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## New Artificial Intelligence Tools For Deep Conflict Resolution and Humanitarian Response

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### Abstract

Truly understanding what others need and want, how they see the world, and how they feel are core prerequisites for successful conflict resolution and humanitarian response. Today, however, human cognitive limitations, insufficient expertise in the right hands, and difficulty in managing complex social, conflict, and real-world knowledge conspire to prevent us from reaching our ultimate potential. This paper introduces *cogSolv*, a highly novel Artificial Intelligence system capable of understanding how people from other groups view the world, simulating their reactions, and combining this with knowledge of the real world in order to persuade, find negotiation win-wins and enhance outcomes, avoid offense, provide peacekeeping decision tools, and protect emergency responders' health. Ready to go today, portable, and requiring virtually no specialist expertise, cogSolv allows governments and local NGOs to use expert culture and conflict resolution knowledge to accurately perform a wide range of humanitarian simulations. cogSolv assists responders with training, managing complexity, centralizing and sharing knowledge, and, ultimately, maximizing the potential for equitable conflict resolution and maximally effective humanitarian response.

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### 1. Introduction and Theoretical Motivation

Humans have proven themselves to be remarkable conflict resolvers, persuaders, and responders to humanitarian disasters of all kinds. Practically speaking, however, responders find themselves confronted by a myriad of cognitive and organizational limitations. Humanitarian contexts are characterized by complex, difficult-to-predict social systems grounded in psychology, culture, and deep knowledge bases. The information needed for response is often distributed across multiple experts, and is difficult to synthesize in ways sufficient to guide response. Countless fragments of information interact in unpredictable ways, making it exceedingly difficult to obtain the 'big picture' and truly understand what is going on. Moreover, NGOs, local groups, and government agencies alike often lack meaningful access to conflict resolution, cultural, and other key knowledge. Therefore, successful conflict resolution and humanitarian response often tend to require a certain amount of *luck* - having the right people come together with the right information.

One reason for this is that, often, critical knowledge is unconscious and not easily accessed or standardized, including cultural and other social knowledge as well as expert knowledge. Nowhere is this more true than when responders must work with those holding worldviews different than their own; the tendency to fall into ethnocentric traps and ignore key aspects of the other side's worldview is very difficult to avoid.

Yet, when seeking to work with and/or convince others who think differently from us, we will only achieve success if we design appeals with respect to the other side's *true* (and often unexpressed) point of view.

Furthermore, it is easy to overlook conflict solutions that *appear to be equitable* but in fact ignore key needs and values for the other side. In disaster response, perceived cultural insensitivity may cause survivors to ignore official communications such as evacuation orders [1], and the inability to manage complex chemical, equipment-related, and other practical knowledge often gives rise to critical health risks.

In the past, factors such as these have led to missed opportunities, renewed conflicts, sub-optimal outcomes, structural violence, and, ultimately, the loss of life. In the case of peacekeeping missions, characterized by the sending of signals that must be correctly understood by those with diverse worldviews, failure may mean the breaking of a ceasefire, rioting, or the resumption of war. Many knowledgeable commentators (see [2], for example) suggest that the failure of UNOSOM II (the mission upon which the movie *Black Hawk Down* was based) was due precisely to factors such as these.

When peacekeeping leaders 'get the call', there often isn't sufficient time to undertake deep study of the cultures they will be working within. (*personal communication, ex-SRSG*) As demonstrated by UNITAR training scenarios, it can be difficult indeed for peacekeeping battalion commanders to determine how to proceed in culturally-appropriate ways. Given the demonstrated need to devolve ever-increasing amounts of decision-making power to the field (cf. [3]), future commanders are likely to find themselves more and more dependent on incomplete information.

As an example, one such UNITAR training scenario, set in Africa, imagines an ex-soldier who has climbed a fence and broken into a UN MOVCON warehouse. Breaking his Rules Of Engagement (ROE), the fictitious peacekeeper shoots the ex-soldier. A crowd begins to gather outside the base, demanding the ex-soldier's body, and the commander must decide what to do. Using models developed in conjunction with a Ugandan informant, simulations have shown that, in such a situation, it would be essential for the UN to engage to some extent with local conflict resolution processes if further bloodshed were to be avoided. It is most probable, however, that under such a scenario the necessary knowledge would not be available to local decision-makers and they would not be aware of this.

Generally speaking, computers hold immense potential for helping humans overcome difficulties such as these. Unfortunately, however, in the past they have been unable to do so, as mainstream Artificial Intelligence (AI) has not had the ability to store and handle nuanced social data in a way that would allow it to in some sense 'understand' and productively model these types of complex systems.

