Emotions and Personality Traits in Argumentation

Hypotheses and Empirical Evaluation

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Joint work of the WIMMICS team and the Heron Laboratory in Montreal (CA)
Outline of the talk

1. Basics of argumentation theory
2. Argumentation and emotions: hypotheses
3. Empirical evaluation: the protocol
4. Empirical evaluation: the results
5. Conclusions and future work
Argumentation: issues

- A reasoning framework based on the need of justifying. Fundamental to decide, convince, explain, …

- Interdisciplinary topic
  - Artificial Intelligence [Loui (1987), Pollock (1987)]
  - Philosophy [Aristotle, Toulmin (1958)]
  - Psychology [McGuire (1960)]
  - Linguistics [van Eemeren et al. (1996)]

- Examples of Applications
  - Medical domain: support systems for argumentative diagnosis
  - Legal domain: argumentative decisions based on laws
  - Online debate platforms (e.g., idebate.org, debategraph, ProCon.org)
  - Online systems for conflicts resolution (e.g., CyberSettle)
Argumentation: reasoning and decision making

Monotonic logic (language $\mathcal{L}$, consequence relation CR)

$\downarrow$

Knowledge base $KB \subseteq \mathcal{L}$

$\downarrow$

Arguments ($A$)

$\downarrow$

Attacks ($R \subseteq A \times A$)

$\downarrow$

Arguments’ evaluation =

Computation of extensions $E_1, \ldots, E_n$ with $E_i \subseteq A$

Acceptability semantics

$\downarrow$

Conclusion = plausible inferences from $KB$
**Example**

A *dialogue between two journalists*

**Paul**: this information is important, we must publish it *(argument a)*

**Mary**: it is a private information about a person who does not want to publish it *(argument b)*

**Paul**: this person is the Prime Minister so the information is not private *(argument c)*

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**Argumentation Theory**

- KB1
- KB2

- Arguments
- Attacks
- Selection of good arguments
- Conclusion

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**Argumentation system**

\[ c \rightarrow b \rightarrow a \]

Paul is right thus we must publish the information
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Argumentation for critical thinking

- Argumentation as a mechanism to support decision-making and persuasion
- **BUT** assuming a purely rational behavior of the involved actors
- Humans are proved to behave differently:
  - Mixing rational and emotional attitudes
Emotions for decision making

- Emotions play an important role in decision making
- Creative thinking, inspiration, concentration and motivation
- Express participants’ beliefs and viewpoints w.r.t. the others’ opinions
Context and motivation

- Understanding **how** human **reason** and take decisions in debates is a key issue in **cognitive science** and a challenge for **social applications**.

- To apply argumentation to scenarios as e-democracy and online debate systems, designers must take both the **argumentation** AND the **emotions** into account.

- **Understand and link the different dimensions of the exchanges**, to detect:
  - a debate turning into a flame war,
  - a content reaching an agreement,
  - a good or bad emotion spreading in a community...
Research questions

- Connection between the arguments proposed by the participants of a debate and their emotional status?
  - correlation of polarity of arguments and of detected emotions?
  - relation between the arguments, and the engagement of participants?
  - influence of personality traits and opinions on participants’ emotions?
Related literature

- Theoretical approaches to argumentation and emotions
  - [Nawwab et al., COMMA 2010]
  - [Dalibon et al., Revista Iberoamericana de Inteligencia Artificial, 2012]
  - [Lloyd-Kelly and Wyner, UMAP 2011 Workshop]
- Empirical experiments for argumentation theory
  - [Cerutti et al., ECAI 2014]
  - [Rahwan et al., Cognitive Science, 2010]

None of these approaches considers the role of emotions in real life debates providing an empirical evaluation with users: OUR GOAL
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Description of the experiment: protocol

Experimental Setting:

- 4 participants for each discussion group
- each participant is placed far from the other participants
- 2 moderators
- Language: English
- Easy-to-use debate platform: IRC network
- Debate is anonymous and participants only visible with their nicknames
- Each participant has been provided with:
  - 1 laptop device equipped with internet access
  - a camera used to detect facial emotions
  - an EEG headset to detect engagement index.
- Each moderator used only a laptop.
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Protocol (continued)

- Participants’ familiarization with the debate platform;

