Annotating Preferences in Chats for Strategic Games

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Objective

Propose an **annotation scheme** for expressions of **preferences** in on-line chats concerning **bargaining negotiations** in the online version of the competitive game *Settlers of Catan*.

Preferences and game theory

- What are **preferences**?
  - ▷ A **complete ordering** by an agent over **outcomes**, which are understood as **actions** (*buy a new car*) or **goal states** (*have a new car*).
  - ▷ Some outcomes are **acceptable** for the agent.
  - ▷ Among the acceptable outcomes, the agent will typically **prefer some to others**.
- Preferences in traditional **game theory**: they drive **rational**, **strategic decision**.

Let o_1, o_2 two outcomes,

- The **preference relation** $o_1 \succeq o_2$ means that outcome o_1 is equally or more preferred to the decision maker than o_2.
- **Strict preference** $o_1 \succ o_2$ holds iff $o_1 \succeq o_2$ and not $o_2 \succeq o_1$.
- The associated **indifference relation** is $o_1 \sim o_2$ if $o_1 \succeq o_2$ and $o_2 \succeq o_1$.

Data

- *Settlers of Catan* is a **competitive game** that involves negotiations.
- Most of the turns involve **negotiation** and represent **offers**, **counteroffers**, and **acceptances** or **rejections** of offers.
- In our corpus: 2 games for a total of 980 turns with 632 outcomes.

Speaker	Id	Turn
Dave	1	I can give you one wheat and ore for wood
Tomm	2	Don't want ore.
Tomm	3	Rennoc what can you offer me for wood?
Rennoc	4	how about 4 clay for 1 wood and 1 ore?
Dave	5	don't do it! it's a trap

Preference annotation scheme

(1) **Identify the set of outcomes**

"I prefer X", "Let's X" where the outcome X is identified with:

- **verb phrase** ("to trade", "to give wheat for sheep")
- **noun phrase** ("some of your sheep")

(2) **Identify the preferences over the outcomes**

- **action** (*receive(o, a, <r,q>)* or *offer(o, a, <r,q>)*)
- **acceptance** (*not*)
- **dependencies**: disjunctions ($\bigtriangledown$), conjunctions (&), conditionals ($\mapsto$).

$\Rightarrow$ In our corpus: 147 unacceptable outcomes (*not* operator), 20 instances of &, 27 of $\bigtriangledown$ and 80 of $\mapsto$.

- **Acceptance**
  - A: <Ore>_1 would be good // receive(A, B, <1,?>)
  - B: I don't have <any ore>_1 // **not** offer(B, A, <1,?>)
- **Dependencies**
  - **disjunctions:** A: I can give <wheat>_1 or <sheep>_2. // offer(A, ?, <1,?> $\bigtriangledown$ <2,?>)
  - **conjunctions:** A: Can I have <one sheep>_1 and <one ore>_2? // receive(A, ?, <1,1> & <2,1>)
  - **conditionals:** A: I can <wheat>_1 for <sheep>_2. // receive(A, ?, <2,?>) $\mapsto$ offer(A, ?, <1,?>)

Inter-annotator agreements

- We compute **4 inter-annotator agreements**: (a) on outcome identification, (b) on outcome acceptance, (c) on outcome attachment and (d) on outcome dependencies.
- The main cases of disagreement concern:

(a): - redundant preferences,
- underspecified preferences,
- resources lexicalized by a synonym,
- confusion in the action (receiving or offering)
- preferences that are not directly related to the action of trading,

(b): negations that are inferred from the context,

(d): the confusion between $\bigtriangledown$ and & because the same linguistic realizations do not always lead to the same annotations.

We compare the results with the ones obtained for `Verbmobil` (C_V) and `Booking` (C_B) (Cadilhac et al., 2012).

	C_V	C_B	Settlers
(a) (Kappa)	0.85	0.85	**0.92**
(b) (Kappa)	0.90	0.95	**0.97**
(c) (F-measure)	93%	82%	**100%**
(d) (Kappa)	0.93	0.75	**0.95**

Table: Inter-annotator agreements for the three corpora.