With the recent advent of the *Atomic* approach to AI, however, this has now become possible. This school of thought represents a fundamentally new perspective on the discipline. Two core Atomic formalisms, *INTELNET* and *COGVIEW* [4], provide the foundation for *cogSolv*, the suite of technologies discussed in this paper. *INTELNET* allows highly nuanced knowledge about the world to be stored and conclusions drawn from it in exceedingly flexible, powerful ways. *COGVIEW* enables computers to conduct simulations grounded in complex psychological and cultural worldviews. Critically, *COGVIEW* models (known as Deep MindMaps) are human-readable and machine-processable at the same time, meaning that they can be created with only minimal training and used by personnel without significant specialist expertise. The exact same data that is entered into the computer can be easily used for teaching and discussion purposes.

As Spriet and Vansteenkiste (1982 in [5]) suggest, "Social systems are sometimes labeled in the literature as soft systems or ill-defined systems where the usefulness of traditional mathematical representations is questioned." *COGVIEW* models allow us to understand complex human situations while retaining their nuance, using flexible, brain-inspired algorithms to effect processing. *Ultimately, this enables us to generate remarkably human-like predictions across complex social systems.*

*cogSolv* and Atomic AI are optimized for the type of data found in humanitarian environments; in such contexts, the 'softer' aspects make all the difference.[4] *COGVIEW* is able to integrate disparate forms of information (such as emotional and practical/commonsense knowledge) quickly and effectively.

### 1.1. What Can cogSolv Do?

In conflict resolution, negotiation, advocacy, persuasion, peacekeeping, disaster response, and other key humanitarian processes, *cogSolv* simulations provide precise guidance as to how to respond, pointing out actions that should be undertaken or strenuously avoided. *cogResolv*, the conflict-focused component of *cogSolv*, can store and simulate expert conflict resolution techniques, automatically integrating these with situational/cultural models developed by field and HQ experts.

*cogResolv acts as a trusted advisor and ally* before, during, and after the mission, centralizing cultural and practical data. In protracted conflict or when stalemates arise, the computer helps find ways around blockages. *cogResolv* simulates the effects of actions and the perceptions that they will create for other parties, identifies hidden win-wins and potential problems, circumvents biases, and helps discover actions that can reinforce the resulting peace. It helps meet needs in creative ways, maximizing 'deep' (integrative) justice.

In line with GRIT (Gradual Reduction In Tensions) theory [6], cogResolv can suggest potential concessions that may reduce tensions while maximizing value for all sides. It makes the hidden explicit, models critical psychological factors such as pain and determination, helps increase decision quality, and models the ripple effects of small decisions across large, complex social systems.

cogResolv helps conflictants separate issues during negotiations, making all parties aware of the totality of the world in which they operate. Its *Integrative Justice Scores* provide a quick, concise metric of the extent to which the deep needs of all parties are being taken into account and hidden biases addressed.

Facilitating situational awareness, cogResolv allows practitioners to work together to manipulate a shared vision of a current situation and to visually indicate points of reference or areas of concern.

cogSolv and cogResolv also support *training and situational awareness*; officials sent to conflict sites on a moment's notice, peacekeepers, and students can all benefit from cogSolv's ability to quickly and easily facilitate understanding. cogSolv enables team members to quickly appreciate the existence, importance, and consequences of critical knowledge, helping to get everyone on the same page.

*In summary, cogSolv's Artificial Intelligence capabilities provide decision-makers with critical tools for making socially-nuanced life-or-death decisions.*

## 2. Core Humanitarian Focus Areas

Current cogSolv/cogResolv focus areas include:

- Conflict modeling/prediction, including protracted conflict,
- Persuasion (especially emotionally/subconsciously-driven: beliefs, values, religion),
- Social media analysis, including sentiment/topic detection and modeling,
- Knowledge/culture-based deep analysis of extremist messages,
- Nuanced conflict understanding and training,
- Peacekeeping,
- Disaster response, and
- Conflict early warning (grounded in analysis of prevailing social scenarios and social media inputs).

## 3. Potential Users

cogSolv and cogResolv find applicability to a wide range of humanitarian and conflict-sensitive domains, including the following:

· **Peacekeeping:** Interactions with local populations, calming tensions, mission design, gender sensitivity.

*Who:* Field battalion leaders, UN Department for Peacekeeping Operations (DPKO) personnel / HQ.

· **Development:** Locally-sensitive intervention design, anti-discrimination advocacy, empowerment of sex workers, gender sensitivity, calming of tensions.

*Who:* Field personnel, planners.

· **Early Warning/Data Mining/Machine Learning:** cogSolv capabilities for natural language and social media processing point the way to a capacity for early warning of conflict hotspots or likely social ruptures. cogSolv and the associated COGBASE[7] commonsense knowledge base support data mining, machine learning and deep learning, as well as other processes for discovering patterns in input data.