- The debate - 2 debates each, about two different topics, 20 minutes each:
  - Moderator provides the topic to be discussed;
  - Moderator asks participants about his/her opinion concerning the topic;
  - Participants expose their opinion to the others;
  - Participants are asked to comment on the opinions of the other participants;
  - If no active debate among the participants, moderator posts new arguments.
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Emotions and Engagement Detection

Emotion detection (Heron Lab, University of Montreal)
- webcams for facial expressions analysis [FACEREADER 6.0]
- physiological sensors (EEG) for cognitive states [Chaouachi et al., 2010]

Real-time engagement
- engagement index [Pope et al., 1995]
- EEG frequency bands

Real-time facial analysis
- classifying 500 key points in facial muscles
- neural network
  - happy, sad, angry, surprised, scared, disgusted.
  - valence, arousal
  - neutral probability.
Personality traits

Big Five personality traits: 50 questions

- Totally Disagree, Disagree, Neutral, Agree, Totally Agree
  - O Openness, Originality, Open-mindedness
  - C Conscientiousness, Control, Constraint
  - E Extraversion, Energy, Enthusiasm
  - A Agreeableness, Altruism, Affection
  - N Neuroticism, Negative Affectivity, Nervousness
Data collection and annotation

During the experiment:

- minimum, average and maximum engagement of every participant
- most dominant emotion (having maximum value)
- pleased/unpleased valence
- active/inactive arousal

After the experiment:

- synchronize arguments, relations and emotional indexes
- bipolar argumentation [1] labelled with:
  - sources, arguments, emotional states
- two independent annotators (IAA of Cohen’s kappa=0.82)

Obtained Dataset - annotated following the methodology of [1]

<table>
<thead>
<tr>
<th>Topic</th>
<th>#arg</th>
<th>#pair</th>
<th>#att</th>
<th>#sup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ban animal testing</td>
<td>49</td>
<td>28</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Go nuclear</td>
<td>40</td>
<td>24</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Housewives should be paid</td>
<td>42</td>
<td>18</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Religion does more harm than good</td>
<td>46</td>
<td>23</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Advertising is harmful</td>
<td>71</td>
<td>16</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Bullies are legally responsible</td>
<td>71</td>
<td>12</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Distribute condoms in schools</td>
<td>68</td>
<td>27</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Encourage fewer people to go to the university</td>
<td>55</td>
<td>14</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Fear government power over internet</td>
<td>41</td>
<td>32</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Ban partial birth abortions</td>
<td>41</td>
<td>26</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Use racial profiling for airport security</td>
<td>31</td>
<td>10</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Cannabis should be legalized</td>
<td>43</td>
<td>33</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>598</strong></td>
<td><strong>263</strong></td>
<td><strong>136</strong></td>
<td><strong>127</strong></td>
</tr>
</tbody>
</table>

<argument id="2" debate_id="4" participant="4" time-from="20:30" time-to="20:30"> The religion is an independent factor, it should not be a dissociative factor separating people. </argument>

<argument id="3" debate_id="4" participant="1" time-from="20:32" time-to="20:32"> The religion gives to his followers hope and help them to overcome some problem of the life so it’s not all bad. </argument>

<argument id="4" debate_id="4" participant="4" time-from="20:32" time-to="20:32"> Here in Canada it is appreciable to find the liberty of religion a practice in a peaceful way. </argument>
<debate id="4" title="Religion" task="relation">
  <pair id="1" relation="support">
    <argument id="2" debate_id="4" participant="4" time-from="20:30" time-to="20:30">The religion is an independent factor, it should not be a dissociative factor separating people.</argument>
    <argument id="3" debate_id="4" participant="1" time-from="20:32" time-to="20:32">The religion gives to his followers hope and help them to overcome some problems of the life so it’s not all bad.</argument>
  </pair>
</debate>
<argument id="31" debate_id="4" participant="1" time-from="20:43" time-to="20:43" emotion_p1="angry" emotion_p2="neutral" emotion_p3="angry" emotion_p4="disgusted">
I don’t totally agree with you Participant2: science and religion don’t explain each other, they tend to explain the world but in two different ways.
</argument>

<argument id="32" debate_id="4" participant="3" time-from="20:44" time-to="20:44" emotion_p1="angry" emotion_p2="happy" emotion_p3="surprised" emotion_p4="angry">
Participant4: for recent wars ok but what about wars happened 3 or 4 centuries ago? </argument>
Hypotheses

