Semantic Role Lists

- Verb have argument lists of semantic roles
  - More general term than case frame or theta grid
  - boil: [Agent, Theme]
- Many potential role labels around
  - Agent, Amount, Beneficiary, Cause, Experiencer, Goal, Instrument, Manner, Means, Medium, Method, Object, Patient, Place, Purpose, Reason, Recipient, Source, Start State, Stimulus, Theme, Time, etc.
  - A lot of debate about which are the correct ones
Characteristics

- Semantic roles are linguistic primitives
  - Linguistic universals
  - Semantically unanalyzable
- Semi-dependent on the verb
  - Exist independently of meaning of the verb
  - Always used in connection with a verb
- Small number of roles
Which Roles?

- Semantic contribution complex
  - Many possible similarities to consider
- Instrument
  - John opened the bottle with a corkscrew
  - John ate the banana with a fork
  - Not all instruments are alike
  - The corkscrew opened the bottle
  - *The fork ate the banana
- Enabling vs. intermediary instruments
  - Wojcik (1976), Marantz (1984)
Grain Size

- Very general roles
  - 6 basic roles
- Verb dependent roles
  - Give: giver, givee, given
  - Van Riemsdijk
  - Meaning-Text Theory
    - Mel’cuk
    - $S_1(\text{give}) = \text{giver}$
  - Construction Grammar
    - Fillmore
    - rob <thief target goods>
Additional Motivations

- Semantic roles need additional motivation
  - Solid criteria to characterize/define the roles
- Explanatory value
  - Entailments
  - Alternations
- Reduction
  - Semantic roles analyzable
  - Semantic structures (Jackendoff)
  - Underlying features (Reinhart)
  - Generalizations (“Levin”)
Bottom-Up Approach

- “Natural classes of arguments result when arguments of a number of verbs share certain lexical entailments. The commonly cited semantic roles can be viewed as labels for certain good-sized natural classes of entailments that are relevant to linguistic generalizations” (Levin & Rappaport 2005, pp 39)
  - Bottom-up approach
  - Start with the verbs
  - Natural classes should fall out
There are many potential alternations to consider
  - Some bordering on paraphrases

Major classes
  - Dative, passive, causative, argument dropping, ...

More specific sub-classes
  - Levin list 79 alternations
  - "Characteristic property of agent alternation"

Derivations
  - Ghosts frighten little children ~ A frightening ghost
  - John walks ~ a walker
## Main Alternations

<table>
<thead>
<tr>
<th>Category</th>
<th>Original</th>
<th>Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dative</td>
<td>John sold mary a car</td>
<td>John sold a car to Mary</td>
</tr>
<tr>
<td>Beneficiary</td>
<td>John baked me a pie</td>
<td>John baked a pie for me</td>
</tr>
<tr>
<td>Passive</td>
<td>John hit Mary</td>
<td>Mary was hit (by John)</td>
</tr>
<tr>
<td>Causative</td>
<td>John broke the window</td>
<td>The window broke</td>
</tr>
<tr>
<td>Middle</td>
<td>The door is easy to open</td>
<td>The door opens easily</td>
</tr>
<tr>
<td>Locative</td>
<td>John sprayed paint on the wall</td>
<td>John spayed the wall with paint</td>
</tr>
<tr>
<td>Conative</td>
<td>John cut the bread</td>
<td>John cut at the bread</td>
</tr>
</tbody>
</table>
More alternations

- **Characteristic property of agent alternation**
  - This dog bites people ~ This dog bites

- **Resultative phrase**
  - That movie bored me ~ That movie bored me silly

- **Extraposition of sentential complements**
  - It amused the children that the clown had a red nose
    ~ That the clown had a red nose amused the children

- **As alternation**
  - The president appointed Smith press secretary
    ~ The president appointed Smith as press secretary
Levin Classes

- **Entailment-driven classification**
  - Look at a large number of verbs
  - List all possible argument realizations and alternations
  - Group together verbs with same alternations and patterns

- **Levin 1993**
  - Study of about 3200 English verbs
  - Grouped into about 200 verb classes

- **Verbnet**
  - Extended to 5256 verbs
  - Linked with other resources
Banish Verbs (10.2)

- **Members**
  - banish, deport, evacuate, expel, extradite, recall, remove

- **Properties**
  - "The king banished the general."
  - "The king banished the general from the army."
  - "The king deported the general to the isle."
  - * Locative alternation
  - * Conative alternation
  - * Caustive alternation
## Hard Line Approach

| Verb   | Passive | Unacc. | Locative | Ag.Noun | Atr.Adj | ...
|--------|---------|--------|----------|---------|---------|----------
| abandon| 1       | 0      | 0        | 1       | 0       |          |
| abash  | 1       | 0      | 0        | 1       | 1       |          |
| abate  | 1       | 0      | 0        | 1       | 1       |          |
| abduct | 1       | 0      | 0        | 1       | 0       |          |
| abhor  | 1       | 0      | 0        | 1       | 1       |          |
| abound | 1       | 0      | 0        | 1       | 0       |          |
| absent | 1       | 0      | 0        | 1       | 0       |          |
| absolve| 1       | 1      | 0        | 1       | 0       |          |
| abstract| 1      | 0      | 0        | 0       | 0       |          |
| abuse  | 1       | 0      | 0        | 1       | 0       |          |
| abut   | 1       | 0      | 0        | 1       | 1       |          |
Natural Classes