· **Diplomacy:** International negotiations, cooperation in international organizations (ASEAN, UNSC), human rights (especially elements oriented towards values, religions, cultures and other intangible variables). Notably included are resource-oriented conflicts, especially when multiple issues may be traded against one another.

*Who:* Those accredited to international fora, human rights personnel, cultural attachés.

· **DOS/DOD/Foreign Ministries/States:** Public information, de-escalation, cultural exchange, locally-sensitive project design, anti-extremism.

*Who:* Public Information Officers (PIO), liaison personnel.

· **NGOs, USAID:** Advocacy, anti-discrimination, gender/culture/religion-responsive planning, prediction of local areas of discontent with particular policies.

*Who:* Local field personnel, HQ planning personnel, USAID Innovation Lab.

· **FEMA, Emergency Responders:** Culture- and task-aware disaster response, bringing AI and deep knowledge management to local organizations.

*Who:* Any organization where having access to the right knowledge (lessons learned, chemical response models, etc.) at the right time can make a significant difference.

· **Oil companies:** Avoiding local conflict, planning project development in locally-sensitive ways.

*Who:* Those who negotiate with local communities, those at HQ responsible for overall peace and production continuation, project planners.

## 4. Current Status

All of the software described in this paper is currently functional and usable for real-world efforts. The underlying technology has been proven in various contexts ([7–10], and others). A significant military customer has expressed interest in using Atomic AI as its standard for commonsense knowledge, and Atomic principles are currently being employed in a US Government application which has received highly favorable feedback from evaluators.

Currently available Deep MindMaps include aspects of US, Chinese, and Iranian cultures, African conflict and peacekeeping models, Corporate Social Responsibility, HIV prevention, and more.

## 5. Packaging

Mindful of the real-world needs of field users, the entire cogSolv system can be run on a single laptop with no Internet connection, across the Web with minimal Internet speed requirements, or on a cell-phone/smartphone with or without Internet connection.

The system is easy-to-use and requires no technical background, making it useful to a wide range of responders, decisionmakers, planners, and conflict resolvers.

## 6. COGVIEW Deep MindMaps: Mapping Beliefs, Religions, Psychology

cogSolv relies on COGVIEW Deep MindMaps to understand people and the world in which they live. Deep MindMap diagrams describe important aspects of how others think and view the world. Simple to create and to understand, Deep MindMaps allow cogSolv to simulate the needs and selected aspects of the thought patterns of others. This in turn allows the computer to create counteroffers and persuasion strategies tailor-made for them, predict in useful part their likely reaction to certain actions, and assist users in ‘getting into the minds’ of others.

Deep MindMaps are able to represent nuanced information about local cultural and conflict resolution practices, including religious practices and viewpoints.

MindMaps provide a critical *knowledge multiplier* in that the information they contain is no longer locked inside the heads of experts - rather, it may be disseminated across the enterprise where it is able to influence the decision making processes of great numbers of personnel.

There are three general types of MindMaps:

- Cultural (Deep Worldview Models)
- Psychological (included with cogSolv)
- Conflict (deep goals and concerns)

Cultural/worldview models tell the computer how a specific group of people (as defined by the user) tends to see the world. Built by or in conjunction with informants, they help remove a significant source of inaccurate decision-making: *ethnocentrism*.

Psychological models provide cross-cultural insight into the human psyche, drawing on cognitive and social psychology. Users need not create such models, however, as a very complete set is provided as an integral part of the cogSolv suite.

In conflict contexts, conflict models provide a simple means of informing the system about the specific content of the conflict at hand.

### 6.1. How are MindMaps built?

Deep MindMaps are easy to create, and can be built in the field by those who have the best knowledge, written at HQ by experts, or created via some combination of the two. Once created, MindMaps are reusable and can be stored in common libraries.

Only minimal training is required in order to create MindMaps via a straightforward two-step process. In the first step, important concepts are identified in the domain of interest. In the second, those concepts are linked together in pairs. The structure of MindMaps makes it easy to test for correctness.

Because *humans can read and understand the exact same models that are presented to the computer*, there is no need to engage in time-consuming model translation between development and deployment stages.

