

Goal-based Decision Making An Interpersonal Model

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Biography

- Stephen Slade earned his Ph.D. in computer science at Yale in artificial intelligence.
- He is the author of several books on object-oriented programming languages and decision making.
- Dr. Slade has taught for many years at Yale University and New York University, as well as on Wall Street.
- He has also developed management information systems for several presidential campaigns, the White House, and Wall Street.

Decision Making Models and Rationality

- Rational economic decision theory [Raiffa, 1968]
- The rational decision maximizes expected value.
- Expected value is the sum of the probability and payoffs of the set of options.
- We have a normal 6 sided die with the numbers 1 through 6 on the respective faces. If the number n on the top face is odd, you pay n dollars. If the number is even, you receive n dollars. For example, if you throw a 3, you lose \$3. If you throw a 2, you win \$2. Do you want to play this game? If so, how much would you be willing to pay for each round?

Decision Making Models and Rationality

Die	Odds	Payout	Odds * Payout
1	1/6	-\$1	-\$0.17
2	1/6	\$2	\$0.33
3	1/6	-\$3	-\$0.50
4	1/6	\$4	\$0.67
5	1/6	-\$5	-\$0.83
6	1/6	\$6	\$1.00
Total	1.0		\$0.50

Thus, we should be willing to pay up to \$0.50 to play this game. If the price is over \$0.50, it becomes a tax on stupid people.

Decision Making Models and Rationality

Rational decision theory assumes that you know:

- The options
- The probabilities
- The payoffs

Outside of the casino, these conditions rarely obtain. One could argue that the stock market is a plausible domain for rational decision theory. Alas, another assumption appears there: computational resources.

- The game of chess is not computationally tractable. The stock market is much more complex.

Cognitive Process Model

Common decisions:

- Buying a car.
- Eating dinner.
- Getting dressed.
- Asking someone on a date.

These decisions are processes that involve:

- Goals (intents): transportation, satisfy hunger, social norms, companionship.
- Resources: money, time, attention, memory.
- Relationships: salesman, cook, friends, family.
- Explanations: often need to justify choice to others.
- Emotions: goal pursuit results in dynamic emotional states.

Cognitive Process Model: Goals

- An agent has many goals with varying priorities.
- A goal may be specific, like *satisfy thirst* or *answer the phone*, or something general, like *save money* or *be honest*.
- Some goals are more important than others. There is a hierarchy of goals, which may change over time.
- An agent executes plans to achieve goals.
- Goals are subjective. Different agents have different goals.
- Otherwise, markets would not exist. No buyer could find a seller

Cognitive Process Model: Resources

- An agent has limited resources.
- A resource is anything that may satisfy the enabling condition of a plan.
- Time and money are typical resources.
- Other resources include skills, credentials, and authority.
- Cognitive resources include knowledge, memory, and attention.
- Different agents have different resources.
- An agent allocates resources to achieve her goals.

Cognitive Process Model: Relationships

- An agent has relationships, positive and negative, with other agents.
- These relationships vary in strength or intensity.
- Personal: family, friends, neighbors.
- Professional: employees, investors, customers, competitors.
- An agent adopts goals through relationships, reflecting the importance of the goal and the strength of the relationship.
- Example: may donate a kidney to your sister, but not to your mailman.

Cognitive Process Model: Explanations

- Decisions require justifications.
- Given that most choices will not be optimal and are based on subjective goals and beliefs, decisions need to be justified or explained.
- The explanation indicates how the agent arrived at the decision.
- The explanation may also acknowledge any adverse consequences, indicating that the agent took those factors into account.
- In our model, the explanation reflects the decision strategy used in arriving at the outcome. Unlike economic decision theory, which has only one strategy (maximize expected value), there are numerous decision strategies for the cognitive model.

Cognitive Process Model: Emotions

- Emotions are a reflection of goal states.
- Emotions have several dimensions:
 - **Physiological**: sweaty palms, rapid heart beat.
 - **Behavioral**: fight or flight, yelling, arguing, display of affection.
 - **Cognitive**: communicating goal state.
- It is the latter dimension that our model reflects:
- Achieving a goal results in a positive emotion, such as happiness or pride.
- Goal failure results in a negative emotion, such as hate or frustration.

