Learning From Historical Precedent

Dr. Michael J. Pazzani
Department of Information and Computer Science
University of California,
Irvine, CA 92717
pazzani@ics.uci.edu

Those who cannot remember the past are condemned to repeat it-
Santayanna

One of the most curious features of the history of economic sanctions has been the the extent to which the experience of past cases has been overlooked or ignored-- Robin Renwick

OCCAM

Question: What would happen if the United States refused to sell computers to South Korea unless South Korea stopped exporting automobiles to Canada?

OCCAM[1]:   The goal of the United States that South Korea not sell automobiles to Canada will fail and South Korea will purchase computers from a country which exports computers. This happened when the United States did not sell grain to the Soviet Union after the Soviet Union invaded Afghanistan. Argentina sold grain to the Soviet Union. Also, Australia did not sell uranium to France after France exploded nuclear weapons in the South Pacific. South Africa sold uranium to France.

---

1. OCCAM's output is edited slightly, by adding tense information to verbs.

Learning from observations: Issues

- Aggregating examples into clusters of similar events
- Determining set of features relevant
- Explaining prediction

1921 League of Nations vs. Yugoslavia
threat: Refuse to import to Yugoslavia
demand: Stop invasion Albania
outcome: success

1948 USSR vs. Yugoslavia
threat: Cut off foreign aid
demand: Stop political independence
outcome: (fail) US give economic aid

1961 USSR vs. Albania
threat: Refuse to sell grain
demand: Stop economic ties with China
outcome: (fail) China sells Albania
              Canadian wheat at lower price

1976 US vs. Ethiopia
threat: Stop aid (57 million)
demand: Stop human rights violations
outcome: (fail) Soviets provide aid

1980 US vs. USSR
threat: Cut off grain sales
demand: Withdraw troops from
            Afghanistan
outcome: (failure) Buy grain from
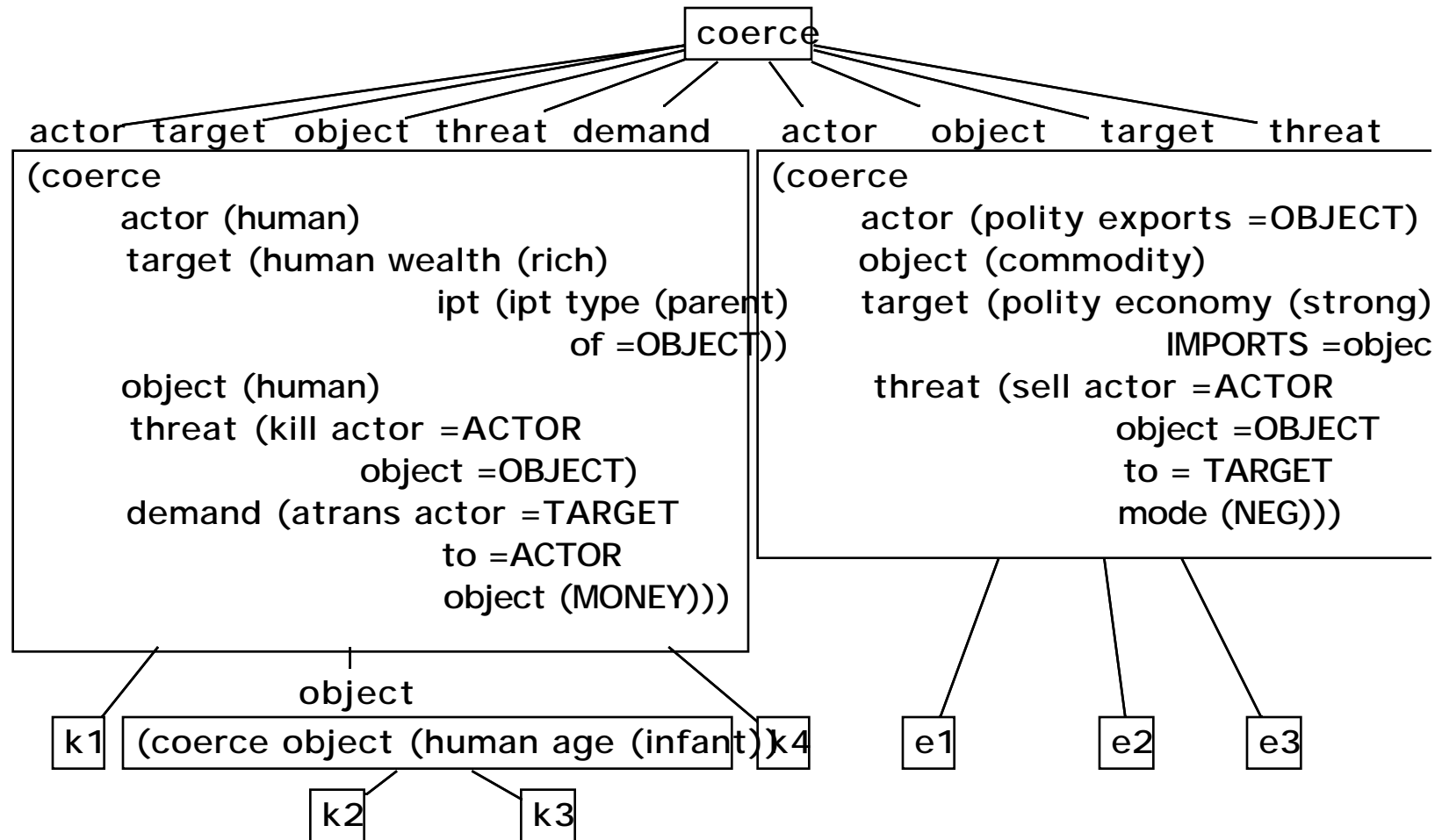   Argentina at a higher price

