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- We analyze creation predicates as predicates referencing two types of scales.

Type of Creation Verbs

(97) a. John wrote a letter.

Type of Creation Verbs

(99) a. John wrote a letter.
b. Sophie wrote for hours.

Type of Creation Verbs

(101) a. John wrote a letter.
b. Sophie wrote for hours.
c. Sophie wrote for an hour.

(102) a. John built a wooden bookcase.
b. *John built for weeks.

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  - EXTENT SCALES: most often found with incremental theme verbs.

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- Ratio scales: have equal distances between scale units as well as a zero value. Most measures encountered in daily discourse are based on a ratio scale.

Generalizing the Path Metaphor to Creation Predicates

Pustejovsky and Jezek 2012

- Use multiple scalar domains and the "change as program" metaphor proposed in Dynamic Interval Temporal Logic (DITL, Pustejovsky 2011, Pustejovsky & Moszkowicz 2011).

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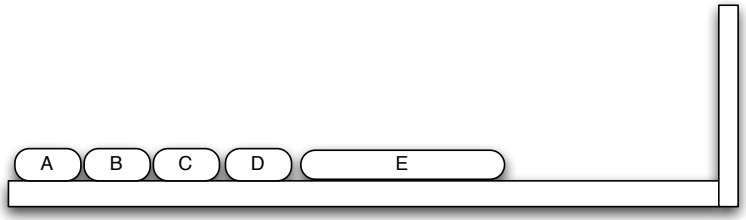
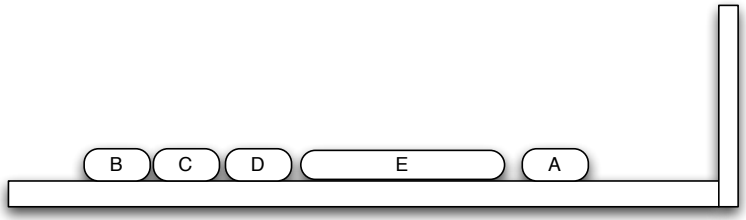
- If the program is "change by assignment", Result refers to the record or trail of the change (e.g., the path of a walking, the stuff written in writing, etc.).

Incremental Theme and Parallel Scales



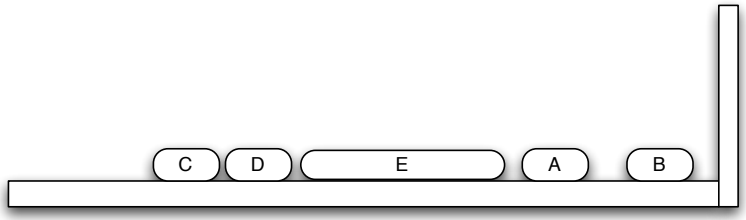
- Mary is building a table.
- Change is measured over an **ordinal scale**.
- Trail, τ is null.

Incremental Theme and Parallel Scales



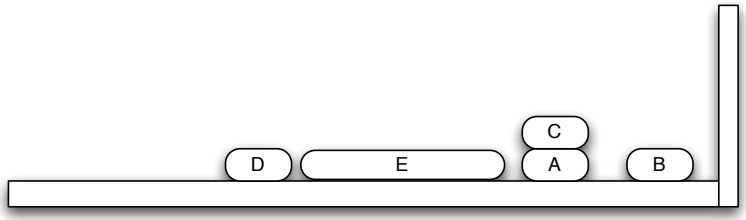
- Mary is building a table.
- Change is measured over an **ordinal scale**.
- Trail, $\tau = [A]$.

Incremental Theme and Parallel Scales



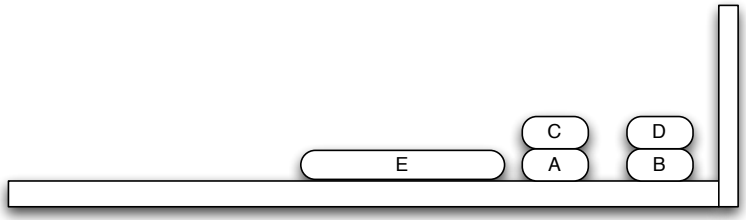
- Mary is building a table.
- Change is measured over an **ordinal scale**.
- Trail, $\tau = [A, B]$

