Deception Detection in Multicultural Coalitions: Foundations for a Cognitive Model

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Topic 3: Information and Knowledge Exploration
This paper presents a cognitive approach to deception.

- Upper-level ontology includes cognition and deception
- Deception theory - common deception themes
- Cognition and the use of heuristics for cognitive simplification
- Preparation Detection Reaction (PDR) deception-detection model
- Cognitive burden and overload in face-to-face deception
- Similar cognitive burden in deception detection

Deception detection in coalition command & intelligence centers

- Cultural differences in meaning inference & communication style
- Deception from within the coalition – the ingroup deceiver

Deception regarding group bias can be detected verbally.

Adversaries will attempt deception about group membership.

Deception-detection tools need SOA to be most useful.
Ontology of Deception – Some Highlights

- Ontology of deception belongs in the upper ontology.
- Inherits properties from cognition and behavior.
- Types of deception
  - Verbal
    - Lies & misleading statements
    - Omission of important details with intent to mislead
  - Non verbal
    - Camouflage - covert channels & hidden messages
- Deception Detection – behavioral & artifact cues
  - Direct personal observation (verbal & nonverbal cues)
  - Recorded observations – voice analysis, body language
  - Linguistic analysis of text – word counts, word associations in formal text, chat transcriptions, & speech transcriptions
Common Deception Themes

Deception Objective

Deception Story

Target’s Perception and Observables

Start Deception Plan

Observe
<table>
<thead>
<tr>
<th>Heuristics</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overconfidence</td>
<td>Overestimation of the probability of being right</td>
</tr>
<tr>
<td>Availability</td>
<td>Using easily available examples as references</td>
</tr>
<tr>
<td>Restriction of search domains</td>
<td>When solving a complex problem and resources (e.g., time, materials, money, personnel, etc.) are limited, the search space for the solution must be restricted to that most likely to yield the desired result using the least amount of resources.</td>
</tr>
<tr>
<td>Anchoring and adjustment</td>
<td>Establishing or declaring an arbitrary basis and adjusting around that point</td>
</tr>
<tr>
<td>Framing (i.e. setting a frame of reference or point of view)</td>
<td>Emphasizing aspects that are consistent with one’s beliefs, values, attitudes, &amp; models, while minimizing or ignoring aspects that are inconsistent with that viewpoint.</td>
</tr>
<tr>
<td>Oversensitivity to consistency</td>
<td>Seeing a pattern in noise</td>
</tr>
<tr>
<td>Frequency</td>
<td>Approaches with a higher frequency of success (or failure) come to mind before approaches with lower frequencies success (or failure).</td>
</tr>
<tr>
<td>“Law” of small numbers</td>
<td>Extrapolation of results from a small population to a larger population</td>
</tr>
<tr>
<td>Perceptual resistance to change</td>
<td>After a conclusion has been reached, it is difficult to change.</td>
</tr>
<tr>
<td>Factor Type</td>
<td>Characteristics of the level</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Most personal and private level, known only to an individual – the smallest sphere of influence</td>
</tr>
<tr>
<td>Personality</td>
<td>Affects small-scale groups and people in the immediate vicinity or under the authority of an individual</td>
</tr>
<tr>
<td>Organizational</td>
<td>Pertains to larger sphere of influence than any single individual. Include multiple individuals, personalities, and subgroups.</td>
</tr>
<tr>
<td>Cultural</td>
<td>Most general and impersonal level – Includes many individuals and organizations. Pertains to the largest sphere of influence, such as coalitions.</td>
</tr>
</tbody>
</table>
# Cognitive Factors that Affect Heuristics

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Arousal</td>
<td>Degree to which the individual is active or passive</td>
</tr>
<tr>
<td>Power</td>
<td>Dominant or submissive. (This factor relates to the expert-novice difference.)</td>
</tr>
<tr>
<td>Pleasantness</td>
<td>Pleasant or unpleasant</td>
</tr>
<tr>
<td>Intensity</td>
<td>Tense or relaxed</td>
</tr>
</tbody>
</table>
## Personality Traits that Affect Heuristics

<table>
<thead>
<tr>
<th>Personality Traits</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Extroversion vs. introversion</td>
<td>Sociable, assertive, playful vs. aloof, reserved, shy</td>
</tr>
<tr>
<td>Emotional stability vs. neuroticism</td>
<td>Calm, unemotional vs. insecure, anxious (Similar to cognitive intensity)</td>
</tr>
<tr>
<td>Agreeable vs. disagreeable</td>
<td>Friendly, cooperative vs. antagonistic, faultfinding (Similar to cognitive pleasantness)</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>Self disciplined, organized vs. inefficient, careless</td>
</tr>
<tr>
<td>Openness to experience (ability to analyze situations and recognize potential)</td>
<td>Intellectual, insightful, vs. shallow, unimaginative (This factor also relates to the expert-novice difference.)</td>
</tr>
</tbody>
</table>
### Organizational Factors that Affect Heuristics

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Collectivism and trust</td>
<td>Value and trust of relationship of people in the network</td>
</tr>
<tr>
<td>Power distance</td>
<td>Degree of separation (e.g. equality or inequality) between individuals at adjacent or other levels of rank in the society (Relates to cognitive power)</td>
</tr>
<tr>
<td>Social network strength</td>
<td>How strong social network connections are (culturally, group strength)</td>
</tr>
<tr>
<td>Shared codes and languages</td>
<td>Specialized languages that the network uses</td>
</tr>
<tr>
<td>Communication context (high or low)</td>
<td>Implicit meaning in phrases &amp; messages vs. literal meaning of the separate words</td>
</tr>
</tbody>
</table>
## Cultural Factors that Affect Heuristics