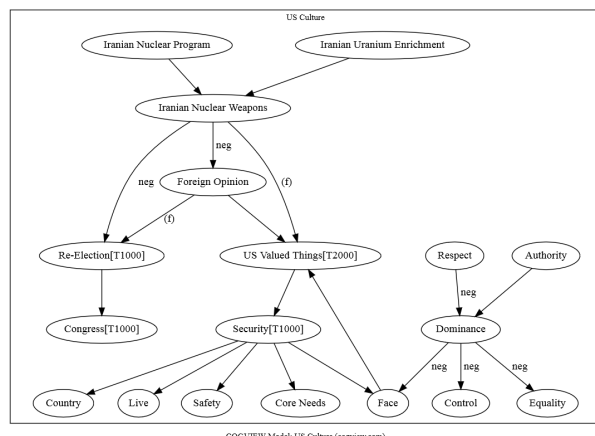


Fig. 1. Sample Deep MindMap

## 6.2. How many MindMaps do I need?

For persuasion, cogSolv performs best with one Deep MindMap for each involved culture or subculture. For conflict resolution, one overall Conflict MindMap and at least one Cultural MindMap for each participant would be ideal. The system can work with less information, at the cost of reduced nuance.

MindMaps are meant to be reused across missions; it is envisioned that, for field use, prebuilt libraries of Deep MindMaps would be created at HQ in conjunction with informants and then made available for reuse in the field.

## 7. cogSolv/cogResolv: What Can They Understand?

cogSolv makes social factors such as religion, culture, values, and history much easier for outsiders to understand and take into account.

cogSolv's combined visualization, collaboration, and modeling capabilities allow interested parties to spatially comprehend the identities, psychological dynamics, and structural factors undergirding the complex relationships between disputants, stakeholders, and community and interest groupings, including:

- the in-depth nature of the relationships between parties, specifically focusing on psychological dimensions such as emotional connections, past history, past grievances, ethnic and clan concerns,
- social, economic, political, and power-related structure issues, including resource contestation, political access, and intergroup rivalries and power imbalances,
- general psychological principles, such as trauma that needs to be resolved, and community integration that may be required,
- the dynamical nature and potential relevance of community-based reconciliation methods (such as *mato-oput*), and
- general related historical circumstances and events.

Through clarity and nuanced simulation, cogSolv seeks to make the hidden explicit, increase decision quality, and model psychological factors such as pain and determination.

cogSolv can model the unobvious effects on complex systems of single changes, including the dynamic effects of changes and perturbations over time.

Essentially, cogSolv 'gets into the head' of participants, modeling subjective experience at a deep level. cogResolv *allows negotiators to discover which parts of the conflict 'space' are more fixed and thus less amenable to negotiation* and areas where there may be more room from the other parties' perspectives.

### 7.1. Peacekeeping

As alluded to above, in many ways peacekeeping is inherently constituted by signaling, especially so because peacekeepers often cannot resort to force to achieve their goals. This means that most actions troops take are calculated to send certain messages, using indirect methods calculated to have certain psychological effects. The system can model these.

Specifically, for local perspectives the system assists users in answering questions like those below:

1. 'Minimal understandings': Can we establish a minimal set of knowledge we must gain about local perspectives in order to properly design a peacekeeping mission? How should local culture modulate our peacekeeping actions?
2. Modulating emotions/fear/mistrust: how can we calibrate our messages to improve these factors?
3. How can we use local conditions to adjust the messages we send?
4. How can we maximize the legitimacy/correctness/appropriateness of our actions relative to cultural and local standards?
5. How do the 'peacekept' differentially perceive message form and content in different cultural/conflictual contexts?
6. What sorts of messages are sent through what actions?

For more detailed analysis on the use of Atomic AI in peacekeeping missions, see [11, 12].

## 8. Training and Situational Awareness

cogSolv and COGVIEW significantly enhance training and situational awareness capabilities.

Trainers can use cogSolv to quickly brief parties who have just entered the field of influence (consultants, military personnel, media, academics, and so on). Multiple-party access to a common picture enables new forms of teamwork and shared access to knowledge.

cogSolv allows trainers to include a greater totality of information not easily provided via other modalities, including relational and psychosocial factors, systems, structure, relationships and psychology. Deep MindMaps allow interested parties to visually arrange, drill-down and spatially understand the true nature of the situation at hand. Grievance details and possible 'angles' of resolution can be understood and simulated using spatial intelligences in addition to purely rationalistic or sequential methods.

### 8.1. Situational Awareness via Story Building

Varied research (cf. [13]) suggests that storytelling is an important part of how humans make sense of their world. Figure 2 demonstrates cogSolv's ability to automatically convert COGVIEW-based analysis into story form.

We are unhappy that you are engaging in Outsider Interference (-100), which is against our Religion ...  
 One must not cause Fear (-100)  
 One must not interfere with Honor (-100)  
 Supporting Others supports Masculinity (1000), which is an important part of Tradition

Fig. 2. Output: Story Building

This functionality is useful when the story-based perspective is of interest and you wish to understand the other side via that lens, or when one wishes to understand the impact of particular goals on the other side from that side's perspective.