VOTE Computer Model

- VOTE decision making model simulates Congressional roll call voting.
- Object oriented database to represent:
 - **Agents:** Members (67) with issue agenda (credo), voting history, and relationships.
 - **Goals:** Issues (> 200), such as gun control or abortion.
 - **Choices:** Bills (42), such as banning flag burning. Past votes are a source of inferred goals.
 - **Relationships:** Constituency groups (150), such as NRA or ACLU, each of which has an issue agenda.
 - **Explanation strategies** (21): standard reasons to justify votes, such as “good for country” or “not constitutional”. Used to guide natural language generation, in English and French.

VOTE Computer Model: Example

```
(vote 'udall 'hr-2978)
```

```
* Member: Morris K Udall
```

```
* Bill: Flag Desecration
```

```
* Bill banning the desecration of the flag
```

(Omitting intermediate output)

English rationale:

Morris K Udall votes against bill HR-2978 the flag desecration bill. After weighing the implications, he believes that provisions of this bill are not constitutional. He completely supports the United States Constitution and the Bill of Rights. Udall readily endorses the right of freedom of speech. Even so, Udall realizes that members of the Democratic party oppose the right of burning the American flag in protest

French rationale:

Morris K Udall s'oppose au projet de loi HR-2978. la loi de la profanation du drapeau. Apres une consideration approfondie il croit que les dispositions de ce projet de loi ne sont pas constitutionnelles. Il est un champion de la Constitution americaine et de la declaration des Droits. Udall desire vivement appuyer le droit de libre expression. Cedependant Udall comprend que les membres du parti Democratique s'opposent au fait de bruler le drapeau americain lors d'une manifestation.

VOTE Computer Model: ISSUES

Name: Women's Rights
Synonyms: (WOMENS-RIGHTS)
Isa: (CIVIL-RIGHTS)
Polarity: Support federal efforts to end sex discrimination
English: women's civil rights
English-Short: women's rights
Pro-English: the legitimate rights and concerns of women
Con-English: radical feminist positions
Groups: (NOW WOMEN)
Pro-Stances: (#{Stance (13) [B:PRO] PRIVACY (ISSUE:WOMENS-RIGHTS)}
#{Stance (14) [B:PRO] ABORTION (ISSUE:WOMENS-RIGHTS)}
#{Stance (15) [B:PRO] EQUALITY (ISSUE:WOMENS-RIGHTS)}
#{Stance (16) [B:PRO] FAIRNESS (ISSUE:WOMENS-RIGHTS)}
#{Stance (17) [B:PRO] PROGRESS (ISSUE:WOMENS-RIGHTS)})
Con-Stances: (#{Stance (18) [C:PRO] FAMILY (ISSUE:WOMENS-RIGHTS)}
#{Stance (19) [B:PRO] TRADITION (ISSUE:WOMENS-RIGHTS)})
Norm: (PRO C ISSUE:ISSUE.818 WOMENS-RIGHTS)
Status: Active
Date-Open: Sunday, January 22, 1989
Symbol: ISSUE.818

The citizenry approves of women's civil rights.

Support of women's civil rights upholds the belief in fairness in society, a woman's right to have an abortion, the principle of equality, the belief in a right to privacy, and the principle of progress and change in society.

Opposition to women's rights is important for tradition and preserving the status quo. Opposition to women's rights is consistent with traditional family values.

VOTE Computer Model: ISSUES

Name: Labor Issues
Type: GROUP
Synonyms: (LABOR)
Isa: (DOMESTIC)
Polarity: Support issues beneficial to working people
English: organized labor and working people
Pro-English: decent working people
Con-English: big labor bosses
Pro-Stances: (#{Stance (12) [B:PRO] JOBS (ISSUE:LABOR)}
 #{Stance (13) [B:PRO] PROSPERITY (ISSUE:LABOR)}
 #{Stance (14) [B:PRO] FAIRNESS (ISSUE:LABOR)})
Con-Stances: (#{Stance (15) [B:PRO] BUSINESS (ISSUE:LABOR)}
 #{Stance (16) [B:PRO] FREE-MARKET (ISSUE:LABOR)})
Status: Active
Date-Open: Sunday, August 28, 1988
Symbol: ISSUE.3844

Support of organized labor and working people is important for prosperity at all levels of society, efforts for job creation and full employment, and fairness in society.

Opposition to organized labor and working people reinforces the principle of free enterprise and capitalism, and the legitimate concerns of the business community.