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<th>Cultural Factors</th>
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<tr>
<td>Individualism</td>
<td>Degree to which the society reinforces individual vs. collective achievement and interpersonal relationships</td>
</tr>
<tr>
<td>Masculinity</td>
<td>Degree to which the society reinforces or does not reinforce male achievement, control and power. Extent to which an individual views the world as competitive rather than nurturing (Relates to power.)</td>
</tr>
<tr>
<td>Uncertainty Avoidance</td>
<td>Level of tolerance for uncertainty and ambiguity within the society. Risk propensity of individuals &amp; tendency to avoid unclear outcomes</td>
</tr>
<tr>
<td>Perceptual Style</td>
<td>“Filters” or patterns that affect how people identify &amp; react to events</td>
</tr>
<tr>
<td>Self concept</td>
<td>Effect of culture on how people perceive, define, portray, value, and view themselves, including but not limited to self esteem.</td>
</tr>
<tr>
<td>Time orientation and perception</td>
<td>Time as monochromatic, linear primary frame of reference that drives schedules and behavior (Western view) vs. time as a tool to meet the needs of the group, enhance relationships, enhance trust, and share information (Middle-Eastern view)</td>
</tr>
<tr>
<td>Ethics and constraints</td>
<td>Moral distinction between good and evil. Extent to which moral behavior is governed by guilt, shame, saving vs. losing “face” and the probability of being caught.</td>
</tr>
<tr>
<td>Cause and effect</td>
<td>Degree to which a person’s destiny is a result of past actions vs. the idea that an individual has no control over destiny</td>
</tr>
</tbody>
</table>
Preparation Detection Reaction (PDR) Deception-Detection model

Preparation
- Own Knowledge
- Deceiver’s Knowledge

Detection
- Observables
- Comparison
- Inconsistencies?
  - No
  - Yes

Reaction
- Counter Deception
An operator notices a discrepancy in a message.

Error could be evidence of tampering or an error

Operator uses experiential knowledge to compare observable data (error in the message) to common errors usually observed in this message format.

- If the error looks like a common error for this message type, the operator may accept it as an honest mistake on the part of the sender.
- If the error reflects a gap in the sender's knowledge about something that should have been known in a truthful setting, the operator can identify the error as a cue to deception.

Operator need not prove deception. - Raises an alert to focus more attention on deception's origin.
Cue Sets and the Use of Heuristics

- Verbal cues alone can trigger a deception alert
- 10,000 cues nonverbal (body language) and paralanguage (voice, tone, rate, volume)
- Nonverbal cues have complex relationships to each other, and to verbal-message content.
  - Facial-muscle group coordination is jerky, uneven in liars.
  - Muscles move smoothly & in concert in truthful situations
- Cognitive burden imposed on deceiver to control many cues simultaneously.
  - Some cues are over-controlled; other cues are ignored.
  - Presents inconsistent, unnatural pattern to an astute observer.
- Deception-detection agent uses heuristics.
  - Simplify the task. Total cue set is too complex to analyze.
Deception poses threats to coalition operations.

Coalitions' members should become familiar with other members’ data and message formats – to notice possible deception in messages.

Communication automation can interfere with deception detection.
- Face-to-face communication offers rich set of cues
- Text-based media offer much fewer cues
- Analysis of text-based messages can be automated.

Deception detection is a complex task.

Combination of task complexity and deception has been linked to poor performance in groups.

Communications-based inefficiency & complex deception environment = a challenge to coalitions.
Language translations can filter out cues to deception. Translators can be “unaware deceivers.”

Different cultures vary in their ability to discern or infer meaning beyond the literal meaning in textual and verbal communications.

- The ability to “read between the lines” depends on culture.
- Middle Easterners are accustomed to more indirect forms of communications.
- May be able to understand better the intent of a high-content message than a Westerner.
- Seemingly small detail could signal deception.
- In contrast, a deceptive message or conversation could express logically inconsistent points of view.
- Westerner using linear logic more likely to detect this.

Different cultures interpret imagery differently.
Detection of group bias can depend on non-traditional key words, e.g. articles, pronouns.
- Use of articles and demonstrative pronouns commonly refer to outgroups.
  - e.g. “the Sunnis” “those tribes”
- Choice of honorifics to refer to respected group leaders.

Deceivers want to gain access to groups in which they are not allowed or they want to avoid being associated with an outgroup to avoid attack.

Deceivers can come from ingroup or outgroup.

Ingroup deceivers do not share group’s agenda.

Ingroup deceivers have an especially negative effect on group performance regardless of whether the deception is detected.
Functional Layers in SOA for Coalition Deception-Detection tool Suite

User-Interface and Data-Visualization Layer

SOA-Based Service Registry and Search Layer

Collection of Deception-Detection Software Tools

Collection of Deception-Detection Fusion and Integration Algorithms

Model base

Sensor Data Sources

Pedigree Metadata

Static Data Sources

Knowledge Bases

Ontologies
SSC PACIFIC
on Point
and at the Center of C4ISR