- Formal Concepts
  - Oranges
  - Greens
  - Yellows
  - Squares
  - Triangles
  - Green squares
  - Yellow triangles
Applying to verbs

- Table leads directly to formal classes of verbs
  - All verbs that share a given set of alternations
  - Identified by all the alternations these verbs allow
- Reformulate alternations over arguments
  - Subject can/cannot be used as noun with adjective
    - The book frightened the children
      - A frightening book / * a frightening child
      - A frightened child / * A frightened book
  - Redraw table for verb arguments
Argument Realization options

<table>
<thead>
<tr>
<th>Verb</th>
<th>Passive</th>
<th>Unacc.</th>
<th>Middle</th>
<th>Ag.Noun</th>
<th>Atr.Adj</th>
<th>...</th>
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<td>-</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Semantic Roles by Realization Options

• Table leads directly to formal classes of arguments
  ○ All arguments that share a given set of realization options
  ○ Identified by all the realization options these arguments allow

• Natural hierarchy of semantic roles
  ○ Formal Concept Lattice
  ○ Superordinate roles have subsets of identifying realizations
Formal Concept Lattice

<table>
<thead>
<tr>
<th></th>
<th>Tr</th>
<th>Sq</th>
<th>Gr</th>
<th>Ye</th>
<th>Or</th>
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<tr>
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<td>1</td>
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<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Formal Concept Lattice

\[ \begin{array}{cccccc}
1 & 0 & 1 & 1 & 0 & 0 \\
2 & 0 & 1 & 1 & 0 & 0 \\
3 & 0 & 1 & 0 & 0 & 1 \\
4 & 1 & 0 & 0 & 1 & 0 \\
5 & 0 & 1 & 0 & 1 & 0 \\
6 & 0 & 1 & 0 & 0 & 1 \\
7 & 1 & 0 & 0 & 0 & 1 \\
\end{array} \]

\[ \langle \{1,2\}, \{\text{Sq,Gr}\} \rangle \]
\[ \langle \{3,6\}, \{\text{Sq,Or}\} \rangle \]
\[ \langle \{4\}, \{\text{Tr,Ye}\} \rangle \]
\[ \langle \{5\}, \{\text{Sq,Ye}\} \rangle \]
\[ \langle \{7\}, \{\text{Tr,Or}\} \rangle \]
\[ \langle \{1,2,3,5,6\}, \{\text{Sq}\} \rangle \]
\[ \langle \{3,6,7\}, \{\text{Or}\} \rangle \]
\[ \langle \{4,5\}, \{\text{Ye}\} \rangle \]
\[ \langle \{4,7\}, \{\text{Tr}\} \rangle \]
\[ \langle \{1,2,3,4,5,6,7\}, \emptyset \rangle \]
\[ \langle \emptyset, \{\text{Tr,Sq,Gr,Ye,Or}\} \rangle \]
Formal Concept Lattice

\[
\begin{align*}
\langle \{1, 2\}, \{\text{Sq, Gr}\} \rangle \\
\langle \{3, 6\}, \{\text{Sq, Or}\} \rangle \\
\langle \{4\}, \{\text{Tr, Ye}\} \rangle \\
\langle \{5\}, \{\text{Sq, Ye}\} \rangle \\
\langle \{7\}, \{\text{Tr, Or}\} \rangle \\
\langle \{1, 2, 3, 5, 6\}, \{\text{Sq}\} \rangle \\
\langle \{3, 6, 7\}, \{\text{Or}\} \rangle \\
\langle \{4, 5\}, \{\text{Ye}\} \rangle \\
\langle \{4, 7\}, \{\text{Tr}\} \rangle \\
\langle \{1, 2, 3, 4, 5, 6, 7\}, \{\}\rangle \\
\langle \{\}, \{\text{Tr, Sq, Gr, Ye, Or}\} \rangle 
\end{align*}
\]
Hard Line Conclusions

- **Semantic roles reduced to realization options**
- **There are natural classes of argument roles**
  - Based on argument realization options they allow
  - Can consist merely of singleton sets
  - Not necessarily a small number
  - Does not guarantee any semantic coherence
- **Naturally ordered into an semantic role hierarchy**
  - Can be a flat lattice (no real hierarchy)
- **Assumes alternations are well-behaved**
  - Doubtful cases
Soft Approach

- Levin takes soft approach
  - Only classes reflecting “important linguistic generalizations”

- Priority of generalization
  - Semantic taken into account in grouping
  - Even allowing exceptions
    - Exceptions should be marginal

- Intuition plays a role in classification
  - Not a purely reductive approach
  - Classes are syntactically pertinent
  - Classes are semantically coherent
Amuse (31.1)

- **Members**
  - abash, affect, afflict, affront, ..., amuse, ..., **frighten**, please, ..., weary, worry, wound, wow

- **Properties**
  - The clown amused the children
  - An amusing joke
  - PRO-Arb Object alternation
    - That joke never fails to amuse little children
    - ~ That joke never fails to amuse
    - ?? Spoken maken (kleine kinderen) altijd bang
Amuse (31.1)

- * Causative alternation (most verbs)
  - The clown amused the children / * The children amused
  - But: the children worried

- Middle alternation (most verbs)
  - Children are easy to amuse / Children amuse easily
  - But not: * Children please easily