VOTE Computer Model: MEMBERS

Name: Morris K. Udall
Fname: MORRIS
Lname: UDALL
Votes: ((DEFENSE-AUTHORIZATION FOR) (SPACE-STATION FOR)
(CIVIL-RIGHTS-RESTORATION-ACT FOR) (REFLAGGING-SHIPS FOR)
(HANDGUN-CONTROL AGN) (CONTRA-AID2 FOR) (STAR-WARS --)
(HOME-HEALTH-CARE AGN) (AIDS AGN) (LIMIT-IMPORTS AGN)
(CAP-TAX-CUT FOR) (EXTEND-SS-BENEFIT AGN)
(ESTAB-DOM-CONTENT FOR) (BAR-IMM-AMNESTY AGN)
(OK-SCHOOL-PRAY AGN) (LIMIT-ABORTIONS AGN) (APPROVE-ERA FOR)
(PASS-IMM-REFORM AGN) (CANCEL-MX-MISSILE FOR)
(HALT-AID-TO-CONTRAS FOR) (INCR-AID-TO-EL-SAL AGN)
(SUPP-NUCLEAR-FREEZE FOR) (CAP-GAINS-CUT FOR)
(LMT-CLN-WATER-ACT AGN) (RPL-TOBAC-SUB AGN)
(GRM-RDMN-DEF-RED AGN) (BAN-POLYGRAPH FOR)
(RETAIN-GUN-CONTROL AGN) (CONTRA-AID AGN) (LMT-TEXT-IMP FOR)
(LIMIT-SDI FOR) (AID-ANGOLA-REB AGN) (TAX-REFORM FOR)
(S-AFRICA-SANC FOR) (IMMIG-REFORM FOR) (CHILD-CARE FOR)
(FLAG-BURNING AGN))
Issues: (PROGRESSIVE)
Relations: ({Relation (0) [B:PRO] ADA (MEMBER:MEMBER.1025)}
{Relation (1) [A:PRO] ACLU (MEMBER:MEMBER.1025)}
{Relation (2) [B:PRO] COPE (MEMBER:MEMBER.1025)}
{Relation (3) [C:PRO] LCV (MEMBER:MEMBER.1025)}
{Relation (4) [B:CON] ACU (MEMBER:MEMBER.1025)}
{Relation (5) [B:CON] NTU (MEMBER:MEMBER.1025)}
{Relation (6) [B:CON] NSI (MEMBER:MEMBER.1025)}
{Relation (7) [B:CON] COC (MEMBER:MEMBER.1025)}
{Relation (8) [B:CON] CEI (MEMBER:MEMBER.1025)}
{Relation (9) [C:PRO] DEMOCRATS (MEMBER:MEMBER.1025)}
{Relation (10) [C:CON] REPUBLICANS (MEMBER:MEMBER.1025)}
{Relation (11) [C:PRO] COUNTRY (MEMBER:MEMBER.1025)})
District: AZ-2
Term-Start: 1961
Term-End: 1991
Party: DEM
Committees: (HOUSE-FOREIGN)
Status: Active
Date-Open: Tuesday, September 19, 1989
Symbol: MEMBER.1025

Morris K. Udall is a staunch defender of the ACLU's strong defense of the Bill of Rights. He is eager to show his support for the ADA as a proponent of basic American values, and moreover the progressive agenda of COPE. He is strongly against the narrow special interest of the Chamber of Commerce, the National Taxpayers Union, the NSI as an example of the radical right, the ACU's right wing reactionism, and the CEI business special interest lobby

Udall is for members of the Democratic party, the League of Conservation Voters, in addition to the country as a whole. Udall is against Republicans.

VOTE Computer Model: GROUPS

Name: American Civil Liberties Union
Issues: (CIVIL-LIBERTIES CONSTITUTION)
Stances: (#{Stance (17) [B:PRO] CIVIL-LIBERTIES (GROUP:ACLU)}
#{Stance (18) [B:PRO] PRIVACY (GROUP:ACLU)}
#{Stance (19) [C:PRO] LEGAL-SERVICES (GROUP:ACLU)}
#{Stance (20) [C:PRO] VOTING-RIGHTS (GROUP:ACLU)}
#{Stance (21) [C:CON] PRAYER (GROUP:ACLU)}
#{Stance (22) [A:PRO] CONSTITUTION (GROUP:ACLU)})

English: the American Civil Liberties Union

English-Short: the ACLU

Pro-English: the ACLU's strong defense of the Bill of Rights

Con-English: the ACLU's radical and subversive posture

Synonyms: (ACLU)

Norm: (CON C GROUP:GROUP.1913 ACLU)

Isa: (LOBBY)

Status: Active

Date-Open: Sunday, August 28, 1988

Symbol: GROUP.1913

The ACLU is a staunch defender of the Constitution. It is a defender of privacy, in addition to civil liberties. It objects to school prayer. The ACLU endorses voting rights, and federal funding of legal services for the needy.

