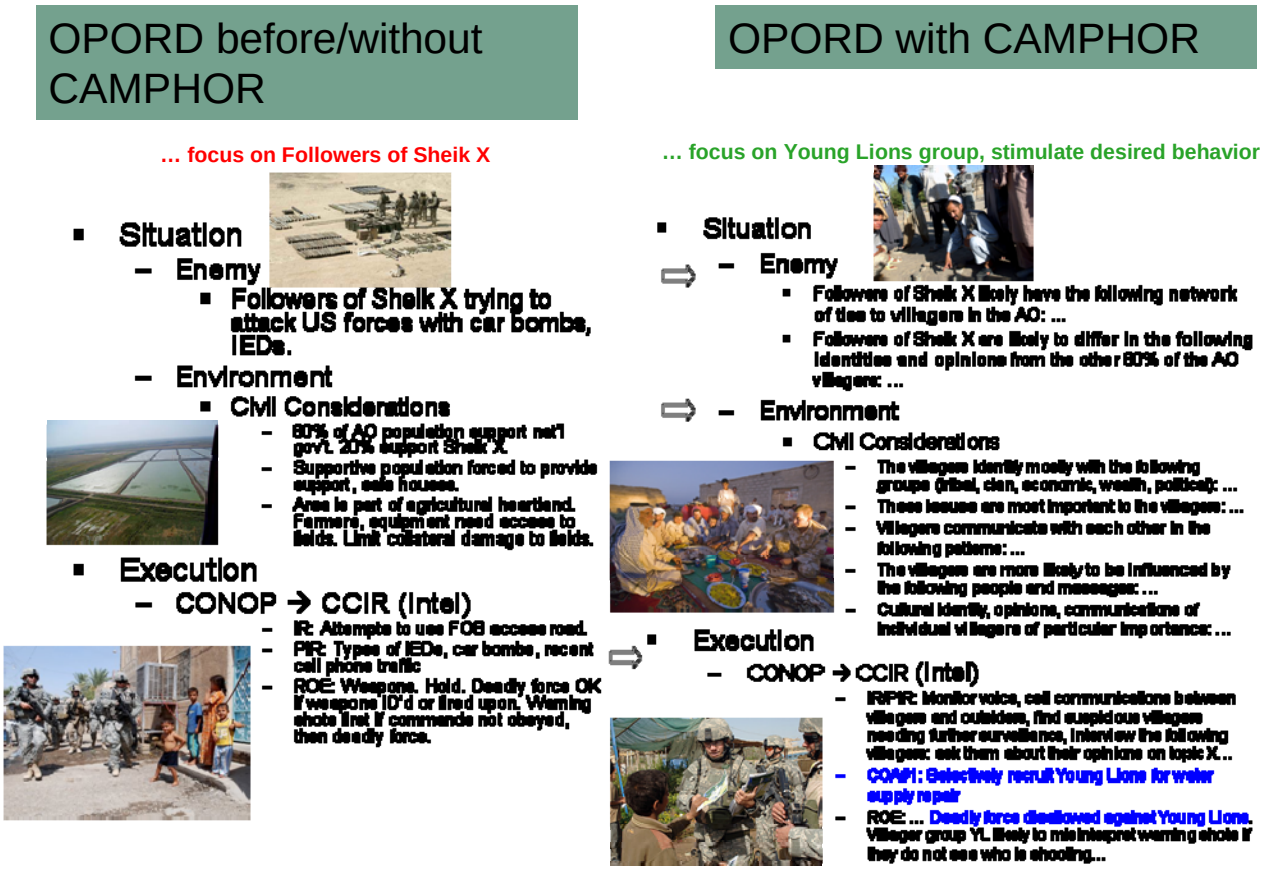

Figure 14. Example OPORD Before/without and With CAMPHOR - an illustration.

Product with CAMPHOR

As illustrated in Figure 14, because of the insights that CAMPHOR provides in this scenario, the socio-cultural parts of the OPORDER are likely to change from:

- *Enemy*
  - Followers of Sheik X trying to attack US forces with car bombs, IEDs.
- *Civil Considerations*
  - 80% of AO population support nat'l gov't. 20% support Sheik X.
  - Supportive population forced to provide support, safe houses.
  - Area is part of agricultural heartland. Farmers, equipment need access to fields. Limit collateral damage to fields.
- *CCIR (Intel)*
  - IR: Attempts to use FB access road.
  - PIR: Types of IEDs, car bombs, recent cell phone traffic
- *ROE*: Weapons. Hold. Deadly force OK if weapons ID'd or fired upon. Warning shots first if commands not obeyed, then deadly force.

to:

Enemy

- Followers of Sheik X likely have the following network of ties to villagers in the AO: ...