1983 Australia vs. France
threat: Not sell uranium
demand: Stop nuclear tests
outcome: (fail) France buys from
            South Africa at higher price

Schemata in OCCAM

- Generalized event
- Causal chain
- Indices

coerce

actor target object threat demand | actor object target threat

(coerce
    actor (human)
    target (human wealth (rich)
                    ipt (ipt type (parent)
                            of =OBJECT))
    object (human)
    threat (kill actor =ACTOR
                    object =OBJECT)
    demand (atrans actor =TARGET
                        to =ACTOR
                        object (MONEY)))

(coerce
    actor (polity exports =OBJECT)
    object (commodity)
    target (polity economy (strong)
                        IMPORTS =objec
    threat (sell actor =ACTOR
                    object =OBJECT
                    to = TARGET
                    mode (NEG)))

object

k1 | (coerce object (human age (infant)) | k4

k2 | k3

e1 | e2 | e3

Explanation-based Learning

- Relevant features identified by domain theory
- Similar events are those that have the same explanation
- Explanation stored with schema

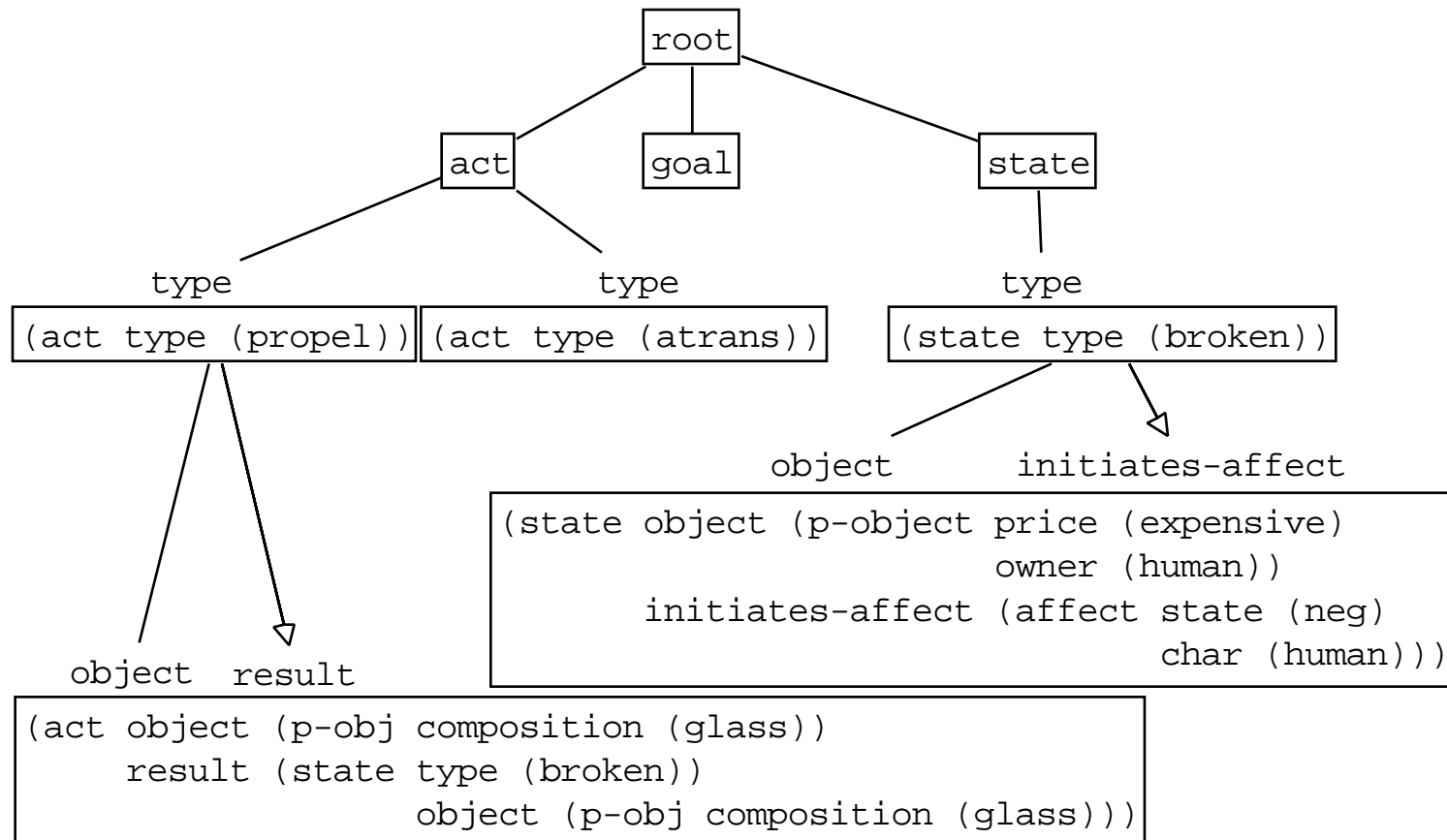Two forms of prediction (and explanation)
- Recognize and instantiate
- Chaining

In OCCAM, EBL forms schemata to recognize successful and unsuccessful types of sanction incidents.

EBL analyzes why one example succeeds or fails, and constructs a general description of the class of situations that will have the same outcome for the same reason.

EBL removes features from a training example that were not needed to construct an explanation.

Explanation by chaining in OCCAM


```
                          ┌──────┐
                          │ root │
                          └──────┘
              ┌──────┐   ┌──────┐          ┌───────┐