Incremental Theme and Parallel Scales



- Mary is building a table.
- Change is measured over an **ordinal scale**.
- Trail, $\tau = [A, B, C]$

Incremental Theme and Parallel Scales

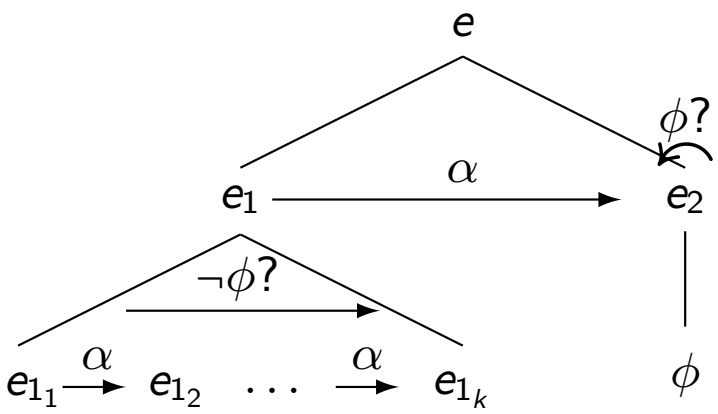


- Mary is building a table.
- Change is measured over an **ordinal scale**.
- Trail, $\tau = [A, B, C, D]$

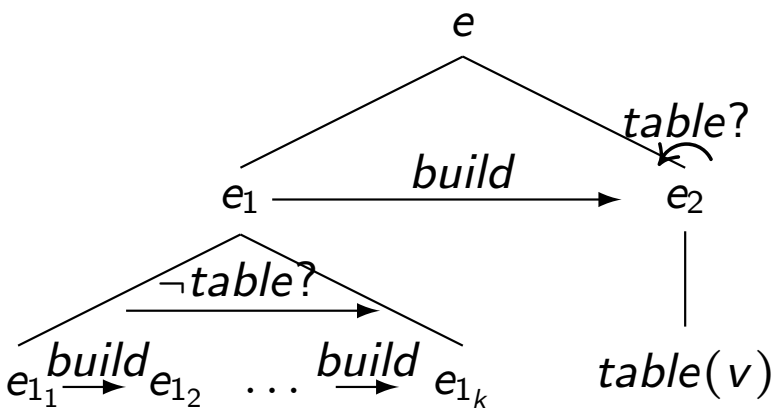
Incremental Theme and Parallel Scales

- Mary built a table.
- Change is measured over a **nominal scale**.
- Trail, $\tau = [A, B, C, D, E]$; $table(\tau)$.

Dynamic Event Structure



Parallel Scales define an Accomplishment



Co-compositionality

Pustejovsky (1995, 2013)

- A semantic property of a linguistic expression in which all constituents contribute functionally to the meaning of the entire expression.
- A characterization of how a system constructs the meaning from component parts.
- It is the set of computations within a specific system that should be characterized as co-compositional for those expressions.

Co-compositionality

(103) a. John ran.
b. John ran for twenty minutes.
c. John ran two miles.

(104) a. John ran to the store.
b. John ran the race.

There are two senses of *run* that emerge in context with these examples:

(105) a. run_1: manner-of-motion activity, as used in (103);
b. run_2: change-of-location transition, as used in (104);

Co-compositionality

(106) a. Mary *waxed* the car.
b. Mary *waxed* the car clean.

(107) a. John *wiped* the counter.
b. John *wiped* the counter dry.

(108) a. John *baked* the potato.
b. John *baked* the cake.

(109) a. Mary *fried* an egg.
b. Mary *fried* an omelette.

(110) a. John *carved* the stick.
b. John *carved* a statue.

Co-compositionality

- Informally, we can view co-compositionality as the introduction of new information to an expression by the argument, beyond what it contributes as an argument to the function within the phrase.
- Hence, it can be considered an ampliative operation, relative to the function application.

