From Field Data to Attitude Dynamics

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Attitude Dynamics

Attitude

“a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” [Eagly and Chaiken, 1993]

Influence on people’s behaviours [Ajzen, 1991]

Application examples

Voting, sales of products (e.g. iPod), adherence to terrorism etc. [Kottonau and Pahl-Wostl, 2004, Thiriot and Kant, 2007, Geller and Alam, 2010]

Our challenge:

Confront simulated result to real world opinion dynamics data
Objectives of this paper

Enhance our previous model of attitude dynamics
[Brousmiche et al., 2014a] [Brousmiche et al., 2014b]
- Based on the evaluation of actions
- Funded on psychological theories
  (e.g. [Fazio, 2007, Ajzen, 1991, Kahneman et al., 1997])

By refining the theoretical model
- Reducing number of parameters using the Simplicity Model [Dessalles, 2007]
- Integrating real world observations

And by evaluating it based on real world data
- Military scenario
- Opinion polls results toward Forces
- Calibration
Existing attitude dynamics model

**Attitude models**

- Binary, discrete or real values [Nowak et al., 1990]
- Sum of the evaluations of the object’s features [Urbig and Malitz, 2007]
- Do not consider the construction mechanism of the attitude
  - Bounded-confidence model
    - attitude-beliefs connections are lost

**Communication models**

- Exchanged information: attitude itself
  - [Xia et al., 2010, Castellano et al., 2009]
- No psychological theory describes the impact of attitude exchange
- Conversational narratives represent up to 40% of daily communication
  - [Eggins and Slade, 1997]
An Attitude Models in Psychology

Attitude as object-evaluation associations [Fazio, 2007]

- Construction of attitude based on links between attitude and beliefs
- Enables the communication of beliefs related to the attitude
General Principle

Actors

Action & Com.

Blah

Blah

Population

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Cognition Revision

1. Acquire beliefs
2. Revise attitudes
3. Communicate beliefs
Attitude construction

- Red Force
  - Strong
  - Weak
- Suicide Attacks
  - Unforgivable
  - S. Attack on day 12: -98
  - S. Attack on day 89: -75
- Preaches
  - Pleasing
  - Preach on day 3: +10
  - Preach on day 270: +12

Accessibilities
General Evaluations
General Payoffs
Attitude construction mechanisms

Evaluation of an action

\[ eval(a) = a.pyf \times attitude(i, a.bnf) \quad [\text{Ajzen, 1991}] \]

Accessibility of an action

- Simplicity Theory [Dessalles, 2007]
- \[ interest(a) = affectiveImpact(a) + suprise(a) \]
- See its implementation for social simulation in [Brousmiche et al., 2014b]

Attitude: aggregation

\[ att(i, actor) = \sum_{ga(i) \in gaList(i, actor)} \left( \sum_{a(i) \in ga(i, a)} \left( \frac{evaluation(a) \times interest(a,i)}{|ga(i, a)|} \right) \right) \]
Application in the Context of Stabilization Operations

Population at the center
- New objective: winning the “hearts and minds”
- New tactics: non-kinetic actions

Needs for new systems
- Population-centric training systems
- Perception-attitude-behavior dynamics toward Forces
Real world data: Scenario

French Forces in Kapisa (Afghanistan)

- We rebuilt a military scenario
- with Blue’s and Red’s (Taliban’s) actions
- From 02/2010 to 09/2011 (unit: week)
- With the participation of officers of CIAE (French InfoOps)
Real world data: Polls

Polls results

- Ordered by the French Ministry of Defence
- About population favorability toward each Forces
- Every 6 months (Kapisa)
Real world data

SUMMER 2011
- Radio 7/w
- Patrol 3/w
- Reconstruction 1/w
- Leaflet
- Presence Op 7/w
- Arrest 1/w
- Brigade Op 1/w
- Special Op 1/w
- COP/FOB transfer

WINTER 2012
- Pressure 7/w
- Preach 7/w
- IED on A 1/w
- IED on FB 1/w
- Suicide attack on A 1/w
- Suicide attack on FB 1/w

SUMMER 2012
- Pressure 7/w
- Preach 7/w
- IED on A 1/w
- IED on FB 1/w
- Suicide attack on A 1/w
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Calibration

CMAES (Covariance Matrix Adaptation Evolution Strategy [Hansen et al., 2003])

- Evolutionary algorithm
- Principles
  1. Select parameters’ values from the parameters’ space
  2. Run several simulations and compute a fitness (distance from objectives)
  3. Change the studied space (move, resize, with a bit of random) ; Repeat
Calibration: Protocol

Initialization scenario

- Agents need beliefs
- And to be “habituated” to usual actions

Parameters to calibrate

- $\alpha \in [0, 1]$ which balance $E$ and $S$ of the interest
  \[ l(i, a) = \alpha \times E(a) + (1 - \alpha) \times S(i, a) \]
- $\xi \in ]0, 1]$, the emotional sensibility of agents
  \[ E(a) = \log \left( 1 + \frac{|a.pyf|}{\xi} \right) \]

CMAES

- 20 simulation replications per generation
- Stop if fitness hasn’t evolved since 50 generations
Calibration: First results

- Pretty accurate for the Red (0.06 of absolute error)
- Opposite tendency for the Blue
Calibration: upgrading the model

“People tend to attribute negative actions of the Red Force to the incapability of the Blue Force to prevent them.” (Officer of CIAE)

- We introduce a co-responsibility mechanism
  - Blue Force is co-responsible of negative Red’s actions at $\rho \in [0, 1]$ degree
  - It corresponds to the “Role Responsibility” in the sense of [Hart, 2008]
Calibration: with coreponsibility

- Obtaining of the right tendency for the Blue Force
- Compromise effect on the Red
Attitude means: Red Force
Attitude means: Blue Force

Graph showing trend over months from March to September 2012 with specific key events such as Radio Patrol Reconstruction Leaflet Brigade Op. COP transfer Pressure Preach IED Suicide attacks.
Conclusion

We proposed

- An attitude dynamics model based on socio-psychological theories
- Evaluation on real world data
- First attitude dynamics model to be calibrated

Future works

- Automatic classification of the agents
- Dynamic coresponsability
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