              │ act  │   │ goal │          │ state │
              └──────┘   └──────┘          └───────┘

      type                    type                 type
┌────────────────────┐ ┌─────────────────────┐ ┌──────────────────────┐
│ (act type (propel))│ │ (act type (atrans)) │ │ (state type (broken))│
└────────────────────┘ └─────────────────────┘ └──────────────────────┘

                                        object      initiates-affect

                        ┌─────────────────────────────────────────────┐
                        │ (state object (p-object price (expensive)    │
                        │                          owner (human))      │
                        │       initiates-affect (affect state (neg)   │
                        │                          char (human)))      │
                        └─────────────────────────────────────────────┘

      object  result
┌───────────────────────────────────────────────┐
│ (act object (p-obj composition (glass))         │
│     result (state type (broken)                 │
│                   object (p-obj composition (glass)))│
└───────────────────────────────────────────────┘
```

OCCAM Control structure

OCCAM(Event)
Schema = find.most.specific.schema(Event)
if explains(Schema, Event)
      Then index.event(schema.event)
elseif chain.explanation(event)
      Then EBL(event, schema)
elseif cluster= retrieve.cluster(schema,event)
      Then SBL(event, cluster, schema)
else index.event(schema.event)

```
(def-rule demand-increase-->price-increase
   (STATE TYPE (DEMAND-INCREASE)
         ACTOR ?X: (POLITY ECONOMIC-HEALTH (STRONG))
         OBJECT ?Y: (COMMODITY AVAILABILITY (COMMON)))
     ENABLES
     (ACT TYPE (SELL)
         ACTOR (POLITY EXPORTS ?Y
                       BUSINESS-REL ?X)
         TO ?X
         OBJECT ?Y
         PRICE (MONEY VALUE (>MARKET)))))
```