The Case of bake

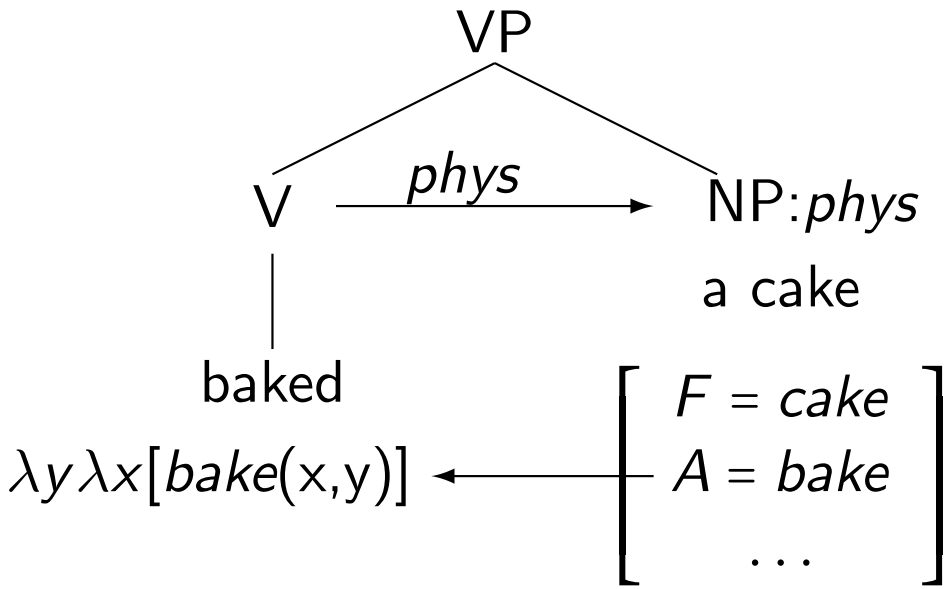
(111) $\lambda y \lambda x \lambda e \left[\begin{array}{l} \textbf{bake} \\ \text{AS} = \left[\begin{array}{l} \text{A1} = x : \mathit{phys} \\ \text{A2} = y : \mathit{phys} \end{array} \right] \\ \text{ES} = \left[\text{E1} = e : \mathit{process} \right] \\ \text{QS} = \left[\text{A} = \mathit{bake}(e, x, y) \right] \end{array} \right]$

(112)

$$\lambda x \exists y \left[\begin{array}{l} \textbf{cake} \\ \text{AS} = \left[\begin{array}{l} \text{ARG1} = x : \mathit{phys} \\ \text{D-ARG1} = y : \mathit{mass} \end{array} \right] \text{QS} = \left[\begin{array}{l} \text{F} = \mathit{cake}(x) \\ \text{C} = \mathit{made\_of}(x, y) \\ \text{T} = \lambda z, e[\mathit{eat}(e, z, x)] \\ \text{A} = \exists w, e[\mathit{bake}(e, w, y)] \end{array} \right] \end{array} \right]$$

The Agentive for *cake* makes reference to the process within which it is embedded in the sentence (i.e., *bake a cake*), which is a case of cospecification.

Co-compositionality



$$(113)\ \begin{bmatrix} \text{V} \\ A = bake \end{bmatrix} \sqcap \begin{bmatrix} \text{NP} & F = cake \\ & A = bake \end{bmatrix} = \begin{bmatrix} \text{VP} & F = cake \\ & A = bake \end{bmatrix}$$

Co-compositionality

From the underlying *change-of-state* sense of *bake*, the *creation* sense emerges when combined with the NP *a cake*.

$$\exists e_1, e_2, x, y[bake(e_1, j, y) \wedge cake(e_2, x) \wedge made\_of(x, y) \wedge e_1 \leq e_2]$$

The operation of co-composition results in a qualia structure for the VP that reflects aspects of both constituents. These include:

(A) The governing verb *bake* applies to its complement;

(B) The complement co-specifies the verb;

(C) The composition of qualia structures results in a derived sense of the verb, where the verbal and complement AGENTIVE roles match, and the complement FORMAL quale becomes the FORMAL role for the entire VP.