- Followers of Sheik X are likely to differ in the following identities and opinions from the other 80% of the AO villagers: …

Civil Considerations

- The villagers identify mostly with the following groups (tribal, economic, wealth, political): …
- These issues are most important to the villagers: …
- Villagers communicate with each other in the following patterns: …
- The villagers are more likely to be influenced by the following people and messages: …
- Cultural identity, opinions, communications of individual villagers of particular importance: …

CCIR (Intel)

- IR/PIR: Arrange surveillance (monitor voice, cell communications between villagers and outsiders, etc.) and Intel gathering to find villagers that are Followers of Sheik X. Upon discovery, seize and hold.

ROE:

- If attacked by Followers of Sheik X, use deadly force, except deadly force is disallowed against villager group Young Lions with legitimate weapons. Villager Young Lions group likely to misinterpret warning shots if they do not see who is shooting…

Above, it is important to note that process and product cycle iteratively. The CAMPHOR Human Terrain Map can be used to check the estimated COA effect against the observed effect and suggest future COAs, which, in turn affect the Human Terrain Map.

Learning Organizational Lessons for Training and Doctrine

The organizational purpose of CAMPHOR is to transmit the lessons learned from *tactical* and *strategic* scenarios to improve training and doctrine related to counterinsurgency and the hearts and minds campaign. The CAMPHOR-relevant organizational tasks in the military include pre-deployment training, re-deployment training, and the improvement of doctrine (although improving organizational memory, knowledge, and learning belong here as well). Many of the operational, civil affairs, and intelligence commands organizations operate under severe time, money, and manpower constraints when it comes to preparing people for (re) deployment to a foreign theater of operations.

The benefit of CAMPHOR to organizations is likely to come from the "lessons learned" ability of the CAMPHOR Human Terrain Map to store knowledge about mission planning. It is possible, if appropriate, to record CAMPHOR-assisted planning sessions in the field to capture the process of planning and compare to the usual planning process. At the very least, this can provide an improvement to the current after action review (AAR) process in the military which is relevant to both training and doctrine improvement.

For training, there are two obvious ways to use the Human Terrain Map. First, CAMPHOR materials can simply be disseminated to US forces in training. Second, US forces can re-enact mission planning using CAMPHOR, with the old Human Terrain Map feeding into the simulated outcomes of trainees' decisions. This will allow additional realism in wargaming where socio-cultural factors are important. More deeply, having many detailed post-mission/post-campaign CAMPHOR maps with the details of a village's society, the actions taken by the US, villagers, and insurgents, and the results of those actions, can allow for mathematically and temporally extensive analysis of socio-cultural operations in the military. Being able to see such a maps progress over

time, being able to dissect them, redo missions from scratch with different COAs, being able to perform countless “what-if?” experiments (with automatic sensitivity testing) will be highly conducive to both rapidly training SOF/US military in village-level cultural dynamics and preserving a dynamic and interactive picture of past missions with a hearts and minds element.

Intelligence Analysts will compactly communicate the lessons learned to the SOF team leader both during mission planning, and when the SOF team is deployed in the field. The SOF team leader will be able to get periodic updates about the probable effects of the relevant mission developments on the opinions of the local population.

Example Real-world Applications: Navy Expeditionary Combat Command

CAMPHOR has been recently briefed to the Navy Expeditionary Combat Command (NECC). According to Dave Balk, PE, CAPT, CEC, USN NECC N9 (Strategy and new Technology):

“As I understand it, CAMPHOR will provide the capability to rapidly and flexibly plan missions in a small geographic area where hearts and minds are important; help with broad, sustained hearts and minds campaigns in low-intensity conflicts; and help organizations rapidly learn, test, and change doctrinal lessons.

This is an important capability to NECC because it will help us to better target our scarce resources in a particular theater to provide a more efficient and effective outcome. By targeting the proper use of culture information and mapping, NECC, the Navy will be able to surgically accomplish our objectives in Theater Security Cooperation. It will also aid our warfighters as we encounter distributive and urbane warfare, especially in today's asymmetrical environment. With the knowledge obtained with the CAMPHOR program, Operational Adaptation, in phases 0 through III operations can be better achieved.”

Conclusions

In this paper, we have described a methodology and a tool for applying the social identity theory, the theories from cognitive and social psychology, and the social network analysis to devise a socio-cultural model of the village-level human terrain. We illustrated the process of using this model to improve the SOF mission planning by systematically accounting for and capitalizing on the local socio-cultural phenomena. In particular, we demonstrated how to devise the non-kinetic means for achieving the desired short- and long-term mission effects. We also addressed the issues of populating the model from partial and incomplete data. The presented methodology will enable the intelligence officers to more efficiently and effectively support the SOF operations in pre-deployment, during mission planning, and in the field.

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