## 9. cogSolv Genies and Their Inputs: Easy To Create and Use

cogSolv is structured as a set of *Genies*, each of which solves a specific problem. Some Genies operate solely on COGVIEW Deep MindMaps, while others also accept simple inputs (of the form described in Section 10.1) describing a specific scenario for which they will be asked to perform a simulation.

For a current list of available *Genies*, please see <http://intmind.com/cogSolvGenies>.

## 10. Sample Humanitarian Applications and Genie Outputs

### 10.1. Brief Technical Introduction

In order to best understand the following demonstrations, it is important to understand two key cogSolv concepts: *energy/concept pairs* and *acceptance scores*.

Energy/concept pairs assign *energy values* to *concepts* (such as HAPPINESS or COMPUTER). Energy values are numbers and can be positive or negative. Positive energy values attached to a concept indicate that the attached concept is desirable, is present in some context, or is a goal that should be pursued. A negative energy value indicates concepts that are undesirable, not present, or should be avoided.

As an example, the energy/concept pair -150/FEAR could indicate that fear has been or *should be* lessened, or that fear creation should be avoided. Concepts are understood from the 'receiving perspective' - thus, the pair 100/DOMINANCE indicates that 100 units of dominance are being applied from the *outside* to the party whose perspective is being described.

When interpreting energy values, 100 is a 'typical amount', so -150/FEAR suggests that Fear has been or should be reduced 1.5 times 'a reasonably typical amount' that one might encounter in practical everyday life.

The second concept, *acceptance scores*, indicate how likely someone would be to accept or reject a particular proposition. Normally, scores range from -1 (absolute rejection) to 1 (absolute acceptance), but they can be much larger or smaller depending on simulation outcomes. As an example, one might assign the score +1 to the proposition OBTAIN FOOD AND SHELTER and -1 to the proposition EXPERIENCE STARVATION.

**Understanding the examples** In some of the examples given below, 'word clouds' are shown with concepts in **red** and **green** text. Red-colored text indicates concepts that have negative energy, and green-colored text the reverse. Words are sized in proportion to the energy they have received.

Depending on the Genie being used, green concepts often represent those that the user should attempt to augment. In the dissonance-induction context (Figure 3(b)), green concepts are those creating dissonances that are foreseeable but whose impact is likely to be misunderstood due to cultural factors. In this context, the color red denotes critical concepts that are *currently being ignored but should be more carefully considered* in order to create positive change.

### 10.2. Advocacy and Persuasion

cogSolv offers significant functionality for advocacy and persuasion. Related Genies help users employ deep knowledge about beliefs, cultures, and cognition during the persuasion process. cogSolv indicates exactly what to emphasize and how (and what to avoid) in order to maximize persuasive effectiveness from the other side's point of view. In line with *Social Justice Theory*[14], the system can also discover the specific 'anchor' concepts (see Figure 3(a) below) across which opinions are formed on specific issues.

cogSolv facilitates the use of Festinger's theory of *Cognitive Dissonance* to achieve belief change (see Directed Dissonance Reduction in [10]). As shown in Figure 10.2, cogResolv can calculate how and why dissonance is being created, supporting understanding, persuasion, and other related processes.

The running example below (starting with Figure 3) describes how Western governments could go about handling the recent wave of anti-LGBT sentiment in Africa. They could usefully include or exclude elements in their persuasive communications as suggested by the figures below, and could craft the core of their appeals taking these psychological simulation results into account.

As indicated in Figures 3, 3(a), and 3(b), cogSolv suggests an approach quite opposite to that currently in use, namely one focused on LOCAL DIGNITY, RELIGION, and TRADITION. cogSolv simulations suggest in part that differing versions of HAPPINESS, as well as concepts regarding POLITENESS, SOCIALITY, and SUFFERING (see Figure 3(a) for more in-depth analysis) are ultimately at issue.

Ultimately, indirect appeals are often the most powerful. During persuasion, *Potential Invoking Concepts* (PICs), shown in Figure 3, provide *alternate concepts* capable of evoking core concepts that the system recommends users include in their persuasive communications. PICs are drawn from the COGBASE commonsense knowledge database [7].

<p><b>Recommended Persuasion Elements (should use in persuasive communication):</b></p> <p>RELIGION - Potential Invoking Concepts: <i>pray, build cathedral, church, tell many person, god, temple, spirit, faith, islam, wicca, shamanism,...</i></p> <p>STRENGTH - Potential Invoking Concepts: <i>go jog, fight war, stay healthy, rod, metal, bridge arch, power, hero, good part, might, vigor, sturdiness, brawn, sea power, concentration, invulnerability...</i></p> <p>LOCAL DIGNITY</p> <p>TRADITION - Potential Invoking Concepts: <i>buy present others, propose woman, party, card, buy present, surprise, give gift, bake cake, convict suspect crime, ...</i></p> <p>SUPPORT OTHERS</p> <p><b>Disfavored Persuasion Elements (should not include):</b></p> <p><i>Secularism, Linking of Development Assistance, Colonialism, Human Rights Discourse, General LGBT Perception, Outsider Interference, Sexuality</i></p>
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Fig. 3. How should we create persuasive appeals for the Africa LGBT scenario?