**H1**: some emotional and behavioral trends can be extracted from a set of debates. [1]

**H2**: the number and the strength of arguments, attacks and supports exchanged between the debaters are correlated with particular emotions. [1]

**H3**: the number of expressed arguments is connected to the degree of mental engagement and social interactions. [1]

**H4**: the personality of the participants modulates their emotional experiences during the debates. [2]

**H5**: the debaters’ opinions regarding the discussed topics have an impact on their emotions. [2]


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Hypotheses

**H1**: some emotional and behavioral trends can be extracted from the debates.

**Methodology**: Pearson product-moment correlation coefficient $r$

- most frequent emotion expressed by participants was **anger**
- second most frequent emotion was **disgust**
- negative emotions have generally more impact on a person’s behavior and cognition than positive ones: negativity effect
- a high level of engagement in 70.2% to 87.7% of the times, correlated with appearance of anger ($r = 0.306$)
Hypotheses

**H2**: the number and the strength of arguments, attacks and supports exchanged between the debaters are correlated with particular emotions.

**H3**: the number of expressed arguments is connected to the degree of mental engagement and social interactions.

<table>
<thead>
<tr>
<th>Emotion</th>
<th>NB ARG</th>
<th>ATTACK</th>
<th>SUPPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant</td>
<td>0.1534</td>
<td>0.0134</td>
<td>-0.0493</td>
</tr>
<tr>
<td>Unpleasant</td>
<td>-0.1534</td>
<td>-0.0134</td>
<td>0.0493</td>
</tr>
<tr>
<td>High ENG</td>
<td>-0.0246</td>
<td>-0.0437</td>
<td>0.3185</td>
</tr>
<tr>
<td>Low ENG</td>
<td>0.2054</td>
<td>0.1147</td>
<td>0.1592</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.0505</td>
<td>0.1221</td>
<td>-0.2542</td>
</tr>
<tr>
<td>Disgusted</td>
<td>-0.0177</td>
<td>-0.0240</td>
<td>0.2996</td>
</tr>
<tr>
<td>Scared</td>
<td>-0.0278</td>
<td>0.0297</td>
<td>-0.2358</td>
</tr>
<tr>
<td>Angry</td>
<td>0.0344</td>
<td>-0.2206</td>
<td>0.0782</td>
</tr>
</tbody>
</table>
Hypotheses

H4: the personality of the participants modulates their emotional experiences during the debates.

Methodology: multivariate analyses of variance with OCEAN personality traits as fixed factors and debaters’ emotions as dependent variables.

- **Extroversion and facial expressions**: extroverted participants showed significantly more frequently expressions of surprise than the introverted ones;

- **Conscientiousness and emotional valence**: conscientious participants expressed significantly higher proportions of negatively valenced emotions during the debates w.r.t. the other participants;

- **Neuroticism and mental engagement**: participants with an anxious temperament had on average significantly fewer proportions of high engagement levels during the debates as compared to the other participants;
H5: the debaters’ opinions regarding the topics have an impact on their emotions

- **no statistically reliable effect** was found in the performed analyses;
- no significant differences in terms of facial expressions, valence, engagement and workload, neither between the debaters who kept the same opinions and the debaters who changed their opinion, nor between those who were for and those who were against the topics.

<table>
<thead>
<tr>
<th>Starting/Final</th>
<th>No-opinion</th>
<th>For</th>
<th>Against</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-opinion</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>For</td>
<td>0</td>
<td>12</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Against</td>
<td>0</td>
<td>1</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2</strong></td>
<td><strong>18</strong></td>
<td><strong>20</strong></td>
<td><strong>40</strong></td>
</tr>
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1. From argumentation to emotions and back
   - Definition of emotional argumentative agents
   - Envisioned applications: education, mental diseases treatment

2. Study the link between emotions and persuasive argumentation
   - Is persuasion influenced by emotions? If so, how?
   - Three kinds of strategy: ethos, logos, pathos

3. Study emotions propagation among the debaters to verify whether emotions can be seen as a predictor of the solidity of an argument
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Thanks for your attention!

SEEMPAD Project:
https://project.inria.fr/seempad/