Co-compositionality

The derived sense is computed from an operation called *qualia unification*, introduced in Pustejovsky (1995). The conditions under which this operation can apply are stated in (114) below:

(114) FUNCTION APPLICATION WITH QUALIA UNIFICATION: For two expressions, α, of type <a,b>, and β, of type a, with qualia structures QS_α and QS_β, respectively, then, if there is a quale value shared by α and β, $[_{QS_\alpha} \ldots [Q_i = \gamma\ ]]$ and $[_{QS_\beta} \ldots [Q_i = \gamma\ ]]$, then we can define the qualia unification of QS_α and QS_β, $QS_\alpha \sqcap QS_\beta$, as the unique greatest lower bound of these two qualia structures. Further, $\alpha(\beta)$ is of type b with $QS_{\alpha(\beta)} = QS_\alpha \sqcap QS_\beta$.

Properties of Co-compositional Derivations

- Within an expression, α, consisting of two subexpressions, α_1 and α_2, i.e., $[_\alpha \alpha_1 \alpha_2]$, one of the subexpressions is an *anchor* that acts as the primary functor;
- Within the argument expression, there is explicit reference to the anchor or the anchor's type (that is, the complement co-specifies the functor);
- The composition of lexical structures results in a derived sense of the functor, within α.

General Co-compositionality

- The derivation for an expression α, is *co-compositional* with respective to its constituent elements, α_1 and α_2, if and only if one of α_1 or α_2 applies to the other, $\alpha_i(\alpha_j)$, $i \neq j$, and $\beta_j(\alpha_i)$, for some type structure β_j within the type of α_j, i.e., $\beta_j \sqsubseteq \mathit{type}(\alpha_j)$.
- $[[\alpha]] = \alpha_i(\alpha_j) \sqcap \beta_j(\alpha_i)$.

The more general characterization of co-compositionality allows us to analyze a number of constructions as co-compositional: *manner-creation polysemy*, *subject-induced coercion* and certain light verb constructions, e.g., *functionally dependent verbs*.

Manner/Creation Polysemy

(115) a. Mary painted the fence.
b. Mary painted a portrait.

(116) a. Mary baked the potato.
b. John sewed a button.
c. The child carved the stick.

(117) a. Mary baked a cake.
b. John sewed a dress.
c. The child carved a boat.

Manner/Creation Polysemy

$$\begin{bmatrix} \textbf{fence} \\ \text{QS} = \begin{bmatrix} \text{FORMAL} = \textbf{physical(x)} \\ \text{TELIC} = \textbf{enclose(x,y)} \\ \text{AGENTIVE} = \textbf{build(w,x)} \end{bmatrix} \end{bmatrix}$$

$$\begin{bmatrix} \textbf{portrait} \\ \text{QS} = \begin{bmatrix} \text{FORMAL} = \textbf{physical•info(x)} \\ \text{TELIC} = \textbf{depict(x,y)} \\ \text{AGENTIVE} = \textbf{paint(w,x)} \end{bmatrix} \end{bmatrix}$$

Manner/Creation Polysemy

(55)
$$\left[\begin{array}{l}\textbf{paint a portrait} \\ \text{AS} = \left[\text{ARG}_1 = \boxed{1}\left[\begin{array}{l}\text{CAT} = \textbf{DP} \\ \text{SEM TYPE} = \textbf{human}\end{array}\right]\right]\left[\text{ARG}_2 = \boxed{2}\left[\begin{array}{l}\text{CAT} = \textbf{DP} \\ \text{SEM TYPE} = \textbf{physical•info}\end{array}\right]\right] \\ \text{ES} = \left[\begin{array}{l}\text{E}_1 = \textbf{e}_1\textbf{:process} \\ \text{E}_2 = \textbf{e}_2\textbf{:state} \\ \textbf{e}_1 < \textbf{e}_2\end{array}\right] \\ \text{QS} = \left[\begin{array}{l}\text{AGENTIVE} = \textbf{paint\_act}(\textbf{e}_1, \boxed{1}, \boxed{2}) \\ \text{FORMAL} = \textbf{exist}(\textbf{e}_2, \boxed{2})\end{array}\right]\end{array}\right]$$

Conclusion

- Manner and result behavior are only surface consequences of a simple dynamic event model.
- Dynamic Event Models account for a broader range of data, including creation verbs, which are both manner and result component verbs.
- Co-composition allows for the object and subject to compositionally influence the resulting semantics of the predication.