Sample text format data supporting the above (concept=energy, *T* denotes *target energy values*): Happiness=10500/*T*1000, Core Emotions=-5900/*T*1000, Power=-5600, Local Cultures=3300, Respect=3300, Ideologies=3300, General LGBT Perception=-3300, Communitarianism=3300, Ego=3300, Tradition=3000, Morality=2600, Face=2500, Masculinity=2000, ... Honor=1000, Conflict=800, Offended=800/*T*-1000, Local Dignity=700, Equality=-700, Christianity=-500, Religion=500, Christian Values=-500, anger=400, trauma=400...

### 10.3. Truly Just, Needs-Focused Conflict Resolution

As mentioned above, cogResolv focuses on resolving conflict in ways that are truly *just* in the sense that deep emotional and practical needs are met. cogResolv’s access to the core needs of each party allows it to determine to what extent any particular resolution is actually just.

For conflict-driven contexts, cogResolv includes the following selected features:

### 10.3.1. Justice Score

In COGVIEW terms, a conflict may be considered to be *justly resolved* when 1) *target scores* (defined next) are maximized and 2) no significant *clashes* (see Figure 5) result. *Target scores*, defined as values attached to specific COGVIEW concepts (such as FAMILY, SAFETY, and BELONGING) indicate the core importance of certain concepts to a party's fundamental well-being. *Clashes*, in turn, indicate when a particular phenomenon violates fundamental, deeply-held values. The location of the clash within the Deep MindMap indicates the cause and nature of the incompatibility. cogSolv's Integrative Option Generator (Section 10.3.2 below) *inherently generates options leading to truly just results*.

Normal Justice Score values range from -1 to 1; values outside this range indicate particularly just or unjust resolutions.

### 10.3.2. Integrative Option Generator

When it is unclear how a conflict may be resolved in an integrative (highly equitable) manner, previous resolution attempts may have failed, and *new ideas are required*, this Genie is able to *find new ways of meeting old needs*. The system helps *separate issues* and *reframe conflicts*.

Each option in Figure 4 below can be interpreted as follows: a concept is given together with an associated energy. If the energy is positive, policy choices/actions that facilitate that concept should be chosen, and the reverse for negative. As suggested above, 100 units of energy is the 'normal' amount.

As an example, EQUALITY/700 suggests that strategists would do well to focus judiciously on that concept. LINKING OF DEVELOPMENT ASSISTANCE/-3000 suggests that strategies should not significantly invoke this concept, and may do well to explicitly disclaim it.

#### Options: Ameliorating 500 units/Colonialism (via relevant African perspective)

**Western-Country could undertake:** Equality/700, Sociality/4300, Local Cultures/700, Linking of Development Assistance/-3000, Strength/1000, pleasure/1000, mad/-1000, anger/-1000, mean/-1000, trauma/-1000, hate/-1000, despise/-3400, scorn/-1000, embarrassment/-1000, Support Others/1000, empathy/1000, enjoy/1000, angry/-1000, Local Dignity/1000, unhappiness/-1000, joy/1000, like/1000, guilt/-400, regret/-400, remorse/-400, Outsider Interference/-3000, Religion/1000, Colonialism/-6000, happy/1000, Social Discomfort/-1000, Human Rights Discourse/-3000, care/1000, Love/1000, Dominance/-1000, Aggression/-1400, heartache/-1000, Support Others/1000, Psychological Drives/1000, Strength/1000, Religion/1000, Local Dignity/1000

Fig. 4. Deep Win-Win (Integrative) Option Generator

### 10.4. Discover Concepts in Conflict (Find Conflict 'Essence')

This functionality, demonstrated in Figure 6, helps one understand the 'essence' of a particular conflict, explain the core of the conflict to others, and gain new perspectives on existing conflicts.

The Genie presents a list of core concepts that are most responsible for driving the conflict at hand. Red concepts are particularly problematic concepts (concepts that are not being properly addressed by the conflictants), and green concepts represent those that, if taken properly into account, could help push the conflict in the right direction.

#### 10.4.1. Protracted Conflict

Untangling the complex issues leading to protracted conflict represents a very difficult task for humans. cogResolv can provide major support in that it is able to simultaneously 'compute all the angles' and point users towards the best solutions. cogResolv's Integrative Option Generator (Section 10.3.2) and Automated Negotiator Agent (next section) automatically generate non-obvious ways forward that simultaneously address all practical and psychological aspects of conflict and equitably maximize benefits for all sides.