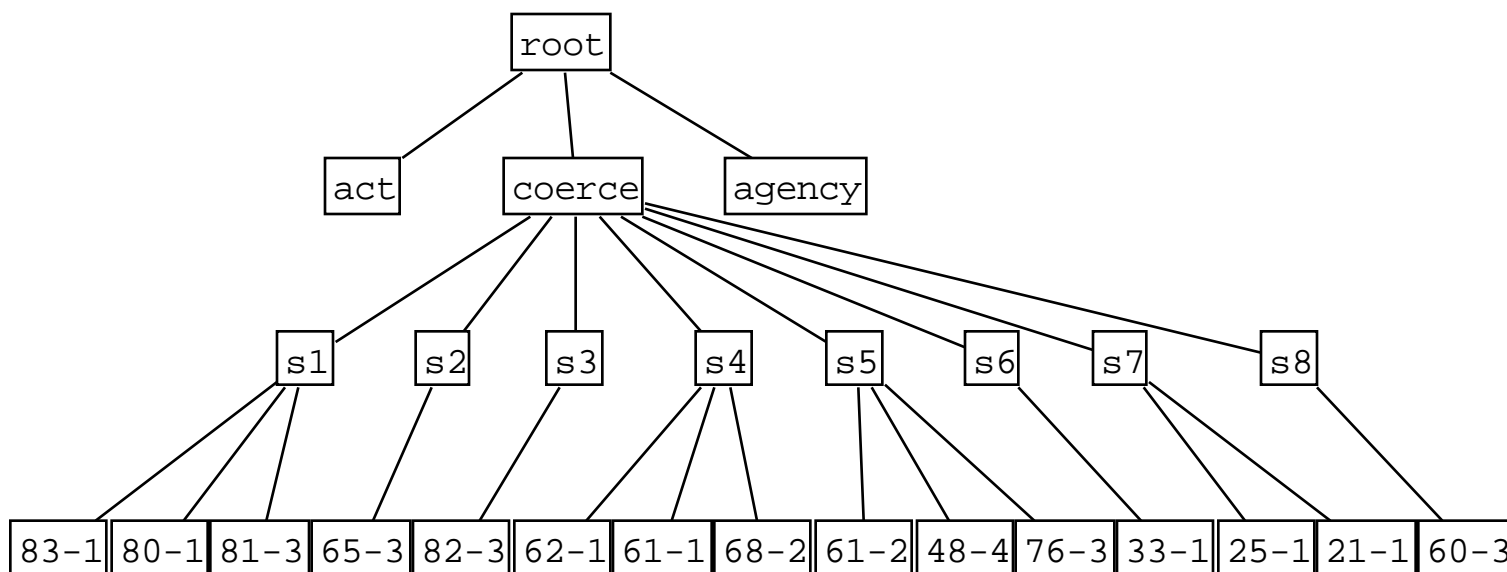# 1948 Soviet Union and Yugoslavia

The Soviet Union threatened to stop granting economic aid to Yugoslavia if Yugoslavia continued its attempts at political independence. The US offered $35,000,000 in aid and Yugoslavia continued to distance itself from the Soviet Union.

1. threat-> goal conflict
(maintain economic health or achieve political freedom)

2. plan (undo-goal-linkage), find another mean of economic health

3. US wants to reduce influence of Soviet Union
4. Providing aid to Yugoslavia will reduce Soviet influence

5. Aid achieves Yugoslavia's goal of economic health

6. Soviet threat does not cause a goal failure for Yugoslavia
7. Yugoslavia continues political freedom, Soviet Goal fails.

Question Answering

Concept completion questions (outcome).
1. Parse (English --> CD)
2. Find.most.specific.schema(question)
3. Infer missing slots
4. Instantiate Explanation
5. Select Answer
6. Generate Answer (CD -> English)
(7 Explain Similar cases)

Analytic Learning vs. quantitative analysis (regression)

OCCAM can explain as well as predict.
EBL can identify relevant features.
EBL performs well with few examples.

Regression analysis tolerates the existence of unidentified factors.

Regression analysis can deal with "graded concepts" and quantitative information (i.e, amount of influence).

Future - Use EBL to determine relevant factors and quantitative techniques to determine amount of influence.