### Integrating the Spatial Semantics of Verbs and Prepositions


**Pomona College, Scripps College, Claremont Graduate University**

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**Introduction**

Many sentence processing studies have examined semantic processing, but most focus on how it influences syntactic processing. Fewer studies have examined how semantic information is integrated and interpreted in real time.

Recently, several studies have addressed this question by looking at enriched semantic composition (McEneely et al., 2001; Traxler et al., 2002). We build on this work by examining how spatial information from verbs and prepositions is integrated, enriched, and interpreted.

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**Locatives and Motion Verbs**

Locative expressions specify where the event described in a clause takes place. In English they are realized predominantly as prepositional phrases such as inside the house, to the store, along the river. Two main classes of locative PPs can be distinguished (e.g., Miller & Johnson-Laird, 1976, Jackendoff 1983):

1. **Directional PPs** characterize a PATH along which the event described in the clause unfolds.
   - Examples: inside the house, to the store, along the river.

2. **Non-directional PPs** characterize the PLACE within which the event occurs or an event unfolds.
   - Examples: inside the house, at the store, within the river.

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**P-Flexibility**

The classification of a preposition as directional ("PATH") or non-directional ("PLACE") is not always clear cut. In particular, a variety of PLACE prepositions can give rise to directional readings when combined with motion verbs:

1. John drove from Denver to LA.
2. John was/sat/exercised inside the house.

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**Manner of Motion Verbs**

Spatial verbs parallel this PATH vs. PLACE distinction. Even though all motion verbs conceptually imply a path, they can be classified linguistically into directional motion verbs (e.g., "ran"). Many motion verbs can be used both directionally and non-directionally. As in the case of prepositions, many matters of motion verbs can be used both directionally and non-directionally.

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**Co-occurrence Restrictions between Motion Verbs and Locative PPs**

| Dir. motion verb | PATH PP (PLACE PP) |
| Non-dir. motion verb | PATH PP (PLACE PP) |
| Non-motion verb | *PATH PP (PLACE PP) |

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**What We Did**

We investigated real time mechanisms of semantic integration of locative PPs by juxtaposing motion verbs with PLACE prepositions. We reason that there are two ways by which this conflict can be resolved: 1. The verb semantics determine the interpretation of the preposition. 2. Preposition Priority: the preposition determines the interpretation of the verb.

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**Verb Priority**

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**Predictions**

1. No conflict conditions: no processing cost because spatial semantics of V and P are consistent.
2. Non-motion Verbs + PATH P: the directionality of the preposition cannot be dropped; the non-motion verb needs to be coerced into a motion verb, hence processing cost in all cases.
3. Dir. Motion Verb + PLACE P: a. Verb Priority: the meaning of the preposition has to be coerced into a PATH reading resulting in processing cost. b. Preposition Priority: The meaning of the preposition is unchanged. Because the verb's path argument is optional it is simply not specified and understood to be within the location named by the PLACE PP. Hence no processing cost.

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**Conclusions**

Consistent with strongly incremental models of semantic selection (e.g., Slobin et al., 1999). Cost of coercion evidence on preposition or word order.

The data support the distinction between directional motion verb that require a PATH PP and non-directional motion verbs that optionally combine with a PATH PP (e.g., Jackendoff, 1983).

PLACE PPs can be coerced into PATH PPs, consistent with Jackendoff (1983) where PLACE PPs are analyzed as (PLACE(PLACE(PLACE))).

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**Crucial prediction**

For Motion+PLACE items, Verb Priority RTs should be longer than Preposition Priority RTs because of coercion.