Argumentation-Based Decision Making and Structural Models of Personality

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“Good Advice”

- The advice should be presented in a form which can be readily understood by decision makers.
- There should be ready access to both information and reasoning underpinning the advice.
- If decision support involves details which are unusual to the decision maker, it is of primary importance that s/he can discuss these details with his advisor [Girle et al., 2003].

Practical Reasoning about “What to do”

Knowledge Representation \[\rightarrow\] Computation of Outcomes

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Knowledge Representation

Computation of Outcomes
Conclusions and Future works
Argument (and Attack) schemes

- Argument schemes for knowledge representation [Walton, 1996]
- Structure which contains the information supporting a given conclusion
- Modelling conflicts by “attack scheme”
- Structure which contains the information supporting a given conflict
The main concepts

- **Circumstance**: a state of the world
- **Fact**: a particular circumstance assumed to be true
- **Goal**: a state of the world we want to achieve
- **Action**: support for the achievement of a goal
- **Emotion**: “a strong feeling deriving from one’s circumstances, [or] mood[...]”
- **Preference**: “[...] a greater liking for one alternative over another or others [...]”
- **Value**: “Worth or worthiness [...] in respect of rank or personal qualities”
- **Must Value**: a value that we are committed to promote
A scenario (1)

I have to go to the Amazon Rainforest

I want to help people!
A scenario (2)

Ough! My Hernia!

Doc! What can I do?

You can:
1) Do a discectomy surgery
2) Have a long non-invasive treatment
3) Take analgesics

Mmmmmh:
1) I promote my safety
2) I promote my safety
3) I promote charity because I can go to Brazil

Let us assume that these actions are mutually exclusive
A2: circumstance: in my situation,
action: discectomy surgery,
goal: reducing disc herniation,
value: safety,
sign: +.
[Greenwood et al., 2003]
A scenario (2): practical arguments

α [PAtS1]:
- source: A1,
- target: A2,
- conditions: A1.action and A2.action are incompatible.
A scenario (2): values arguments

V1: value: charity.
V2: value: safety.

They are “socially accepted values”.
A scenario (2): values defence (i)

\[ \beta \] [VDes1]: source: V2, target: \( \alpha \), conditions: \( \alpha.target.value = V2.value \) and \( \alpha.source.value \neq A2.value \).

Each value is committed to protect each practical argument that promotes it! And...
A scenario (2): values defence (ii)

\[ \gamma \text{ [VDes2]}: \text{ source: } V1, \]
\[ \text{ target: } \beta, \]
\[ \text{ conditions: } \beta.\text{source} \neq V1 \text{ and } \]
\[ \beta.\text{target.source.value} \neq V1.\text{value}. \]

Each value is committed to protect each attack grounded on each practical argument that promotes it!
\( \beta \) [VDefence]: defending: A2,
defended: V2,
conditions: defending.value =
defended.value and defended.sign = +.
A scenario (2): values defence (ii)

\[ V_{\text{Defence}}: \]
defending: A1, 
defended: V1, 
conditions: defending.value = defended.value and defended.sign = +.
But I can't do a discectomy surgery since I have a history of anaesthesia allergy
A scenario (3): contradictory pract. arg. (i)

A4: circumstance: alternative anaesthesia not available for discectomy,
    action: not discectomy surgery,
    goal: risk of shock,
    value: safety,
    sign: −.
A scenario (3): contradictory pract. arg. (i)

\[ \delta [\text{PAtS2}]: \quad \text{source: A4, target: A2, conditions: } A_4.\text{action} = \neg A_2.\text{action}. \]
A scenario (3): contradictory pract. arg. (ii)

\[ \epsilon [\text{VAAtS}]: \text{source: A4, target: } \beta, \text{conditions: } A4.\text{action} = \neg \beta.\text{defended}.\text{action} \text{ and } A4.\text{value} = \beta.\text{defended}.\text{value} \text{ and } A4.\text{sign} = - \text{ and } \beta.\text{defended}.\text{sign} = +. \]
But I can't do a discetomy surgery since I have a history of anaesthesia allergy

Don't worry... There is a kind of anaesthesia you are not allergic to
A5: circumstances: alternative anaesthesia is available for discectomy.
$\iota$ [FAtS1]: source: A5,
target: A4,
conditions: A5.circumstances = $\neg$ A4.circumstances.
OK. With surgery I will get over my illness in very few days.

