

Fluid Construction Grammars

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Goal:

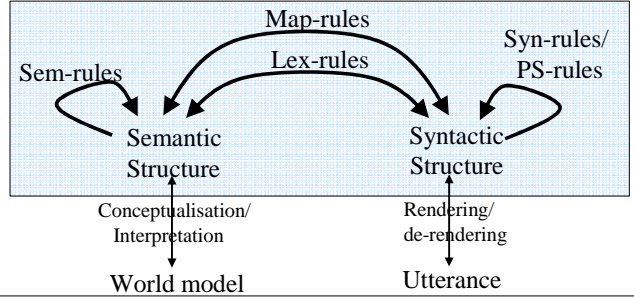
Develop a formalism for construction grammar and computational mechanisms for parsing and production
Should be usable in multi-agent simulations of language evolution.

Requirements:

- > Linguistic Requirements:
 - ✓ Representation of constructions (meaning-form mappings)
 - ✓ Representation of hierarchical categorisation rules (syntactic and semantic)
 - ✓ No formal distinction between lexicon and grammar
- > Processing Requirements:
 - ✓ No distinction between parsing and production
 - ✓ Multiple hypotheses tracked in parallel
 - ✓ Partial analysis if rules are missing or violated
- > Adaptation Requirements:
 - ✓ New categories can be added or changed at any time
 - ✓ New constructions can be added at any time
 - ✓ Rules are in competition for dominance in the population

Approach:

- >Lexicon and grammar are expressed by constraints on feature structures
- >Construction application through matching + unification over feature structures
- >All form aspects are represented in a declarative way
- >Multi-tasking to explore multiple hypotheses



Ex: ((walk ev1 true) (walk-1 ev1 obj1) (john obj1)) <==> "John walks"

Lex-rules: relate part of semantic structure to lexemes (words):

```
(def-lex walk-entry
  ((?unit (referent ?event)
    (meaning
      (== (walk ?event ?truth)
        (walk-1 ?event ?object))))))
<->
((?unit (form (== (string ?unit "walks"))))))

(def-lex john-entry
  ((?unit (referent ?obj)
    (meaning (== (john ?obj))))))
<->
((?unit (form (== (string ?unit "john"))))))
```

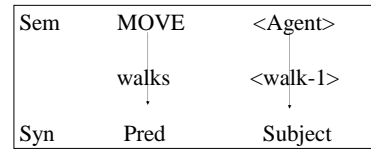
Syn-rules: categorise aspects of syntactic structure:

```
(def-syn john-noun
  ((?unit (form (== string ?unit "john"))))
  ->
  ((?unit (syn-cat (== noun (number singular))))))

(def-syn walk-verb
  ((?unit (form (== (string ?unit "walks"))))
  ->
  ((?unit (syn-cat (== verb (number singular))))))
```

Sem-rules: categorise aspects of semantic structure

```
(def-sem walk-1-agent
  ((?event-unit (referent ?event)
    (meaning (== (walk ?event ?true) (walk-1 ?event ?object))))))
->>
((?event-unit (sem-cat (== (move ?event) (agent ?event ?object))))))
```



Map-rules: relate part of semantic structure to syntactic

```
(def-map SV-construction
  ((?parent-unit (referent ?ev1)
    (sem-subunits (== ?event-unit ?agent-unit)))
  (?event-unit (referent ?ev1)
    (sem-cat (== (move ?ev1) (agent ?ev1 ?obj))))
  (?agent-unit (referent ?obj))
  <->
  ((?parent-unit (syn-cat (== SV-sentence)))
  (?event-unit (syn-cat (== (subject ?parent-unit ?agent-unit))))
  (?agent-unit (syn-cat (== (predicate ?parent-unit ?event-unit))))))
```

Ps-rules: relate constructions to phrase structure

```
(def-ps SV-sentence
  ((?top-unit (syn-cat (== SV-sentence)))
  (?subject-unit (syn-cat (== (subject ?top-unit ?subject-unit))))
  (?predicate-unit (syn-cat (== (predicate ?top-unit ?predicate-unit))))))
<->
((?top-unit (syn-cat (== sentence)
  (form (== (precedes ?subject-unit ?predicate-unit))))
  (?subject-unit (syn-cat (== noun (number ?number))))
  (?predicate-unit (syn-cat (== verb (number ?number))))))
```