### 10.5. Automated Negotiation

The ability to understand counterparts' worldviews, goals, needs, and so on, leads to the ability to automate and predict potential flows for entire negotiation processes.

cogResolv's *Automated Negotiator Agent* helps discover options that optimally maximize both sides' perceived value. The agent is able to automatically simulate opinions, needs, and goals on both sides of a conflict.



**Sample Clashes:**

Christian Values vs. Christianity, via:  
Human Rights Discourse [-100],  
Outsider Interference [-300],  
Equality [700.0]

Communitarianism vs. Ideologies, via:  
Colonialism [-100], Equality [700.0],  
Christian Values [500.0],  
Christianity [500.0],  
Religion [1500.0], Local Cultures [700.0]

Empathy vs. Morality, via:  
Colonialism [-100]

Face vs. Core Needs, via:  
Equality [700.0], Christian Values [500.0],  
Christianity [500.0], Religion [1500.0],  
Local Cultures [700.0], Respect [700.0]

Fig. 5. Sample Clashes

Fig. 6. Concepts In Conflict (*Conflict Essence*)

At each round, the agent chooses options that have been determined to best meet the needs of the other side while avoiding overly negative costs for one's own side. Potential offers that would be insulting to or overly damaging to either side are automatically suppressed.

From Iran's perspective:  
Proposal IRANIAN NUCLEAR WEAPONS/-300 receives desirability score -4.5658 (i.e. quite low)  
*Reasons:* -3600/Security, -2700/Values, -2700/Power, -1880.0/Safety, 1600.0/Dominance, -1600/Country, -900/Control, -675/Equality, -600/Freedom, -600/Honor, -600/Respect ...  
**Agent chooses proposal Trade/132.3725, Diplomacy/65.0, Sanctions/100, score 1.3915.**

*Example 'Odious Proposal':*  
3000/Attack (i.e. allow other side to attack - even though this may offset other factors, US can't offer this as it too negatively affects its interests)

Fig. 7. Automated Negotiation Agent (Iranian Nuclear Weapons)

The system's ability to calculate the value of various offers allows it to *offer progressively more value* as negotiations continue.

As confirmed via human evaluation, the system's offers are remarkably human-like. In the case of cogResolv's simulation of the Iran/US conflict over nuclear weapons, cogResolv's recommendation was in fact nearly identical to a settlement which took place in 2013 (that is, some months after the initial simulation was run - see for example [15]).

## 11. Culture- and Knowledge-Aware Disaster Response

Experiences from the field clearly demonstrate the importance of cultural sensitivity to effective disaster response. [1, 16, 17]

It is critical to perform modeling in *both directions* - how responders should act in order to be viewed positively as well as the process by which viewpoints are generated on the survivor side. Bottom line: *if responders fail to cater to cultural needs, survivors won't trust you and may not evacuate or follow other directions.*

The benefits of Atomic AI for human decision making apply here as well; cogSolv's cogResponder component can manage detailed task and threat information and help responders triage and avoid emerging threats.

cogResponder simulates cultural perception both with respect to 1) responder actions and 2) Tweets and other social media data discussing the actions that responders take. Sentiment and task models are used to extract opinions being expressed. The latter capability allows cogResponder to automatically discover that messages about EXPLOSIONS affect human safety (including possibly EYES and HEARING).

cogResponder's deep culture and domain knowledge base allows it to provide scores for response activities across various *cultural and practical dimensions*, including Capability, Responsiveness, Correctness, Values Alignment, Solidarity, and Legitimacy.

Lastly, cogResponder enables responders to **master counterintuitive aspects of response**, including the

need to take specific actions for particular ethnic groups, which could include, for example, providing information through messages from friends and family instead of formal sources for Vietnamese communities. ***During response, intelligent actions build solidarity.***

### 11.1. Tweet/Social Media Processing for Disaster Response

cogResponder includes a powerful opinion mining engine capable of using deep semantics, Atomic AI, COGVIEW, and COGBASE [7], to *determine the real-world effects of events using commonsense knowledge* and, in turn, the pleasantness and emotional effects (including cultural and other perceptions) of raw social media textual content.

As an example, if an incoming tweet suggests that an explosion has taken place, the system understands that this is likely to cause pain and unhappiness, which will be viewed negatively *and will also reflect poorly on responders as they did not prevent this from occurring.*

In the sentence ‘I have no shoes’, the system’s knowledge enables it to understand that a shoe is an article of clothing, the lack of which affects the health of the individual, which in turn affects perception of response. The system contains significant knowledge about what *health* is and what affects it.

