Affective Dynamics and Control in Group Processes

Jesse Hoey
David R. Cheriton School of Computer Science

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Artificial Intelligence

AI lacks:

- empathy,
- altruism,
- culture, ... and
- emotion.
1997: Rosalind Picard in *Affective Computing*

*This book proposes that we give computers the ability to recognize, express and in some case “have” emotions. Is this not absurd?*
Low Road and High Road

![Diagram showing two separate pathways from sensory stimulus to emotional responses](image)

**Fig. 3.** Two separate pathways from sensory stimulus to emotional responses (adapted from LeDoux 1996, p. 164).

Low Road and High Road

- **System I (Fast):** Operates automatically and quickly, without voluntary control
- **System II (Slow):** effortful mental activity, complex calculations
- When system I “runs into trouble”, it calls upon System II
Affective Computing

A cognitive machine disrupted by emotion
An emotional machine disrupted by cognition
Osgood’s Semantic Differential

Fundamental Sentiments

Evaluation

Power

weak

strong

bad

good

Activity

hyper

asleep
Fundamental Sentiments

Asleep  Activity  Hyper  Strong  Power  Weak  Bad  Good
Evaluation  Apologize  Hug  Polite  Child  Serene  Student  Professor  Boss
Bossy  Fight  Yell at  Hyper  Activity  Asleep  Abusive  Brat  Bad  Enemy  Librarian  Child  Ask  Gaze  Obey  Prompt  Fondle  Plead with  Beg  Dropout  Cure  Bully  Prom
Affect Control Theory

Affect Control Principle
- people try to experience
- events that confirm
- fundamental sentiments

- fundamental sentiments
- transient impressions

emission

social action

transient impressions

deflection

- Shared sentiments
- Shared emotional dynamics
- Shared consistency → Cooperation

Affect Control Theory

- Actor-Behaviour-Object
- fundamental sentiments: \( F \in [-4.3, 4.3]^9 \)
- transient impressions: \( T \in [-4.3, 4.3]^9 \)
- prediction \( T_{t+1} = MG(F_t, T_t) \) measured empirically
- deflection \( D = \sum_i w_i(f_i - \tau_i)^2 \)
- **Affect Control Principle**: actors work to experience transient impressions that are consistent with their fundamental sentiments
- Emotion \( \epsilon \propto f - \tau \)
Affect Control Theory

Social Interaction

Actor | Behavior | Object
--- | --- | ---
nurse | comforts | patient

Sentiment Dictionary

| $A_e, A_p, A_a$ | $B_e, B_p, B_a$ | $O_e, O_p, O_a$ |
| [2.9, 1.5, 0.2] | [2.8, 2.1, 0.1] | [1.1,-0.8,-0.9] |

Population Survey

Impression Formation Equations

$A'_e = 0.42B_e + 0.12B_p O_e - 0.05O_e + ...$

| $A'_e, A'_p, A'_a$ | $B'_e, B'_p, B'_a$ | $O'_e, O'_p, O'_a$ |
| [3.3, 1.2, 0.3] | [2.3, 1.4, 0.4] | [1.4,-0.9,-0.7] |

DEFLECTION predicts next behaviors

Symbolic Interpretation

EMOTION

Fundamental Sentiments

Transient Impressions

DEFLECTION
Affect Control Theory

Deflection:

nurse
F: [2.9, 1.5, 0.2]

patient
[1.1, −0.8, −0.9]
Affect Control Theory

Deflection: 1.3

nurse comforts patient

F: [2.9, 1.5, 0.2]  comforts: [2.8, 2.1, 0.1]  patient: [0.9, −0.7, −1.1]
T: [3.3, 1.2, 0.3]  comforts: [2.3, 1.4, 0.4]  patient: [1.4, −0.9, −0.7]
Affect Control Theory

![Diagram showing the deflection of emotions: nurse strong, patient weak, ignore, indignant, agitated. The deflection value is 13.4.]

**Deflection: 13.4**

- **nurse**
  - F: [2.9, 1.5, 0.2]
  - T: [−0.5, 0.9, 0.3]

- **ignores**
  - [−1.9, −0.3, −0.9]
  - [−1.2, 0.4, −0.4]

- **patient**
  - [0.9, −0.7, −1.1]
  - [0.4, −1.4, −0.8]
Deflection:
Deflection: 1.0
ACT Examples

Deflection: 8.0
ACT Examples

Deflection: 6.0
ACT Examples

Deflection: 4.0
Bayesian Affect Control Theory

- models **uncertainty**
- identities and behaviours: **probability distributions**
- external goals and **planning**
- Partially Observable **Markov Decision Process**
- Affect Control Principle guides action selection

Partially Observable Markov Decision Process

- $Pr(x'|x, a)$
- $Pr(\omega_x|x)$
- $R(x')$
Artificial Intelligence: Decision Theoretic

- Current State
- Post-Action State
- Next State

Agent Action
Observation/Alter Action
Agent Action

DENOTATIVE
COGNITIVE

REWARD/UTILITY

TIME

- Next State
- Current State
\begin{align*}
\Pr(x'|x, a) \\
\Pr(\omega_x|x) \\
\Pr(\omega'_x|x) \\
R(x')
\end{align*}
$Pr(x'|x, a)$