But I'm frightened by surgery...
Noo... I categorically reject the idea!
A scenario (5): preferences...

A scenario (5): preferences...

\[ \lambda \text{ [PRAtS]}: \]
source: P1,
target: \( \kappa \),
conditions: \( P1.\text{preferred} = \kappa.\text{target} \)
and \( P1.\text{notpreferred} = \kappa.\text{source} \).
E1: emotion: surgery frightening.

Are emotions rational?
A scenario (5): ...and emotions

\[ \mu \text{ [EAtS1]}: \quad \text{source: E1,} \]
\[ \text{target: A2,} \]
\[ \text{conditions: } e(E1,A2) = - . \]

with \( e(E1, A2) = - \)

\[ \beta \]
\[ \alpha \]
\[ \delta \]
\[ \kappa \]
\[ \lambda \]

\[ \gamma \]
\[ \varepsilon \]

\[ \mu \]
OK. I must care about my health. Then, I will help people again!
A scenario (6): Must Value

MUST V2: value: safety.

This is again a rational choice!
A scenario (6): Must Value

\[ \nu \text{ [MAtS2]}: \quad \text{source: MUST V2,} \\
\text{target: } \gamma, \\
\text{conditions: MUST V2.value} = \gamma . \text{target.source.value and} \\
\text{MUST V2.value} \neq \gamma . \text{source.value.} \]
Why three boxes?
Why three boxes?

1. The set of arguments that take into account values; **VAS** arguments.
2. The set of arguments whose bases are not rational; **EAS** arguments.
3. The set of arguments that deal with both facts and values; **FAS, PAS, PRAS, and MAS**.
Look familiar?

Freud’s theory of the personality

I NEED TO DO A BIT OF PLANNING TO GET IT.

YOU CAN’T HAVE IT. IT’S NOT RIGHT.

I WANT IT NOW!

ID

EGO

SUPER EGO
Look familiar?

1. The **Superego** strives to act in a socially appropriate manner.
2. The **Id** is the innate part of our personality and is based on the pleasure principle.
3. The **Ego** represents what may be called reason and common sense and has to conciliate the innate instincts and the social constraints.
Knowledge Representation

Computation of Outcomes

Conclusions and Future works
Argumentation Framework for Decision Support Problem

An Argumentation Framework for Decision Support Problem (AFDSP) is a 12-ple \(<A_{PAS}, A_{PRAS}, A_{EAS}, A_{VAS}, A_{FAS}, A_{MAS}, R_{PAS}, R_{PRAS}, R_{EAS}, R_{VAS}, R_{FAS}, R_{MAS}>\) s.t.:

- \(A_{PAS}\) is a set of instances of PAS;
- \(A_{PRAS}\) is a set of instances of PRAS;
- \(A_{EAS}\) is the set of instances of EAS;
- \(A_{VAS}\) is a set of instances of VAS;
- \(A_{FAS}\) is a set of instances of FAS;
- \(A_{MAS}\) is a set of instances of MAS;
- \(R_{PAS}\) is a set of instances of PAtS1 and PAtS2;
- \(R_{PRAS}\) is a set of instances of PRAtS;
- \(R_{EAS}\) is a set of instances of EAtS1 and EDefence;
- \(R_{VAS}\) is a set of instances of VAtS, VDeS1, VDeS2, VAAAtS;
- \(R_{FAS}\) is a set of instances of FAtS;
- \(R_{MAS}\) is a set of instances of MAtS1, and MAtS2.
An Argumentation Framework with Recursive Attacks (AFRA) is a pair \( \langle A, R \rangle \) where \( A \) is a set of arguments and \( R \) is a set of attacks, namely pairs \( (A, X) \) s.t. \( A \in A \) and \( (X \in R \text{ or } X \in A) \).