The general population opposes the ACLU.

VOTE Computer Model: BILLS

Name: Flag Desecration
English: the flag desecration bill
French: la loi de la profanation du drapeau
Bnumber: HR-2978
Synonyms: (FLAG-DESECRATION)
Date-Of-Vote: Tuesday, September 12, 1989
Vote-Tally: (PASSED 380 38 (R 151 21 D 229 17))
Pres-Pos: FOR
Session: 101-1
Issues: (FLAG-BURNING BILL-OF-RIGHTS FREE-SPEECH)
Importance: B
Stance-For: ({Stance (20) [B:CON] FLAG-BURNING (BILL:HR-2978)}
#{Stance (21) [B:PRO] PATRIOTISM (BILL:HR-2978)})
Stance-Agn: ({Stance (22) [B:PRO] FREE-SPEECH (BILL:HR-2978)})
Status: Active
Date-Open: Monday, January 29, 1990
Symbol: BILL.155
Remarks:
Bill banning the desecration of the American flag.
Support of the flag desecration bill stands firmly against the
right of burning the American flag in protest. Support of the
flag desecration bill upholds the belief in patriotism and devotion
to this country.
Opposition to HR-2978 upholds the right of freedom of speech.

VOTE Computer Model: STRATEGY

0	Popular decision	[A]	@@@ (POPULAR)
1	Unimportant Bill	[B]	@@@ (UNIMPORTANT-BILL)
2	Non-partisan decision	[B]	@@@ (NON-PARTISAN)
3	Not constitutional	[B]	@@@ (NOT-CONSTITUTIONAL)
4	Balance the books	[C]	@@@ (BALANCE-THE-BOOKS)
5	Minimize adverse effects	[C]	@@@ (MINIMIZE-ADVERSE-EFFECTS)
6	Inconsistent constituency	[C]	@@@ (INCONSISTENT-CONSTITUENCY)
7	Simple consensus	[C]	@@@ (SIMPLE-CONSENSUS)
8	Not good enough	[C]	@@@ (NOT-GOOD-ENOUGH)
9	Best for the country	[C]	@@@ (BEST-FOR-THE-COUNTRY)
10	Shifting alliances	[C]	@@@ (SHIFTING-ALLIANCES)
11	Partisan Decision	[C]	@@@ (PARTISAN)
12	Normative decision	[D]	@@@ (NORMATIVE)
13	Simple Majority	[D]	@@@ (SIMPLE-MAJORITY MAJORITY)
14	Deeper analysis	[E]	@ (DEEPER-ANALYSIS)
15	No decision	[F]	@ @ (NO-DECISION)
* 16	Unpopular decision	[X]	@@ (UNPOPULAR)
17	Inoculation	[X]	@@@ (INOCULATION)
18	Change of heart	[X]	@@@ (CHANGE-OF-HEART)
19	Mixed constituency	[X]	@@ (MIXED-CONSTITUENCY)
20	Two Minds	[X]	@@@ (TWO-MINDS)
21	It couldn't pass	[X]	@@@ (IT-COULD-NOT-PASS)

VOTE Computer Model: STRATEGY

Name: Minimize adverse effects
Synonyms: (MINIMIZE-ADVERSE-EFFECTS)
Quote: Nothing's perfect. You have to break a few eggs to make omelets.

Rank: C
Test: There is a majority opinion. The importance level of the stances in support of the majority is greater than the importance level of the other side.

Test-Code: #<FUNCTION STRAT-MINIMIZE-ADVERSE-EFFECTS>
Preamble: PREAMBLE-MINIMIZE-ADVERSE-EFFECTS
Protocol: PROTOCOL-MINIMIZE-ADVERSE-EFFECTS
Status: Active
Date-Open: Wednesday, May 3, 1989
Symbol: STRATEGY.1423
Remarks: Adverse effects are less important than the benefits of the vote.

Multi-agent tasks

- Multi-agent tasks: advice, persuasion, negotiation provide a framework for conversation.

Future work and questions

- Future work and questions.