$Pr(\omega_x|x)$

$R(x')$
BayesACT

\[ Pr(f'|f) \propto e^{-\beta(f'-f)^2} \]

\[ Pr(f', \tau') \propto e^{-\alpha(f'-\tau')^2} \]

\[ Pr(\tau'|\tau, f') = \delta(\tau' - MG(f', \tau)) \]

\[ Pr(f', x') \propto \hat{G}(f', \{x', b'\}) \]

\[ \pi^+(f'_b) = \int_{f'_a, f'_c} \int_s Pr(f'|f, \tau, \ldots) b(s) \]

- \( Pr(x'|x, a) \)
- \( Pr(\omega_x|x) \)
- \( R(x') \)

- \( \beta \) sentiment inertia
- \( \alpha \) Affect Control Principle
- \( MG \) Impression Formation
- \( \hat{G}(y, \{x, b\}) \) Somatic Potential
Somatic Potential

DENOTATIVE PLAN TREE

DENOTATIVE SPACE (ACTION SPACE)

CONNOTATIVE SPACE (EPA SPACE)

UNEXPLORED BRANCH

EXPLORED BRANCHES

P(a)

P(f_b)

F

τ

AFFECTIVE DYNAMICS

search away from connotative optimal solution

culturally shared affective meaning of actions

exploration branches
"...responses of the habitus may be accompanied by a strategic calculation... but these calculations are first defined without any calculation, in relation to objective potentialities, immediately inscribed in the present, things to do or not to do, things to say or not to say..." – Pierre Bourdieu, The Logic of Practice, 1990.
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Homo Economicus and the Prisoner’s Dilemma

**Score:** 2

Aria’s Last Move: Take 1
Aria’s Score: 5

Agent’s Emotion: awe-struck
Client’s Emotion: happy
Agent’s Identity: friend
Client’s Identity: date

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
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</thead>
<tbody>
<tr>
<td><strong>C</strong></td>
<td>2,2</td>
<td>0,3</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>3,0</td>
<td>1,1</td>
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</table>
Rational Game Tree
Rational Game Tree (assuming rationality)
### Homo Socio-Psychologicus (BayesACT)

<table>
<thead>
<tr>
<th>agent</th>
<th>client</th>
<th>optimal behaviour</th>
<th>closest labels</th>
<th>distance from</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>friend</td>
<td>friend</td>
<td>1.98, 1.09, 0.96</td>
<td>treat toast</td>
<td>0.4</td>
<td>23.9</td>
<td></td>
</tr>
<tr>
<td>friend</td>
<td>scrooge</td>
<td>0.46, 1.14, -0.27</td>
<td>reform lend money to</td>
<td>1.7</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>scrooge</td>
<td>friend</td>
<td>-0.26, -0.81, -0.77</td>
<td>curry favor look away</td>
<td>8.5</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>scrooge</td>
<td>scrooge</td>
<td>-0.91, -0.80, -0.01</td>
<td>borrow money chastise</td>
<td>9.6</td>
<td>2.7</td>
<td></td>
</tr>
</tbody>
</table>
For *friend* playing *friend*
For *enemy* playing *enemy*
Homo Socio-Psychologicus (BayesACT)

Cooperation Rates (last 10 games):

- Human-Human: $0.56 \pm 0.45$
- Human-BayesACT: $0.54 \pm 0.40$
- Human-Tit-for-Tat: $0.81 \pm 0.35$
Homo Socio-Psychologicus (BayesACT)

- Two BayesAct agents (red/blue) with same timeout, discount $\gamma = 0.9$.
  - dashed=std.dev; solid (thin): mean; solid (thick): median.
  - As timeout increases, more defections gives less reward.
- With more discounting ($\gamma = 0.9$),
  - more time buys more breadth of search,
  - agents explore more short-term options,
  - agents get away with a defection for a short while.
- With less discounting ($\gamma = 0.99$, not shown),
  - more time buys more depth,
  - better long-term decisions,
  - agents always cooperate.
Emotions: the new AI

- Artificial Intelligence: 
  intelligence = rationality
- We now know that emotions are necessary for intelligence
- A low road gives “heuristic” social intelligence
- Encode a social order that allows us to work in a society

With infinite resources, are emotions necessary?
Forms of Commitment

- **Instrumental Commitment**
  - a
  - b: Normative Commitment
  - c: Affective Commitment

- **Normative Commitment**
  - Normative commitments: external enforcement of joint efforts/collective goods (b)

- **Affective Commitment**
  - Affective ties arise as a by-product of instrumental conditions (a)
  - Individualization narrative: Instrumental, normative and (b) only
  - Socio-Relational narrative: all forms + links

Support

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More Information:
- THEMIS.COG: themis-cog.ca
- Bayesian Affect Control Theory: bayesact.ca
- Jesse Hoey:
  - jhoey@cs.uwaterloo.ca
  - @drjessehoey