Given an attack \( \alpha = (A, X) \in R \), we will say that \( A \) is the source of \( \alpha \), denoted as \( \text{src}(\alpha) = A \) and \( X \) is the target of \( \alpha \), denoted as \( \text{trg}(\alpha) = X \). [Baroni et al., 2009b]
From $AFDSP$ to $AFRA$

The instances of argument schemes in $AFDSP$ compose the set of arguments in $AFRA$ and the instances of attack schemes in $AFDSP$ give rise to the attack relation in $AFRA$.

Let $\Phi = \langle A_{PAS}, A_{PRAS}, A_{EAS}, A_{VAS}, A_{FAS}, A_{MAS}, R_{PAS}, R_{PRAS}, R_{EAS}, R_{VAS}, R_{FAS}, R_{MAS} \rangle$ be an $AFDSP$, the corresponding $AFRA$ is defined as $\Gamma = \langle A, R \rangle$ s.t.

- $A = A_{PAS} \cup A_{PRAS} \cup A_{EAS} \cup A_{VAS} \cup A_{FAS} \cup A_{MAS}$; and
- $R = R_{PAS} \cup R_{PRAS} \cup R_{EAS} \cup R_{VAS} \cup R_{FAS} \cup R_{MAS}$.
Defeat relation

**Definition (Direct Defeat)**

Let \( \langle A, R \rangle \) be an \( AFRA \), \( V \in R, W \in A \cup R \), then \( V \) directly defeats \( W \) iff \( W = \text{trg}(V) \).

**Definition (Indirect Defeat)**

Let \( \langle A, R \rangle \) be an \( AFRA \), \( V \in R, W \in A \), if \( V \) directly defeats \( W \) then \( \forall \alpha \in R \) s.t. \( \text{src}(\alpha) = W \), \( V \) indirectly defeats \( \alpha \).

**Definition (Defeat)**

Let \( \langle A, R \rangle \) be an \( AFRA \), \( V \in R, W \in A \cup R \), then \( V \) defeats \( W \), denoted as \( V \rightarrow_R W \), iff \( V \) directly or indirectly defeats \( W \).
Definition (Conflict-free)

Let \( \langle A, R \rangle \) be an \( AFRA \), \( S \subseteq A \cup R \) is conflict–free iff \( \nexists \mathcal{V}, \mathcal{W} \in S \) s.t. \( \mathcal{V} \rightarrow_R \mathcal{W} \).

Definition (Acceptability)

Let \( \langle A, R \rangle \) be an \( AFRA \), \( S \subseteq A \cup R \), \( \mathcal{W} \in A \cup R \), \( \mathcal{W} \) is acceptable w.r.t. \( S \) iff \( \forall \mathcal{Y} \in R \) s.t. \( \mathcal{Y} \rightarrow_R \mathcal{W} \) \( \exists \mathcal{V} \in S \) s.t. \( \mathcal{V} \rightarrow_R \mathcal{Y} \).

Definition (Admissible set)

Let \( \langle A, R \rangle \) be an \( AFRA \), \( S \subseteq A \cup R \) is admissible iff it is conflict–free and each element of \( S \) is acceptable w.r.t. \( S \).
A preferred extension is a maximal (w.r.t. set inclusion) admissible set.
Recalling the example...
...and the preferred extension
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Computation of Outcomes

Conclusions and Future works
Conclusions

- Extension of a previous proposal [Baroni et al., 2009a]
- Human emotions in decision making process
- Main contribution: preliminary description of a mapping between argumentation based decision process and Freud’s three entities model of personality
Future works

- Fill the gap between attack schemes and critical questions
- Deep analysis on Superego and Id:
  - Enhancing the relevant argument schemes
  - More articulated personality models
Thank you
References

An argumentation-based approach to modeling decision support contexts with what-if capabilities.

Encompassing attacks to attacks in abstract argumentation frameworks.

Decision support for practical reasoning: A theoretical and computational perspective.

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