This knowledge also allows the system to determine that BOMB has semantics related to those of EXPLOSION, so *social media users can employ a wide range of vocabulary to describe the things they see.*

cogResponder can bring particular Tweets to responders’ attention based on the semantics described therein - ‘trapped’, family members in distress, and so on. **The cogSolv sentiment engine is the first to use deep semantics to this extent.**

Outputs include 1) trending topic and valence detection (i.e. ‘I love FEMA’ → positive sentiment towards FEMA; ‘Thankfully there was no explosion’ → negative energy into *explosion*, which provides positive sentiment for responders as well as the Tweet itself), and 2) semantic concept histories (*bomb* and *explosion* would trigger the same trending topics).

Finally, cogResponder can also discover trending locations so that hotspots may be quickly identified and resources diverted.

**Input Sentence: ‘I got chemicals on me.’**  
**Key Concept: Chemical**  
**Computed Semantic Consequences and Dimensions Affected:**  
 Explosion/600, High Temperature Explosion/400, Pain/200, Explosive Decomposition/200, Heat/200, Burn(Medical)/200, ... Fire/200, Oil/100, Combustibles/100, Eyes & Skin/-200.0  
**Cultural Dimensions:**  
 Physical Effectiveness/-600, Personnel/-600, Physical Security/-600, Core Needs/-600, Responsiveness/-1200, Infrastructure/-1200, Health/-1700, Legitimacy/-1700, Correctness/-1800, Capability/-3500.0

Fig. 8. Deep-Knowledge Sentiment and Effect Mining

### 11.2. Task Models

In line with the AI functionalities put forth above, cogResolv is able to automatically comprehend response-related tasks, understand their implications, and prioritize subtasks. Commonsense knowledge acts here as a storehouse of lessons learned, providing detailed information about how to handle dangerous situations.

As an example, in a response where the chemical *chloropicrin* is involved, the system can use its knowledge of the profile and properties of this substance to indicate what tasks, in the current response context, workers should take in order to protect themselves. cogResponder can identify Personal Protective Equipment (PPE) that should be used, materials to be avoided, possible symptoms, and so on.

The goal is to use unobvious information and/or information that is likely to be overlooked in order to keep responders out of harm’s way, such as the fact that methyl bromide is often present where chloropicrin is and that sea ports often have both chemicals present, in order to help facilitate an ideal response. *The system provides real-time task prioritization based on the computed consequences of each choice and can adjust priorities automatically.*

## 12. Conclusion

It is all too easy to take the state of today’s world for granted - to assume that the limitations we have today as human beings can never be transcended and that we must therefore accept things as they are.

If, on the other hand, we could use the power of accurate, truly culturally-aware Artificial Intelligence to understand, reason about, and deeply dive into human data, it seems possible we could understand others more profoundly and in so doing find new solutions to problems that have eluded us in the past.

(a) General Task Modeling			(b) Consequence-based Reasoning					
Task Reasoning			Concept	Desire	Impact	Concept	Desire	Impact
Concept	Criticality	Import.	Vapors	-2400	141.94	Combustibles	-200	3.68
Search and Rescue	380	14.44	Substance Chloropicrin	-4000	118.28	Oil	-200	3.68
Hospital Transport	300	9	Vapor Cloud	-2400	70.97	Oxidizer	-200	3.68
Deploy Food Aid	200	2	Evacuation	1300	36.71	Paper	-200	3.68
Housing	100	1	Effluent	-1200	35.48	Wood	-200	3.68
Health	100	1	Vapor Cloud Drift	-1200	35.48	Explosion	-100	1
Trash	-100 (no trash)	1	Disperse	1200	35.48	High Temperature Explosion	-100	1
Manage Donations	100	0	Effluent Disposal	1200	35.48	Lacrimation	-100	1
Damage Assessment	100	0	Ventilate	1200	35.48	Shock Explosion	-100	1
			Health Effects Methyl Bromide	-1400	28.89	Trash	-100	1
			PPE	1300	28.25	Decontaminate	100	1
			Substance Methyl Bromide	-1400	27.89	Deploy Food Aid	100	1
			Choose Incorrect PPE	-1200	25.15	Health	100	1
			SAR	380	14.44	PPE Bags	100	1
			Fire	-500	9.21	PPE Disposal	100	1
			Hospital Transport	300	9.00	Skin	100	1
			Burn(Medical)	-300	4.50	Housing	100	1

Fig. 9. Sample Disaster Response Output

Bringing the wisdom of experts to those who would normally not have access to it, avoiding humanitarian mission failure, improving disaster response, and reducing violent, intractable, and latent conflict alike - this is cogSolv's vision. Future work will involve enhanced field outreach and further development of *Genies* for specific users' needs and particular conflict theories.

As adoption grows, it is hoped that cogSolv's impact will as well.

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